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# Intellectual Resources in Modern Universities: Knowledge Emergent Mechanism and Adjustable Management

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## Abstract

Based on the theory of intellectual complex adaptive system, the paper attempts to construct a “controllable self-organized” management pattern for university intellectual resources. It also illustrates an emergent mechanism of intellectual resources at modern universities and how to put it under adjustable management. This research is significant for its ideas about how to put university intellectual resources under creative management.

**Keywords:** Knowledge System, University Intellectual Resources (UIR), Intellectual Emergence

## 1 Introduction

In an age of knowledge economy, there appeared the “networked” intelligence organization [1]. One typical example of such an organization is modern university where knowledge innovation plays a key role. Characterized with a large number of high-intellectual experts and condensed intellectual resources, such an organization demands new ideas about knowledge management, its pattern and operational mechanism. In response to the demand, Wang Zhongtuo puts forward the theory that knowledge system is CAS system [2].

Alex Bennet and other experts formulate the ICAS theory [3]. Inspired by their theories, we are trying to enrich them with our findings to construct a “controllable self-organized” management pattern for university intellectual resources (UIR), to illustrate its operational mechanism, and above all to find strategies for its management.

## 2 CAS and ICAS Principles as the Foundation for UIR Management

### 2.1 CAS Theory as the Foundation for UIR Management

Since the 1990s Holland of Santa Fe Institute began to establish the theory of complex adaptive system, shortened as CAS; its key idea is that adaptation creates complexity [4]. CAS theory treats the constituencies of the system as the principal parts of intellectual activity, with self-purposes and spontaneity, and therefore the theory can be applied to UIR management.

One important property of the CAS system is its overall emergence [5]. When intellectual resources of a knowledge-intensified organization begin to aggregate, group wisdom and action will appear to accomplish tasks with organized intellectual action. From the perspective of intellectual resources management, the CAS theory can illustrate how knowledge emergence occurs at the university level.

### 2.2 Emergence as a Property of ICAS System Generated from CAS

American scholar Alex Bennet and his wife generated the concept of intelligent complex adaptive system (ICAS) out of the CAS theory [6], but the principle of ICAS was taken from emergence property theory [7]. The ICAS has eight emergence properties. They are organizational intelligence, unified and shared purpose, optimum complexity, selectivity, knowledge centricity, flow, permeable boundaries, and multidimensionality. These eight properties decide what can be served as philosophical bases for knowledge innovation in the system of UIR.

From these properties management pattern and operational mechanism of UIR can be formulated and paradigms for UIR management provided.

### **3 The Concept of UIR Management and Its Theoretical Construction**

#### **3.1 Principles of UIR Management**

First, self-organized principles will be followed by people who are responsible for teaching, research, and business endeavors at universities. Since a university is expected to take knowledge production, distribution, processing, dissemination, and transformation as its main activities, personnel training and knowledge innovation become its key tasks. Research shows that a motivating atmosphere from “self-organized” management is instrumental to knowledge innovation. The properties of university knowledge emergence are produced when a large number of individual members begin to disseminate and share tacit knowledge. And the tacit knowledge can be shared by members of an organization only after they are self-organized. This is a “bottom-up”, “networked” organizational structure. For this reason, it is only after all university professionals and researchers “self-organize” themselves that they are able to converge their power of knowledge innovation.

Second, a university’s objective management and principles of adjustment. A university should make strategies for macro-development, mobilize its intellectual resources from the system with a definite purpose, deploy them with sound reasons, and accomplish its tasks by “top-down” “instructional adjustment”. To meet the demand of a complicated, changeable environment, a university must possess: (1) the function to select information and knowledge; (2) the function to converge intellectual resources; (3) the function to construct “internal models”; and (4) the “labeling” function when a principal part of intelligence is searching for and receiving useful information. By this way intellectual resources of all specialties and personnel at all levels can be integrated into a massive effect.

Third, the optimum principles of UIR management. According to the ICAS theory, the principal parts of intellectual activity inside a university should remain highly independent, though under necessary control from the or-

ganization as a whole. Inside the same system, the principal parts of intellectual activity should remain connected among themselves. On the other hand, they should be prepared for environmental changes from outside. To make such a balance possible, demands from every aspect should be taken into consideration and a proper “degree” selected. In this way, an overall optimum of intellectual resources management can be achieved.

Fourth, the principle of dynamic balance of the “flow” in the UIR. The UIR possesses “flow” as its property. In the system of organizational intellectual resources, there are not only the flow of data, information, and knowledge, but also the flow of various experts as intellectual resources both into and out of the system. The UIR system exchanges information and knowledge with the outer world to keep the system open, and reasonable flow of experts both on and off campus as the principal parts of intellectual resources can keep the UIR structure anew and provide reasonable flow and storage of intellectual resources for the system.

The above principle is the foundation for the UIR’s “controllable self-organized” management pattern [6].

#### **3.2 The UIR’s “Controllable Self-Organized” Management Pattern**

The basic meaning of “controllable self-organized” management pattern is that by certain measures, management personnel exercise control and adjustment for specific purposes to make it possible for university experts who are responsible for teaching, research, and business endeavors to form a reasonable structure by self-organization so that intellectual resources can be best deployed.

