Preface

Knowledge science is a broad study investigated from various practical and theoretical aspects that can be traced back from the age of Plato or even earlier. Russell argues that the definition of knowledge is “perhaps the most important and difficult of the three with which we shall deal.” System science is a cross-discipline study that covers a variety of areas in science and engineering, and the way of systematic thinking could benefit and complement the complex study of knowledge science. The research of knowledge science and systems science has gone through dramatic changes and will continue to change in the next decades, coupled with the developing novelty and variety of this field, especially due to the emergence of multi-discipline studies. While the topic is vitally important, the characteristics of multi-discipline studies of knowledge and system sciences make it quite difficult to build a unified theoretical framework, as well as speculating on potential future directions. Without loss of generality, most researchers focus on three major dimensions: methodology-centric dimension, technology-centric dimension, and application-centric dimension.

The methodology-centric study roots in philosophies, such as epistemology and ontology, and debates what knowledge is and how to acquire it, similar to Plato, Confucius, and Avicenna. The philosophical speculations are not purely academic and far from real applications, and many bright ideas are inspired by or borrowed from epistemology. For example, the term “tacit knowledge” widely mentioned in knowledge management was first introduced by philosopher Michael Polanyi in 1958 who asserted, “We can know more than we can tell” and later promoted by Ikujiro Nonaka in his SECI model, which is one of the most famous theories in knowledge management. Besides philosophy, the methodology-centric study of knowledge and system sciences is also fertilized by psychology, sociology, and so on. However, we could observe that the research of fundamental theories in this area are still insufficient and need to be encouraged, as the strong and important downstream rivers could not be gathered without the essential and abundant head waters.

The technology-centric research includes methods, algorithms, and systems developed from the areas of information technology, complexity science, systems engineering, organization theories, etc. This kind of research representative shows the multidisciplinary features of knowledge and systems science, and people continuously contribute to enrich the toolbox, increasing both diversity and specialization of the field. Recently, the study of big data is also an important direction in knowledge and systems science, where on one hand it will certainly be a huge source of operational knowledge for our society, and one another hand its complexity must be considered under systematic frameworks. Despite the debates and arguments that have started to flourish largely as a consequence of diversity, this book will juxtapose the different perspectives on particular technology which will lead to even more diversified research topics.
The application of knowledge and system sciences is a popular topic in the fields of computer science, management science, business administration, public health and policy, as well as natural scientific research including physics, chemistry, biology, and so on. We have seen a rapid expansion in the number of journal and conference papers, both academic and practitioner, devoted to the applications of knowledge and system sciences. Taking the applications in organization sciences for example, all of the growing interest reflects the acceptance of the concept that organizations have knowledge systematically integrated within them, and consider knowledge bases as valuable assets, and it also reaffirms the legitimacy of practical research and application of knowledge and system sciences in organizations.

The International Journal of Knowledge and Systems Science published a series of papers to discuss extensive and in-depth topics about methodology-centric, technology-centric, and application-centric research in its publication year 2011. The book aims to provide researchers and practitioners with examples to conduct their multidisciplinary study of knowledge and systems science, and it will present you a variety of exciting methodology-centric, technology-centric, and application-centric approaches in the following twenty-one chapters.

Chapter 1: “Clarification of Abilities and Qualities of Knowledge Coordinators: The Case of Regional Revitalization Projects.” The first chapter presented by Kayano Chihara and Yoshiteru Nakamori studies abilities and qualities of key persons in regional revitalization projects, which were reactivated in recent years by the Japanese Cabinet Office. In fact the identification of key persons is not only a crucial step in the Japanese regional revitalization but also in many of the national or regional projects all over the world. This paper has applied a knowledge construction system model called the i-System to explore this issue from the viewpoint of knowledge coordination and presuppose a key person is a knowledge coordinator. A knowledge coordinator is defined as a person who can make innovation using knowledge, and in their survey the authors choose 100 “Tourism experts” who were selected by Japan Tourism Agency as the objective knowledge coordinators. Then they choose 7 knowledge coordinators in 7 cases for an interview survey and use 96 cases of “Tourism Experts” introduced by Japan Tourism Agency. Based on the i-System, they study the abilities and qualities of the knowledge coordinators in three fronts including Social-Relational (SR) front, Scientific-Actual (SA) front and Cognitive-Mental (CM) front, and the results show that abilities and qualities of knowledge coordinators emphasize abilities of heart related to involvement (the SR front), and abilities of mind related to imagination (the CM front) rather than abilities of head related to intelligence (the SA front). They also find that both “inward” and “out-ward” help to make “human network” an important factor for knowledge coordinators in the SR front.

