Fundamental Productivity Improvement Tools and Techniques for SME

Productivity improvement techniques can be applied effectively in enterprises of any size, from one-person companies to corporations with thousands of staff. The majority of the techniques were first seen in mass-production operations but the benefits they can yield in SMEs is not to be underestimated. Indeed, the absence in SMEs of many of the rigidities commonly found in large companies make it easier for them to reap the benefits of productivity improvement techniques.

This review surveys a range of productivity improvement techniques suitable for implementation by SMEs. Following a general examination of the implications for SMEs of lean thinking and enterprise resource planning systems, it zooms in on productivity improvement techniques mostly pioneered in the Toyota production system. They include just-in-time, kanban, kaizen, jidoka, heijunka and the five S’s. Concluding sections highlight the increasing pressure on manufacturing companies to exploit such methods to become agile manufacturers of mass-customised products.

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Pera Knowledge
Published in 2001 by
PRIME Faraday Partnership
Wolfson School of Mechanical and Manufacturing Engineering
Loughborough University, Loughborough, Leics LE11 3TU
http://www.primetechnologywatch.org.uk

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ISBN 1-84402-001-0

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Contents

1.0 Introduction ........................................................................................................... 1
2.0 The Role of SMEs in Supporting Large-Scale Manufacturing Firms ................. 2
3.0 Current Demands on SMEs ........................................................................... 4
   3.1 Lean Manufacturing ...................................................................................... 4
   3.2 ERP Systems ................................................................................................. 6
   3.3 Supply Chain Responsiveness ....................................................................... 7
   3.4 The Internet .................................................................................................. 8
4.0 Perceived Barriers to Tackling Productivity Improvements ................................ 10
5.0 How to Become Responsive, Flexible and Agile through Fundamental
   Productivity Improvements ................................................................................. 11
   5.1 The Toyota Production System .................................................................... 11
       5.1.1 Jidoka .................................................................................................. 11
       5.1.2 Heijunka ............................................................................................... 12
       5.1.3 Just-In-Time ........................................................................................... 12
       5.1.4 Kanban .................................................................................................. 14
       5.1.5 Kaizen ................................................................................................... 15
       5.1.6 Waste Reduction ..................................................................................... 16
       5.1.7 Visual Management ................................................................................ 18
       5.1.8 The 5 S’s ................................................................................................. 19
       5.1.9 Standard Operations .............................................................................. 21
6.0 Future Demands on SMEs ................................................................................. 24
   6.1 Agility ............................................................................................................. 24
   6.2 Mass customisation ......................................................................................... 25
       6.2.1 Methods and Benefits of Mass Customisation ........................................ 26
7.0 Conclusions ......................................................................................................... 28
8.0 Further Sources of Support Available to SMEs ............................................... 29
9.0 References and Further Reading ...................................................................... 30
   9.1 References ...................................................................................................... 30
   9.2 Further Reading .............................................................................................. 31
Appendix 1 .................................................................................................................. 32
1.0 Introduction

Two recent reports highlight future directions for manufacturing industry. The first, UK Manufacturing: We can make it better, the final report from the Manufacturing 2020 Panel of the UK Foresight Programme, stated:

‘...manufacturing is becoming the provision of complete service over the whole product lifecycle. This new service provision requires manufacturers to get much closer to their customers and to operate far more responsively than they have in the past.’

The second report, Emerging Global Manufacturing Trends - Output from the working sessions at Informan 2000, prepared by the Institute for Manufacturing at the University of Cambridge, contains the following list of issues that organisations should consider in response to the main trends in global manufacturing:

- human resources issues
- using regulations as a positive force
- intellectual capital/knowledge management
- agility and dynamic supply chain network
- innovation
- migration to higher/value-added service
- clear core competencies that will create a barrier to new entrants

Therefore, it seems that a key theme now and in the future will be the ability of an organisation to get close to the customer by becoming a key part of an agile and dynamic supply chain.

Alongside larger companies, SMEs have a vital role to play in the effective operation of these supply chains, as satisfying the demands of any market rarely depends upon a single organisation. Usually it depends upon several companies, each carrying out its own role effectively as part of a larger, overall supply chain.

At each stage in the supply chain, the integration between each organisation is a key method of improving the performance of the whole system. Each ‘link’ in the chain presents opportunities to both satisfy or to disappoint the customer.

