The Process of a Small Group Self-Organization under Intellectual and Emotional Relationships

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Abstract[1]

We consider the problem of small social groups management, namely the problems of its functioning improvement and work rhythm ensuring. In order to solve this problems, we construct cognitive dynamic models of small social group based on linear and nonlinear relationships. Next by means of computer simulation the rate and sustainability of the small work group activity process are evaluated, control algorithms are produced and required rate of activity are obtained. Besides each person in the group is considered as a person, i.e. as a system capable of self-regulation and self-organization.

1. Introduction

Small social group (SSG) is a small group of people (from 3 to 15) who share common social activities, communicate directly and have emotional relationships. Interest in SSG is determined by several important points, as they are an important intermediate link in the understanding of different types of social relations-making in the system "Person-Group-Society."

From the society standpoint public relations in SSG are realized in the form of direct and sustainable personal contacts. From the individual standpoint SSG play an important role in education and formation the individual as person as its identity, values and norms, system of ideas about the world are formed in the process of integrating the individual throughout his life to the activity of the various groups [1, 2].

Control problems of SSG as the most important form of social association in a process of collaboration and communication is one of the central problems of sociology and social psychology . However in modern sociology studied structural characteristics of SSG are studied more than the question of group dynamics , i.e. processes of group members self- organization the atmosphere within the group, stages of SSG development, etc. are scantily explored because of its complexity. At the same time the study of group dynamics focuses on the processes and stages of group development , norm-formation in the group cohesion , conformity, group decision- making, etc. , whereas the study of the fundamental general laws of interaction and joint activities of the group members remains in the shadows [3,4].

On the other hand modern organizational science comes from the fact that no organization can develop under the hard artificial control, without the elements of self-organization as a form of self-control, and purposeful management should take decisions which extend the capabilities of the system self-regulation [5].

In this connection, the study of the dynamics of SSG self-organization in modern society obtain the particular relevance. Besides, as in sociology personality is determined as included into group and joint work, and considered as a subject of social relations, it is necessary to consider personality as included in SSG.

Thus, the article considers the problem of personal self-organization in joint work of project implement as part of SSG taking into account its individual characteristics. In order to identify the most effective ways of self-organization in the SSG and study its properties cognitive dynamic model based on linear relationship is constructed.

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2. Cognitive dynamic model of a small social group

The article examines the SSG consisting of three people who are on one hierarchical level (having the same position or performing similar functions), and united by common goal (by implementation of some project (Fig. 1)).

Every individual in the group is a personality, i.e. the organized and self- organized whole (structure), consisting of number of relatively constant properties which are dynamically developed from innate instincts of the individual (R.Konechny, M.Bouhal, 1983).

There are many approaches to consider the individual structure, however, the available models have more general social nature and, as a rule, poorly suitable for the study of social processes and phenomena involving human subjects.

In this connection, we propose an approach under which a personality is considered as one of project participants who has a stable mentality, able to think and be aware of its actions due to its intelligence and implement a purposeful activity. [6] In other words, the structure of the personality in the cognitive model is represented as a system triad, i.e. as a three-element connected set, basic concepts of which are:

- intellectual activity (IA) is a human brain activity directed to solving intellectual problems, developing plans, ideas, models, etc.;
- organizational and work activity (OWA) is an activity aimed at transforming natural resources into material, technical, innovative and intelligent objects, as well as putting this activity in a system which is characterized by internal orderliness, coherence and synergies of all phases of activity;
- psychophysical state (PS) is a mental (emotional state, activity, tonic status, cognitive activity, volitional, etc.) and physical (the set of morphological and functional properties of an organism, health) conditions of the person.