Chapter 2: “A Task Context Aware Physical Distribution Knowledge Service System.” This chapter is presented by Liang Xiao and Yanli Pei, and the authors define the context of physical distribution tasks to establish a context-aware based physical distribution knowledge service, in order to support collaborative management of the physical distribution tasks. The effective physical distribution system could not only support the business to respond customers quickly, but also improve enterprises’ competitiveness and customers’ satisfaction, which plays a more and more important role in modern mobile environments.

In this paper, the context of physical distribution tasks is defined as all kinds of internal and external environmental information while implementing physical distribution tasks, and the authors investigate on the existing typical Location and Routing Problems (LRP) of distribution tasks and survey 212 samples of distributing tasks and then get 30 possible context elements, by assorting distribution task context into four types: network context, the product context, customer context and resource context. The proposed knowledge services system includes 9 modules: Task Raw Data Acquisition, Task Context Aware and Processing, Distribution Knowledge Register Center, Distribution Knowledge Calling, Distribution Knowledge Construction, Distribution Knowledge Push, Abnormal Context Monitoring and Managing.
Distribution Plan Self-Adaptively Adjusting, and Modular Distribution Knowledge Integration. With the support of the proposed system, the external and internal environmental information during the distributing process could be completely acquired and distinctly described, and the distribution tasks could be understood in a structured way. Meanwhile, the system realizes intelligent distribution knowledge sending and collaborative distributing management.

Chapter 3: “Evaluation of Technological Influence Power of Enterprises through the Enterprise Citation Network.” When making the innovation strategy, the primary task is to discover the technologically influential enterprises in the industry, which is an important support for enterprises to identify their actual and potential competitors and make an effective innovation strategic deployment. In this chapter, Jiangning Wu, Shu Wang, and Donghua Pan establish an enterprise network based on the patent citation information where both weight and direction information of links are concerned, in order to find these technologically influential enterprises. The authors first establish a weighted and directed enterprise network based on the citation relations of patents, and then a new algorithm coming from the main idea of the Google PageRank algorithm is put forward to evaluate the technological influence power of enterprises in terms of the number of citing enterprises, the importance of the citing enterprises and the citation strength between enterprises. The patent data is collected in the field of fluid-pressure and analogous brake systems during a 25-year period from 1975 to 1999 and some experiments are taken to compare the new indicator with the common assessment indicator based on the citation count method. Empirical study indicates that the new ranking indicator is a better measure for the enterprise to discover its potential competitors in the same industry.

Chapter 4: “A New Method for Ranking Intuitionistic Fuzzy Numbers.” In this chapter, Cui-Ping Wei, and Xijin Tang extends the possibility degree formula of interval values to Intuitionistic Fuzzy Number(IFNs), and propose a possibility degree method for ranking n IFNs, which are used to represent the degree of satisfiability and non-satisfiability of each alternative with respect to a set of criteria for MCDM problems. The authors first define a possibility degree formula to compare two intuitionistic fuzzy numbers. For two IFNs, their method brings the same ranking order of IFNs as that derived by the score function defined by Chen and Tan (1994). Moreover, adoption of possibility degree provides additional information for the comparison of IFNs. As to more than two IFNs, their method can do further comparison of the IFNs that are indifferent when only using the possibility degree formula.

