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Guest Column 1:

Expert Mining for Solving Social Harmony Problems

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Social Harmony System

We may define following systems, which closely related with the social harmony system:

(1) Nature – Resource – Environment system;
(2) Economy system;
(3) Social system.

For coordination between system (1) and (2) our government had proposed the policy for sustainable development. Many scientific methods to help describe the sustainable development on the base of more clear qualitative and quantitative demonstration has been developing.

In recent ten years with the development of economy the contradiction has emerged between the systems (2) and (3), such as corruption, an income gap between interior areas and coastal regions as well as between

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Researcher Column:

Knowledge Sciences and *Nanatsudaki* Model of Knowledge Creation Processes

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We observe here first the increasing importance of the concepts of *knowledge management*, *technology management*, *knowledge economy*, *knowledge civilisation*, recent theories of *knowledge creation*, etc. The importance of these concepts today implies that we are observing now a need and an emergence process of a new understanding of *knowledge sciences.*

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Expert Mining for Solving… (con't)

urban and rural population, unemployment, poverty, poor production safety and pollution etc.

In order to establish the harmony society or coordinate the relationship between systems (1), (2) and (3), we have to use scientific methods both from social and natural sciences to describe the phenomena more deeply and widely.

From the channels of acquaintance of information and knowledge we may divide our society into three societies: formal and central society, informal society and network society. The first one undoubtedly controls our society dominantly; we may use most data resources and formal information from statistics, press and documents from authorities in different level of governments. But we may also find that the other two societies have their own channels for obtaining information and knowledge which played some roles in our society. Considering the new features in the social harmony system we wish use Metasynthesis system approach proposed by Qian et al., some new techniques and methods, such as 6 mining methods (Data mining, Text mining, Web mining, Psychology mining, Model mining and Expert mining).Here we will emphasize the expert mining.

Metasynthesis System Approach

Metasynthesis approach is to integrate various data, information, and model, experiences, wisdom and computer capacity to solve the complex system problems. For realizing this system approach our team in a major project supported by National Natural Science Foundation of China has designed a flowchart: Synchronous → Asynchronous → Synchronous, or Meeting I → Analysis → Meeting II.

And a series of theory, methods, modeling paradigms and computer software and platforms are developed, and had been applied to some macroeconomic problems, e.g. forecasting the GDP growth rate and the one under the impact of SARS, and some general complex economic systems

For social problem solving mental factors instead of physical factors play more important roles to social impact. Then psychological factors and social behavior modeling will be in consideration to expose some attitudes towards some concerned problems based on psychological tests. Internet is now another carrier of public opinions. Although there are official channels to get information, prompt information and true public opinions may be easier emerged via unofficial channels. From technical point of views, more mining techniques, such as data mining, text mining, web mining and opinion mining, multi-media information mining shall be applied to acquire further information from different media.

Both psychological tests and various technologies provide information via diverse channels, while it is still necessary to consider opinions from human expert.

Expert meeting is a usual way to collect opinions or even knowledge or wisdom toward difficult issues. Moreover, it is a way of collective problem solving. From another point of view, expert meeting could also serves as one kind of expert mining, i.e. to acquire more information from human experts. To facilitate

expert mining, computerized tools for group work will be applied; such as group argumentation environment (GAE) and new functions are needed to be explored

Expert mining

Expression of expert's thoughts may be taken in following fashions: speak explicitly (language, word); speak implicitly-tacit; express by gesture (expression in eyes, gesticulation, and tone); speak on Web; speak lie (speak insincerely, false intelligence, rumor;

We may propose some basic ideas for mining the thoughts: Netting globally, optimum seeking locally; 6 mining (Data mining, Text mining, Web mining, psychology mining, Model mining, Expert mining); from tacit to explicit (SECI model); combination of human and machine; spatial information analysis.

Then we will metasynthesize the expert's opinions by text, meeting and interview.

(1) Metasynthesis of opinions by text have three kinds: Simple survey (narrative); Meta-analysis; Qualitative Metasynthesis

(2) Metasynthesis of Opinions by meeting should consider the types of meeting and discussion, Ba, Facilitation, and Mediation.

There are three types for convening the expert meetings: 1) *brainstorming type* for collecting the vivid and frank opinions; 2) *studying type* for collecting and studying some opinions on the base of deep investigation; 3) *decision type* for concentrating the opinions. In order to obtain the consensus from experts we also studied different methods, tools for getting the consensus, such as DMTMC-system, GAE and PathMaker etc.

