
Training: an inhibitor of innovation in the automotive supply chain?

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Abstract: *Have training programmes become the new Taylorism: allowing OEMs to exercise control over their smaller suppliers and unconsciously preventing these SMEs from innovating, diversifying and growing to become competitive rivals?*

At the Lisbon Council in March 2000, European government leaders set themselves the target of making the European Union the “most competitive and dynamic knowledge-based economy in the world, capable of sustained economic growth ...” within ten years. Human resources are central to the creation and transmission of knowledge and a determining factor in the European automotive industry's potential for innovation.

This research seeks to clarify whether the new skills that are being promoted across the supply chain are truly enablers for competitiveness and innovation. As currently practised they may be providing a less effective response to the Lisbon Agenda, i.e. increasing the distribution of skills without the depth that allows companies to become potentially innovative.

For SMEs to be encouraged to grow, to be innovative and so be truly competitive, they need training support. The training may be designed just to tackle short term skills needs. It may be designed to instil the demonstrable best practice of its customer and lean manufacturing is an eminent example of this type. Training must also be designed in the context of where the SME aspires to be, to allow the SME to mature and develop. This research has highlighted the risk when externally promoted and funded training potentially constrains the potential for innovation and the Lisbon goals.

Keywords: Training; Lean; Innovation

1 Introduction

The European Automotive industry is a key strategic player in the European Union with an estimated 10 million workers. A European employers' survey has demonstrated that majority of these work in the supply chain [1]. As a major employer, the sector must work to maintain its competitive edge if it is to keep that workforce engaged.

Nearly 250,000 people in Britain work in the automotive manufacturing sector which contributes around 1.1% of GDP, with around £9-billion of added value, representing 6.1% of UK manufacturing.

The work reported here was started in 2006 just as the UK Government was launching a programme of National Skills Academies. In particular, one of the first to be set up was the National Skills Academy for Manufacturing, NMSA.

Its forerunner, the Automotive Academy was the product of a recommendation of the Automotive Innovation and Growth Team Report, AIGT, [2]. The major stakeholders in the industry worked together to identify the key issues facing the industry and to determine how the UK should respond to the competitive challenges they represent. One recommendation was that

"The SMMT Industry Forum model should be extended to create an Automotive Academy of international standing to provide a comprehensive range of support to greatly enhance process improvement activities right across the industry." [2].

According to its website "**The National Skills Academy for Manufacturing** is a central part of the government's skills strategy. The Academy will focus on meeting the skills needs of both large and small employers from the manufacturing sector, including Aerospace, Automotive, Electronics and Marine." Thus it has absorbed the activity of the Automotive Academy.

At the heart of both these initiatives is the use of the National Vocational Qualifications, NVQ, as the tool to measure and accredit learning related to the workplace. Whilst recognising the need for improvement, Tolley believes that neither initiative has recognised the tension that lies between sectorial requirements and the specific needs of individual employers [3].

This paper has been produced within a programme of research focusing on sustainable training models for manufacturing SMEs within the automotive sector. At an earlier stage in our research [4] we demonstrated that the outcomes of training across this segment of the industry were mostly unknown, unmeasured and often unpredictable. This result was in keeping with wider research which has indicated that even in large enterprises some 60% of training budgets lack quantifiable targets to achieve.

The questions raised by this previous research concern how training is commissioned for SMEs and what determines the nature and expected outcomes of that training; whether training is focused on the organisation or the individual; whether the objectives are remedial or aspirational. The pressing question is whether training is being deployed to improve the competitiveness of the SMEs. The inference from earlier work in the region based on intense interviews and factory visits [5] is that for training to support the drive for competitiveness it must nurture innovation within those SMEs.

At the Lisbon Council in March 2000, European government leaders set themselves the target of making the European Union the "most competitive and dynamic knowledge-based economy in the world, capable of sustained economic growth ..." within ten years [6]. Human resources are central to the creation and transmission of knowledge and a determining factor in the European automotive industry's potential for innovation. Employees in most industries are increasingly required to demonstrate significant

judgement and flexibility, while maximising performance and improving productivity. But to become more efficient and competitive, the Leitch Report highlighted that people need the right skills and therefore to be better trained, more innovative, more customer focused and more determined [7].