Chapter 5: “Knowledge Mining Wikipedia: An Ontological Approach.” The question of turning information into knowledge is one of the most important problems in knowledge science, and in this chapter Herbert Lee, Keith C. C. Chan, and Eric Tsui gives a practical and feasible ontology management tool based on the use of Wikipedia as the knowledge source. The easier information can be retrieved, so that the most relevant information will always be available when needed, the more we can exploit the power provided through such information. Ontology is the most versatile and powerful information categorization schemes. Traditional approaches to building ontology fall into two basic categories. One is to rely on carefully handcrafted human resources, and ontology so built is generally of high quality, but restricted in size and coverage. On the other hand, automated methods using text-mining techniques can produce ontology with incredible size and coverage, but at the expense of quality. Wikipedia, as a knowledge source, provides a middle ground between the two approaches by offering both quality and quantity. The authors presents a system architecture for an advanced information retrieval system with background knowledge base, and propose ANTOM as a practical and feasible ontology management tool based on the use of Wikipedia as the knowledge source. The current version of ANTOM generates ontology by making use of an algorithm to crawl related Wiki pages in Wikipedia by traversing the hyperlinks to different Wiki pages, and the preliminary test results on both the quality and coverage of the ontology have been shown to be quite promising.
Chapter 6: “Systems of Communication: Information, Explanation, and Imagination.” This chapter is presented by Peter Murphy. In this chapter, three fundamental systems of communication are defined: information, explanation, and imagination. Information is based on analytic distinctions between objects in the world. Explanatory communication provides knowledge through discourse, narration, logic, rhetoric and other forms of systemic elaboration. Intellectual discovery relies on a third system of communication, that of imagination. Rather than distinction or elaboration, imagination is rooted in intuition and analogy. The most powerful medium of the imagination is antonymous insight. The article discusses examples of the latter from warfare, politics, and science. All kinds of discursive knowledge, including scientific, technological, legal, political, social, and aesthetic knowledge, reach a limit at which point they cease to satisfy us. We are left feeling that the explanation or narration is not adequate, however elaborate it may be. How then, when faced with such conditions, is knowledge advanced, developed, or kick-started? The invigoration of knowledge happens because of acts of imagination. Imagination is synthetic, not analytic. It relies on intuition, analogy, and the ability of creating resemblances between things rather than drawing distinctions. Analogical-synthetic acts of imagination overcome the periodic stagnation of the discursive system of communication. Imagination plays the central role in audacious kinds of problem solving, visualization, projection, anticipation, and creative thought.

Chapter 7: “Imagination in Creative Design: Towards Conceptual Clarification and Integration Around the Key Notion of Insight Moments.” This chapter is presented by Stefan Wiltschnig, and the author aims to unpack the notion of imagination presented in the I5-system of knowledge creation along several theoretical contributions and process models from “knowledge science,” creativity research and design studies. It aims at conceptual clarification and integration around the key notion of “insight moments” across various levels of abstraction from system perspectives through foci on groups and individuals to mental activity. This work is meant to serve as a conceptual foundation for microanalyses of in-vivo data of creative design processes based on protocols of participatory ethnographic research and interview accounts from first, second and third person perspectives. In the realm of design studies it can be observed that mappings of design processes are more and more enriched with integrated perspectives on the heuristics and methods applied by designers, based on approaches inspired by anthropology, sociology, and psychology combining field studies, video protocol analysis, and interviews. This opens up new avenues for studying creativity in design with professionals “in the wild.” The status of insight moments in the three strands of literature is summarized and forms the analytical base for an outlook to further empirical research.

Chapter 8: “From Creative Ideas Generation to Real World Solutions: Analysis of the Initial Situation for Inventive Design.” The first stages of the creative inventive process are devoted to choosing the problem and redefining its conditions. Most of the time, the original statement of the problem is imprecise, and occasionally even incorrect. This is why it is necessary to have mechanisms to help structure the creative thinking of a set of experts during their analysis of the problem, by providing them a knowledge-based framework. This article presented by François Rousselot presents the first stages of IDM (Inventive Design Methodology). IDM is a set of methodological tools whose main interest is the evolution of technical systems. The use of these methodological tools provides the needed structuring framework to the experts’ creative idea generation. In this paper, a collaborative model is proposed for creative design based on interactive genetic algorithms. The collaborative computational model has been shown to possess exploratory transformation creativity, and is also related to the meta-design approach for solving complex design tasks using open support systems. The proposed model is implemented to collaboratively evolve floor plans and interactively evolve editorial design layouts for brochures and
posters—two applications that use an established body of knowledge and rely on user preferences. An open computer support system is central to the premise of meta-design, with the promise of enhanced knowledge creation and computational system intelligence.

