A Human-centered information system Research framework: metasynthesis

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With the viewpoint of system sciences and noetic sciences,this paper propose a new framework for IS research framework based on OCGS and metasynthetic engineering. this IS framework is going to answer the question for IS solving problem as thus, what is the reality, what we can do and how we do. So this type information system is knowledge conductive, human-centerd date computing. Men guide and decide the key points with creative thinking, machines carry out the repetitive and tedious work.

Keywords: IS, meta-synthetic engineering, open complex system, knowledge, interactions

1. General remarks

With different view of understanding information system, information system research frameworks can be divided on different principles into the following different class types.

First, with the understanding that social science plays an important role in natural science, Burrell & Morgan presents a perspective for a research framework in the social sciences in 1979. Among the natural sciences, which include research in the physical, biological and behavioral domains, social science plays an important role. Extended from this framework, including the "human nature" in the ontology and adding "ethic" as a new dimension, Iivari *et al*. presented a new framework and applied it in an IS development context in 1998. Dimensions of the paradigmatic analysis are *ontology*, *epistemology*, *research methodology*, and *ethics.* Moreover, all these dimensions are not mutually exclusive dichotomies because "an Information System Development Approach may simultaneously incorporate assumptions from more than one paradigm". And with "ethics" we look more at the role of IS science (what this role should be) and at IS research value.

Second, with the interactions between the two species of scientific activity: design and natural sciences, March & Smith present a two-dimensional framework for research in information technology (IT) in 1995. Taking as reference Simon's (1981) work, March & Smith state that two distinct pieces of science, design (prescriptive) and natural (descriptive) sciences can contribute to IT research.

Another IS research framework is proposed by Järvinen in 2001. There are two main classes with regard to the type of research question: one class contains research questions concerning what is a (part of) reality – *basic research* – and the other includes research questions that stress the building and evaluation process of innovations – *applied research*. Concerning the two research questions, the author divides research strategies into six classes, separates the mathematical approaches from the other approaches that do not have a direct link with reality, and adds social science to describe the human side of life.

The researches above are rather straight-forward, but the point of view stresses too much on the concrete intension, so the essence of the information system is thereby neglected. In this paper, based on open complex giant system and its methodology, i.e. meta-synthetic engineering, I therefore argue for a different approach to a new research framework for information system:

[1] Information System (IS) is a tool for human being to solve open complex problem, which is "complex organizations of hardware, software, procedures, data, and people, developed to address tasks faced by individuals and groups, typically within some organizational setting".

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So information system must be a man-machine system. Men guide and decide the key points, and machines carry out the repetitive and tedious work. In the process of solving the problem, the experience and knowledge of the expert group contributed much to its success, i.e. Human-centered.

[2] We must incrementally build up the capabilities of intelligent information systems for solving some certain problem or fulfilling the tasks. Having complete systems at each step of the way and thus automatically ensure that the pieces and their tools are valid.

[3] At each step we should build complete intelligent information systems that we let loose in the real world to solving problem in reality. Anything less provides a candidate with which we can delude ourselves.

We have been following this approach and have built a series of intelligent systems. We have reached a conclusion [4] and have a hypothesis [5].

[4] Information system with human beings have the complexity outlined as thus: The system and its subsystem exchange energy, information or material with environment; the subsystems of many varieties have different ways of expressing and acquiring knowledge; the structure of the subsystems change with evolution, so the structure of the system is in a state of flux. What is the reality, what and how we can do are objects of IS solving complex problems, human-centered and in reality may be principles to design the information system.

[5] Computer is intelligent, but it can not creative. So it is fool, and it is a intelligent tool for men solving certain problem.

With viewpoint of system sciences and noetic sciences, Human-centered and Reality have been the central issue in information system framework only because it has provided a thinking deeply interface between IT otherwise isolated modules and conference papers.