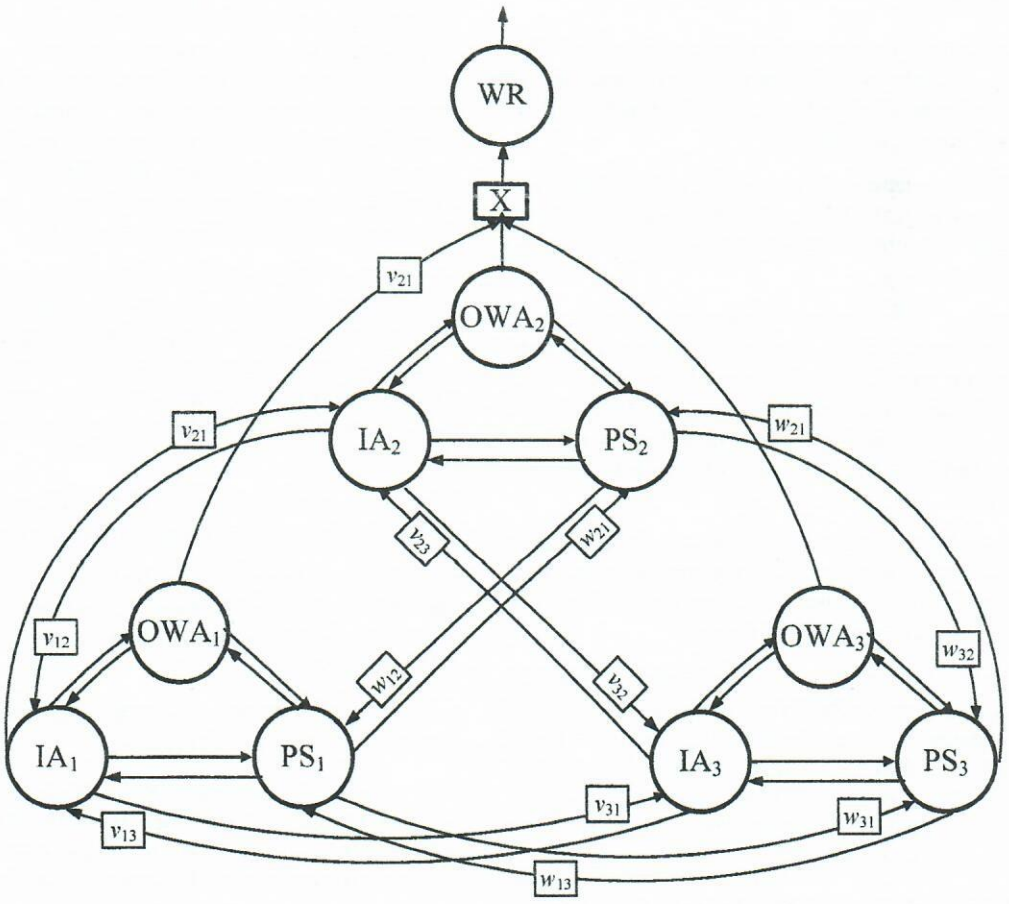

Fig 1. Cognitive model of a small social group consisting of three personalities

Each personality is considered as a self-organizing system in which support of self-organization is made by means of self-regulation mechanism - the process of forming mental activity and its management in order to achieve consciously put forward and accepted person's goals. [7]

Self-regulation mechanism is realized by means of negative feedback loops which provide that the output signal about the control object condition (in our case the activity paces of the IA, PS and OWA concepts) propagate to the input of the system. Negative feedback loop reduces control influence, the effect of disturbing factors of the work control objects and brings back the changed measure to the desired level.

All personality concepts are interrelated and form the whole. Exception of any concepts leads to the destruction of a personality as a system.

Backbone connection between the elements is exchange of information which is realized in the form of linear relationships between of each pair of personality's concepts IA and PS. At the same time the interaction nature is such that one personality stimulates (via positive feedback) or inhibits (via negative feedback) the activity of other personalities.

The work result (WR), i.e. the output coordinate of SSG functioning, is rate of SSG activity obtained as an integral (multiplicative) effect of combining OWA personalities' individual rates.

Thus, SSG is a complex system where each element has its own influence on the WR, contributes and is in certain respects with the other members of the group and also influencing them.

The objective of mutual collective activities is maintaining a certain pace of work on the project when the appropriate work pace of the group members form their own. At the same SSG must be "effective group", which are characterized by the interaction, cohesion, coherence, understanding and lack of conflicts between group members.

Since all members of the SSG are on the same level of the hierarchy, none of them is the manager of the project. In this regard, social power is exercised through the leadership of one of the group members.

The leadership phenomenon in the model is realized through the negative feedbacks going firstly from WR to the group leader (the person with the index 1) to its concepts IA_1 and OWA_1 that means rational perception and awareness of the group activity pace, and secondly, from the group leader to concepts OWA_2 and OWA_3 of two other members of the group.

Also it should be noted that each person on the level of each concept contributes to the result achievement.

Studying the SSG self-organization processes is based on system approach. At the same time it is considered that new SSG states are the result of the coherent nature of the operation of different elements during its self-organization.

Thus, we pose the problem of studying the self-organization processes of SSG management in the view of systems perspective designed to identify all possible forms of motion process of the project implementation. [6]

The SSG cognitive dynamic model (Fig. 1) can also be expressed as a system of differential equations in the Cauchy form. This system consists of 10 differential equations describing the dynamics of the behaviour of all concepts of each individual, taking into account the relationship between the ID and PS components and the above links between WR and the leader and between the leader and two remaining group members on the OWA concepts.

3. Cognitive analysis of the group properties on the basis of computer simulation

Features of management model of SSG self-organization processes were analyzed by computer simulation in MATLAB and the method of formation scenarios (situations). Time, interaction parameters and individual contributions in the scenarios formation are taken dimensionless from 0 to 1, i.e. from very weak to very strong, and defined by experts. During the analysis model individual parameters are changed and the effect of these parameters on the final project implementation rate of joint SSG members activities are evaluated, as well as on its stability. It also studied the effect of changing the individuals contributes values on the level of each concept on the pace of the group activity.

The pace of SSG activity at symmetric of personalities interaction parameters and self-organization parameters is sustainable if the individual activity of each participant is organized according to mutual assistance to each other and control of group activity final output, aimed at maintaining the work pace of the project implementation [8–11].

Simulation results presents that positive effect on the project implementation pace maintaining have:

- stability of each personality in autonomous behavior due to the self-organization parameters formation, i.e. relationships between the elements and parameters of self-regulation;
- harmonious relations between personalities on the intellectual and emotional levels.

Moreover it is determined that increased leader exposure to other group members leads to work rate decrease, as well as relaxation oscillations of the transition process, i.e. to the irregularity of the project implementation.

Different rates of execution of functions by each person, i.e. at the asymmetry of relationships parameter between concepts OWA, ID and PS, and self-regulation parameters, as well as conflicts between group members also lead to irregularity of the project implementation

process, and in some cases to the instability of the whole system.

Considered in this section SSG states are not the all possible, because a vast variety of scenarios, which are determined by different qualitative and quantitative relationships, lead to situations the study of which is a laborious task. However, consideration the above cases is enough to understand the general trends of SSG functioning during the project implementation, as they obviously describe the relationships in the group, and the simulation results show the system conduction of personalities self-organization aimed at maintaining a high rate of project implementation.

4. Conclusion

Thus, SSG consisting of three personalities capable to self-organization can achieve high rates of project implementation to complete it in time due to the self-organization of its executives as active elements, and by establishing effective relationships between personalities on the intellectual, emotional, and working levels. Irregularity or instability in the process of the project implementation are the result of inconsistent and conflict behavior of individuals in the process of joint activities as part of SSG.

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