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Multi-agent simulation of group behavior in E-Government policy decision

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Abstract

To research complex group behavior in E-Government policy decision, this study proposes a multi-agent qualitative simulation approach using EGGBM (E-Government Group Behavior Model). Causal reasoning is employed to analyze it from the perspective of system. Then, a multi-agent simulation decision system based on Java-Repast is developed. Moreover, three validation experiments are designed to prove that EGGBM can exactly represent the actual situation. At last, an example of application is given to show that this method can help policy-makers choose appropriate policies to improve the level of accepting information technology (LAIT) of groups. It is shown that this approach could be a new attempt for the research of group behavior in governmental organization.

Keywords: Group behavior; Repast; Multi-agent; E-Government; Causal reasoning

1. Introduction

In recent China, with the accelerating pace of information technology applied in E-Government and China government's promotion under the guidance of Document No. 17 of Ministry of Information Industry in the year 2002, E-Government applications have spreaded at all levels, and national attentions are also attracted to a greater extent. At present, during the reform in government informationization, there have been some thorny issues. Behavioral and psychological problems are often the most difficult to solve, however they are just the key to the success of the reform.

Any reforms, whether technical or management reform, will exist a negative psychological and behavioral resistance. Governmental organizations, in the very nature, are conservative. In the face of the pressure from information, government organizations will take the initiative to resist reform. According to the survey of China Social Science Institute published in March, 2006, nowadays, there are four main obstacles of government information as follows:

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(1) *Structural inertia:* structure of government in some way shapes and guides their behavior, and tends to form a stable structure, said as structural inertia. When government is facing reform and development, structural inertia will serve as a stable inertial reaction force.
(2) *Group pressure:* some formal or informal groups have strong controls over their members. If the interest of the majority or the interest of its main leaders feel threatened in government information, this group possibly exerts pressure by regulation of the group on who are willing to accept information reform.
(3) *Existent power:* in governmental organization there are some groups that control a certain amount of power resources. Some groups tend to feel satisfied with the current state, and information may mean that their budget will be reduced. They will hinder reform. But these groups who control resource often determine the direction of the reform.
(4) *Threat of expertise:* reform on the governmental organization could threaten expertise of professional groups. For example, governmental computerized financial process will challenge those financial officers who would like to follow their old customs and practices.

Among these obstacles, groups in the organization play a decisive role. Psychological and behavioral reaction of groups in the whole process of information is delicate. Person is not as a single person, who exists in the circumstance under the influence of groups, and environment and groups will have impact on his psychology [1]. Therefore, human psychological and behavioral analysis is very necessary for proper decision-making in government information. It can provide an appropriate basis for policy-makers.

The combination of information and psychological research, in particular combination with social psychology, has become a new area of research [2]. It has been deep-in-depth studied that information method such as Internet have great impact on people's psychology, which has also created a new discipline-Internet psychology [3]. In addition to psychological research, more analysis is taken from the perspective of organization and management of groups [4], which is usually qualitative analysis.

In the social sciences, dynamical systems theory (DST) has also served as a tool for analysis in various areas of psychology such as perception, attention, speech production and human development [5]. Using the DST was able to encompass the dynamic and complex nature of social psychological phenomena. They have also written on the validity of dynamical systems as applied to, along with various concepts and methods (including ABMS), social psychological study [6]. From Vallacher and Nowak's work, we learn that the heart of social psychology is found among complex causalities. Agent based simulation has been employed to demonstrate the dynamics of reputation and social order in artificial societies. Among the areas studied are the connection between image and reputation, as well as the factors by which each is influenced [7]. Reputation is seen as an agent property resulting from the agents' socially desirable behavior such as cooperation, altruism, reciprocity, conformity or subservience. An agent is combined with data resulting from the complex interplay of the above within a simulation, resulting in a yield of useable data. This research highlights the importance of qualitative simulation in the study of group behavior. Using Multi-agent based simulation allows one to navigate effectively the complexities of group dynamics by following the rules of interaction among members.

Multi-agent modeling and simulation methods (ABMS: agent based modeling and simulation) originated in the 20th century, the 1960s, and into the mid-1990s, the ABMS has been widely publicized and been applied to social [8] and economic fields [9], military fields [10] and industrial engineering [11]. Cellular Automata (CA), also a multi-agent simulation tool, has been used to study the behavior of human and simulate migration, change of concept, as well as change of cooperation relationship in human society [12]. Multi-agent simulation is based on characteristics and behavior of individual and establishes individual characteristics and behavior in the model. Individual will be mapped as agent, individual characteristics mapped as the attributes, and individual actions mapped as the methods of agent [13]. Using agent's autonomy, reasoning, communication and coordination mechanism [14,15] to simulate an independent group of the mutual interaction between individuals, thereby structure and function of groups or the overall organization system will be researched.

An advantage of using agent based simulation is that it is necessary to think through one's basic assumptions very clearly in order to create a useful simulation model. Another benefit of simulation is that, in some circumstances, it can give insights into the 'emergence' of macro level phenomena from micro level actions [16]. Within organization science in particular, and social science more generally, scientists and practitioners are turning to computational analysis to address fundamental socio-technical problems that are so complex