Chapter 9: “Model of Meta-Reflection and In-Depth Analysis of Knowledge Creation Process in Design.” This article presented by Georgi V. Georgiev proposes meta-reflection as a qualitative analysis tool for the Knowledge Creation Process (KCP) in research projects. The new method of meta-reflection is applied both to reflection on research about design creativity and object of research—design creativity. The meta-reflection approach is built upon Knowledge Process Analysis (KPA) theory, adding primitive relevant to creative design. One result of the applied method of meta-reflection was that the analysis of KCP in research on design involved different tacit forms of knowledge and creativity and included a wide spectrum of knowledge processes and knowledge types. KPA elaborates knowledge creation primitives from various theories of knowledge creation that have been proposed in the last few decades. This case study of research project on creative design is a case where creativity is involved at the level of research knowledge creation and research objectives. Our insight into what promotes and what hinders successful knowledge creation was deepened. Moreover, the importance of creativity and imagination in research projects can be seen from this case. This case study contributes to the development of the knowledge creation model with specific applications to scientific projects by proposing a Model of Meta-Reflection (MMR). The value of this study is in the identification of the connections between knowledge creation processes, theory proposition, hypothesis formulation, and creativity/imagination in research.

Chapter 10: “A Computational Model of Collaborative Creativity: A Meta-Design Approach.” The role of collaboration in the realm of social creativity has been the focus of cutting edge research in design studies. In this paper, Amit Banerjee, Juan C. Quiroz, and Sushil J. Louis investigate the role of collaboration in the process of creative design and propose a computational model based on the newly proposed meta-design approach to possess exploratory transformation creativity and solve complex design tasks using open support systems. Meta-design is a unique participatory approach to design that deals with opening up of design solution spaces, and is aimed at creating a viable social platform for collaborative design. This paper has addressed several issues relating to implementation such as ones relating to creative spaces, user fatigue, subjective fitness evaluation, mediators, affective mechanisms, interaction, and collaboration. The model has been implemented to collaboratively evolve floor plans and interactively evolve editorial design layouts for brochures and posters—two applications that use an established body of knowledge and rely on user preferences by using interactive genetic algorithms and a set of collaborative users for subjective fitness evaluation. Although these implementations are designed at the product level (a floor plan or a brochure is a product), the same principles can be used to design for at an abstracted level, e.g. instead of directly evolving floor plans as physical artifacts, they can be evolved at the “idea” level in terms of their constitutive elements. This is almost certainly more realistic and also mimics the creative process architectural teams go through at design conceptualization time. The amount of creative content is more at the abstracted level compared to the physical level of design, involves more imagination than knowledge.

Chapter 11: “A System Method to Elicit Innovative Knowledge Based on Chance Discovery for Innovative Product Design.” For responding to global competition, increasing activities in product design has been changing from investment-driven landscape to an innovation-driven economy. Supplying value-added and innovative products has become an important business strategy. In this paper, Hao Wang, Yukio Ohsawa, and Yoko Nishihara proposed and described a system method of innovative knowledge elicitation based on chance discovery for new product design. This system contains three functional
modules: (1) scenario graph generation module by using Keygraph, a visual tool of chance discovery, and a tool called data crystallization that chance discovery extended for dealing with unobservable events. Chance Discovery is a human-computer interaction process to detect rare but important chances for decision making. (2) Innovative knowledge solicitation module by Innovators Market Game (IMG), a kind of table game for collaborative innovation; and (3) innovative knowledge alternatives selection module based on the method of Analytic Hierarchy Process (AHP). The experiment is taken to play IMG and make value cognition by humans based on the scenario graph generated by Keygraph. During the IMG, innovative knowledge as new value is co-created by humans. AHP is used to evaluate these innovative alternatives. The performance of the method is illustrated by using a case study on innovative product design. The results indicate this method can aid humans in eliciting innovative knowledge for creative product design at the early stage of product development. Through IMG experiment, there are some results: 1) Customers’ requirements drive innovators and market innovation. 2) Keygraph can splendidly assist human’s value cognition for creating new idea. Meanwhile, IMG can effectively improve humans’ understanding of Keygraph to accelerate the process of humans’ value cognition. 3) It is found that the number of proposed requirements is almost equal to the number of created ideas.