Leitch goes on to describe skills as a derived demand, “employers’ skills needs are a consequence both of their product strategy and the firm’s characteristics” [7]. It is the managers of a business who must decide strategically how skills are deployed and on the level of training investment required.

Stepping back and taking a transnational view, there is wider evidence to support the Leitch Report. Looking at employment and economic performance, Leney argues that the European Union is weak on competitiveness and performance and that the Lisbon goals cannot be reached without significant action and innovation [8]. On the same scale the view of the automotive manufacturers themselves is one of losing competitiveness due to the lack of skilled labour to fill open positions [1].

The UK Government’s White Paper on Skills provided an agenda for change including free workplace based training in basic skills¹ and NVQ Level 2 Skills through a National Employers’ Training Programme and a series of Employer led Skills Academies of which the National Manufacturing Skills Academy would be one [9].

In the decade before these policies emerged, employers in general were recognising the increased demand for skills. The “Skills Needs in Britain” survey [10] showed 69% of employers acknowledging that increase. Following from this, there is also evidence that upskilling is taking place. Employers are investing in training and employees are increasing their qualifications [11]. Both these indicators are acknowledged by Goodwin who goes on to query the interpretation of upskilling [12]. It is potentially this confusion around the interpretation of upskilling within the automotive industry that underlies the issues raised by this paper.

In a later project targeted at a group of SMEs, Keogh highlighted further difficulties relating to the intent to train. Amongst a sample of fourteen SMEs He found that “recruitment and staff development were addressed as and when required, thereby catering for immediate operational needs. Only three of the 14 companies had formal training plans in place, which integrated human resource plans with long-term strategic business plans.” [13]

A survey of SMEs in the automotive supply chain based in East of England region [5] showed a marked difference between the stagnant or declining companies and those that were competitive and growing. The most significant differences were in the management attitude towards innovation and the evidence of innovative practice.

Here innovation is taken in its broadest sense to encompass the design of new products or services, the introduction of new processes or materials and juxtaposition of processes,

¹ Basic Skills are defined as the ability to read, write and speak in English / Welsh and to use mathematics at a level necessary to function and progress at work and in society in general. (www.basic-skills.co.uk)

materials, products and services in a new way. In all three cases the objective is to achieve and increase a competitive advantage.

The central aim has been to determine the potential for current training initiatives in the UK to meet the requirements of the Automotive Industry SMEs in a sustainable way. It is one thing to provide training that develops an SME to become a stronger member of a particular supply chain. It is quite another to develop that SME's level of competitiveness so as to allow it to operate successfully in a global market beyond its dependant supply chain

This research has sought to investigate training provision for the sector from three objective perspectives:

- 1) To determine national policy on skills development for the Automotive Industry's SME community.
- 2) To determine the level of provision of skills development amongst both the private and public providers and the drivers for that provision.
- 3) To determine the declared skills development needs of SMEs from sources of data on SMEs in East of England.

2 The Question of a Taylorist Undercurrent to Training

Have training programmes become the new Taylorism: allowing OEMs² to exercise control over their smaller suppliers and unconsciously preventing these SMEs³ from innovating, diversifying and growing to become competitive rivals?

Dankbaar compared the basic elements of lean production with the traditional Fordist system of mass production and argued that despite its benefits, lean production is just extending the life of Taylorist mass production control [14]. The suggestion behind this current work is similarly that if companies are to develop and grow, issues such as learning and innovation are every bit as important as the benefits of lean.

In publishing his 'scientific management approach' in 1923, F. W. Taylor started a concerted search for efficiency. In his experiment at the Bethlehem Steel Works he studied the efficiency of the workers' shovelling. [15] By showing how management could control the workforce he reduced the workforce from 500 to 140, increased output, increased workers' earnings and saved the company \$75,000 per year. His ideas set the tone of workforce development for the middle part of the twentieth century. Management control was all important to ensure consistent performance and ever higher efficiency.

This research seeks to clarify whether the new skills that are being promoted across the supply chain are truly enablers for competitiveness and innovation. As currently practised they may be providing a less effective response to the Lisbon Agenda, i.e. increasing the distribution of skills without the depth that allows companies to become agile, resourceful and potentially innovative.

² OEM: Original equipment manufacturer. In the automotive industry this is the vehicle manufacturer.

