

The Fourth International Workshop on  
Meta-synthesis and Complex System

July 22-23, 2004, Beijing, China

Program and Abstracts

**Organized by**

Institute of Systems Science, Academy of Mathematics and Systems Science,  
Chinese Academy of Sciences, Zhongguancun, Beijing 100080

## PREFACE

Formerly as a Sino-Japan workshop, the International Workshop on Meta-Synthesis and Complex System aims to facilitate the exchanges between Chinese and Japanese scholars in the field of systems science, especially complex problem solving and cooperation among researchers involved into the major project on *Man-Machine cooperated Meta-synthetic Support for Macro Economy Decision-Making* (Grant No. 79990580) sponsored by Natural Science Foundation of China initiated in the June of 1999. As the workshop had gained so much attentions not only from both Japanese and Chinese scholars, but also from Australian and European people during and after the successful MCS'2001 (Beijing), MCS'2002 (Shanghai) and MCS'2003 (Guangzhou), the fourth international workshop is planned for the researchers to exchange the state-of-the-art work in systems sciences, complex problem solving and advanced modeling, creativity support system, knowledge science, complexity research, etc. intensively in the July 22-23 of 2004 in Beijing. Some feature lecturers include an introduction of the Japan MEXT 21st Century COE Program on Technology Creation based on Knowledge Science, system methodologies and various modeling strategy research on different complex problems.

The concerned NSFC project is finished in the end of last year. Before the incoming final expert assessment, the workshop provides an opportunity for part of members of the NSFC major project to report impressive progress and review achievements within past five years. Different from past workshops, a specific session on exhibition of computerized results, such as various tools or platforms for group argumentation, group decision making and consensus building, complex network research, etc. will be arranged. The half-day activity is not only as a rehearsal before the final check from NSFC, but to contribute our latest results for those who are so interested in meta-synthesis approach and even eager to apply some of our lab results into practice. Moreover, we wish to disseminate our ideas and practices in meta-synthesis and complex problem solving to a wider community. The workshop is oriented to the audience who wish to learn effective concepts, methodologies and advanced tools to

tackle those complicated problems in strategic planning, organization diagnosis, project management, knowledge creation for the enhancement of the organizational core competence, etc. and to explore next-generation knowledge intensive tools for organizational thinking and decision making. Besides keynote speeches which will last one day, two technical streams, meta-synthesis and advanced modeling, complex system and complexity research are set during the workshop.

On behalf of program and organizing committee, we would like to thank all the people who contribute abstracts or endeavors to this workshop. We want to express our acknowledgements to Institute of Systems Science, Academy of Mathematics and Systems Science, Chinese Academy of Sciences, and national Natural Sciences Foundation of China for great support. We hope to see a growing community to distribute new ideas and latest research results in meta-synthesis and complex system modeling.

Thanks for your contributions. Hope you have good experiences during MCS'2004.

GU, Jifa  
Wang, Huanchen  
TANG, Xijin  
*July, 2004*

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## WORKSHOP INFORMATION

### International Program Committee

#### Chairman:

Professor Gu, Jifa	Institute of Systems Science, AMSS, CAS, China
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### **Hosted by**

Institute of Systems Science, Chinese Academy of Sciences

**Web Link:** <http://www.amss.ac.cn/iss/conferences/mcs2004/mcs2004.htm>

## GENERAL PROGRAM

### Registration (Place: Siyuan Building, AMSS,CAS)

July 21 Rm 313 and 316, Phone: 62553291, 62651427;  
16:30-18:00 Contact: Dr. Xijin Tang (唐锡晋), Ms. Yijun Liu (刘怡君), Mr. Kun Nie (聂锱)  
July 22 Rm 706, Phone: 62562042  
8:00-9:00 Contact: Dr. Xijin Tang (唐锡晋), Ms. Yijun Liu (刘怡君), Mr. Kun Nie (聂锱)

### Time Schedule

#### July 22, 2004 Siyuan Building, Rm. 703

8:00-9:00 Registration  
9:00-9:20 Chairman: Opening Address by Heads of Institute of  
Professor J. F. GU (顾基发) Systems Science, AMSS, CAS

#### Plenary Session I:

Chairman: Professor J. F. GU (顾基发)

9:30-10:10 NAKAMORI, Yoshiteru Knowledge Management in Scientific  
(*Japan Advanced Institute of Research Institutions*  
*Science and Technology*)

10:10-10:50 SHI, Yong Cross-validation and Ensemble Analyses on  
(*Chinese Academy of MCLP Classification for Credit Cardholder*  
*Sciences, University of Behavior*  
*Nebraska at Omaha*)

10:50-11:00 Tea Time

11:00-11:40 MAYER-KRESS, Gottfried J Conferences with Internet Web-Casting as  
(*Dept. of Kinesiology, Penn Binding Events in a Global Brain: Example*  
*State University, USA; Data from Complexity Digest*  
*Editor, Complexity Digest*)

11:40-12:20 WANG, Huanchen The Possible Solutions for the  
(*Shanghai Jiaotong Human-oriented e-Government with its*  
*University) Complexity by Using the SPIPRO Systems*  
*Methodology*

12:20-13:30 Lunch Time

## Plenary Session II

Chairman: Professor H. C. WANG (王浣尘)

13:30-14:10	CHAO, Xiuli <i>(North Carolina State University, USA)</i>	Scale-free Structure in Transportation and Healthcare Systems
14:10-14:50	HU, Xiaohui <i>(Beijing Institute of Systems Engineering)</i>	The Research on Large Project Demonstration with the Method of Meta-synthetic Engineering
14:50-15:30	YUE, Wuyi <i>(Konan University, Japan)</i>	Modeling and Methodology for Performance Evaluation in Next-Generation Wireless Ad Hoc Networks

15:30-15:40

Tea Time

15:40-16:20	YANG, Jianmei <i>(South China University of Technology)</i>	Simulation Study on Decision-making to Key Investment Region Based on Industrial Cluster
16:20-17:00	GU, Jifa <i>(Institute of Systems Science, Chinese Academy of Sciences)</i>	On Consensus Building
17:00-17:40	DI, Zengru <i>(Center for System Complexity, Beijing Normal University)</i>	Structure of Production Network

18:00-20:30

Reception Dinner

**July 23, 2004 Siyuan Building, RM. 703/ 712**

**Session I: Complex system and complexity research, RM. 703 Siyuan Building  
8:30-12:00, Chairman: Professor Z. R. DI (狄增如)**

