Innovation in Manufacturing, Energy, and Service Systems

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Abstract

Innovation is a key strategy for competitiveness in the global market by setting a stage for economic progress. The practice of innovation is fragmented and centered on specific cases. This presentation contributes to better understanding of the process of innovation which is considered from a data-driven perspective. The proposed approach extends the practice of integration of users and stakeholders into product, manufacturing, and service development activities. The fact that the product and process requirements are elicited from multiple sources and analyzed with the modern analytical tools is likely to lead to business success.

Selected concepts of creativity, inventiveness, innovation, and innovation facilitators such as leadership, entrepreneurship, and idea incubation are introduced. Business rules and best practices enhancing innovation are discussed. The data stored in data warehouses is a valuable source of process improvement and innovation. Methodologies and tools supporting innovation are presented, for example, data mining, process modeling, dependency analysis, and social networks.

Process modeling is a backbone for defining the best innovation practices. Many of the classical analysis tools when combined with data and text mining tools offer a viable innovation toolkit. Increasing customer base is of paramount importance in the global economy. Companies compete in various ways, including the design of large product portfolios aimed at meeting expectations of an individual customer. Meeting these individual customer expectations could significantly increase complexity of products and manufacturing. Various approaches have been considered to manage the product and manufacturing complexity. Some of these strategies such as modularity, mass customization, assemble-to-order, and supply chain management and the underlying modeling approaches are considered in the presentation. Though the task of product complexity reduction does not appear to have a direct link to innovation, the research demonstrated in the paper shows that the relationship between the two is meaningful. Many of the design and complexity management approaches are based on data mining. Data mining-algorithms determine products sought by the customers that can be produced in large quantities. Various principles of mass customization are discussed in the context of innovation and product complexity management. The impact of the innovation and mass customization on products, manufacturing, and service is illustrated with examples. The ideas outlined in the presentation are illustrated with industrial examples.

Bibliography:

Dr. Andrew Kusiak is a Professor and Chair of the Department of Mechanical and Industrial Engineering at the University of Iowa, Iowa City. He directs the Intelligent Systems Laboratory. Dr. Kusiak is interested in applications of data mining, evolutionary computation, and optimization in energy, manufacturing, product development, sustainable systems, and healthcare. He has authored and edited fifteen books and handbooks and published over 280 papers in journals sponsored by societies, such as AAAI, ASME, IEEE, IIE, ESOR, IFIP, IFAC, INFORMS, ISPE, and SME. Dr. Kusiak speaks frequently at international meetings, conducts professional seminars, and consults for industrial corporations. He has served on editorial boards of over forty journals and as editor of book series with John Wiley, Chapman and Hall, Springer, and Taylor and Francis. Dr. Kusiak is the Editor-in-Chief of the *Journal of Intelligent Manufacturing* and the Fellow of the Institute of Industrial Engineers. His research has been sponsored by the National Science Foundation, Department of Defense, Department of Energy, and private corporations. The Intelligent Systems Laboratory maintains long-standing relationships with numerous corporations.