2. the IS Framework based on Meta-synthesis: meta-synthetic engineering

2.1 Meta-synthetic engineering

As one of science and technology domains, systems science takes systems as its study object from its application to the basic theory research. Early in 1990, Chinese scientist H.S. Tsien and his colleagues proposed a new discipline of science—the study of open complex giant system(OCGS) and its methodology, i.e. meta-synthesis (meta-synthetic engineering from the qualitative to the quantitative).Depending on the quantity and interactive complexity of the subsystems and variety of subsystems contained in the systems, system can be divided into two large groups: simple systems and giant systems. If the number of subsystems is comparatively large(e.g. a hundred), such as a manufacturing plant, it can be called a large system. No matter which it is, small or large, such a simple system can be studied, starting from the interaction of the subsystems, then directly synthesizing the dynamic function of the complete system. This can be called the direct method. At most, a large computer or a supercomputer is needed to process such a system. If there are a large variety of subsystems with hierarchical structure and complex interrelations, then the aggregate is called a complex giant system. As examples, there are the biological system, human brain system, social system, etc.. On the higher level are systems with human beings as their main subsystems. For such, “open” and “complex” have newer and broader connotations. Here the openness of such systems can be summarized as the following (1) system and its subsystems exchange information with the outside world; (2) the subsystems acquire knowledge by learning. Moreover, the complexity of such systems can be outlined as thus: (1) between the subsystems there are many modes of communication; (2) subsystems are of many varieties; (3) the subsystems have different ways of expressing and acquiring knowledge; (4) the structure of the subsystems change with evolution, so the structure of the system is in a state of flux.

OCGS’ methodology is meta-synthesis: meta-synthetic engineering, characteristics of meta-synthetic engineering from the qualitative to the quantitative can be summarized as follows: (1)Based on the characteristics of complex mechanism and large number of variables of the OCGS, qualitative study and quantitative study are united organically; qualitative comprehension is raised to quantitative comprehension. (2)Owing to the complexity of the system, scientific theory and empirical knowledge must be combined, and piecemeal of knowledge of the object world must be collected to solve problems. (3)With system in mind, various scientific disciplines are studied as group. (4)According to the hierarchical structure of OCGS, macroscopic study and microscopic study are united. (5)Application of this method should be supported by computer system, not only including management information system and decision support system, but also the function of meta-synthesis. It is these characteristics that make the

method capable for solving complex problems in the OCGS. Its significance is far above the progress and development of science and technology.

2.2 IS in the viewpoint of system sciences

According the system classification above in 2.1, information system, which is "complex organizations of hardware, software, procedures, data, and people, developed to address tasks faced by individuals and groups, typically within some organizational setting", is a classic open complex system in higher level with human being as main subsystem. To solve the problems of IS, meta-synthetic engineering from the qualitative to the quantitative is its methodology.

In order to address tasks faced by individuals and groups, IS need to unite organically the users, data about certain tasks, all sorts of information, and the computer technology, and to unite scientific theory of various disciplines and human experience and knowledge. Successful application of IS depends on giving full play to the synergetic advantages of the system.

In the process of solving the problem, the experience and knowledge of the users contributed much to its success. The distinguishing feature of the knowledge type is in solving problems by knowledge-controlled inductive method rather than precise quantitative procedure. This is because a great part of knowledge is empirical and cannot be described with precision. Knowledge is a fluid mix of framed experience, values, contextual information, and expert insight, in general falling into one of two categories: explicit or tacit. Tacit knowledge resides in people's mind, while explicit knowledge is knowledge that can be articulated using grammatical statements, mathematical expressions, specifications, and manuals. As a general rule of thumb, explicit knowledge can be documented, archived and codified, often with the help of IS, such all kinds of mining tools, Text mining, KDD and DM, ect.. For IS, much harder to grasp is the concept of tacit knowledge, or the know-how contained in people's heads. The challenge inherent with tacit knowledge is figuring out how to recognize, generate, share and manage it. While information technology in the form of e-mail, groupware, instant messaging and related technologies in IS can help facilitate the dissemination of tacit knowledge, identifying tacit knowledge in the first place is a major hurdle for most organizations. There is dynamic complexity for grasping tacit knowledge in people's heads, concerning the qualitative-quantitative research, including research in ontology, interactive epistemology, noetic science, cognitive science, human nature and behavioral domain, so social science plays an important role.

Solving problems means to study what is the reality, what we can do, and how we do in reality. What is reality? Data and information reflects reality, empirical knowledge reflect reality too. So based the study by Järvinen (2001), Approaches of study the reality divided into six classes: *mathematical approach*, *mathematical approaches*, *conceptual-analytical approaches*, *theory-testing* and *theory-creating approaches*, and *innovation building* and *evaluation approaches*. Here mathematical approach has a direct correspondence to objects in reality. What we can do and how we do are high related to the men's cognition, noetics and wisdom. Human wisdom includes the qualitative opinion (thinking in imagery) and the quantitative understanding (thinking in logic), the quantitative understanding can be done by computer built on the logic, but the qualitative opinion is only done by human being. So meta-synthetic engineering from the qualitative to the quantitative is to combine the human's wisdom and the computer's high capability to reach beyond nature (*physis*) as we perceive it, and to discover the "true nature" of things, their ultimate essence and the reason for being. There are hierarchical structures in meta-synthetic engineering as thus: micro motives and macro behavior, empirical experience, hierarchy of advanced science and technology, methodology. In qualitative opinion, with the view of system sciences, there are individual thinking, individual thinking and situation (or natural & social), Group Thinking, Group Thinking and Society. All the representation is illustrated in figure 1.

