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Editorial

# Advances in aligning knowledge systems, improving business logistics, driving innovation and adapting customer centric services

This special issue of Expert Systems with Applications recognizes the contributions of authors and participants in the 16th ISPE International Conference on Concurrent Engineering (CE2009, July 20–24, 2009, Taipei, Taiwan). Among more than 100 papers presented in CE2009, the guest editors have selectively identified and invited the authors to re-write and extend their short articles for re-submission to the special issue. The papers selected for the special issue demonstrate the ideas, models, and methods used to create expert systems that better manage organization knowledge, service delivery, integrated applications, product design, and manufacturing. The research unveils *new directions in aligning systems within the firm, improving business logistics, driving engineering innovation, and adapting a customer centric approach to improve sales and services*. In this introduction, the papers are organized into categories covering systems, logistics, innovation, and services to unify the underlying theme of this special issue.

## 1. Systems

Expert system solutions have evolved over the last 40 years but the core problem remains capturing knowledge and creating entities that emulate people to solve complex problems. The complexity of world systems is growing in pace with the development of knowledge. Early expert systems targeted molecules and blocks and these elegant models and approaches created the foundation for the application of expert systems and knowledge engineering applications across disciplines. However, our small worlds of knowledge have grown so fast that everyone is overwhelmed.

Manufacturers are challenged by the complexity of systems in an environment where product lifecycles are very short. Even though manufacturing expertise is being engineered into the enterprise systems and logistics networks, the systems have grown so complex, that the inability to define these systems directly impacts profits. Engineering design and re-use of patented knowledge is an emerging strategy used to quickly satisfy market demand. Manufacturers cannot risk re-inventing designs and are integrating in-house knowledge with licensed knowledge to derive quick-to-market products. For example, Lin and Cheng, the authors of "The Application of Systematic Knowledge Analysis for Improved Door Structure Designs" show the importance of tracking external knowledge (patents) as well as internal expert experience to improve final designs. Expert knowledge is represented by engineering knowledge and by patent knowledge. Then, a system using traditional engineering principles and the finite element analysis confirms the rationality and applicability of the design decision to create light weight door shaped structures.

One approach to better manage manufacturing systems relies on the ability to define processes, people, knowledge, and mobile agents. Chen and Chen, in their paper "The Application of Multi-Agent Technology to a Multi-Section Flexible Manufacturing Systems," apply multi-agent technology to flexible manufacturing system controller design. The agent based (not people based) control improves the availability of machines, shortens the manufacturing time, and increases capacity. The agents are in charge of finding the best dispatching rules. Message transfer and coordination among agents uses a communication language and a coordination mechanism to analyze and resolve task conflicts. Virtual agents set the priority of machines and assign delivery services for the overall benefit of the system.

## 2. Logistics

The logistic related papers introduce forward and reverse supply flows for green products. The emergence of new regulations for the disposal of electrical and electronic equipment, directives on the use of certain hazardous substances, and the Kyoto Protocol are changing industries approach to product design and manufacturing. If disposal is to be considered as part of the supply chain, then the supply chain is modeled as a forward and reverse flow. Product lifecycle management systems provide a platform for the management of data related to the creation and disposal of products. These systems assist the participants of the products' life cycle processes (manufacturers, suppliers, customers, and regulators) to use data efficiently for planning and control. In the paper "An XML Based Supply Chain Integration Hub for Green Product Lifecycle Management" by Taghaboni-Dutta et al. an integrated green parts information platform framework and a working prototype of a reverse logistics system are described. This system uses XML file transmission to improve the quality, cost and time-to market issues for green designs.

Green reverse logistics analyzes the processes associated with the flow of products, components and materials from end users to re-users consisting of second markets, re-manufacturing, and disposal. The components may be widely dispersed among channel members during reverse logistic flows. The research paper "Genetic Algorithm Dynamic Performance Evaluation for RFID Reverse Logistic Management" (Trappey et al.) uses fuzzy cognitive maps and genetic algorithms to model and evaluate the performance of RFID-enabled reverse logistic operations. Fuzzy cognitive maps better enable the linguistic expression of causal relationships between reverse logistic parameters. Inference analysis using genetic algorithms contributes to the performance forecasting and decision support for improving reverse logistic efficiency.

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## 3. Innovation

Knowledge systems and embedded intelligent methodologies are critical to enable product and service innovations. This special issue collects fours innovation-related research papers. In the paper "A Multidisciplinary Implementation Methodology for Knowledge Based Engineering: KNOMAD," Curran et al. have proposed a knowledge based engineering framework that integrates multidisciplinary approaches used during engineering design. The authors Lo, Tseng and Chu provide a paper entitled "One Step QFD Based 3D Morphological Charts for Concept Generation of Product Variant Design" to facilitate conceptual design innovation. The article entitled "An Expert system Using Rough Sets Theory and Self-organizing Maps to Design Space Exploration of Complex Products" (by Chu et al.) describes an expert system that applies rough sets theory and self-organizing maps for creating innovative and complex products. In the area of service innovation, Wu et al. have identified bottlenecks and use Web 2.0 technology to solve the problems.

## 4. Service

This section describes the ways sales and service models can be used to create business information systems that assist in design trouble-shooting, sales forecasting, strategic planning, and select among alternatives. Hiekata, Yamato, and Tsujimoto's paper "Ontology Based Knowledge Extraction for Shipyard Fabrication Workshop Reports," provides a service to design engineers by helping to prevent design errors. Ship building companies keep very detailed records of problems in order to avoid making the same mistake again. However, if no one reads the reports or processes the reports into knowledge, then there is likelihood that the construction mistake will be repeated. The authors create a failure database using text processing technology to define synonymous component and trouble names, consolidate the names into normalized terms using an ontology, and then statistically analyze the results. The system evaluates frequent trouble records by classifying the records using component and process ontology. In the last step, the designers extract knowledge from the information generated by the system and avoid very costly ship building mistakes.

Retailers have difficulty forecasting sales which contribute to lost sales and future logistical and manufacturing problems. Kenji Tanaka, in the paper "A Sales Forecasting Model for New-released and Non-linear Sales Trend Products," provides retailers with the ability to create long term forecasts using the sales results from the product's very early release. Thus, if a book seller launches a new title, Tanaka's models and method enables the retailer to make critical reprint decisions and modify the merchandise mix to best satisfy the customer. The approach also shows robust results predicting new release consumer electronic goods.

A difficult problem for government agencies is to select, assist, and promote companies with the greatest potential for international trade development. Local information service providers have a tendency to saturate the local market without achieving sufficient scale to develop internationally. Thus, in the paper "The Use of a Hybrid Fuzzy Delphi AHP Approach to Develop Global Business Intelligence for Information Service Firms," Chen and Wang provide a decision making methodology that helps firms plan global market entry strategies.

Determining which product to develop when given a portfolio of ideas is addressed by Chiang and Che in the paper "The Application of Bayesian Belief Networks and Weight Restricted Fuzzy DEA to Evaluate and Rank New Product Development Projects." In order to help a company determine new product development selection and strategic formulation, the authors apply the fuzzy analytical hierarchy procedure (AHP) and fuzzy data envelopment analysis (DEA) to develop an evaluation and ranking methodology. The analysis output are projects which have the highest development potential and contribute the most added value to the firm. Manager's decision making risk is reduced using Bayesian belief network technology to create the risk evaluation models.

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