- 1 SUGANUMA, Shigemasa A Landscape Theory Based Perspective for  
(*School of Knowledge Science, Japan* Global Alliance in Civil Aviation  
*Advanced Institute of Science and*  
*Technology, Japan*)
- 2 LI, Xinmiao A Study on Activity Tracking Approaches to  
(*Antai Management School Shanghai* Team Knowledge Creation  
*Jiaotong University, Shanghai*)
- 3 WANG, Dahui Firm size distribution and bipartite network  
(*Department of System Sciences,*  
*Beijing Normal University, Beijing*)
- 4 CHEN, Liujun On the mechanism of Catastrophic shift in natural  
(*Institute of Nonequilibrium System,* resource and environmental system  
*Beijing Normal University, Beijing*)
- 5 LE Jianbing An Agent - based Simulation Study on  
(*South China University of Technology,* Decision-making to Key Investment Region  
*Guangzhou*)
- 6 YANG, Jianmei A Study of Approach for Qualitative Hypothesis  
(*South China University of Technology,* Testing- Taking Interfirm Rivalry of Lighting  
*Guangzhou* Product Enterprise Cluster in Guzhen Town as  
Example
- 7 ZHOU, Xiaoji Approach of HWMSE from Macroeconomic  
(*Beijing Institute of Information and* System Analysis  
*Control, Beijing*)

**Session II: Advanced Modeling & Knowledge Science, RM.712 Siyuan Building, 8:30-12:00  
Chairman: Professor J. F. GU**

- 1 YU, Lean TEI@I — A new methodology for crude oil price  
(*Institute of Systems Science, AMSS,* forecasting  
*CAS, Beijing*)

- |   |  |   |
|---|--|---|
| 2 | ZHANG, Pengzhu<br><i>(Antai Management School Shanghai<br/>Jiaotong University, Shanghai)</i>                            | Research on Indicating System and Methods of<br>the Quality Evaluation of Leading Cadres                                    |
| 3 | SHEN, Huizhang<br><i>(Institute of System Engineering,<br/>Shanghai Jiao Tong University,<br/>Shanghai)</i>              | A new algorithm to allocate the decision-makers'<br>weight in group decision-making problems                                |
| 4 | LIU, Yijun<br><i>(Institute of Systems Science, AMSS,<br/>CAS, Beijing)</i>  | Clustering Analysis of Qualitative Data   |
| 5 | NIE, Kun<br><i>(Institute of Systems Science, AMSS,<br/>CAS, Beijing)</i>  | Science Collaboration Network On Our NSFC<br>Project  |
| 6 | TANG, Xijin<br><i>(Institute of Systems Science, AMSS,<br/>CAS, Beijing)</i>   | Meta-synthesis Approach to Exploring<br>Constructing Comprehensive Transportation<br>System in China                        |
| 7 | MAYER-KRESS, Gottfried J<br><i>(Dept. of Kinesiology, Penn State<br/>University, USA;<br/>Editor, Complexity Digest)</i> | Self-Organization and Management in Science<br>Education: Some Observations from a Complex<br>Adaptive Systems Perspective" |

12:10-13:30

Lunch Time

**Rm. 703**  
**(14:00-17:30)**

**Professor J. F. Gu**  
**and H. C. Wang**

Exhibition of NSFC Major Project  
( NSFC 重大项目部分成果展示 )

1. Group Argumentation Environment (群体研讨环境) (ISS, CAS)  
with examples on
  - a) how to evaluate SARS impact to China economy development in 2003 (与 710 所宏观经济预测模型链接演示) ;
  - b) Exploring Creative Ideas from Xiangshan Science Conference.
2. Electronic Common Brain (电子公共大脑) (SJTU)
3. Agent-based Model Integration (多 agent 模型集成环境, SJTU)
4. Meta-synthetic System Reconstruction Modeling (综合集成系统重构, ISS, CAS)
5. HWMSE platform (综合集成研讨厅平台, 北京系统工程研究所, BISE)
6. Some support tools for consensus building and project evaluation
  - Preference Cycle Testing ( 克星循环判定, SJTU )
  - PS method ( 可能满意度方法, SJTU )
  - AHP ( 层次分析法, ISS )
  - Nominal Group Technique ( 名义小组法, ISS )
  - Complex Network Analysis about scientific collaboration ( 重大项目学术合作网, ISS )

(Note: All above will be demonstrated in parallel. Please contact with the group who hold the specific demonstration if you are interested.)

17:30-18:00

Closing

18:30-20:00

Farewell Dinner

## PLENARY SESSION

1. NAKAMORI, Yoshiteru  
*Knowledge Management in Scientific Research Institutions*
2. SHI, Yong  
*Cross-validation and Ensemble Analyses on MCLP Classification for Credit Cardholder Behavior*
3. Gottfried J. Mayer  
*Conferences with Internet Web-Casting as Binding Events in a Global Brain: Example Data from Complexity Digest*
4. WANG, Huanchen  
*The Possible Solutions for the Human-oriented e-Government with its Complexity by Using the SPIPRO Systems Methodology*
5. CHAO, Xiuli  
*Scale-free Structure in Transportation and Healthcare Systems*
6. HU, Xiaohui  
*The Research on Large Project Demonstration with the Method of Meta-synthetic Engineering*
7. YUE, Wuyi  
*Modeling and Methodology for Performance Evaluation in Next-Generation Wireless Ad Hoc Networks*
8. YANG, Jianmei  
*Simulation Study on Decision-making to Key Investment Region Based on Industrial Cluster*
9. GU, Jifa  
*On Consensus Building*
10. DI, Zengru  
*Structure of Production Network*

## 1. Knowledge Management in Scientific Research Institutions

**Yoshiteru NAKAMORI**

*School of Knowledge Science, Japan Advanced Institute of Science and Technology*

*Ishikawa 923-1292, Japan*

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**Keywords:** Knowledge management, systems approach, knowledge structuring, research roadmaps.

**Abstract:** This presentation introduces a research program on theory and practice of technology creation based on knowledge science. After discussing the purpose, necessity, importance and possibility of the new program, we introduce some concrete research results that promote this program; which include the idea of virtual salon with systems approach, and the service systems for knowledge management in a scientific laboratory such as the systems for structuring scientific papers or patents, or for developing personal research roadmaps.

## 2. Cross-validation and Ensemble Analyses on MCLP Classification for Credit Cardholder Behavior

**Yong SHI**

*Graduate School of Chinese Academy of Sciences, Beijing 100039, China*

**Keywords:** Credit Card Portfolio Management, Data Mining, Classification, Multi-criteria Linear Programming, Cross-Validation, and Ensemble

**Abstract:** In credit card portfolio management, predicting the cardholders' behavior is a key to reduce the charge off risk of credit card issuers. As a promising data mining approach, multiple criteria linear programming (MCLP) has been successfully applied to classify credit cardholders' behavior into two or multiple-groups for business intelligence. The objective of this paper is to study the stability of MCLP in classifying credit cardholders' behavior by using cross-validation and ensemble techniques. An overview of the two-group MCLP model formulation and a description of the dataset used in this paper are introduced first. Then cross-validation and ensemble methods are tested respectively. As the results demonstrated, the classification rates of cross-validation and ensemble methods are close to the rates of using MCLP alone. In other words, MCLP is a relatively stable method in classifying credit cardholders' behavior.