³ SME: Small to medium sized enterprise

Dion emphasizes “The success of the Lisbon process hinges more than ever on the optimal formation and usage of the stock of human capital. Human resources are the main engine for the creation, dissemination and application of knowledge essential for the increase in productivity and creation of jobs necessary for the sustainability of the European economic and social model.” [16]

Decisions about training are supported by three sources: funding initiatives; the promotional drive from the training providers themselves, both public and private; and management drivers including customers and in some instances human resource professionals. There is, of course, additional advice and guidance available from research projects and brokerage agencies that may or may not be associated with one of the three groups listed. The methodology has been modified to cater for these external and internal drivers for training. For the former, the method was to interview key players in the training arena. These have ranged from the funding agency for training, the Learning and Skills Council, and the academies set up to focus training in support of employers’ needs, the Automotive Academy and the National Skills Academy for Manufacturing. This was balanced by studying the internal drivers by reviewing data from a number of surveys of manufacturers’ training needs.

3 Findings and Analysis

Public Policy on Training

To represent the public funding initiatives the three UK schemes pertinent to the automotive industry were chosen. These were the Automotive Academy, the newly launched National Manufacturing Skills Academy and the national “Train to Gain” Scheme. Interviews with senior managers questioned the strategic objectives for these nationally funded programmes.

The key driver for the first two was the concept of a nationally agreed view of “World Class Manufacturing” which coming largely from the perspective of Automotive OEMs was based on Lean Manufacturing.

Working with the Automotive Academy since its inception in 2003 and interviewing its CEO, Professor Alan Begg, has provided an insight into its vision and its actions in the industry. The drive from the board, which included senior representatives of Toyota, Jaguar, General Motors, GKN and SMMT, was for the highest quality of training. These major industrial players saw Lean Manufacturing as key to their success and therefore the starting point for Automotive Academy Activity. The Academy’s “Team Leader” programme was developed from experience with interactive Lean Manufacturing programmes and was built around the National Vocational Qualification in Business Improvement Techniques Level 3. This led to a substantial programme of training for Trainers to deliver the Team Leader Programme and also NVQ2 in Business Improvement Techniques at Levels 2 and 3.

Whilst other programmes such as an Automotive Leaders Programme at the University of Cambridge attracted a handful of applicants the main concentration of the Academy’s staff across the country has been in the assessment and upskilling of trainers to deliver Level 2 and 3 training to support lean manufacturing.

The National Manufacturing Skills Academy is still in a state of flux, having been set during 2006. Whilst early interviews indicate a continuation of Automotive Academy programmes and a strong interface with Train to Gain, this area needs further enquiry to give a clear and fair picture. Since its launch in November 2006, its product portfolio is predominantly that of the preceding Automotive Academy.

For “Train to Gain” the strategic objective at present is to raise the base level of qualification of the UK workforce. Within manufacturing this has been interpreted as basic operations or lean principles. The Learning and Skills Council claims to be achieving record numbers of NVQ Level 2 qualifications with “Train to Gain” assisting 79,000 adults to achieve qualifications[17]. Regional initiatives such as “Towards 2010” in the East of England allow more flexibility but at the price of lower funding per individual.

Separate interviews with three “Train to Gain” brokerage team leaders revealed an inadvertent focus on NVQ Level 2 qualifications. The concept is for the brokers to engage directly with the owner managers of “hard to reach” SMEs. [18]These are the companies who are eligible for support but consistently fall outside any State funded provision. The broker is to work with the company to determine skills needs and to direct the company to suitable training providers. The brokerage service is free. The very first level of training is free to staff who have no other training already. Whilst the range of training could be wide; “Performing Manufacturing Operations” and “Business Improvement Techniques”, which covers Lean Manufacturing, are the key courses being delivered to companies in the automotive sector.

Public and Private Provision

The providers sampled included Further Education colleges and private providers who have a track record of servicing the needs of the automotive and advanced engineering industry. Within this sector the connection between funding initiative and training provider has polarised the training available to SMEs to be either business focused management development or workplace lean manufacturing. This supports the industry sector as a whole in line with the American experience of rolling out process innovation (in this case lean manufacturing) across company and supply chain, but does not equip SMEs to innovate in order to be able to diversify into new markets at a time when the automotive market is under pressure. What is a process innovation for an OEM may indeed be an external control for a supplier, however beneficial it might be.