So based on Meta-synthetic engineering combing human's thinking in imagery and logical reasoning &machine intelligence, the research framework of IS to solve problems is built on the basis of system sciences, cognitive& noetic sciences, illustrated in the fig.2

3. Integrate learning organization and knowledge creativity

In CWME, being faced with open complex problem, the generalize members is the most creative component interacting with each other. Moreover, the individual action has effect on the others as well as being effected by the

environment, and there is the dynamic complexity for man's social being determines his consciousness. HWME is driven by interactions.

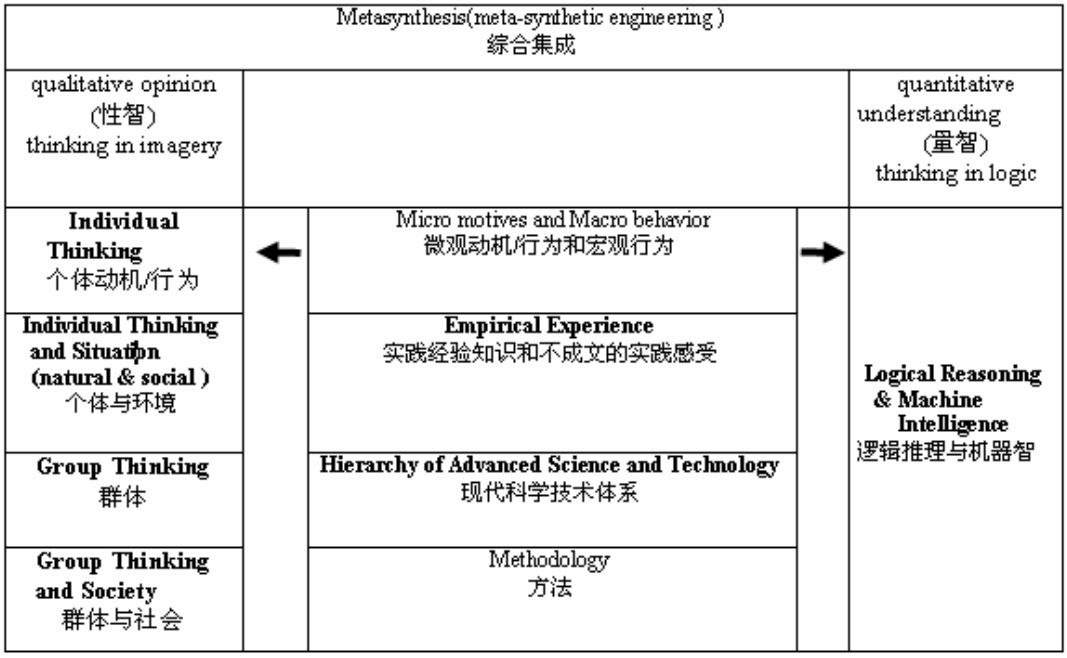

Fig.1 Meta-synthetic engineering combing human's thinking in imagery and logical reasoning &machine intelligence

To make the whole be smarter than the sum of individuals in a dynamic complex environment [19], i.e. collective intelligence emergence, it requires interactions among the generalized members and more understanding, knowledge, preparation, and agreement than one person's expertise and experience provides. So learning organization is fused into the coherent body of interactions, this makes HWME be a global organization, where new and expansive patterns of thinking are nurtured as well as collective aspiration is set free, making people continually expand their capacity to create knowledge from the explicit to the deeper explicit as from the tacit to explicit, from the explicit to the deeper tacit as from the tacit to deeper tacit by means of positive feedback.

