Emergent Behavior in Complex Organizations: Teamwork on Software Development Process

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ABSTRACT

Organizations are complex systems, which are formed by other subsystems such as work teams, and are the focus of attention in this research. This article makes an approach to the teams involved software development process in IT companies using a viable system based model and computational modeling. An analysis of teamwork is made from a socio-technical perspective, where individuals and technology produce emergent behaviors that may be crucial to achieving goals, since fellowship, collaboration, and culture are relevant processes within these organizations and technology also playing an important role.

Keywords: Complex Systems, Fuzzy Logic, Multi-Agent Systems, Organizations, Teams

1. INTRODUCTION

We live in a world of organizations, we are born in a hospital, we have our records in government organizations, we study in schools and universities, and the food we eat comes from giant corporations. This is one reason why organizations have become an important element in the present context because of the influence it has on human life. This has attracted the attention of the scientific community from different knowledge areas.

Organizations are man-made systems and their behavior is similar to a living organism (Miller, 1965), these have been classified as complex systems (Bohórquez Arévalo, 2013; Los & Zolotova, 2014), consisting of a set of elements that interact with each other where these interactions are nonlinear, and different behaviors emerge as culture, self-organization and adaptation.

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From the perspective of general systems theory (Von Bertalanffy, 1968), an organization can be seen as a system composed of several related subsystems interacting with each other. Another approach to organizations is by socio-technical systems (Trist, 1981), these are systems composed of people (social system) and technology (technical system). Another approach is the organizational cybernetics with viable systems model, this model identifies five subsystems (viability functions) necessary for the survival of a system (viability), presenting a recursive feature which allows us to analyze different levels of abstraction, for instance: Individual, Team, and whole Organization (Beer, 1972, 1979, 1985).

One of the strategies of organizations to achieve their viability is to focus on collaborative work, as the organization to which working teams belong; there are a variety of simpler work structures in which people contribute their efforts in order to achieve their own goals within the overall goals of the organization.

For example, in developing software projects generally work teams focus on building subsystems according to requirements set by customers and participate in proposing a general architecture. Team members can live locally or can work remotely causing a virtual coexistence depending on technology. These conditions create emergent behaviors that are not necessarily seen in local teams and generate other problems.

Software development becomes complex because the development process is complex depending on interaction of those involved, and the influence of technology. Making a complex systems approach to software development organizations that are globalized is necessary, since culture, collaboration and fellowship becomes relevant for team functioning.

The role played by development teams in IT organizations is crucial because they are the ones who produce software that can be sold as a product, or used as a support tool for the proper operational functioning of organizations.

The complexity of the equipment can be seen from various factors, including the nature of human beings as complex systems; complexity increases when multiple people interact, collaborating as a team, where individuals have different characteristics, as gender, age, and personality. Nowadays because of globalization one of the most important factors is the personality of individuals since studies have linked it in the performance of work (Kramer, Bhave, & Johnson, 2014).

It cannot be ignored the technical part, where technology and processes interact with the team, rapid technological progress also influences emergent behaviors such as resistance to change, quickness to learn the use of new technologies, as all of this can affect maintenance or lost of competitiveness.

Teams are influenced by the operational support that gives the organization, this means that decisions taken in higher levels within the organization have an impact on the development process and therefore in work teams.

The relevance of this paper’s research is to propose an approach to the phenomenon of emerging behaviors in software development teams to thus describe those using computational models and understand how they occur. This approach is performed by discussing the use of computational models such as multi-agent systems and fuzzy systems to model emergent behavior in software development teams.

The structure of this paper consists of six sections. Section one is an introduction describing in general terms the contents of the article. Section two describes the theoretical framework, where relevant concepts are shown for this research. Section three describes the organization as a complex system, and also ways to measure the complexity in organizations, discussing what is the role of software development teams in complex systems. In section four we discuss emerging
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