Chapter 12: “Association Rules Evaluation by a Hybrid Multiple Criteria Decision Method.” Association rule mining algorithms can generate amounts of association rules, but only a small number of rules may be selected for implementation. There is a need for developing techniques to obtain rules that are more interesting to the users. In this paper, in order to solve this question, Zhen Zhang and Chonghui Guo proposed a framework based on multiple criteria decision theory. This framework is evaluating the mined association rules using TOPSIS method with combination weights which is determined by entropy method and takes into account both objective interestingness measures and the users’ domain information. The proposed framework can be illustrated: First of all, the transaction database is constructed, and association rules can be generated by using Prior algorithm with minimum support and minimum confidence thresholds. After that, the users are required to select criteria taking into account both the objective interestingness measures and the users’ domain information, and determine the weights for the selected criteria using the method proposed in this paper. Finally, TOPSIS method can be used to rank the mined association rules, and the rules at the top of the ranking list can be selected for implementation. Market basket analysis is applied to illustrate the applicability of this method. Compared with other methods, the proposed method has the following advantages: 1) this method takes account of both the subjective weights and objective weights of the data; 2) this method is computationally efficient and easy for implementation; 3) the proposed method can rank all the association rules, which may provide more information to the users.

Chapter 13: “A Study of Organizational Narrative Simulation for Decision Support.” Although there are many decision-making approaches in the modern era, it was found that current approaches mainly provide abstract information and require a huge amount of labor and time resources to facilitate decision-making. In this paper, in order to redress this problem, C. L. Yeung, C. F. Cheung, W. M. Wang, and E. Tsui presented an Organizational Narrative Simulation (ONS) method which showed limited support to educate participants to learn how to make decisions and facilitate them to generate prompt responses to the circumstances. The ONS methodology is presented which includes three stages: data transformation, narrative construction and evaluation, decision simulation. By using the ONS method, possible and plausible narrative-based environments can be simulated. Participants can take actions based on their decisions; they can also observe the changes and the consequences. The decisions for handling new challenges generated purposely are validated in a trial that allows prompt responses to the situations. The ONS method is implemented in a selected reference site. The implementation processes, findings, and benefits are presented. The experiment is conducted in Construction industry in Hong Kong and the result is suited well.
Chapter 14: “Total System Intervention for System Failure: Methodology and Its Application to ICT Systems.” In this chapter, Takafumi Nakamura and Kyoich Kijima propose using “Total System Intervention for System Failure” (TSI for SF) as a methodology for preventing future system failures. They also proposed using the “System of System Failures” (SOSF) meta-methodology to provide a common language for understanding system failures among the various stakeholders. In the subsequent discussion, the main factors causing system failures are debated using SOSF and other methodologies in different models. Meanwhile, through comparisons, such conclusion is drawn that the SOSF meta-methodology overcomes the shortcomings of the current methodologies. In the following, the statement TSI for SF can do a lot of help in preventing system failures is come out. Then application examples of ICT systems were used to demonstrate that the TSI for SF methodology is effective. At last, three checkpoints are concluded to prevent system failures: 1) Close the gap between the stakeholders. 2) Introduce absolute goals to avoid local optimization and to ensure that the essential goal is pursued. 3) Enlarge system boundary.

Chapter 15: “A Formalised Approach to the Management of Risk: Process Formalisation.” In this chapter, Make Brownsword and Rossi Setchi propose and validate a multi-view approach to define the processes required to carry out risk management. The formalized approach proposed includes a definition of risk, an ontology, a set of processes, and a pragmatic methodology, which shows an application of these processes enabling pro-active management of change. The ability of the processes to be applied to different types of risk has been demonstrated through a case study highlighting health and safety issues. Within the current engineering and economic climate, this logical approach provides a visualization which is consistent, repeatable, view based, and pragmatic. Firstly, this chapter provides the background understanding of risk and reviews the relevant literature. Then, it focuses on defining a set of processes, which can be used to manage risk, and a methodology, which provides theoretical and practical application sequences for the processes. Thirdly, the approach is validated through a case study, which is presented. Finally, it provides conclusions and recommendations for areas of further work.

