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The changing relationship between production and inventory examined in a concurrent engineering context

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Abstract

This paper examines some of the changes that are occurring in manufacturing companies and in the market in which they operate. Changes include the product design process, reduction in product design time, new technology, new materials and production methods, the availability of better quality data, organisation change including changes in techniques and tools used for planning and control. Changes in the market include increased competitiveness, the need for shorter lead times, shorter product life cycles, pressures on costs and the need for greater responsiveness.

The paper discusses these among other changes and suggests that the relationship between production and inventory needs to be reviewed to determine whether and how it should respond. A generalised concurrent engineering context is proposed within which it is suggested that production and inventory planning and control should be included.

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1. Introduction and objectives

The purpose of this paper is to consider the implications of the changes that are occurring in manufacturing companies and in the markets in which they operate and, in particular, to consider the effect that these changes are likely to have on the relationships between production and inventory. Specific changes are that the market is becoming progressively more competitive and the technology associated with manufacturing and its control is developing rapidly. The objective of

production planning and control (PPC) is to design and operate a planning and control system appropriate to the expected volume and variety of products, the proposed manufacturing system and the company 'philosophy'. Because all aspects of manufacturing are interdependent and companies wish to satisfy market needs, production and inventory control will need to adapt to provide the appropriate service.

The paper examines some of the variables that are being affected by the dynamic environment in which companies operate. It then goes on to examine the production and inventory control options that are open to companies and considers how the manufacturing organisation may identify sensible responses.

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2. The changes that are occurring

The market environment is becoming progressively more competitive and this is placing pressures on companies. Companies need to be more responsive to these pressures and they are introducing many technical and system changes to achieve this. In particular, industry is currently investing in new approaches to technology and organisation of manufacture to reduce the lead-time from concept to production. These approaches include rapid prototyping, concurrent engineering, lean manufacturing and agile (responsive) manufacture. In addition companies have been making changes to their manufacturing systems including introducing new software and philosophies such as JIT and organisational changes such as having more focussed manufacture.

In the transitional economies the move from a planned to a market economy has further increased the need for change. These economies need much investment. Additionally, the workforce probably needs training to become more market oriented and to be prepared to take the risks associated with meeting the requirements of the market.

Some of these developments are now discussed and the responses required by manufacturing organisations are identified. These include changes resulting from the need for manufacturing systems to remain balanced and integrated.

3. Changes in the market

The world is a globalised competitive market. When companies innovate with products, processes, systems and marketing, that, in turn, requires other companies to change e.g. to redesign products and shorten delivery lead-times in order to remain competitive. Low wage economies force industrialised nations to maintain their competitiveness by investing in productivity and in product innovation. The market wants high quality products available at a competitive price within a short delivery time. Companies wish to have high quality manufacturing, short manufac-

turing lead-times and to minimise stocks. They would also like flexibility so that they may respond easily to changing requirements. Legislation including environmental issues, health and safety legislation and product liability, force other changes e.g. the need to be able to trace the parts within a product. The need for maintainability of products in locations determined by the customer adds another dimension to design. There is also increasing concern about social issues such as the effects of shift work, the distribution of tasks between workers, designing jobs and workplaces to meet the needs of specific populations including people from different ethnic backgrounds, disabled workers, different sexes and different age distributions. Environmental requirements add further requirements such as the need to reduce the amount of packaging, designing for disassembly so as to maximise the possibilities for recycling materials, using more environmentally friendly materials and using more environmentally friendly manufacturing processes to reduce pollution and energy expenditure. Additional materials, processes, machines and computing power are available and new demands for products and services continually arise. Many other examples of changes and opportunities could be added.

4. Changes in manufacturing and manufacturing systems

Manufacture is responding to these market imperatives in a variety of ways. The changes include making organisational changes, changing and improving the design process, introducing different planning and control methods, using different machines and processes, providing better quality data more quickly, etc. All of these changes need to be assimilated so that the total system remains a coherent integrated whole. For convenience the changes are categorised into changes to design methods, changes to hardware, the provision of better quality data, changes to the organisation of manufacturing systems and changes to planning and control methods. Understandably these categories are not mutually exclusive in their effects, e.g. different planning

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