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The Generalized Stability Indicator of Fragment of the Network. I. Modeling of the Corporate Network Fragments

Irina Nizovtseva

Ural Federal University
Office 607, Turgeneva str. 4, Ekaterinburg, Russia, 620075
Nizovtseva.irina@gmail.com

Abstract

In this paper we consider the stability of the enterprise-node that is functioning and has a network of homogeneous companies with regard to their interaction and influence on each other. This means that we come to consider the wider subnet model containing the node structure of homogeneous him nodes and their vendors. Consider also the parameters and factors that have a direct impact on the stability.

Keywords: generalized stability, directive impact, corporate network

1 Modeling of the corporate network fragments in point of view of the generalized stability

In [1-6] defined stability of a single node $\boldsymbol{P_0}$ based on its interaction with only vendors of various types of resources. It is one of the elements of the complex reference system enterprises [7, 8]. This means that we are in step $\boldsymbol{A_i}$ (detail within the model $\boldsymbol{A_i}$) and treated it only a small fragment of a node $\boldsymbol{P_0}$ and its vendors. In fact, as a rule - is an abstract factor-node a subnet (in the algeb-

raic sense of the term "factor"), i.e. the union of the whole structure of their own kind one-profile units that are represented on the diagram as a single unit.

Subnet homogeneous nodes H is a component of the homomorphism kernel $\boldsymbol{A_i} \xrightarrow{\boldsymbol{\varphi_i}} \boldsymbol{A_{i+1}}$ acting in the formation of the next, more general model. This subnet of homogeneous nodes under the influence of the homomorphism H moves (combined) in the model into a single abstract node [5].

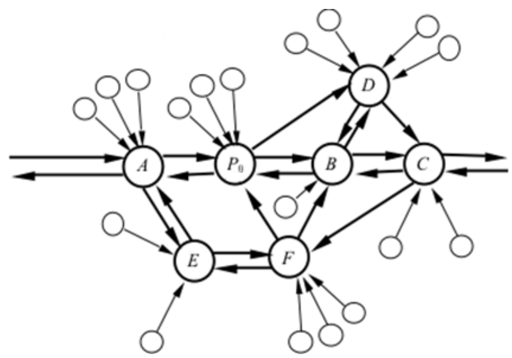

Fig. 1. Fragment of a network diagram

Let us turn to the more complex and detailed case where we are interested in the node-enterprise $\boldsymbol{P_0}$ functions in a corporation network and itself is part of a subnet of their own kind nodes. A fragment of a network diagram is shown in Fig. 1.

For the generalized coefficient of stability of network fragment $\{A, P_0, B, C, D, E, F\}$ in Figure 1 can be taken stability coefficient of the node P_0 in a more general abstract network. More precisely, the generalized stability of the subnet H of the network $G(N,A)$ will be called the stability of the node $h = \varphi(H)$ - the image of a subnet H under the natural homomorphism $\varphi: G \rightarrow {}^{G}/_{H}$ on the factor-network ${}^{G}/_{H}$ (Fig. 2).

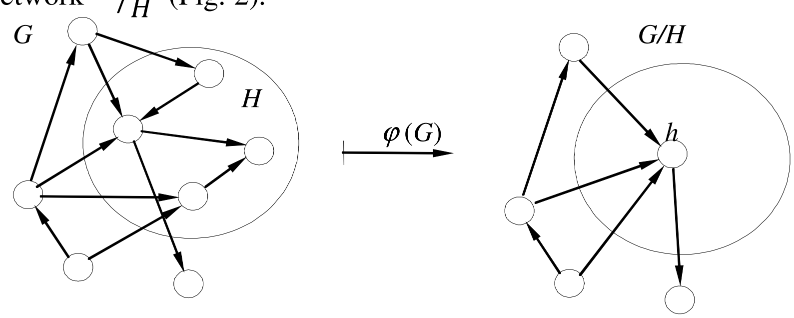

Fig.2. Graphical interpretation of the generalized stability

The generalized stability factor shows how reliable and stable operating analyzed fragment of the whole network, the entire network fragment is regarded as a node.

Thus, the concept of external stability of the node and its internal stability from a formal point of view, are one and the same concept (the same numerical

characteristic with the same method of calculation) applied at different steps of the considered morphisms chain network structures

$$A_0 \xrightarrow{\varphi_0} A_1 \xrightarrow{\varphi_1} A_2 \xrightarrow{\varphi_2} \ldots \xrightarrow{\varphi_i} A_{i+1} \xrightarrow{\varphi_{i+1}} \ldots$$

2 Factors

Let's keep in mind that we are interested in the node P_0 - this is, for example, the structural unit of a larger structure *H* of homogeneous nodes.

1. Statistical certain stability coefficients of all nodes of suppliers for all the nodes that make up the subnet investigated *H*.

2. Each node h_i substructure *H* comprising nodes uniform profile that requires a supply of the same species consumed products $A_i^1, A_i^2, \ldots, A_i^m$, wherein A_i^k a denotes the volume of the desired product supply node k-th species.