The intention was to look separately at public and private provision of training for SMEs. In fact the two groups are tightly knit with each other and with the funding sources. To illustrate two distinct views this paper includes interviews with a practitioner and a manager. The practitioner has worked in Industry and then closely with both public and private providers. The manager runs a private provider often delivering on behalf of the public sector. In this way we will see the role of Lean Manufacturing in company development.

Methods of training in Lean Manufacturing vary, from classroom theory to active intervention. To gain an understanding of how Lean can be inculcated into a company, I interviewed an Automotive Academy manager who arrived with a history of Lean implementation. Simon Wells had spent fifteen years in the Aerospace industry with TI Reynolds. His final position with the company had been “Lean Co-ordinator”. Simon’s expertise comes from his own self training started off with just one short course. On to that he has built a proven track record of experience [19].

Within his role he saw three key pillars for a sustainable implementation of lean practices. The first was his position as an advocate within the organisation. For a company to take on “Lean” there has to be a champion within the organisation who is prepared to campaign and support the development.

The second pillar is management commitment. Simon described this as a passionate group who want to see change. The final pillar is an understanding of the fundamentals of lean including the “Five Ss”⁴, “Standard Operations” and “Seven Wastes”⁵. These are the basic lean principles that can be taught in the classroom, but underpin every activity in the lean armoury.

The process that Simon employed was to engage just one cell within the company. The whole cell was extracted from the company for a week. As well as teaching the fundamentals Simon helped the group to understand how to justify the necessary changes to get from their current position to a targeted future position. At the end of the week, the group members themselves gave a thirty minute presentation to senior management and colleagues.

A second cell was trained four weeks later and then the same process repeated until all 120 staff on the shop floor had been involved. On reflection the four week cycle should have been six weeks to allow changes to bed in before introducing more.

Despite a reluctant shop floor supervisor the outputs of the project were a 75% reduction in overtime, machine utilisation up by 300% and absenteeism down by 25 – 30%. The improved maintenance reduced stores inventory by two thirds and the Finance Director could see that costs were down. Further case studies were available to demonstrate the benefits of including “Lean” training in a wider intervention to support participating companies.

The Out-Sourced Training Company, TOTC, derived historically from the training arm of the Ford Motor Company in the UK. Having now been disassociated it has been able to develop its own identity and profile as a training organisation. TOTC has a turnover of €9M of which less than 30% is State funding. Having started its operation with automotive manufacturing, it has now grown beyond that sector, but manufacturing still equates to 83% of its business.

National Vocational Qualifications are less than 10% of its work. The Business Improvement Techniques Levels 2 and 3 constitute only half of that. It is the other manufacturing skills that make up 40% with Computer Aided Design, CAD, adding another 10%.

⁴ 5S is a set of techniques providing a standard approach to housekeeping within Lean Manufacturing. Showing its Japanese origin the “Ss” stand for **Seiri** (Sort), **Seiton** (Set), **Seiso** (Shine), **Seiketsu** (Standardisation) and **Shitsuke** (Sustain)

⁵ Taiichi Ohno defined the **Seven Wastes** defined as the Unnecessary **Transport** of materials **Inventories** beyond the absolute minimum, **Motions** of employees, **Waiting** for the next process step, **Overproduction** ahead of demand, **Overprocessing** of parts and producing **Defective** parts

Basic Skills are 15% and the softer management behavioural skills make up another 20%. The remainder of its business is not direct training.

Training Needs for SMEs

Insight into the SME management views on training requirements has been collected from a number of surveys aimed at the manufacturing SMEs in general and the automotive and advanced engineering SMEs in particular. These have included region and sub region cohorts of manufacturers. The survey data has been updated from the researcher's current online survey. Whilst the companies surveyed all reside in one European region and work in the same sector, for the most part they cannot be represented as members of a cluster or network. This current paper looks at two localised surveys and a region wide interactive survey.

The Breckland Survey concentrated on small manufacturing companies in the North East of the Region, namely Norfolk and Suffolk [20]. Here we found that there are skills gaps in nearly half the companies and these gaps and training needs reflect the experience across the region with a strong emphasis on general engineering and machine shop skills.

Forty-four SMEs were surveyed within a forty-mile radius of Thetford, Norfolk. Twenty-eight would class themselves as being in advanced engineering. The other sixteen are all in the automotive sector and predominately in motorsport. Just nineteen had more than ten employees.