Chapter 16: “Simulation on Knowledge Transfer Processes from the Perspectives of Individual’s Mentality and Behavior.” In this chapter, knowledge transfer is defined as a communication process with information processing activities, where the actors involved can carry out the transfer of knowledge using an appropriate mechanism. It is believed that both the knowledge disseminative capacity of knowledge sender and the knowledge absorptive capacity of knowledge recipient have a great impact on the performance of knowledge transfer. Therefore, it is necessary for the organization to study the way to stimulate both knowledge senders and knowledge recipients. However, little research concerns how to promote the disseminative capacity of knowledge sender or absorptive capacity of knowledge recipient. The contributions of this study are trifold. First, it reveals the relationships between knowledge disseminative capacity, absorptive capacity, individual’s mentality, and the performance of knowledge transfer. Second, it indicates that individual’s mental factors such as prestige and reputation can encourage knowledge senders to improve their disseminative capacity of knowledge, and accelerate the knowledge transfer within the organization. Third, it confirms that a reasonable personnel movement across different departments can promote the speed of knowledge transfer between individuals within the organization. This paper presents the knowledge transfer model, including the conceptual model and the network model, of which a knowledge exchange rule is described in detail and addressed the way to measure the performance for knowledge transfer. This paper presents two knowledge transfer models including a conceptual model and a network model. The results of the study show that the positive mental factors of individual’s benefits such as prestige and reputation can enhance the disseminative capacity of knowledge senders, accelerate the knowledge transfer, and further improve the knowledge stock of the organization. These findings can help the organization make some decisions on knowledge transfer and knowledge share.
Chapter 17: “Delivering Knowledge Services in the Cloud.” This chapter explores various topics and resources in recent years about the fundamental knowledge-based services that can be rendered in a cloud environment. The authors, Farzad Sabetzadeh and Eric Tsui from The Hong Kong Polytechnic University, review some of the basic concepts of cloud computing, position the cloud as the front end of the computational value chain, and identify the challenges and opportunities for delivering Knowledge Services in the cloud. All the three components of infrastructure, platform and software, including (1) IaaS—Infrastructure as a Service, (2) PaaS—Platform as a Service, and (3) SaaS—Software as a Service, come together to provide an aggregated ecosystem for the delivery of services. The authors also discuss a schematic view of cloud intelligence, about how cloud can work in different levels of intelligence in order to tackle problems that could not managed in traditional look in grid computing. The cloud logic underpins much of the intelligence in a knowledge cloud, and emerges as a key area for researchers to focus on in order to identify, prioritize, decompose tasks, and scale up resources dynamically in the cloud for high gain applications. Advancements in Web 2.0 offers, among others, crowd sourcing and massive collaborations but the intelligent knowledge cloud delivers future knowledge services at even more elevated levels.

Chapter 18: “Social Responsibility: A Crucial Knowledge and Ethics.” This chapter is presented by Matjaz Mulej with his colleagues from University of Maribor in Slovenia, discussing a new remedy offered under the label of Social Responsibility (SR), which is aimed at support to sustainable development. There are many millions contributions about social responsibility on Web pages. The simplest and oldest version of SR is charity, but it might only be a mask for real one-sidedness rather than requisite holism of behavior of influential persons and their organizations. SR includes seven content areas: (1) organization, management, and governance; (2) human rights; (3) labor practices; (4) environment; (5) fair operating practices; (6) consumer issues; and (7) community involvement and development. The authors come to think of combining in a synergy (a) social responsibility, (b) innovation, (c) the (Dialectical) Systems Theory (as the theory of attainment of the requisite holism, without which the benefit of all can hardly be yielded). Without SR, the current civilization hardly has a chance to survive. Data from USA, Germany, etc. show that customers are increasingly embracing it. This makes this invention start becoming a crucial non-technological innovation, which shall enter the economic practice and education quickly. The authors prefer no limitation of SR to companies: they follow influential humans’ decisions. SR is a human attribute. Interdependence makes human honest and leads from one-sidedness to holism.

