

The transfer of selected lean manufacturing techniques from Japanese automotive manufacturing into general manufacturing (UK) through change agents

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Abstract

The North East Productivity Alliance (NEPA) has disseminated selected lean manufacturing tools and techniques into companies in the North East of England. The aim of NEPA is to help companies improve productivity through applying lean manufacturing management practices and knowledge. The Industry Forum's master class methodology is being used to transfer technology into local companies. This paper considers the process in terms of Lillrank's model of innovation transfer.

Initial results obtained from 15 companies show that the savings are eight times greater than total costs. It has been found that the commitment of management and the ability of the change agents are the key determinants of success.

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1. Introduction

In 2000, 18.2% of the population of the North East of England was employed in manufacturing, which was 20% higher than the UK national average of 15.1% [1]. However, the level of productivity (measured in terms of gross value added i.e. the value of outputs minus the value of inputs) in the North East was 25% lower than the national average. Manufacturing employment in the North East is forecast to fall from around 175,000 in 2000 to 146,000 in 2010, a fall of 19% [2]. This situation has made the support of manufacturing companies a major policy objective of One NorthEast (ONE), the Regional Development Agency (RDA). ONE has funded the North East Productivity Alliance (NEPA), which aims to improve the productivity of regional companies to make them globally competitive.

The overall project is of 6 years duration and will involve 93 companies across all sectors of manufacturing.

The objectives of this paper are to:

1. briefly review the literature on lean manufacturing and its implementation in new contexts;
2. describe the work of the NEPA;
3. model the NEPA process of implementing lean manufacturing using the technology transfer model developed by Lillrank [3];
4. investigate the correlation between the ability of change agents and the manufacturing improvements achieved;
5. evaluate the economic impact of NEPA initiative.

2. Lean manufacturing and its transfer to non-Japanese and non-automotive situations

The Toyota Production System (TPS) [4] was developed in Japan by Ohno and Shingo and forms the basis of lean manufacturing. Toyota could not afford the capital-intensive mass production systems used in the USA so instead focused upon minimising waste in all aspects of its operations. Toyota used many techniques and tools to

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reduce waste including Kaizen, cellular manufacturing, synchronous manufacturing, Poka-Yoke, standardised working and work place organisation [5]. The outcomes included significantly reduced inventory and lead-times, improved delivery performance, better space and resource utilization, and enhanced productivity and quality [6].

The arrival of Japanese automotive companies in the UK in the 1980s and 1990s highlighted the uncompetitive nature of UK automotive components suppliers [7,8]. Strategies were therefore developed to improve the product quality, cost and delivery (QCD) performance of UK companies. In 1996, the Society of Motor Manufacturers and Traders (SMMT) [9], in collaboration with the Department of Trade and Industry, created the Industry Forum (IF) [10]. This was supported by Honda, Nissan, Toyota, General Motors and Volkswagen. They provided ‘master engineers’ who were world experts in manufacturing process improvement [11,12]. The master engineers trained a cadre of UK engineers in the use of best practice manufacturing tools and techniques. The IF created a number of programmes based around a ‘common approach toolkit’ which comprises: (i) ‘The building blocks’ (5C/5S [13], 7 Wastes [5], standardised work and visual management); and (ii) supporting tools (data analysis, problem solving, set-up improvement and line balance) [11]. IF engineers transferred their skills, knowledge and delivery techniques into the companies with whom they worked through master classes [14,15]. Master classes are practical, shop floor-based process improvement activities implemented with a ‘hands-on’ approach. The objective of the training is to enable companies to make significant improvements in QCD and to encourage the development of partnerships with their customers and suppliers. The master engineers have now returned to their respective companies and the training is now provided by senior IF engineers who carry on the high standard of work [11].

The major Japanese car manufacturers have made substantial investments in supplier development teams [16]. These teams train suppliers in manufacturing best practices, which has promoted the dissemination of lean manufacturing throughout the supply chain. In Japan, suppliers and customers often have interlocking business relationships and shareholdings through the ‘Keiretsu’ system [17]. This encourages suppliers to accept the support of their customer. In contrast, in the West, supplier development teams have to work in situations where the companies are independent and there is less loyalty [18]. This can make supplier development much more difficult.

The superior performance of lean manufacturing systems has encouraged the idea of transferring lean manufacturing to non-Japanese and non-automotive situations. This is based upon the premise that manufacturing problems and solutions are universal. However, in practice, Western manufacturers are often able to emulate the structural parts of lean, but have found it difficult to adopt the required organisational culture and mindset. The

impact is often localised and falls short of the desired improvements in the overall system [19].

Lillrank [3] suggested that ideas emanating from Japan have to travel along an ‘idea line’. The ‘distance’ is not only geographical, but also due to differences in culture, society and history, as well as strategic paradigms. ‘Distance’ leads to misunderstandings, incomplete information and incorrect context. Fig. 1 illustrates Lillrank’s model, which is based upon an analogy with the transmission of electrical power, where the power loss is a function of the voltage and distance travelled. Japanese concepts, tools and models are packaged and abstracted for the transfer process. At the receiving end, an application process interprets and applies the package through a learning process that suits local conditions. When implementing lean manufacturing in Western countries there are geographical, educational, cultural, societal and historic barriers, as well as mismatches in strategic thinking [16,18,20].

The implementation of lean manufacturing techniques and philosophies requires the transfer of explicit and tacit knowledge [21]. The transfer of knowledge, particularly tacit knowledge, requires the abstraction and packaging of knowledge from a host. The application of the knowledge by a client involves an unpacking process [3]. The master class [15], which is a 15 day team event, is an example of this form of technology transfer. The abstraction and packing activities took place when the IF engineers were trained by the master engineers. The unpacking takes place through master classes run for recipients.

Lean tools, such as statistical process control (SPC) [22], failure modes effects analysis (FMEA) [23], single minute exchange of dies (SMED) [24], fool proofing and process mapping [25], involve mainly explicit knowledge, which can be codified. These techniques are well documented and are relatively easy to learn from the literature. However, other tools such as total productive maintenance (TPM), Kanban, 5S/5C, standardised working and policy deployment require mainly tacit knowledge [21] to apply them, which makes them difficult to implement without support. The general manager of international purchasing for Toyota commented that ‘(t)he ideas behind the Toyota Production System (TPS) have basically diffused and are

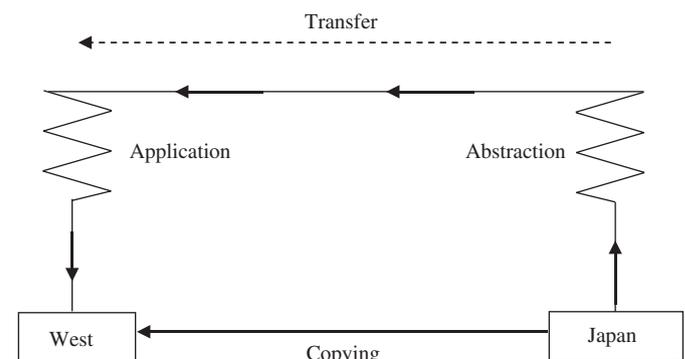


Fig. 1. The transfer of management innovations from Japan [3].

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