Earlier research amongst employers conducted by the Regional Development Agency in 2003 [21] identified generic skills needs that appeared to a greater or lesser extent across most sectors in the areas of

- management and business (some of which will be Level 3)
- ICT for non-professionals
- customer service
- multi-skilling – particularly for manual workers/trades people
- teamworking/flexibility

Within the automotive sector itself that research had identified technical and operative level engineering skills ...” [21].

Much of this is borne out by the survey with 45% of the sample companies experiencing skills shortages. Actual listed shortages included: general engineering, CNC, CAD, machine shop skills, pattern makers, welding. 80% of the companies do invest in skills training for their employees. Amongst the companies the level of participation in specific training has been:

Technical skills training.	80%
Health & Safety.	64%
IT Skills.	49%
Management / Supervision.	40%
Finance.	22%
Personnel Issues / legislation.	18%

The next survey looks particularly at an urban area to the South of the Region. As part of the Luton City Growth project, during 2005, the senior executives of eighty nine small companies across Luton were interviewed. [22] Of these eighteen could be classed as manufacturing companies. The interviews covered a number of aspects that impinge on the companies from local crime to recruitment, skills and the market environment. The interviewers were providing the executives or owner managers the opportunity to present their case without pressure of other agendas.

On the skills issue, 32 of the 89 companies indicated that they had skills needs. Amongst the manufacturers the fraction was higher; nine out of the eighteen.

The range of skilled roles mentioned included design engineers, senior marketing positions, sales people, skilled metal workers, millers, machinists, aerospace structures assembly technicians, senior and qualified finance staff, trained mechanics, sheet metal workers/fabrication, merchandising, technical design, ideally business & financial skills, business/finance manager electronic component repair, food process-millers, food marketers, food packing machine and specialist engineers.

Notably it is the practical skills, finance and management skills that have been identified. There was no mention amongst these companies of the supervisory role seen as a requirement within larger companies.

Finally a more wide ranging survey is based on regional responses to the i10 interactive innovation tool [23]. Here five distinct themes emerge from the data [24]. Specialist technical training is a key requirement, is peculiar to each individual SME and has to be seen outside any provision of generic training.

Supervisory training is the closest match with the two Academies' agendas; highly skilled supervisors are needed to support both the implementation of process innovation driven by the customer and the introduction of innovations for the sole benefit of the SME itself. There are records of good commercial benefits accruing from Lean Manufacturing and supervisory training, but these appear within a stable manufacturing environment.

The next two move away from the comfort of stable manufacturing environments. There is the breadth of experience for apprenticeships where staff need a range of knowledge and experience to engage in innovation. Marketing has been the strongest amongst the micro and small enterprises – again a skill required when a company innovates by producing a new product or service or attempting to penetrate a new market.

A further source of national reference data is the “People Skills Scoreboard” which has been run annually since 1998 by the Engineering Employers Federation. It provides a loose benchmark for training activity together with a number of case studies on individual training scenarios within companies. Its intended purpose is to encourage companies to engage in training [25].

One important caution to be acknowledged is the great variation in the motivations and cultures that drive SMEs.

4 Conclusions and Recommendations

For SMEs to be encouraged to grow, to be innovative and so be truly competitive, they need training support. This training may be designed just to tackle short term skills needs.

Other training that we have seen promoted by national programmes is designed to instil the demonstrable best practice of its customer and lean manufacturing is an eminent example of this type. It is interesting to recall the previous Japanese criticism of UK for a lack of emphasis on practical skills, the use of old-fashioned equipment and teaching methods. [26].

This research is demonstrating that from the view across the manufacturing sector and in particular the automotive sector, there is a marked difference between the intent and desire of the major companies and government agencies on the one hand and the perceived needs of SMEs on the other, leading to reduced encouragement for innovation.

There does appear to be a national policy on skills development for the Automotive Industry's SME community, although with changes of "Academies" this is developing further. The primary links to policy are the promotion of Lean Manufacturing and the raising of the minimum skills level of all workers.

There is more work to be done to determine the level of provision of skills development amongst both the private and public providers, but it appears diverse and not necessarily in line with national policy. Although there exist funding drivers to steer that provision, those mechanisms are new.

Various sources of data on SME in East of England have been mined for the companies' declared skills development needs. Each example shows a closer connection to the needs of the individual and less emphasis on the national policy issues.