Even though the majority of the techniques were first seen in the mass-production, Toyota-style operations, their application to SMEs should not be underestimated, as the concepts are basically the same. This report clearly illustrates that there are existing techniques that can be applied to companies of any size.
2.0 The Role of SMEs in Supporting Large-Scale Manufacturing Firms

Of the entire 1999 business population of 3.7 million enterprises, only 24,000 were medium sized (having 50 to 249 employees) and fewer than 7,000 were large (having 250 or more employees). Small businesses, including those without employees, accounted for over 99% of businesses, 45% of non-government employment and (excluding the finance sector) 38% of turnover. In contrast, the 7,000 largest businesses accounted for 45% of non-government employment and 49% of turnover (Figure 1).

Figure 1: Proportion of businesses, employment and turnover in small, medium and large firms at start of 1999

The data in Table 1 below suggest that making improvements to the productivity of SMEs by applying cost reduction tools and techniques commonplace in larger companies can have a direct impact on the 35% contribution they make to turnover within the manufacturing sector.

But is there a reluctance to accept that the success enjoyed by large companies due to productivity improvements can be translated to SMEs? Generally there are differences in how SMEs and larger organisations operate, from the visibility of the process to the availability of capital. (Appendix 1 gives a comprehensive list taken from the report *Total Quality Management in SMEs* (Ghobadian and Gallear 1996).)

Why should these differences present barriers to the introduction of productivity improvements? Many SME characteristics lend themselves to the introduction of new ways of improving productivity as the usual barriers identified in larger companies do not exist. The resources often at the disposal of larger companies are not always required for SMEs to implement productivity improvements. SMEs can learn from some
of the methods employed by larger companies to improve productivity to become and remain preferred suppliers.

Table 1: SME share of businesses, employment and turnover by industry at start of 1999

<table>
<thead>
<tr>
<th>Industry</th>
<th>Total Number</th>
<th>SME Percentage Share</th>
<th>Total Employment (000s)</th>
<th>SME Percentage Share</th>
<th>SME Percentage Share</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>All industries</strong></td>
<td>3,676,940</td>
<td>99.8</td>
<td>21,746</td>
<td>55.4</td>
<td>51.0</td>
</tr>
<tr>
<td>A,B Agriculture, forestry &amp; fishing</td>
<td>185,305</td>
<td>100.0</td>
<td>452</td>
<td>97.6</td>
<td>97.6</td>
</tr>
<tr>
<td>C Mining and quarrying</td>
<td>3,860</td>
<td>98.4</td>
<td>83</td>
<td>30.8</td>
<td>29.4</td>
</tr>
<tr>
<td><strong>D Manufacturing</strong></td>
<td>332,070</td>
<td><strong>99.2</strong></td>
<td>4,334</td>
<td><strong>49.6</strong></td>
<td><strong>35.6</strong></td>
</tr>
<tr>
<td>E Electricity, gas, water supply</td>
<td>325</td>
<td>86.9</td>
<td>139</td>
<td>2.6</td>
<td>6.9</td>
</tr>
<tr>
<td>F Construction</td>
<td>683,530</td>
<td>100.0</td>
<td>1,524</td>
<td>83.7</td>
<td>69.8</td>
</tr>
<tr>
<td>G Wholesale, retail &amp; repairs</td>
<td>533,140</td>
<td>99.8</td>
<td>4,416</td>
<td>52.1</td>
<td>54.8</td>
</tr>
<tr>
<td>H Hotels &amp; restaurants</td>
<td>154,400</td>
<td>99.8</td>
<td>1,598</td>
<td>55.6</td>
<td>52.9</td>
</tr>
<tr>
<td>I Transport, storage &amp; communication</td>
<td>225,725</td>
<td>99.8</td>
<td>1,538</td>
<td>39.8</td>
<td>39.9</td>
</tr>
<tr>
<td>J Financial intermediation</td>
<td>59,455</td>
<td>99.4</td>
<td>1,043</td>
<td>21.1</td>
<td>35.5</td>
</tr>
<tr>
<td>K Real estate, business activities</td>
<td>800,515</td>
<td>99.9</td>
<td>3,146</td>
<td>69.6</td>
<td>73.1</td>
</tr>
<tr>
<td>M Education</td>
<td>107,850</td>
<td>99.9</td>
<td>255</td>
<td>83.8</td>
<td>86.5</td>
</tr>
<tr>
<td>N Health and social work</td>
<td>203,465</td>
<td>99.7</td>
<td>2,107</td>
<td>41.7</td>
<td>33.7</td>
</tr>
<tr>
<td>O Other social /personal services</td>
<td>387,295</td>
<td>99.9</td>
<td>1,111</td>
<td>76.7</td>
<td>64.1</td>
</tr>
</tbody>
</table>

Finance sector excluded from turnover

Source: Office for National Statistics 2001
3.0 Current Demands on SMEs

There are many factors that have a direct impact on the operational capabilities of SMEs. The following section reviews the major factors with regard to production management and control.