There are a lot of discussion types here we only wish mentions some of them: 1). Syntegration (Beer); 2).meeting on Web (WebScope); 3) Nominal Group meeting

In order to run the meeting well we have to pay attention to the Ba, Facilitation, and Mediation in order to run the meetings efficient and effective

(3) Metasynthesis of Opinions by interview deeply Psychology mining can help people to analyze the thinking behinds.

Recently we have run a scientific test on discussing the social harmony by the expert mining, psychology mining and model mining in a MBA course. We divide all MBA students into six groups to attend the discussion on six selected topics separately. In each group we assign one facilitator using different discussion methods with some useful tools and methods, such as PathMaker, GAE, UciNet, GIS, interview and game theory. Most of them satisfied such new scientific discussion test.

The investigation for social harmony system in China is just started in recent years. We will put a lot of efforts for running investigation, especially if we can collect a lot of data and use many new techniques, the problem for metasynthesizing all concepts, methods, experience and tools still stands as a hard task for our Chinese scientists.

Knowledge Science and Nanatsudaki… (con't)

This is not a discipline but rather interdisciplinary field that goes beyond the classical epistemology, includes also some aspects of *knowledge engineering* from

information technology, some aspects of *knowledge management* from management and social science, some aspects of *technology management*, some aspects of *interdisciplinary synthesis* and other techniques (such as decision analysis and support, multiple criteria analysis, etc.) from systems science.

This emergence process is motivated primarily by the needs of an adequate education of *knowledge workers* and *knowledge managers and coordinators;* however, also the research on knowledge and technology management and creation needs such interdisciplinary support.

The classical understanding of the words *knowledge science* might imply that it is epistemology enhanced by elements of knowledge engineering, knowledge management and systems science. However, the strong disciplinary and historical focus of epistemology suggests an opposite interpretation: knowledge science must be interdisciplinary, thus it should not start with epistemology, although it must be enhanced by elements of epistemology. The field closest to knowledge sciences seems to be systems science – at least, if it adheres to its interdisciplinary origins and does not suffer from the unfortunate disciplinary division into *soft* and *hard systems science.*

The cultural sphere of social sciences with humanities differs today from the cultural sphere of technology, and the latter differs from the cultural sphere of hard sciences, because they adhere to different values, have different episteme, use different concepts and language. We discuss these fundamental issues here because we insist that diverse disciplines must be represented in knowledge sciences *on equal footing.* There is an observable tendency today in management science to teach future managers while insisting that the episteme of social sciences is superior. But, when taught that way, the future managers will not be able to understand knowledge workers coming from hard science or technology. Future managers should thus understand each of these three episteme, for example, should know that *technology is an art of constructing tools, not a technocratic, functionalist worldview.*

To summarize, we should thus require that knowledge sciences give home to several disciplines (in an alphabetic order):

- Epistemology,
- Knowledge engineering,
- Management science with knowledge management,
- Sociological (*soft*) systems science,
- Technology management,
- Technological (*hard*) systems science,

on equal footing, with a requirement of mutual information and understanding.

Knowledge science is naturally concerned also with models of knowledge creation processes. In the book *Creative Space,* we have shown that there are many spirals of knowledge creation, but we can distinguish two essential types. On of them are spirals of *organizational character;* typical for market innovations and practice-oriented organizations, another type are spirals some of *normal academic character,* typical for research organizations.

The *normal academic research* combines actually three spirals: *hermeneutics* (gathering scientific information and knowledge from

literature, web and other sources and reflecting on these materials), called by us the *EAIR* (*Enlightenment – Analysis – Immersion – Reflection*) *Spiral; debate* (discussing in a group research under way), called by us the *EDIS* (*Enlightenment – Debate – Immersion – Selection*) *Spiral; experiment* (testing ideas and hypotheses by experimental research), called by us the *EEIS* (*Enlightenment – Experiment – Interpretation – Selection*) *Spiral.* Since all of these spirals begin with having an idea, called the *Enlightenment* (*illumination, aha, eureka*) effect, they can be combined into a *Triple Helix of normal knowledge creation,* typical for academic work.