The initial doubt raised at the beginning was that too great an emphasis on lean manufacturing would be detrimental to SMEs that needed support for innovation and development. Lewis also highlights cases where companies can become less innovative as they become more lean [27].

Training must also be designed in the context of where the SME aspires to be, to allow the SME to mature and develop. There is a great risk that externally promoted and funded training, designed to suit needs of OEMs and large companies, can constrain the potential for innovation and the Lisbon goals. European manufacturers have also seen that national programmes are currently part of the problem [1].

References

1. CLEPA (2005) Education, Training and Learning to Increase Competitiveness in the Automotive Industry. European Association of Automotive Suppliers.
2. Gibson, I. (2002) The Automotive Innovation and Growth Team (AIGT) Report. DTI.
3. Tolley, H. Greatbatch, David. Bolton, Jean. Warmington, Paul. (2003) Improving Occupational Learning: The Validity and Transferability of NVQs in the Workplace (Stage 3) Research Report No 425. CDELL, The University of Nottingham.

4. Bevis, K. (2006) A review of the current state and sustainability of in-company training in the Automotive Supply Chain in East of England. *School of Aerospace, Automotive and Design Engineering*. Hertfordshire, Hatfield.
5. Bevis, K., Kalantaridis, C., Nelder, G (2001) Report of the Supply Chain Group Research for the Luton Vauxhall Partnership. Regional Supply Network - East.
6. Leitch, S. (2005) Skills in the UK: The long-term challenge. HM Treasury.
7. Leitch, S. (2006) Prosperity for all in the global economy - world class skills. HM Treasury, p. 154.
8. Leney, T. (2005) Challenges and Opportunities that European countries face. QCA.
9. DfES (2005) Skills for Productivity. In DfES, (ed.). DfES Publications.
10. (1997) Skill Needs in Britain. *Industrial Facts and Forecasting*. London.
11. Green, F.A., D; Burchell, B; Davies, B; Felstead, A (1997) An analysis of changing work skills in Britain. *Low Wage Employment Conference*. Low Wage Employment Network, CEP, LSE, London.
12. Goodwin, J., Hills, K., Ashton, D. (1999) Training and development in the United Kingdom. *International Journal of Training and Development*, **3**, 167-179.
13. Keogh, W., Stewart Victoria., (2001) Identifying the skill requirements of the workforce in SMEs: findings from a European Social Fund project. *Journal of Small Business and Enterprise Development*, **8**, 140-.
14. Dankbaar, B. (1997) 'Lean production: denial, confirmation or extension of sociotechnical systems design? *Human Relations*, **50**, 567-83.
15. Taylor, F. (1947) *Scientific management*. Harper and Row, New York.
16. Dion, D.-P. (2005) The Lisbon Process: a European Odyssey. *European Journal of Education*, **40**, 295-313.
17. Wye, R. (2007) Pro 'full-fat': To help adults get the skills that best equip them to gain employment. *The Guardian*. London, p. 5.
18. DfES (2005) Skills: Getting on in business, getting on at work.
19. Wells, S. (2006) Interview. In Bevis, K., (ed.).
20. Bevis, K., Brooks, L. (2005) Motorsport & Advanced Engineering in Norfolk Needs Analysis. Breckland Council.
21. EEDA (2003) East of England Framework for Regional Employment and Skills Action. EEDA, Cambridge, p. 68.
22. Philpott, E., Wogan, P (2005) City Growth, Luton Survey of Business Needs - a report to City Growth, Luton Board.
23. Philpott, E., Bevis, K. (2006) 'Access to knowledge' – a successful approach to university-business working using an online innovation test as a CRM tool. *ISPIM 2006 Conference - Networks for Innovation*. Athens.
24. Newman, R., Philpott, E., Bevis, K., (2004) An analysis of skills needs in small and medium sized manufacturing companies in the Eastern region. i10, Cambridge.
25. EEF, S., MORL., (2005) 2003-2004 People Skills Scoreboard for the Engineering Industry. EEF and SEMTA, p. 104.
26. DTI (1998) Study on Japanese Automotive Component Manufacturers in Britain. *Internal DTI Study*. DTI.
27. Lewis, M.A. (2000) Lean production and sustainable competitive advantage. *International Journal of Operations and Production Management*, **20**, pp. 959-78.