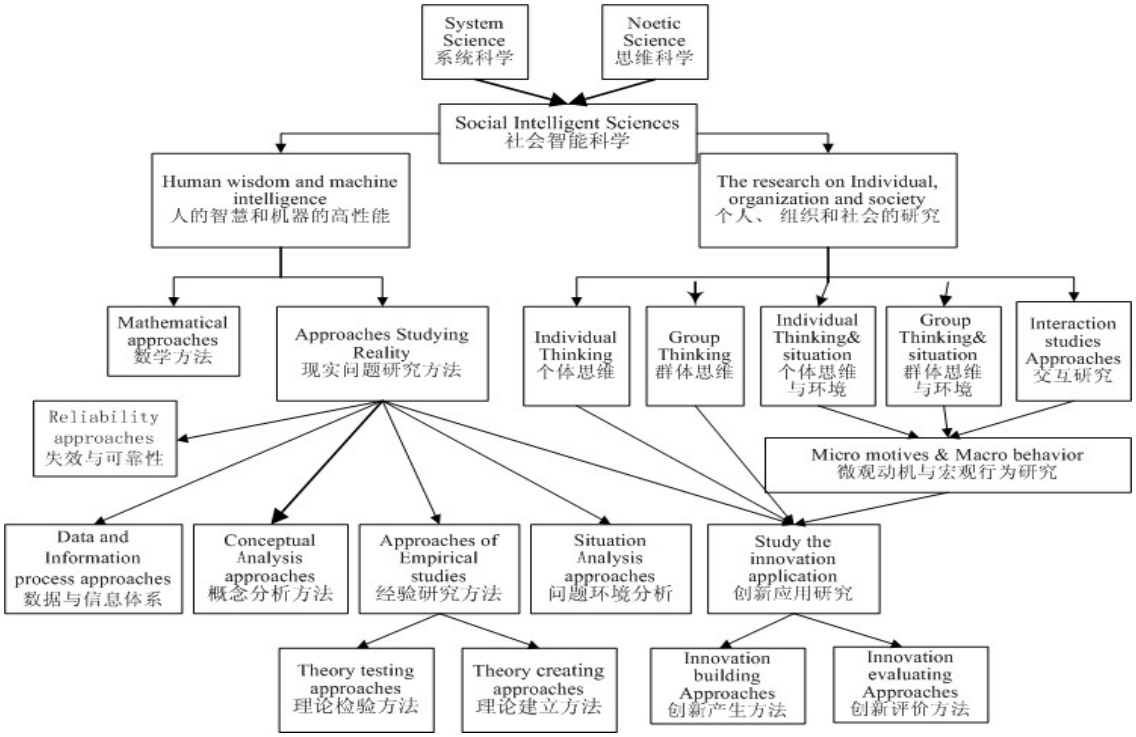

Fig.2 the research framework for IS based on meta-synthetic engineering.

Further, the process of interactions leads to the emergence of collective wisdom of the whole participants. The system implement of the fusion is realized through the computational work on discourse and dialogue in artificial intelligence and computation language domain.

3.1 kinds of interactions

The one inter-effect is the interaction between the human members and the especial member, in which the www assist the individual to think and provide the authoritative opinion in www for the existed human members, just like the above in section 2, the www is considered as an especial member orienting on problem. Thus, this inter-effect is regarded as the especial interaction among or between the generalized members.And the other inter-effect is the interaction among or between the members. At local level, the discourse of the member is embedded the member's explicit thought in formal language, involving intangible factors such as personal belief, perspective, and the value system. It is difficult to understand at local level.The inter-responding relationships among the generalized members induce the network of responding environment in HWME, which can be a rich source of information about the content of the environment.

3.2 The effective interactions among members of the ways learning organizations

The members think about problem congruently with their theories-in-use, i.e. mental models which are remained unaware and unexamined, but are active—they shape how members solve the problem. Metal models, defensive routines and leaps of abstraction have a great effect on knowledge creativity.

According to the theory of learning organization proposed by Senge, et al, the discuss and dialogue joined with system thinking, self-reflection in and on action, and balancing inquiry and advocacy, can overcome the obstacles to interact effectively, emerge the experience of the member, change the metal model on his own initiative, convert the knowledge from the tacit to the explicit, from the explicit to deeper explicit, from the explicit to the tacit, from the tacit to deeper tacit, and emerge the collective wisdom from the global organization of the HWME.

So the effective interactions among generalized members in HWME are the two distinct conversation ways: effective dialogue and discuss with self-reflection openness. And it is necessary to apply some approaches as follows: system thinking, self-reflection, balancing inquiry and advocacy.

Further, the law of effective interactions in HWME is the self-reflective openness discussion and dialogue balancing inquiry and advocacy.

4. Conclusion

This paper propose a new framework for IS research framework based on OCGS and metasynthetic engineering. With the viewpoint of system sciences and noetic sciences, this IS framework is going to answer the question for IS solving problem as thus, what is the reality, what we can do and how we do. So this type information system is knowledge conductive, human-centerd date computing. Men guide and decide the key points with creative thinking, machines carry out the repetitive and tedious work.

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