\*This research has been partially supported by a grant of US Air Force Research Laboratory (PR No. E-3-1162) and a grant from the K.C. Wong Education Foundation (2003), Chinese Academy of Sciences.

### 3. Conferences with Internet Web-Casting as Binding Events in a Global Brain: Example Data from Complexity Digest

#### **G. Mayer-Kress**

*Dept. of Kinesiology, Penn State Univ., PA. and Editor, Complexity Digest.*

*Email: gxm21@psu.edu*

#### **A. Das,**

*PRA Vidyalaya, Kolkata 700047, India. Email: dasatin@yahoo.co.in*

#### **C. Gershenson,**

*Center Leo Apostel, Vrije Univ.Brussel,Belgium. Email: cgershen@vub.ac.be*

**Keywords:** Global Brain, binding factor, characteristic time scales, video formats

**Abstract:** There is likeness of the Internet to human brains which has led to the metaphor of the world-wide computer network as a 'Global Brain'. We consider conferences as 'binding events' in the Global Brain that can lead to meta-cognitive structures on a global scale. One of the critical factors for that phenomenon to happen (similar to the biological brain) are the time-scales characteristic for the information exchange. In an electronic newsletter- the Complexity Digest (ComDig) we include webcasting of audio and video files from international conferences in the weekly ComDig issues. Here we present the time variation of the weekly rate of accesses to the conference files. From those empirical data it appears that the characteristic time-scales related to access of web-casting files is of the order of a few weeks. This is at least an order of magnitude shorter than the characteristic time-scales of peer reviewed publications and conference proceedings.

Apart from estimating the characteristic time scales, we also discuss about the problems due to different video formats that are popular choice for the users. Several formats (for example, MP3/4, rm, asf etc.) are being simultaneously used and results are compared to find out which satisfies the needs of webcasting. Not a single video format seems to be satisfying the large number of our readers- contrary to the claims of the manufacturers of these formats. We hope for a more standardized common format rather than a particular commercial brand. It is predicted that the observations made in this paper will have significant impact on future documentation of conferences and publication of conference proceedings - presumably in electronic form.

#### 4. The Possible Solutions for the Human-oriented e-Government with its Complexity by Using the SPIPRO Systems Methodology

**Huanchen WANG**

*Shanghai Jiaotong University, Shanghai, 200030, China*

*E-mail: hcwang@sjtu.edu.cn*

**Keywords:** complexity, human-oriented e-government, SPIPRO systems methodology

**Abstract:** In this paper the content of the human-oriented e-government is given, and its related complexity is discussed. The solution could not be gotten in the practice to meet the three requirements (i.e. service, efficiency and supervision) simultaneously. At that time, if the Spiral Propulsion Systems Methodology (SPIPRO Methodology in short) were adopted, then some solution could be gotten possibly. The related illustration is given.

## 5. Scale-free Structure in Transportation and Healthcare Systems

**Xiuli CHAO**

*North Carolina State University, USA*

*email: xchao@ncsu.edu*

## 6. The Research on Large Project Demonstration with the Method of Meta-synthetic Engineering

**Xiao-hui HU, Wei ZHAO, Xin CHEN**

*Beijing Institute of Systems Engineering, Beijing, 100101, China*

**Keywords:** large project demonstration, complex giant system problems, meta-synthetic engineering, evaluation indicator systems

**Abstract:** Large project demonstration is one of the typical complex giant system problems. The complexity of large project demonstration lies in the complex relationships among the resources space, problems space, and results space. The resources space is the resources used in large project which includes simulation models, domain experts, data, and info resources. The problems space includes all kinds of problems in large project demonstration. The results space is the set of the results of large project demonstration. For large project demonstration, the input is the demonstration resource in the problems space and the resources space of the demonstration problems. And the output is the results space. The resources space exists problems of resource waste and info island. The method of meta-synthetic engineering is the efficient solution.

In this paper, five levels of integration conceptions are proposed. They are data integration, application integration, processes integration, service integration, and human beings integration. The integration elements include data, object, component, services, and human knowledge. The most difficult integration is the combination of human beings and computers.

The characteristics of the problem space are its complexity and diversity. The key is the decomposition, recombination and merger of problems. We propose a method to describe large project with evaluation indicator systems, and then decompose, recombine and merger problems driving by them. The process of setting up the evaluation indicator systems is actually the level-by-level decomposition process of the demonstration. The evaluation indicator systems should be hierarchy, which is like a tree, the root is the demonstration and evaluation problem, the leaves are qualitative or quantitative sub-problems that can't be decomposed. We can decompose the complex problems into any qualitative or quantitative sub-problems, to take advantage of the results and results merger of simulation systems. Based on the above researches, we put forward to the framework of the evaluating environment suitable for large project demonstration.

## 7. Modeling and Methodology for Performance Evaluation in Next-Generation Wireless Ad Hoc Networks

**Wuyi YUE**

*Department of Information Science and Systems Engineering, Konan University, Japan*

**Keywords:** Modeling and optimization, methods for performance analysis and evaluation, next-generation wireless ad hoc networks, dynamic network, multi-hop communications.

### **Abstract:**

Wireless communications including next-generation wireless ad hoc networks with the demand for voice, Internet, and multimedia services for fixed and mobile user have a bright future. These networks are now being considered for many commercial applications, including in-home networking, wireless LANs, nomadic computing, and short-term networking for disaster relief public events, and temporary offices. Both the IEEE 802.11 and HIPERLAN wireless LAN standards support ad hoc wireless networking.

Drastic innovations are required of the Internet's architecture in order to cope with such an environment. Novel concepts will also be required in wireless mobile communication at that age and ad hoc networks may hold the key as a basis of next-generation Internet. In this paper, we offer some discussions as to the kinds of next-generation wireless ad hoc networks that will emerge over the next few years and our reflections on the model and methodology for the performance analysis and evaluation.

Mobile computing systems based on IEEE 802.11 and HIPERLAN protocols are classified into the following two types: infrastructured networks and ad-hoc networks. A wireless ad hoc network is a collection of wireless mobile hosts forming a temporary network without the aid of any established infrastructure or centralized control. Ad hoc wireless networking is experiencing a resurgence of interest because of new applications and improved technologies.

It is a significant technical challenge to provide reliable high-speed end-to-end communications in wireless ad hoc networks given their dynamic network topology, decentralized control, and multi-hop connections. It is necessary to analyze the system performance and the departure processes of successful packet or message transmissions and the probability distribution of their delays employing some random multiple protocols in ad hoc network environments by application of queueing theory where we need to take into account the interdependence in the transmissions among users, and multi-hop transmissions with user mobility and user's random multi-traffic demand.