“Self-organized” activities in a modern university refer to the process in which people who are responsible for teaching, research, and business endeavors within the organization, equipped with their own expertise and interest, and supported by their tacit knowledge both from the individuals and the group, make full use of their intellectual resources without instructional interferences from people out of the organization [4]. People of the same professional organization should be aware that the “self-organized” process includes self-organization when they are looking for cooperation, doing scientific research, and

making research plans.

Second, the organization's need of intellectual resources from experts' who are responsible for macro control and adjustment [1]. The control and adjustment of "controllable self-organized" pattern includes three aspects: how to make and implement "long-term knowledge prospect" and macro strategies within the organization, how to deploy the UIR as a whole, and how to create a soft as well as hard condition for the UIR. What "controllable" means is that the strength of the organization comes not from compulsory management, but from instructional or steering management. So long as intellectual activities of the system are confined within the boundaries (such as regulations and mechanism), these activities should be totally "self-organized".

Third, a complete sharing of tacit knowledge [3]. From the perspective of knowledge management, to create, share, spread, and transform experts' tacit knowledge within various professional organizations at a university can generate essential competitiveness on the part of the university. At a modern university, the principal parts that create values are the front-line people who are teaching, doing research, and making business endeavors. The so-called tacit intellectual resources within a university mainly include valuable innovations, possible ideas, ideas for decision making, and the ability to cooperate for innovation. These resources are imbedded in the brains of the experts who possess them as private, contextual, progressively accumulative, and, above all, not easy to spread. But if colleagues and experts at universities form a "networked" structure of self-organization, free exchanges can happen, and, what's more, tacit knowledge can be shared, applied, and transformed.

Fourth, coordination between macro adjustment and micro self-organization [2]. As the principal part of intellectual activities, a university has to have a regulatory and "instructional" management mechanism to make it possible for the organization as a whole to operate normally. But such management must go hand in hand with the "self-organized" mechanism. Proper control and adjustment are instrumental to speed up knowledge accumulation, dissemination, and application. In this way, the UIR management will turn into a positive cycle of "innovation, accumulation, dissemination, application, and re-innovation". Here management is an element of inborn variant in the system of university

knowledge and all experts in the system should participate, to some degree, in management activities. Such management starts from the upper level of the university knowledge system, extends to every corner of a professional organization, and finally get all experts involved. The coordination between "self-organized" management and "controllable and adjustable" management will be helpful not only to the operation of a university as a whole, but also to endless innovation at the university. In the end, self-adaptation and intellectual evolution will be realized.

Fifth, the essence of "controllable self-organization" is to cultivate knowledge emergence [6]. The conceptual model of the UIR indicates that, with "controllable self-organization" as its pattern, the management of the UIR can be implemented through three mechanisms: "environment creation", "resources sharing", and "emergence adjustment." The relations between the three mechanisms are: environment creation is the foundation of resources sharing and knowledge emergence while knowledge emergence is based upon how to share knowledge resources, and the essential point is how to cultivate, "control and adjust" knowledge emergence.

## **4 UIR's Emergent Mechanism and Measures for Its Adjustable Management**

### **4.1 UIR's Emergent Mechanism**

In the process of CAS "self-organization", "emergence" appears as a new structure, pattern, and property. "Emergence" occurs at the macro level of the system. When the UIR is properly managed, knowledge emergence can bring about knowledge innovations, new solutions, and decision-making strategies. The conceptual pattern of the UIR is shown in Figure 1. With self-organization of knowledge as mechanism, knowledge emergence can occur like "mushrooms" if permeable boundaries are available. New ideas are the products of intellectual activities. Although ideas are generated from an individual's brain, as a prerequisite, the organization has to provide an open platform for mutual exchange and revelation, knowledge sharing, and knowledge aggregation.

The construction of a "dialogue field" in Fig.1

is instrumental when a strong atmosphere of discussion is to be created. The dynamic balance of resources “flow” is a guarantee for the UIR system to keep contact with the outer world in terms of information and knowledge exchanges. Thus the system’s openness can be protected.

The “permeable boundaries” among organi-

zations of different specialties will serve as a guarantee for intellectual resources to aggregate, for universities to demonstrate a great variety of specialties, and for information to be effectively selected. This is an indispensable condition for the controllable mechanism of knowledge emergence to function properly.