These three spirals contained in the *Triple Helix* do not exhaustively describe all what happens in academic knowledge creation, but that they describe most essential elements of academic research: gathering and interpreting information and knowledge, debating and experimenting. These spirals are individually oriented, even if a university and a laboratory should support them; e.g., the motivation for and the actual research on preparing a doctoral thesis is mostly individual. Moreover, the *Triple Helix* only describes what researchers actually do; it is thus a descriptive model that does not give clear conclusions *how to organize research.*

However, there are also several other creative spirals described and analyzed in the book *Creative Space.* Important for practical knowledge creation, for innovations, particularly in industry and other purpose-oriented organizations are the *organizational creative spirals,* motivated by purposes of a group and aimed at using the creative power of the group. One of them is the widely known *SECI* (*Socialization – Externalization – Combination – Internalization*) *Spiral;* another, actually older but formulated as a spiral only recently, is the *brainstorming DCCV* (*Divergence – Convergence – Crystallization – Verification*) *Spiral;* still another, the Occidental counterpart of the *SECI Spiral* (which is of Oriental origin), is the *objective setting OPEC* (*Objectives – Process – Expansion - Closure*) *Spiral.*

Each of these spirals has a different role and can be applied for different purposes, but all have their strengths. Unfortunately, they cannot be easily combined into a multiple helix like the *Triple Helix,* because they do not share the same elements. However, the main challenge is not only to combine these spirals between themselves, but also with the spirals of academic knowledge creation. This might be important for several reasons:

- Combining these spirals might strengthen academic knowledge creation, because it would increase in it the role of the group supporting the individual research;
- Combining these spirals might strengthen also industrial innovation and knowledge creation, because some individual elements should be explicitly accounted for;
- Combining these spirals might help in the cooperation of industry with academic institutions in producing innovations, because it could bridge the gap between the different ways of conducting research in academia and in industry.

With these purposes, we present here the *JAIST Nanatsudaki Model* – an exemplar

(serving as an example to follow, a prescriptive model) of a process of knowledge and technology creation. It consists of seven creative spirals; and each of these spirals might be as beautiful and unpredictable in its creativity, as water whirls in the seven waterfalls (nanatsudaki) on Asahidai close to JAIST. The seven spirals include the three academic and the three organizational mentioned above, but are supplemented by a planning *roadmapping spiral* based on the *I-System* (the pentagram of Nakamori). The model is build following the assumption that its applications will concern technology or material science development, thus the application phase consists of experimental work.

Although the model could start with any constitutive spiral, we assume that it starts with *objective setting* (thus uses part or entire of the *OPEC Spiral*) and end with the applications, experimental work, here represented by the *EEIS Spiral.*

Importance of some of its constitutive spirals was recently supported empirically by the results of a survey of opinions about creativity conditions conducted at JAIST.

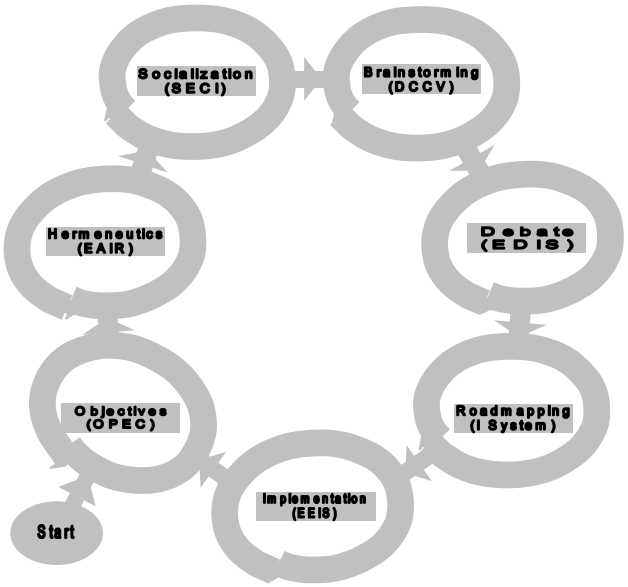

Diagram of JAIST Nanatsudaki Model (Septagram of Creative Spirals)

Introducing the On-going Research by Research Assistants at the COE Center

(1) Andre Saito *(PhD candidate at the School of Knowledge Science; E-mail: asaito@jaist.ac.jp)*

Research Title: Developing knowledge management competence through graduate education