The main characteristics of wireless ad hoc networks relevant to the performance analysis in this paper are considered as follows:

(i) Dynamic Network

We all want any-where any-time communication. Ubiquitous communication has been made possible in the recent years with the advent of mobile ad hoc networks. Ad hoc networks require a peer-to-peer architecture, and the dynamic topology of the network depends on the location of different mobile users, which changes randomly and rapidly over unpredictable times. Network topological changes can occur due to the breakdown of a mobile user in a hostile environment, and the failure of a connected link due to signal interference and changes in signal propagation conditions. Therefore, an ad hoc routing protocol must be able to dynamically update the status of its links and reconfigure itself in order to maintain strong connectivity to support communications among the users.

In wireless networks, given a channel access protocol and a set of source-to-destination paths, the performance evaluations such as end-to-end throughput and delay are widely used. However, since the network topology is dynamically changing, the bandwidth and battery power are important factors in wireless ad hoc networks. In the performance analysis, we should also consider these factors such as the design of routing protocols, trade-offs in using different performance measures to make the maximum end-to-end throughput, the minimum end-to-end delay, total power, bandwidth, and the shortest path/minimum hop, and so on.

(ii) Bandwidth Constraints and Variable Link Capacity:

Due to the effects of multiple access, multipath fading, noise, and signal interference, the capacity of a wireless link can be degraded over time and the effective throughput may be less than the radio's maximum transmission capacity. We should consider efficient use of the limited available bandwidth. In order to reduce interference among mobile users occurring over the same channel, a multichannel assignment algorithm should be provided, thus decreasing the possibility of affecting an existing transmission and wasting. No detailed numerical analysis and evaluation seem to have appeared on the effects of multipath fading, noise, and signal interference on the multichannel network capacity with user mobility. We have not determined what features involved in the multipath fading, noise, signal interferences and user mobility are decisive to the network performance.

(iii) Multi-Hop Communications:

Since the propagation range of a given mobile user is limited, the mobile user may need to enlist the aid of other mobile users in forwarding a packet to his final destination. Thus the end-to-end connection between any two mobile users may consist of multiple wireless hops. That is, mobile users that cannot reach the destination user directly will need to relay their packets through other users.

Basically, there are two approaches in providing ad hoc network connectivity. One is to employ a flat-routed network architecture, and the other is to use hierarchical network architecture. In the former type of network, all the users are equal and packet routing is done based on peer-to-peer connections. On the other hand, in the latter type of network, at least one

user in each lower layer is designated to serve as a gateway or coordinator to higher layers. We can model the former to be a general multi-hop queueing system and the latter to be a priority multi-hop queueing system but with some peculiar conditions.

For example, since ad hoc mobile users need to relay their messages through other users toward their intended destinations, a decrease (i.e., users (hosts) can stop transmitting and/or receiving for arbitrary periods of time) in the number of mobile users can also degrade network performance. As the number of available users (hosts) decreases, the network may also be partitioned into smaller networks. When we analyze the system, we need to obtain not only average performance measures but also higher moments of packet interdeparture times and packet delay, etc., because the output stream from one hop often forms the input stream to another taking dynamic number of available users into consideration.

Moreover, in an ad hoc network the traffic generated by different sources (which are associated with several applications such as voice, video and data) must be transmitted between any two mobile users. In general, depending on the application, each type of traffic imposes different requirements on the system (such as, for example, response time). Under such a situation, a priority mechanism must be employed in order to provide a solution which satisfies the particular requirements for each source.

We should consider prioritized multiple access, broadcast communication channels employing message-based and/or user-based priorities, to compare the performance of systems with different multiple access protocols.

## 8. Simulation Study on Decision-making to Key Investment Region Based on Industrial Cluster

**Jianmei Yang, Jianbing Le, Fengbiao Ma**

*Business School, South China University of Technology,*

*Guangzhou, P. R. China 510641*

*fbajyang@scut.edu.cn*

**Keywords:** IT industrial cluster, GEM model, agent simulation, Evolutionary Game.

### **Abstract:**

By studying the decision-making on key investment region in Mainland (KIRM) of the Taiwanese of China - funded IT enterprises (TITE) based industrial cluster, this paper proposes the idea and method that combine GEM model which reflects cluster competitive capacities with agent simulation technique and evolutionary game. The idea defines the specific economic background for the “environment” of agents and then expands the apply of agent simulation technique. The study conclusion may supply references to the investment decision-making of TITE and to the policy-making of local government.

## 9. On Consensus Building

**Jifa GU**

*Institute of Systems Science, AMSS, CAS, Beijing 100080, China*

*email: jfgu@amss.ac.cn*

**Keywords:** Metasynthesis system approach, consensus, DMTMC system

**Abstract:** According to Metasynthesis system approach originated in 1990 by Qian, Yu and Dai we should use the data, information, model and expert's judgments for solving the open complex giant system problems. In order to get expert's judgments, especially the group expert's judgments usually we will invite a group of experts to consult their opinions on some topic of problems by using the meeting or questionnaire. But how can we utilize their opinions correctly are problems for studying itself. Within these problems the building consensus is a very important one. This paper investigates the consensus from different aspects. According to the DMTMC (Data-Meeting-Tool-Method-Consensus) system we will describe the process of building consensus in more details. The mathematical methods for building consensus are also mentioned from different points of views. such as voting consensus, statistic consensus, fuzzy consensus etc.

## 10. Structure of Production Network

**Klaus Hubacek<sup>1</sup>, Jinshan Wu<sup>2</sup>, Menghui Li<sup>3</sup>, Zengru Di<sup>3</sup>**

<sup>1</sup>*School of the Environment, University of Leeds, Leeds, LS2 9JT, UK*

<sup>2</sup>*Department of Physics, Simon Fraser University, Burnaby, B.C.Canada, V5A 1S6*

<sup>3</sup>*Department of Systems Science, School of Management, Beijing Normal University, Beijing 100875, P.R.China*

**Keywords:** Complex Networks, Input-output Table, Technology Development

**Abstract:** Recent development in Complex Networks provides the possibility to concepts and technics to deal with some problems in complex systems. For many questions in economic systems, we can also get some new or deep understanding by network analysis. Production chain, namely a network of made-from relation between products is an important subject for economic analysis. Many economic problems including growth of economy, allocation of scarce resources and social welfare, can be investigated on production chain. On the other hand, as in network analysis of food web, not only new results and phenomena valuable for ecology were revealed, but also some new topics and analysis technics for general network analysis were proposed. The same should be happened in the network analysis of production network. In this paper we proposed some primary results on the structure of production network by a rough exploration. A real network of highly clustered group of products is actually constructed from Input-Output Table. It is a weighted and directed network. Some basic geometrical quantities such as clustering coefficient, average shortest distance, degree distribution, and betweenness of vertexes and links are presented. The essentiality in classification of products is pointed out in network construction. Some further questions about economical issue and network issue of production networks are proposed while collection of more detailed database is necessary to analyze them.

