

Manufacturing engineering



Running Head: MANUFACTURING ENGINEERING Manufacturing Engineering

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Manufacturing Engineering

Manufacturing engineering is moving in the direction of high flexibility, low production cost and high product quality. During the last few years, several new manufacturing engineering paradigms have been proposed. The most important of these include: computer integrated manufacturing (CIM) (Nagalingam & Lin 1999), intelligent manufacturing systems (IMS) (Kusiak 1990), fractal manufacturing (Warnecke 1993), bionic manufacturing (Okino 1992), and holonic manufacturing (HMS) (Wyns & Langer 1998). Most of the proposed paradigms focus on improvement of manufacturing systems through the development of two factors: information management and the human factor. Ideas such as intelligent manufacturing systems combine the latest achievements in various directions and put significant stress on the problem of artificial intelligence supported by machine operators. Machine operators working on holonic systems focus their activity on complex problem solving (Oborski & Szafarczyk 2001). Fractal and bionic manufacturing ideas propose manufacturing system performance improvement by stressing work organization factors based on autonomous groups. The human operator also plays a vital role in computer integrated manufacturing (Nagalingam & Lin 1999). All of those new manufacturing engineering paradigms are aimed at creating so-called advanced manufacturing engineering systems. In such systems, several factors are decisive for success: technology, information processing and human factor. Moreover, those factors must coexist together. One of the most crucial and not yet appreciated factors in this combination is the cooperation of

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technical systems and the human operator. The proposed research will be based on advances in socio-technical approach in Manufacturing Engineering.

The socio-technical approach to system design was introduced by the Tavistock Institute of Human Relation in London in the early nineteen-fifties. The idea behind this approach was the elimination of the negative influence of technical systems on social systems in production (Mumford 1994). The socio-technical systems theory (STS) was proposed based on the principles of socio-technical design elaborated by Trist several years ago (Jones 1995). The main idea of STS is the integration of the social requirements of people doing the work with the technical needs that allow the system to work efficiently. These two aspects must be considered independently, because arrangements that are optimal for one may not be optimal for the other. However, they should be optimised together and some trade-off can be made to find the best solution (Fox 1995). Many people contributed to the development of the STS theory. Significant stress was placed on practical utilisation. Research in this direction was carried out in Europe by: Dutch Maastricht Economic Research Institute on Innovation and Technology (MERIT), Swedish Work Environment Fund's LOM program, which involves more than 100 companies, and the Work Research Institute in Oslo. The most well-known organisations and research centres in North America are Alcan, the American Productivity Center in Huston, AT&T, Best Foods, Clark Equipment, Cummins Engine, Digital Equipment Company, Exxon, Ford, General Foods, General Motors, Harman International, Hewlett Packard, Inland Steel, LTV Steel, Mead Paper, Procter and Gamble, Shell Oil, Sherwin-Williams, Tektronix, TRW, Weyerhaeuser, the Work in America institute in New

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York, Xerox, Zilog and various U. S. and Canadian government agencies, such as the Total Quality Management program of the U. S. Defence Department (Fox 1995).

Most research effort on utilising the socio-technical approach in manufacturing system organisation was done in companies and research institutes from the United States. It appears that the benefits of the theory are not well known in Europe. Some researchers have attempted to develop new work organisation concepts to meet today's needs, forgetting about good ideas that were developed almost 50 years ago. Those approaches, like socio-technical design, should be taken into account as new conceptions of work organisation and human-technical system interaction are developed.

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