Chapter 19: “A Combined Forecast Method Integrating Contextual Knowledge.” Economic forecast can predict the future by the rules extracted from historical information and thus bring the information advantage to decision makers, which is a key factor of success for the executives to obtain market information swiftly and make decisions scientifically. In this chapter, Anqiang Huang, Jin Xiao, and Shouyang Wang introduce a Combined Forecast Method Integrating Contextual Knowledge (CFMIK) under the framework of TEI@I methodology, which integrates qualitative and quantitative analysis, and has been successfully applied in an increasingly number of areas owing to its high effectiveness of analyzing complex systems. The contextual knowledge in economic forecast is defined as the aggregation of relevant knowledge of the forecast object, which can be obtained from 3 sources: historical data, Internet information, and expert experience. A framework of contextual knowledge in economic forecasting is also proposed to integrate these 3 sources. CFMIK, proposed in this chapter, adopts data mining, text mining, and expert system to generate contextual knowledge, and then applies the contextual knowledge to the process of the model selection, model combination, and result adjustment to obtain the final forecast result. Based on the knowledge engineering theory, the authors present a theoretical model of CFMIK,
which considers 4 significant problems and mainly about one kind of contextual knowledge—the time series characteristics and the effectiveness of CFMIK is verified through an empirical study of forecasting Tianjin Port’s container throughput.

Chapter 20: “Using Network Analysis and Visualization to Analyze Problematic Enterprise Information Systems.” Problems associated with the troubleshooting of Social and Technical Systems have never been resolved, and systems science has long since been applied to the studies of these problems. In recent years a new set of tools and techniques from complexity science has become available to socio-technical systems, especially when the advances in complex network analysis provide a fertile territory. In this chapter, David Greenwood and Ian Sommerville explore proof-of-concept tools for network analysis and visualization that may provide a promising avenue for identifying problematic elements and interactions among an overwhelming number of socio-technical elements. The authors demonstrate the potential of this approach by showing that: 1) a problematic situation may be represented as a directed graph such that the elements in the situation are represented as nodes, and interactions between nodes as edges; 2) that eigenvector centrality, a well established measure of node importance, may be used to rank the importance of elements in a situation and that highly ranked elements match those identified as important by a human analyst; 3) the ‘complexity’ of a situation, or a part of a situation, may be characterized using a feedback degree score which provides an indication of the extent elements are highly interconnected and are involved in feedback loops. This contribution is significant as it provides an avenue for developing scalable engineering techniques to troubleshoot large-scale situations.

Chapter 21: “Opinion Dynamics: A Multidisciplinary Review and Perspective on Future Research.” Opinion dynamics is a key sub-field of social dynamics and sociophysics to investigate the spreading of opinions in a collection of human beings, and it cover a wide range of social phenomena, e.g. emergence of fashions and fads, minority opinion survival and spreading, collective decision making, consensus building, emergence of political parties, diffusion of rumor, expansion of extremism, and propagation of cult. In this chapter, Xia, Wang, and Xuan give a multidisciplinary review on opinion dynamics and attempt to keep track of the historical development of the field and to shed light on its future directions. Various studies in sociology and social psychology have great impact on the birth of opinion dynamics, and in this academic confluence, the use of mathematical, physical, and computational tools plays a vital role. The main body of opinion dynamics can roughly be divided into four major streamlines, i.e., the voter model, the Sznajd model, the culture dissemination model, and the bounded confidence model, which follow a bottom up modeling approach to study the aggregate dynamics of opinions and are determined by the local rules of inter-agent interactions and the environmental structure or topology of the agent society where the inter-agent interactions take place and the aggregate opinions evolve. Three key features or modeling elements hence characterize a specific opinion dynamics model: the representation of the opinions, the local rules for the agents to influence each other to change their opinions, and the overall social structure that interlinks the agents. At last, the authors also envision the important directions in the near future.

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