**Pacs:** 89.75.Hc, 89.65.Gh

## PARALLEL SESSIONS

### Session I: Complex System and Complexity Research

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## **Session I: Complex System and Complexity Research**

### **1. A Landscape Theory Based Perspective for Global Alliance in Civil Aviation**

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**Keywords:** Landscape Theory, civil aviation, Fuzzy partition

#### **Abstract:**

Global alliances have major influences on spurring competitiveness and rationalizing the management of member companies.

Commercial airlines form global alliances in several ways. A regulatory body with enforcement powers or a single dominant state sometimes can impose a rule on a market. As a result, it is increasingly common for carriers to join together into one or more global alliances in order to improve business efficiency. Global alliances formed before 2000 to increase the business efficiency of the members are examples of this phenomenon. Little attention has been given to research on how a carrier decides which airline alliance to join. Increasing our understanding of the process by which carriers choose a global alliance would provide insights into both the formation of global alliances and the structures that emerge from such alliances.

The concept of landscape theory provides a way of thinking about the many possible ways in which elements of a system can fit together, predicting which configurations are most likely to occur, how much dissatisfaction with the outcomes is inevitable, and how the system will respond to changes in the relationship between the elements. Recently we extended landscape theory using the notion of fuzzy partitions.

In this paper we study the formation of competing alliances by companies who wish to increase their own business efficiency in the civil aviation industry. The purpose of this paper is to evaluate the fuzzy landscape theory by using an airline industry case.

## 2. A Study on Activity Tracking Approaches to Team Knowledge Creation

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**Keywords:** teamwork, knowledge creation, team communication, knowledge creation activity tracking approaches , Backpropagation Neural Networks (BPNN)

### **Abstract:**

Knowledge creation is an important competitive factor in many organizations. In order to compete in increasingly complex and turbulent markets, these firms must create, share and manage knowledge that will give them a competitive advantage. Specifically, knowledge creation has become a focal point for managers who seek to capture the collective wisdom of their employees, customers and shareholders. One method of knowledge creation that has been used by organizations for many years is group or teamwork. Modern organizations are successfully using teams to address complex or creative tasks[1].

To compete in today's rapidly paced business environment, many companies are increasingly relying on their employees to generate creative solutions to business problems. Specifically, through the use of record approaches of team knowledge creation and team communication medias among team members, business owners hope to promote creative idea generation by their employees. This study seeks to find effective and efficient approaches to promote team knowledge creation.

In the paper, the promotion relationship model of team knowledge creation activity tracking approaches is at first put forward to show how various activities tracking approaches promote team knowledge creation. Then, the cases on team knowledge creation are gathered and analyzed in R&D center and management strategy designing center of large institutes and enterprises in China. The communication medias among team members are observed on the spot. On the basis, the record approaches of team knowledge creation and the team communication medias among team members are analyzed and put forwarded. Consequently, the conditions about various tracking approaches of team knowledge creation activity are concluded by case study and questionnaire survey.

In the paper, ANN theory and method is applied. The applicability model of knowledge creation activities & tracking approaches is set up by the method of Backpropagation Neural Networks (BPNN).

Under definite condition, in definite context, for a definite creative task, under definite task demands, the effective activity tracking approaches were selected to promote team knowledge creation. Generally, the communication media and the activity tracking approaches are not unique under definite conditions. However, various communication media and tracking approaches have different applicability. Commonly, the relationship between various communication media, tracking approaches and the definite conditions are uncertain. Therefore, BPNN is used to fit the corresponding relation. That is, the condition of a definite team, the demands of a definite task, etc, has various influence on the choosing tracking approaches and communication media with various conditions. We can fit this relationship by BPNN with training samples and acquire the grade of fit of various activity tracking approaches and communication media given the condition of a team, the demands of creation task, and so on.

The model is applied in the study on Web-based Group Argumentation Support System (GASS). The results show that the method can evaluate record modes quantitatively based on concrete argumentation activity. Thereby, the method can provide more effective support to group decision.

According to the results of NN model, the appropriate tracking approach is rationally selected on different conditions. The NN model provides a tool to support to rationally select tracking approaches on different conditions.

The effectiveness of Multi-creative tools and approaches in certain conditions will be studied in our future research. And new team creative support tool will be designed and developed. The method by which individual and team creative information enters CIS (creation information system) will also be studied.

### **Acknowledgements**

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### 3. Firm size distribution and bipartite network

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**Keywords:** firm size, bipartite network, consumption, growth

**Abstract:**

The paper depicts the economy as a bipartite network, consumers and firms are different kinds of node, the edge represents one unit consumption and connected from consumer to firm, some edges will be rewired after consume according to firm's size with preference. The degree of firm describes its size. We research the firm size distribution by investigating firm's degree distribution. We get following results: the firm size distribution is exponential if the total consumption is constant, and the firm size distribution obeys the power law when total consumption grows with time.

#### 4. On the mechanism of Catastrophic shift in natural resource and environmental system

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**Keywords:** dynamic model; catastrophe; natural resource; environment

**Abstract:**

In this paper, a dynamic model of natural resource and environmental system is developed on macro level, and its catastrophic characteristics as well as relevant economic meanings are analyzed. By considering a specific coupling relation between natural resource and environment pollution, we build a two-dimensional dynamic model. The equilibria analysis reveals that the catastrophic feature could be classified as swallowtail catastrophe. The relation between the change in parameters of economic activities and the equilibrium transition of the dynamic model is also discussed with the projection of bifurcation sets onto economic parameter space. The Simulation under given specific change mode of economic activities parameters shows that the related policy parameters have to satisfy some requirements to avoid such catastrophic shift, for example, the abatement time should be earlier than some critical moment.

## 5. An Agent - Based Simulation Study on Decision-making to Key Investment Region

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**Keywords:** IT industrial cluster, GEM model, agent simulation, Evolutionary Game.

### **Abstract:**

By studying the decision-making on key investment region in Mainland (KIRM) of the Taiwanese of China - funded IT enterprises (TITE) based industrial cluster, this paper proposes the idea and method that combine GEM model which reflects cluster competitive capacities with agent simulation technique and evolutionary game. The idea defines the specific economic background for the “environment” of agents and then expands the apply of agent simulation technique. The study conclusion may supply references to the investment decision-making of TITE and to the policy-making of local government.

6. A Study of Approach for Qualitative Hypothesis Testing - Taking Interfirm Rivalry of Lighting Product Enterprise Cluster in Guzhen Town as Example

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**Keywords:** qualitative hypothesis testing, cognition, enterprise cluster, interfirm rivalry

**Abstract:**

There are two kinds of hypotheses in management research: quantitative and qualitative hypotheses. Quantitative hypotheses are subject to statistical test. But there are no formal tests for qualitative hypotheses. Based on the interfirm rivalry analysis of lighting product enterprise cluster in Guzhen Town of Guangdong Province, this paper puts forward some qualitative hypotheses about the rivalry firstly, and then, raises an approach for qualitative hypotheses testing based on cognition, finally, summarizes the characteristics of interfirm rivalry in the cluster in Guzhen Town, and points out the problems for further study.

