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## **Editorial: Innovation in manufacturing: a new perspective for improving competitiveness**

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**Biographical notes:** Dr. A. Gunasekaran is an Associate Professor of Operations Management in the Department of Management at the University of Massachusetts, Dartmouth, MA 02747, USA. Prior to this, he has held teaching positions at Brunel University (UK), Monash University (Australia), the University of Vaasa (Finland), the University of Madras (India) and the University of Toronto, Laval University and Concordia University (Canada). He has 125 refereed articles published in journals such as the *International Journal of Production Research*, *International Journal of Operations and Production Management*, *Computers in Industrial Engineering: An International Journal*, *European Journal of Operational Research*, *International Journal of Production Economics*, *Journal of Operational Research Society*, and *International Journal of Computer-Integrated Manufacturing*. He has presented 50 refereed papers in conferences and given a number of invited talks in about 20 countries. He is on the Editorial Board of 15 International Journals that include *International Journal of Production Planning and Control*, *Computers in Industry: An International Journal*, *International Journal of Production Economics*, *International Journal of Computer-Integrated Manufacturing*, *Journal of Operations Management*, *Supply Chain Management: An International Journal*, and *International Journal of Quality & Reliability Management*. Prof. Gunasekaran is currently interested in researching agile manufacturing, concurrent engineering, management information systems, technology management, supply chain management, computer-integrated manufacturing and total quality management. Prof. Gunasekaran is the Editor of *Benchmarking: An International Journal*, an Associate Editor of *Integrated Manufacturing Systems* and the Regional Editor (USA) for the *Supply Chain Management: An International Journal*. He also edited a couple of books on agile manufacturing and knowledge and information technology management.

The globalisation of markets, the worldwide dispersal of production facilities and trade related conflicts between nations are all tied to long-term change in the technologies of production, communication and distribution. Management of this change requires increasing international cooperation on innovation in manufacturing industries. Innovation plays a significant role in improving the quality of product development and manufacturing. Increasingly, innovation affects organisations and political institutions in unusual and complex ways over long time horizons. Specifically, innovation in manufacturing organisations as it applies to corporate, regional, national and global bases is very important.

Recognising innovation as a manufacturing competitive strategy, a call for papers for a special issue on the 'Innovation in Manufacturing: A New Perspective for Improving Competitiveness' was issued by the *International Journal of Manufacturing Technology*

*Management.* Strategic frameworks, conceptual and analytical models, empirical research and case studies focusing on improving the design, justification and implementation of innovation in manufacturing are included in this special issue. However, contributed papers deal with, but are not limited to:

- Innovation in international manufacturing operations
- Product development strategies and innovation
- Interrelationships between technological, economic, social and political objectives of innovation in manufacturing
- Innovation strategies in manufacturing
- Multiple levels of innovation across manufacturing organisations in competitive and/or conflicting situations
- Implementation effectiveness of innovation in manufacturing
- Innovation in manufacturing at international, country and company level

This special issue contains theoretical contributions, case studies and empirical investigations emphasising different aspects of innovation in manufacturing, including new frameworks for the implementation of new concepts and technologies in manufacturing, implications of information technology and information systems in manufacturing competitiveness, management of innovation in manufacturing, new tools for customer-supplier analysis, innovations in supply chain management, modelling of strategic issues and so on. An overview of the papers included in this special issue is presented hereunder.

The use of multifunctional project teams to facilitate the introduction of new technologies into organisations is advocated by many academics. The paper, *'Teamwork in New Technology Implementation'* by Sohal and Schroder attempts to clarify empirically the influence of such teamwork through analysis of the statistical associations between teamwork and the planning and implementation processes involved in technology adoption, using survey data from 132 organisations. The influence of teamwork is marked. Multifunctional project teams do expand the scope of issues considered to break down functional barriers and improve the quality of decisions made. However, these teams also soak up time and resources, which highlights the need for teams to operate more efficiently if they are to be more effective.

Implementation of quality initiatives in manufacturing has, in general, increased operational efficiency, brought down manufacturing costs and made companies strategically competitive in many countries. The literature on quality is rich with cases on adoption of quality concepts in manufacturing companies. Country specific survey reports are also available on implementation/adoption of quality concepts. However, very little has been discussed in the literature on the extent of the adoption of quality concepts in various functional areas (product design, production, R&D, finance, human resources, administration, etc.) of manufacturing. The paper, *'An Analysis of Quality Initiatives in Australian and Indian Manufacturing Industry'* by Mandal and Gunasekaran contributes to this important gap in the study of manufacturing and quality literature. It reports the results of two surveys (one in Australia and the other in India) related to the manufacturing sector. The paper shows that quality concepts have spread

disproportionately across functional areas of product design, production, sales and marketing and finance and administration.

Through an empirically based study on 65 medium sized manufacturing firms corresponding to 12 industrial sectors and located in the Spanish region of Valencia, March-Chorda and Yagüe -Perales in their paper, *'Finding Evidence on the Innovative or Positional Character in Medium Sized Manufacturing Firms'* provide enough evidence about the prevalence of positional, static and myopic values and, conversely, innovative, dynamic and open minded principles, among the firms under study. Gathered into three groups of sectors, depending on the scope of demand (weak, medium and strong demand sectors), the author concludes that the weak and medium demand sectors are still facing remarkable challenges and barriers basically connected to technology issues, despite improvement in other variables directly linked to an innovative character.