3. Influencing factor on the subnet *H* external environmental conditions and different force majeure (accidents, natural disasters, etc.). Let the requirement of each individual node h_k (fig. 3) subnet *H* as a result of accidents increases with the random variable [6] $\eta(t)$ is proportional to the V_k - standard average needs, so $V(t) = \eta(t) \cdot V_k$.

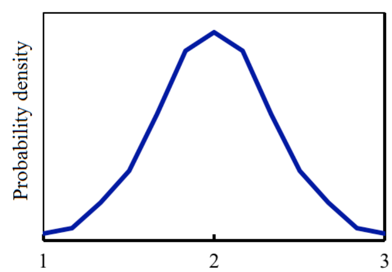

Fig. 3. Density plot of the random variable $\eta(t)$

4. An essential feature of the proposed model and the new element becomes the accounting impact of foreign policy on the subnet *H* from a superior organizational and regulatory authority. This can be forced redistribution of resources within the subnet *H* in case of force majeure situation on one (or even several) of its nodes. In addition, the regulatory impact on an individual node or group of nodes subnet *H* can be exercised for any other reason (economical or technical). Redistribution is not an arbitrary manner, but with the priority of the normal functioning of a particular node, given its importance for the overall production process. Also take into account the amount of expenses for redistribution. Each node $h_i$subnet N is associated with a natural number - the priority of the node.

The set of all nodes in a common network somehow affecting the stability of the site, divided into four groups: direct vendors of P_0, component group *H* subnet with priority higher than the priority of the node P_0, node group N subnet with a lower priority and a group of nodes with equal priority (Fig. 4).

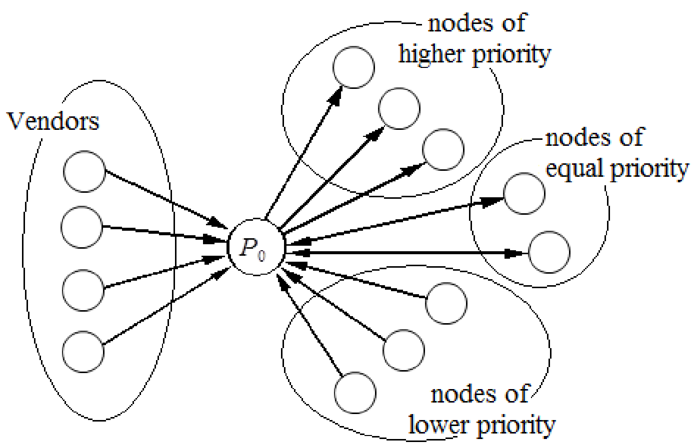

Fig. 4. Subnet *H* Nodes priorities

As shown in each of Figs. 4 groups units initially have the following data (Table 1 and 2).

Coefficients $p^{(k)}_{1j_k}$ assumed to be defined on the basis of observations and statistical studies; amount of supplies to enter into treaties (the third row of the table) for each desired product is exactly equal to the demands A^k.

$$\sum_{i=1}^{j_k} V^{(k)}_{1i} = A^k$$

Demand volume of products	A^1				…	A^k			…
Vendors	$P^{(1)}_{11}$	$P^{(1)}_{12}$	…	$P^{(1)}_{1j_1}$	…	$P^{(k)}_{11}$	…	$P^{(k)}_{1j_k}$	…
Stability coefficients	$p^{(1)}_{11}$	$p^{(1)}_{12}$	…	$p^{(1)}_{1j_1}$	…	$p^{(k)}_{11}$	…	$p^{(k)}_{1j_k}$	…
Contracted volumes of supplies	$V^{(1)}_{11}$	$V^{(1)}_{12}$	…	$V^{(1)}_{1j_1}$	…	$V^{(k)}_{11}$	…	$V^{(k)}_{1j_k}$	…
Stockpile	$\Delta^{(1)}_{11}$	$\Delta^{(1)}_{12}$	…	$\Delta^{(1)}_{1j_1}$	…	$\Delta^{(k)}_{11}$	…	$\Delta^{(k)}_{1j_k}$	…

Table 1. Vendors of node P_0

	Higher priority			Equal priority			Less priority		
Nodes	b_1	b_2	…	r_1	r_2	…	m_1	m_2	…
Priority	β_1	β_2	…	n_0	n_0	…	μ_1	μ_2	…
Demands	$A^1_{b_1}, A^2_{b}$	$A^1_{b_2}, \ldots$	…	$A^1_{r_1}, A^2_{r}$	$A^1_{r_2}, \ldots$	…	$A^1_{m_1}, A^1$	$A^1_{m_2}, \ldots$	…
Stability	p_{b_1}	p_{b_2}	…	p_{r_1}	p_{r_2}	…	p_{m_1}	p_{m_2}	…

Table 2. Homogenies nodes of subnet *H*

3 Conclusion

So, developed methods for determining and calculating the stability of the host (as the network characteristics) are so universal and applicable (with the necessary potential interpretive) anywhere on the network under consideration of

the chain of mathematical models of the structures of corporations from any industry.

The next part will be detailed formalized critical performance situations. The formalization will develop a methodology for calculating the generalized stability of the enterprise.

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