## 7. APPROACH OF HWMSE FROM MACROECONOMIC SYSTEM ANALYSIS

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**Keywords:** HWMSE, Metasyntheses, Macroeconomic system

### **Abstract:**

Being the method and platform for complex system problem solving, the effectiveness of HWMSE (Hall for Workshop of Meta-synthetic Engineering) depends upon the field knowledge of object complex system. Thus to discuss the approach of HWMSE based on macroeconomic system analysis and macroeconomic decision making study from system science view, four parts of researches are carried out as follows:

1. Metasyntheses and its way to HWMSE: Metasyntheses is a complex huge system problem solving oriented methodology. The substantial process of metasyntheses consists three stages or aspects, they are qualitative metasyntheses, qualitative combined with quantitative metasynthese and from qualitative to quantitative metasyntheses respectively. HWMSE is a human mastered human-machine-net integrated system to realize the metasyntheses of information, knowledge and wisdom.
2. Macroeconomic system analysis and knowledge system construction: Complexity and complex adaptability of macroeconomic system are studied as basis. Then, from the perspectives of system description, system analysis and system control, an open framework for macroeconomic analyses are set up. According to this framework, the further work is to establish macroeconomic data system, information system, indicator system, model system, case system and adjustment and control system to set up the knowledge system aiming to support macroeconomic issues discussion and study under HWMSE.
3. Studies about HWMSE supporting Macro-economic policy making. This part of studies is focused on the discussion patterns, problem solving process and possible programs, and

organization pattern of economic knowledge under HWMSE. Then basing on the fundamental studies on tasks, knowledge, tools, methods of different macroeconomic problem solving tasks, discussion templates of different tasks are designed, including that for macroeconomic forecast, evaluation, economic prosperity analysis, policy simulation and model construction, etc. Furthermore, taking real macroeconomic issues as background to compose the discussion scripts, some experiments are carried out together with other collaborative research groups to simulate and validate the methods and platform of HWMSE. Among that, the experiments on “Macroeconomic situation and policy analysis of China under SARS”, collaborated with researchers from ISS and IA,CAS and Qinghua University, were demonstrated in CSM'2003 workshop at IIASA.

4. Application study and decision-making supporting. All these works are application oriented and practically used in macroeconomic analyses.

## Session II: Advanced Modeling and Knowledge Science

### 1. TEI@I — A new methodology for crude oil price forecasting

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**Keywords:** TEI@I methodology, forecasting of oil price, text mining, econometrics, intelligence, integrations

#### **Abstract:**

The role of crude oil in the world economy becomes more and more significant because nearly two-thirds of the world's energy consumption comes from crude oil and natural gas [1]. For example, the worldwide consumption of crude oil exceeds \$500 billion, roughly 10% of the US GDP [2]. Besides, crude oil is also the world's most actively traded commodity, accounting for about 10% of total world trade [2]. The crude oil price is basically determined by its supply and demand, and is strongly influenced by many irregular future events like the weather, stock levels, GDP growth, political aspects and people's expectation. Because it takes considerable time to ship crude oil from a country to another country, there is often a variation of prices in different parts of the world. These facts lead to a strongly fluctuating and interacting market whose fundamental mechanism governing the complex dynamics is not well understood. Furthermore, because sharp oil price movements are likely to disturb aggregate economic activity, volatile oil prices have been considerable interest to many researchers and institutions. Therefore, forecasting oil prices is an important and very hard topic due to its intrinsic difficulty and practical applications.

For crude oil price forecasting, most of the literature is focused only on the oil price volatility analysis (see e.g. [1, 3]) and oil price determination within the framework of supply and demand (see e.g. [4, 5]). There are only very limited number of related papers on oil price forecasting in the literature, such as [6-8]. But all the methods published so far are of the traditional approaches.

With the increase of competition, the prediction performance of the traditional approaches can not meet the practical needs. Therefore, it is significant to develop new methodology for predicting oil price by combining some advanced techniques (e.g., integration techniques, artificial intelligence technique).

In view of difficulty and complexity of crude oil price forecasting, a new methodology named TEI@I is proposed in this study to “integrate” systematically “text mining”, “econometrics” and “intelligent techniques”, and a novel integrated forecasting approach with error correction and judgmental adjustment within the framework of TEI@I methodology is presented for improving prediction performance. Here the name “TEI@I” is based on “text mining”+ “econometrics” + “intelligence (intelligent algorithms)” @ “integration”. Using “@” to replace “+” is to emphasize the functional of integrations. The general framework structure is shown in Fig. 1.

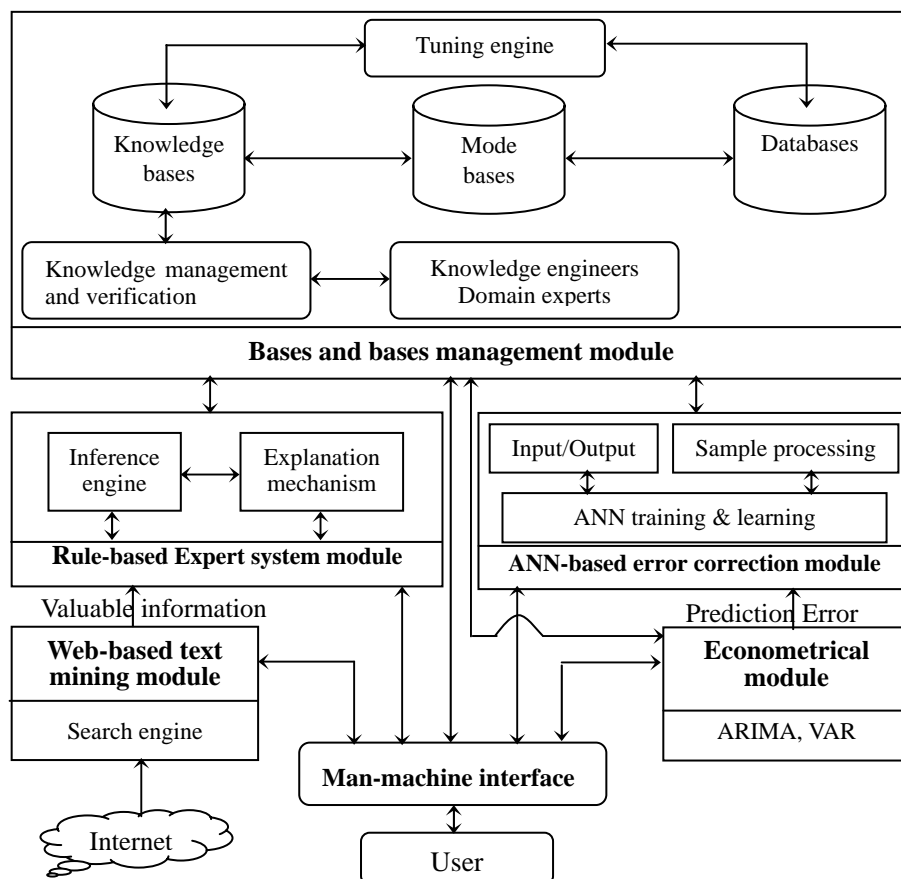


Fig. 1 The general framework structure of the TEI@I methodology

In this methodology, econometrical models (e.g., autoregressive integrated moving average (ARIMA)) are used to model the linear components of crude oil price time series (i.e., main trends), while nonlinear components of crude oil price time series (i.e., error term) are modeled by neural network (NN) model. In addition, the effects of irregular and infrequent future events

