

## **HOW FAULT LINES FORMED IN THE ORGANIZATION INFLUENCES ON DOUBLE-LOOP LEARNING**

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### **ABSTRACT**

One of the factors that inhibit double-loop learning in organizations is the formation of fault lines (hereafter referred to as "FLs") caused by diversity in the organization. FLs have a negative impact on the organization because they promote interactions only among individuals only with similar attributes, and interactions among individuals with various attributes throughout the organization cannot be promoted. This paper builds a model to analyze how the strength of FLs influences on organizational learning of individuals and the entire organization.

### **1 INTRODUCTION**

An important issue for companies is how to respond to the recent increasingly complex business environment. One of the effective means is the organizational learning activity called double-loop learning. This activity is said to bring about long-term growth of a company through the search and development of new knowledge (R. Espejo 1996). The concept of fault lines (FL) helps to understand the relationship between individual attributes that bring about organizational diversity and organizational performance (Lau, D. C. 1998). FL takes a state in which subgroups (SGs) are formed among individuals with similar attributes in an organization, and the organization is virtually divided into subgroups. It has been shown in previous researches that the strength of FL and the way SGs are divided affect organizational performance. For example, SG formation by FL generally has a negative effect on the organization by causing conflicts in the organization. On the one hand, van (2004) showed that FL has also positive effects on organizations as well. When FLs are formed based on categorical attributes such as gender, age, and race, their interaction and information exchange among SGs are hindered. On the other hand, when FLs are formed based on task-related attributes such as job functions and individual skills, conflicts among SGs are less likely to occur, and rather, organizational performance is enhanced through increased interaction and information exchange. Most of the findings on FL have been obtained so far from empirical researches based on questionnaire surveys and described in qualitative ways. Kumada (2021) quantifies organizational diversity in terms of the strength of FL and the number of SGs by using a cluster analysis called ASW (Meyer, B. 2013), and then quantitatively analyzes the influence of diversity on organizational performance by observing how individuals interact with each other using an agent-based model (ABM). However, it has not been clarified how the strength of FL and the number of SGs affect the way individuals interact with each other.

This paper creates an organizational model to consider the effects of organizational structure, such as the strength of FL and the number of SGs, on individuals' interaction activities. Using the constructed model, we will examine measures to facilitate organizational interactions and improve the overall performance of the organization and analyze the effects of the measures quantitatively.

### **2 MODELS CREATED**

#### **2.1 Model Created as ABM(Agent Based Model)**

In the organization, employees share their opinions and create new ideas within the organization while communicating among them in order to solve various issues. Thus, agent-based model followed by simulation analyses is expected to analyze the influence of individual actors, called agents, on the entire organization through interactions among agents. In this model, agents interact with other agents by interacting and learning from each other in order to improve their own evaluation values. By designing the model so that this activity is affected by the FL and SGs, we analyze how the structure of the organization affects activities in the organization.

## 2.2 NK model

The NK model was originally introduced as a mathematical model used in biological evolution and mathematical systems of complex systems, and has been also used to represent organizational behavior and organizational learning. In the NK model, there is a fitness function for sequence of integers whose length is  $N$ , and each of which takes the value of 0 or 1. The evaluated value depends not only on the integer itself but also on the other  $K$  adjacent integers. Thus, an integer sequence is evaluated as string with multiple integers of length  $K+1$  by fitness table. The fitness value of string is the average of the evaluated values of all integer strings.

In this paper, each agent is assigned an attribute value, which is expressed by two types of bit sequences. One is an invariant eigenvalue such as age and gender, and the other is an attribute that changes with daily activities such as skills and self-values. The FL and the SGs in the organization are determined from the eigenvalues of each agent using the ASW. The degree of adaptability of each agent is calculated by using the value of bit strings representing skills and values, referring to the conventional NK model.

## 2.3 Target problem situations represented by the model

In the conventional organizational learning models using the NK model, the performance of an organization is improved by learning agents with high adaptability within the organization. In this model, based on the findings in the literature, we express a problem situation as a target to be reproduced first in which organizational learning does not proceed well due to the influence of the attributes of individuals who form FL and SG, and analyze the effect of the measures applied to improve performance.

Lau et al. (2005) showed in their empirical study that the stronger the FL is, the more active the interaction within the SG is and the less the interaction outside the SG is, and that there is a tendency to overestimate the members in the SG and underestimate the members outside the SG. Based on these results, our model determines the learning targets of agents based on the similarity of their attributes as well as, on the degree of adaptation expressed by the NK model. The model is set up in such a way that the higher the similarity of attributes, the more highly other agents are evaluated, thus representing a situation in which learning is more likely to occur within an SG and less likely to occur outside of an SG.

## 3 EXPECTED RESULTS

In this paper, we analyze how the adaptability of the entire organization changes in each organizational situation by setting the size of the strength of FL and the number of SGs as scenarios of the organizational situation. As a result of the analysis, the progress of organizational learning, which is inherently difficult to visualize, can be indirectly measured by quantitatively clarifying how much organizational learning is advanced or inhibited by measurable organizational structures such as the FL and the SGs.

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