Abstract: This research aims to apply the concept of competence to the knowledge management activity, proposing a framework of *knowledge management competence* that will contribute to facilitate the development of core skills for the knowledge economy. The emergence of the knowledge economy has brought new challenges to organizations, managers and workers. As knowledge becomes more important than capital, land or labor in the creation of economic value, organizations experience an acceleration in the pace of innovation and their boundaries begin to blur, managers must adopt strategizing as a way of life and have to master the complexity of knowledge work, and workers are compelled to learn continuously, expand their creativity, and collaborate more and better. The field of knowledge management has been advanced in

response to such challenges. Drawing contributions from a wide range of disciplines like economics, management, information studies and computer science, research on knowledge issues has grown steadily in the last decade. In practice, experience on knowledge management advances as organizations of all sectors and sizes continue to launch initiatives to improve their capacity to create, transfer and use knowledge. Despite the progress of the field, little work has been done regarding the development of knowledge-related skills in managers and workers.

(2) Nie Kun *(PhD candidate at the School of Knowledge Science; E-mail: niekun@jaist.ac.jp)*

Research Title: Social network analysis and knowledge mapping for implementing the EO-SECI and the pentagram I^5-System

Abstract: Starting from the discussion of knowledge creation processes, both organizational and normal academic knowledge creation, we emphasize the technical solution and application of these knowledge creation models, since these models are well established and interpreted, it is still difficult to implement them. EO-SECI and I^5-system are two of the most famous one, this article was going to describe large scientific research process using EO-SECI model, and Intervention and Integration of I^5-system were supposed to be the two most important and difficult subsystems, taking a look at an example which is a large project in China consisting of many small sub-projects, actually, each sub-project by a group had done a excellent job, but the challenge was to integrate all the sub-project as a whole to step up the project, finally, we found that Social network analysis and knowledge mapping are targeted ways to these two subsystems.

(3) Haigang Song (*PhD candidate at the School of Knowledge Science; E-mail: haigang@jaist.ac.jp)*

Research Title: Regional Knowledge Creation in Cluster Promotion Organizations through Ma Management

Abstract: Despite some significant contributions to the regional innovation research field in previous regional innovation theories, there are still at least two theoretical gaps that need to be filled: (1) what are the knowledge creation processes among diverse members?, and (2) what are the structural elements, processes and role of cluster promotion organizations based on knowledge management?. The purpose of this research is to create a new framework for cluster promotion organizations to fill these theoretical gaps by introducing a new concept of Ma. The objectives of this research are three fold: first, to define a new concept of Ma, and indicate three main characteristics of Ma by integrating Japanese concept Ma, western philosophy with Chinese philosophy; second, to define the concept of Ma Management, and indicate three types of knowledge on which Ma Management based; third, to discuss epistemological levels, conditions, and structural elements of Ma Management in a cluster promotion organization.

(4) Tian Jing *(PhD candidate at the School of Knowledge Science; E-mail: jtian@jaist.ac.jp)*

Research Title: Knowledge Management and Knowledge Creation in Academia

Abstract: This thesis advances the belief that knowledge management (KM) is applicable not only in industrial and market organizations, but also in academia – at universities and research institutes. Specific features, methods and techniques of KM in academia are analyzed or proposed, so as to develop an appropriate framework, new methods of measurement and new approaches to improve research efficiency and effectiveness as well as to promote scientific knowledge creation.

(5) Hongtao Ren *(PhD candidate at the School of Knowledge Science; E-mail: hongtao@jaist.ac.jp)*

Research Title: Implementing Creative Environments for Scientific Research

Abstract: The research considers the design and implementation of environments that support creative processes (Creative Environments, CE for short) from a software engineer's perspective, using experience from two implemented Creative Environments. Starting from user requirements for a CE and from models of creative processes, the research describes a functional specification of a CE. From this specification, a general modular architecture of a CE is derived. The paper considers methods of data representation in a CE. The paper also describes two implemented Creative Environments and relates the experience of the two implementation efforts. The first described CE has been implemented at the Japanese Advanced Institute of Science and Technology (JAIST), and the second at the Polish-Japanese Institute of Information Technology (PJIIT). The subject of information security in a CE is also considered in the paper.

Upcoming Events

- 'Social Innovation Forum'Tatsunokuchi, Ishikawa, August 1, 2006
- JAIST Forum, Tatsunokuchi, Ishikawa November 10 - 13, 2006
- The 7th International Symposium on Knowledge and Systems Science (ISKSS) "Towards Knowledge Synthesis and Creation" Beijing, China, September 22-25, 2006

COE Center News

- *Dr. Hiroyuki Tsuruoka* joined the Center as Visiting Fellow as of April 1, 2006.

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