on crude oil price are explored by web-based text mining (WTM) and rule-based expert systems (RES) techniques. Thus, a single forecast is formulated by the summation of the three parts mentioned earlier. Theoretical speaking, the simple summation does not necessarily obtain better forecasting performance at all circumstances. In view of this point, a new nonlinear integration method by the neural network technique is proposed for improving the forecasting performance.

Assume that  $\hat{Y}_t$  is the  $t$ th integration forecasting result,  $\hat{E}_t$  is the  $t$ th forecasting result of linear component by econometrical models,  $\hat{I}_t$  is the  $t$ th forecasting result of nonlinear component by intelligent techniques (i.e., neural network models),  $\hat{T}_t$  is the  $t$ th forecasting result by text mining technique and expert systems techniques. A question is how to integrate these different parts ( $\hat{T}_t$ ,  $\hat{E}_t$  and  $\hat{I}_t$ ) into a more accurate forecast ( $\hat{Y}_t$ ), i.e.,

$$\hat{Y}_t = f(\hat{T}_t, \hat{E}_t, \hat{I}_t) \quad (1)$$

Thus the current problem is how to determine a function  $f(\cdot)$  to obtain synergetic effect and make error metrics minimal. However, determining the function  $f(\cdot)$  is quite challenging, in this study, neural network technique (e.g., BPNN) is employed to realize nonlinear mapping and integration.

Actually, the BPNN training is a process of searching for optimal weights to fit the nonlinear function. That is, this training process can make the sum of square errors minimal, i.e.,

$$\text{Min}[(Y - \hat{Y})(Y - \hat{Y})^T] \quad (2)$$

or

$$\text{Min}\{[Y - f(\hat{T}, \hat{E}, \hat{I})][Y - f(\hat{T}, \hat{E}, \hat{I})]^T\} \quad (3)$$

Therefore, a nonlinear integration forecasting technique is formulated by integrating text mining technique, econometrical techniques and intelligent techniques.

To further explain the proposed methodology and verify the effectiveness of the proposed methodology, a simulation study is presented. The experimental results obtained prove that the proposed methodology is significantly effective and practically feasible. This might lead to a conclusion: the novel TEI@I methodology can be used as an alternative tool for crude oil price forecasting to obtain better forecasting accuracy and to improve the prediction quality further.

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## 2. Research on Indicating System and Methods of the Quality Evaluation of Leading Cadres

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**Keywords:** system evaluation, leading cadres

### **Abstract:**

The research on the development and administration of human resources is an extensive and complicated question; especially the research on leading cadres is more synthesized. It should be carried out from various points of view, which is an important difficulty among the indicating system of the quality evaluation of leading cadres (ISQELC). This issue is studied by collecting the information about the behavior of leading cadres in their leading field and leading activities, then to give the evaluation of quality or quantity of the objects and to provide reliable suggestion for the choice of leading cadres. Considering 19 factors, which the indicating system based on, were built on the analysis of the values, the synthesized quality of leading cadres, and some responds from the investigation toward some experts working in universities, institutes and organization and personnel departments. We comprehensively adopted fuzzy mathematical and philosophical mathematical theories and methods to determine the weight of respective participant group and respective indicator in the evaluation of the leading cadres. So the indicating methods and system of quality evaluating of leading cadres has been established. Moreover, the methods which used to calculate the weights of experts of each level and the applications of the model are presented. The computer should be used in such a method. Only by this means the evaluating could be done democratically and reasonably, the leading cadres could be as "make the best possible use of men and make the best possible use of abilities".

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### 3. A new algorithm to allocate the decision-makers' weight in group decision-making problems

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**Keywords:** preference utility value, group decision-making , decision-makers' weight, normal stochastic matrix, normal distribution

**Abstract:**

One of the most difficult problems in group decision-making is to allocate the decision-makers' weight in the decision. Decision makers' weight is being discussed as one of the key pillars in this paper. Prior research methods on the weight allocation of group decision-making include Authority Allocation, Nominal Group Technique method, Entropy Method and Fuzzy Cluster Analysis. The first and the second methods analyze the weight from the subjective aspect and the rest analyze the weight based on the historical decision-making data. Essentially, weight allocation is a complicated problem. These methods unavoidably lead to unilateral conclusion. This paper defines the quantificational preference utility value of a scheme, puts forwards a new algorithm to determine the decision-makers' weight in group decision problems, and considers three factors affecting the decision-makers' weight from subjective and objective aspects in the weight evaluation model, including the subjective evaluated weight, the consistency weight and the diversity weight. This paper studies the resolving algorithm of weight evaluation based on hierarchical analysis and normal stochastic matrix, analyzes the quantitative relationship between decision maker's weight and the consistency index and characteristic vector of preference judgment matrix. In the end, the paper puts forward the interactive implementation steps of the decision-making algorithm for group decision-making problems.

#### 4. Clustering Analysis of Qualitative Data

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**Keywords:** qualitative data, clustering analysis, dual scaling method, principal components analysis, Xiangshan Science Conference

##### Abstract

Qualitative data are those used to reflect categories and level, rather than the typical interval scale. For example, data collected in social surveys, which are often presented in tabular form. Now, heated discussions are how to extract quantitative information from qualitative data, how to exploratory and explain the complicated relationships between the rows and columns data, and how to produce a visual representation of those in the same space. In this paper, we will introduce a multi-variant statistical clustering method—dual scaling method, which has also been called correspondence analysis, principal components analysis of qualitative data and optimal scaling, etc. The criterion of algorithm is Guttman's interval consistency, and the correlation between the rows (objects) and columns (the attributes of objects) is given by:

$$\frac{\text{covariance between objects and attributes}}{\sqrt{\text{variance of objects}}\sqrt{\text{variance of attributes}}}$$

“Dual scaling” was coined by S.Nishisato in 1976, which is nonlinear principal component analysis (PCA). It can be reduced to acquire the maximum eigenvalues problem like the PCA's algorithm. The 2-dimensional visualized graph uses two sets of values (rows and columns) as the coordinates which correspond to the first two dominant eigenvalues. The meaning of the axes of the graph is also similar to the PCA, which can be called inertia axes. Most of the clustering algorithm of qualitative data are exploratory data analysis, so dual scaling. Therefore, it is difficult to give a precise explanation or label to the clusters. Such kind of work mainly depends on the domain experts' intuition and experiences.