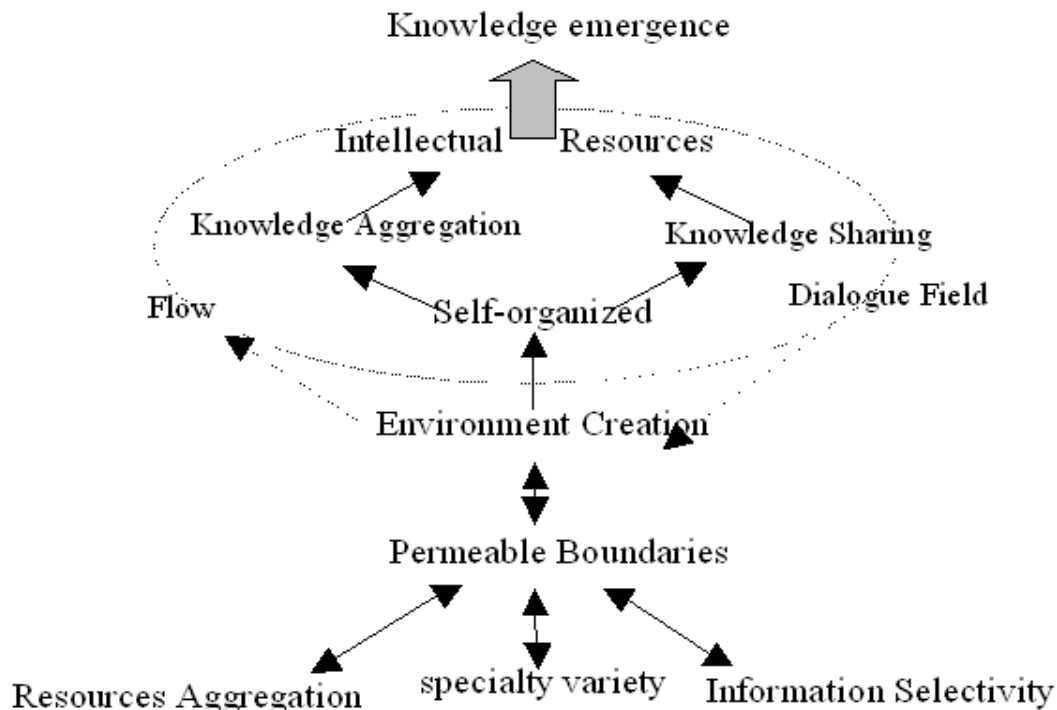


Figure 1 A UIR conceptual model

#### 4.2 Measures for UIR’s Adjustable Management

Management should undergo the following six stages before the modern UIR happens at all levels:

First, for the management of UIR, focus should be directed to the time when knowledge emergence occurs and analysis should be made about the role chances play when knowledge emergence occurs. Based on the CAS theory, it is necessary to investigate the structures and properties of knowledge emergence that happens in different professional organizations, especially about how random incidents are soon amplified for knowledge emergence. Knowledge emergence can be established, but it can be destroyed too. For this reason, research should be done about how to take proper nurturing measures to increase the chances of knowledge emergence.

Second, attention should be given to the role played by metaphors, analogies and model’s methods in cultivating knowledge emergence among a project team because they are expected to activate “inspiration”, and accelerate knowledge emergence. For instance, in his case study of enterprises motivated by knowledge innovation, Ikujiro Nonaka presents “the theory of automobile evolution” and this metaphor was responsible for the birth of Honda City automobiles designed by R&D project team.<sup>[7]</sup> The successful development of this product benefited from the project team’s knowledge emergence and group intelligence. The method of metaphor has an obvious function in “hastening the birth” of knowledge emergence when the ideas of a team are being clarified from chaos to order.

Third, by intensifying “positive setback” and amplifying the “key signals” or the signals of “innovative ideas”, valuable or creative thoughts can be constantly generated and developed.

Valuable ideas such as opinions from university experts and decision proposals from management personnel should not be rejected before careful consideration. Strengthened communication among team members is one important aspect to incubate positive setbacks from an organization. There are many ways for communication and contact, such as face-to-face talk, conference, and email. There are also a great many contents in such communication and contact, such as contact for academic information, exchange of ideas, discussion about the prospect of a research project. In this way optimization of information and knowledge sharing will turn from possibility to certainty.

Fourth, to create an environment of knowledge differential. Through extensive contact with people out of a university--organization of knowledge—e.g. experts of science and engineering and management who seek for business startups and flow, dynamic exchange of information and knowledge with the outer world can be accomplished. To invite academic experts from other universities, research institutions or business circles to play a role in the organization and to have regular exchange of ideas, a dynamic environment of a variety of intellectual resources can be created. Through communication and contact, management personnel will be able to evaluate the values of certain information and knowledge when a decision is made so that knowledge innovation and decision management can be guaranteed.

Fifth, challenging but undefined tasks for individuals of intellectual activity. Management personnel at a higher level may find it useful to design undefined tasks instead of defined research direction or objective. They are advised to provide incomplete research models to stimulate experts' various exploratory activities. Incomplete research models can effectively stimulate the people who are responsible for teaching, research, and business endeavors to seek new methods and encounter collisions for knowledge emergence.

Sixth, a comfortable and loose atmosphere for intellectual exchanges. An environment of frequent contact and intellectual activity such as tutorship, task-based cooperation, Community of

Practice (shortened as Cop), "knowledge bar", can be adopted for the UIR adjustable management to help people share tacit knowledge. Such an environment is exactly what is needed for knowledge recreation, new idea incubation, and knowledge innovation.

## 5 Conclusions

The paper constructed a theory of UIR management, specifically a controllable self-organized pattern of management, benefiting from intelligent CAS theory. It also illustrated an emergent mechanism of knowledge resources at modern universities and how to put it under adjustable management. It put forward theoretical implications, six UIR management countermeasures.

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