Hitomi in his paper, *'Historical Trends and the Present State of Japan's Industry and Manufacturing'* reviews the historical developments in Japanese industry, especially the manufacturing industry during the period 1955–1995, and analyses Japan's manufacturing efficiency and evaluates from three kinds of measures; that is, yield rate, efficiency index and relative productivity. Evidence is found that Japan's manufacturing efficiency is high in terms of efficiency index and relative productivity, but the lowest from the standpoint of the yield rate among classified industrial sectors. Japan's industrial labour productivity is also compared with that of other industrialised countries, which results in rather low productivity for Japan's industry from the standpoint of purchasing power parity.

Aziz and Beamish in their paper, *'Customer-Supplier Relationship Analysis Model for the European Multichip Module (MCM) Industry'* present an overview of the MCM (Multichip Module) technology and illustrates the technological benefits that can be derived by the application of this technology. The paper further shows that the working relationship between customers and suppliers in the MCM industry is extremely poor. A new method for analysing and improving the customer – supplier relationship has been developed and applied within the MCM industry. The paper concludes that there is a substantial shortfall in expected performance of both customers and suppliers and shows the need for joint improvement actions to be developed through discussions at joint review meetings.

Having achieved significant improvements in manufacturing, many firms are now focusing their attention on their supply chains. With increased globalisation, supply chains for most products have become longer both on the input as well as the output sides. This, combined with the trend towards proliferation of products, makes management of the supply chain a very challenging task. Apte and Viswanathan in their paper, *'Strategic and Technological Innovations in Supply Chain Management'* review some of the recent strategic and technological innovations in the management of manufacturing supply chains. They specifically discuss innovations in the management of product and information flows in the supply chain. In the management of product flow, the innovations include concepts such as modularisation, postponement, mass customisation and flexible automation, time-based logistics and cross docking. In the management of information flow, the innovations include the use of information technologies and strategic partnerships to improve the transparency of information. They also review the specific strategies that use the enhanced information flows such as

continuous replenishment; vendor managed inventory, quick response and efficient consumer response.

The nature of competition is changing both in terms of the dynamics of market requirements and who the competitors are. The changing market requirement creates the need for an uninhibited flow of information up and down the organisation and across the value-added network. As organisations cooperate to compete, competition is increasingly between value-added chains rather than between companies. The integration of organisations into the value-added chains, resulting in extended enterprises, where product and process design of an organisation will have to reflect the operating conditions of the customer's customer and the supplier's supplier, has therefore become a very significant importance to the emerging reality of competition between value-added chains. However, building a solid foundation for the integration of an extended enterprise must start with the integration of internal capabilities, facility and functions within individual enterprises. It is against this background that the enterprise-wide integration programs in three companies have been studied and reported by Yusuf, Little and Onuh in their paper, *'Multiple Case Studies of Total Enterprise Integration Programs: Lessons and Benefits'* for the purpose of a deeper understanding of the requirements, problems, lessons, benefits and implications regarding telecommunications companies with extensive international business interests.

The business environment in which manufacturing operates has become increasingly dynamic and complex. Consequently, there is an increasing need for manufacturing companies to develop business policies that are able to respond to changing environmental conditions. Before an effective policy can be designed, developed and implemented, management should understand how various inputs and outputs of the manufacturing environment influence a company's business policy. Hence there is an increasing need to model business policy to support managerial and operational decision making. Managers entrusted with strategic decision making in manufacturing companies should be able to take a holistic view of their business so that they can acquire an understanding of how various elements of the manufacturing environment interact with each other. Mandal, Love and Gunasekaran in their paper, *'A Conceptual Approach to Modelling Strategic Issues to Improve the Performance and Competitiveness of Manufacturing'*, describe and demonstrate how system dynamics can be used to develop a conceptual model of strategic issues, such as quality and how investment and government policy influence the performance and competitiveness of manufacturing. The utility of the model for policy making is discussed.

One of the principal concerns with ISO-9000 is its inability to document and monitor continuous improvement. QS-9000 has recognised this weakness and incorporates and demands a comprehensive philosophy of continuous improvement. As QS-9000 is relatively new for all companies, whether auditing or implementing, little experience is available for individuals to be confident that any new method of working is acceptable. Given that QS-9000 does not accept minor non-compliance as ISO-9000 does, there is a risk that changes to companies' systems may have far-reaching implications in gaining and maintaining QS-9000. Arunachalam, Gunasekaran, McAndrew and O'Sullivan in their paper, *'Implications of QS-9000 in the Implementation of a New Technology - A Case Study'* address some of the major concerns, when implementing new technologies within the QS-9000 framework and how the detail of a new technology, superabrasive reaming, may relate to individual aspects of the standard.

Improvements in quality in organisations result due to interactions and interdependencies among various factors such as an organisation's physical capability, people, technology and employee skills and management leadership. These interactions can be studied through cause and effect modelling. There is a need to understand how policies relating to quality effect and transform an organisation's performance over time and ultimately determine the dynamics of quality. Mandal, Love and Gunasekaran in their paper, '*Towards a System Dynamics Modelling Framework for Quality in Manufacturing*' present a System Dynamics framework, based on causal relations, to model quality issues in a manufacturing environment. The framework can be used to identify the long-term consequences of policy options on quality and manufacturing system performances. As a result of applying this framework it is suggested that it can be used to improve organisational performance and competitiveness.

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