Different from the topological graph, the above of graph is an interpretable graph, which reflects the data's nature in the database. But the topological structures have been designed and the forms are structured. In our research, we want to cluster the utterances and keywords of the experts in brainstorming, and the aim is to externalize the mental process of the human thinking. Here, we think, the interpretable diagram is more suitable to embody the thinking activities than the topological graph.

After nearly 30 years developed, dual scaling method got a lot of applications and its potentials are being explored gradually. Recently, Nishisato pointed some improvements of dual scaling method, for example, the standard procedure of graphing data in terms of two components (solutions, dimensions), projected on orthogonal axes, may not be the best way to elucidate the input data since the data are not always interpretable in terms of orthogonal components, but perhaps interpreting clusters in multidimensional space may be more meaningful. For that, more and more attention is kernel PCA, it is also our further research work.

Now, we had used dual scaling method to analyze the information came from Xiangshan Science Conference. Lots of association relation can be acquired from that top-level science forum for interdisciplinary and cutting-edge studies in China.

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## 5. Network Analysis of Science Collaboration in a NSFC Major Project

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**Keywords:** scale-free network, science collaboration, NSFC project

### **Abstract:**

As we enter into 21st century, complex network research is becoming a very hot area. Researches on social networks of scientific collaborations become popular such as the co-authorship networks of scientists in the fields of mathematics, neuro-science (Barabási, et.al. 2002), physics, biomedical, and computer science (Newman, 2001), the citation network (Redner 1998), indicating that science collaboration networks are scale-free networks.

From 1996-2003, we have undertaken a major project of National Natural Science Foundation of China (NSFC). Many materials such like published papers, meetings, discussions and acknowledgements were accumulated as we submitted final report for NSFC in the start of 2004. Based on scale-free network research results, we intend to establish an integrated network to synthesize all these materials. In the integrated network, the vertexes are the authors; the links are the collaboration or intercourse between the scientists, such as co-authorship, citation relation, discussions and academic workshops. We expect to explore some issues from project management perspective, such as

- to explore how a major NSFC project is organized and undertaken;
- how such a project incubates new scientific ideas and enable those ideas developed into validated new theory;
- how such a project disseminate scientific ideas to new participants who share common grounds and enable to form communities and then led to further collaboration.

Currently, a database had been constructed. We had started our exploration from complex network perspective and acquired some basic results. It is sensed that lot of mining work is worth to be done to uncover some hidden facts about large-scale scientific project management.

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## 6. Meta-synthesis Approach to Exploring Constructing Comprehensive Transportation System in China

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### **Abstract:**

Proposed by a Chinese system scientist Qian Xuesen (Tsien HsueShen) and his colleagues in 1990, meta-synthesis system approach (MSA) is regarded as an effective method to deal with open complex giant systems problems. The typical characteristics of an open complex giant system (OCGS) are, 1) there are more than hundreds of subsystems of different categories; sometimes the number of subsystems may be over one billion; and there are the communications between subsystems; 2) there are continuous exchanges in material, energy and information between the system together with its subsystems and external world; 3) the structure of subsystems are evolving with the system evolution. Usually OCGS is simplified as complex system. MSA approach emphasizes "confident hypothesis, rigorous validation", i.e. quantitative knowledge arises from qualitative understanding.

In 2002, Chinese Academy of Engineering (CAE) initiated a consulting project on "constructing comprehensive transportation system in China", whose purpose to explore the possibility of developing a national integrative transportation system in order to meet the continuously increasing demands from the national socioeconomic development, especially the national strategic goal for comparatively well-off living for whole population, i.e. the per capita income is over 1000 US dollars. Currently 5 available transportation modes, railway, highway, airway, waterway and pipes, are independently managed by different government departments who have made their own strategic development plan for next decade respectively. There are a number of problems in the current national transportation framework. One of the serious problems is the structure conflicts, which bring uncertainties toward the development of each transportation mode. How to construct a national comprehensive system to overcome those problems is the principal focus of the CAE project. Actually the focused system is a complex system. Thus meta-synthesis approach is applied to the project development.

For better research, the CAE project has 6 subprojects on different goals. One subproject is on theory, directions and methods about comprehensive transportation system construction, and expected to provide guidelines and coordination for other 5 subprojects. A mix of different domain people from different organizations attend the “theory” subproject. Those participants include 3 kinds of people, system researchers, management researchers and representatives from 3 major transportation modes, railway, highway and airway. Here we focus on the work of this subproject.

In the beginning period, project members held many discussion meetings to exchange opinions and define the pathway toward the project goals; even there are many discussions about the definition and contents of a so-called comprehensive transportation system, which is obviously totally different from an aggregation of current independent systems of 5 transportation ways. Such kind of brainstorming meetings facilitate those participants to think of many original diverse ideas about the focused topics and move outward into a variety of perspectives. Moreover, participants learn from each other during such a divergent thinking process which is an efficient way of knowledge acquisition. Our developed Group Argumentation Environment (GAE) is utilized here to provide augmented support help for expert discussions and trigger idea generation and incubation. Gradually, some principal topics are attained or consensus is built about project pathway. The results of such a divergence-convergence process is to transfer a messy problem into a structured problem for quantitative modeling, which is regarded as qualitative meta-synthesis.

As the major problems are fixed after several rounds of group discussions, different modeling work is undertaken based on qualitative meta-synthetic results. One of them is modeling by rules. An agent-based model is constructed to analyze competitive relations in passenger traffic between railway and highway. Simulations are undertaken using a multi-agent system (MAS) platform Starlogo developed by MIT to testify some qualitative hypothesis about passenger traffic based on different conditions about the traffic system and passenger behaviors. Here MAS simulation is expected to provide useful information for quantitative understanding about passenger traffic system behavior based on qualitative rules and helpful for further research about comprehensive transportation system development.

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## 7. Self-Organization and Management in Science Education: Some Observations from a Complex Adaptive Systems Perspective"

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Complex systems adapt to their environment according to evolving fitness landscapes. Adaptation is closely related to learning at all levels from animals to global organizations.

Science education addresses the most basic form of learning namely learning about the world of our empirical observations using the scientific method.

Here I want to discuss some observations during my stay in Taiwan where there appears to emerge a conflict between the objectives of teaching correct scientific content and other interests of management and administration.

Perhaps the Wu-li, Shi-li and Ren-li system approach can help to better understand these issues.

For details see <http://www.comdig2.de/Conf/NTSEC04/> .

## WORKSHOP LOCATION