3.1 Lean Manufacturing

Many of the ideas behind what is now termed lean thinking were originally developed in Toyota’s manufacturing operations. The Toyota Production System spread through their supply base during the 1970s and their distribution and sales operations during the 1980s.

The term ‘lean manufacturing’ was popularised in the book, *The Machine that Changed the World* by Womack, Jones and Roos, which illustrated for the first time the significant performance gap between the Japanese and western automotive industries. It described the key elements accounting for this superior performance as lean production - ‘lean’ because Japanese business methods used less of everything (human effort, capital investment, facilities, inventories and time) in manufacturing, product development, parts supply and customer relations.

The key lean-thinking principles include the following.

- Recognise that only a fraction of the total time and effort in any organisation actually adds value for the end customer. By clearly defining value for a specific product or service from the end customer’s perspective, all the non-value activities - or waste - can be targeted for removal. For most production operations only 5% of activities add value, 35% are necessary non-value adding activities and 60% add no value at all. Eliminating this waste is the greatest potential source of improvement in corporate performance and customer service.

- Few products or services are provided by one organisation alone, so waste removal has to be pursued throughout the whole value stream - the entire set of activities across all the firms involved in jointly delivering the product or service. New relationships are required to eliminate inter-firm waste and to effectively manage the value stream as a whole.

- Instead of managing the workload through successive departments, processes are reorganised so that the product, or design, flows through all value-adding steps without interruption. Obstacles to uninterrupted flow are identified and removed using the toolbox of lean techniques. Activities across each firm are synchronised by pulling the product or design from upstream steps at just the time when required to meet the demand from the end customer.

- Removing wasted time and effort represents the biggest opportunity for performance improvement. Creating flow and pull starts with radically reorganising individual process steps but the gains become truly significant as
these process steps link together. As this happens more and more layers of waste become visible and the process continues towards the theoretical end point of perfection, where every asset and every action adds value for the end customer. In this way, lean thinking represents a path of sustained performance improvement - and not a one-off programme.

The organisation must view itself as just one part of an extended supply chain and think strategically beyond its own boundaries. Because value streams flow across several departments and functions within an organisation, it needs to be organised around its key value streams. Stretching beyond the firm, some form of collective agreement or organisation is needed to manage the whole value stream for a product family, setting common improvement targets, rules for sharing the gains and effort and for designing waste out of future product generations. This collective group of organisations is called a ‘lean enterprise’.

Lean thinking can be applied to any organisation in any sector. Although the origins of lean thinking are firmly rooted in an automotive production environment, the principles and techniques are transferable, often with little adaptation. Lean Thinking by Womack and Jones illustrates how firms in several industries in North America, Europe and Japan followed this path and have doubled their performance while reducing inventories, throughput times and errors reaching the customer by 90%. These results are found in all kinds of activities, including order processing, product development, manufacturing, warehousing, distribution and retailing.

Many of the tools and techniques associated with lean ways of working emerged from the Toyota Production System, while others have since been developed by research organisations such as the Lean Enterprise Research Centre (LERC) based at Cardiff Business School.

The mission of the LERC is to be a world-class lean-thinking and supply-chain research centre. The LERC is dedicated to:

- developing pioneering, leading-edge lean-thinking research tools and techniques;
- helping organisations achieve world class performance through the application of lean-thinking principles and techniques; and
- disseminating lean-thinking knowledge through a broad range of education programmes and management courses and by communicating with the broader management population.

The aims of the LERC are to develop a detailed knowledge of lean-management principles and techniques and identify new methods of applying them for the benefit of businesses and other organisations. Formed in 1994, it brought together the benchmarking and lean-production work of Daniel Jones (together with James Womack of MIT) and the work on supplier development and materials management of Peter Hines. Originally, their work concentrated in the automotive sector but it has now
extended into new areas as the desire to adopt and implement lean principles has spread. The research portfolio of the LERC is now very diverse, encompassing, for example, steel, retailing, components distribution and packaging sectors.

As more and more organisations strive to become lean, they will expect their suppliers to do the same. These expectations will be communicated through such things as:

- the responsibility for quality inspection
- the responsibility for some aspects of product development
- requests for engineering changes
- expectations of reliable quality and delivery performances.

These may all be pushed further down the supply chain.

In order to meet these types of requirements from larger companies, SMEs will need to progress towards becoming lean themselves. It is logical that a lean manufacturer at the head of a supply chain will prefer to work with suppliers who can align their processes to comply with lean manufacturing.

3.2 ERP Systems

Enterprise Resource Planning (ERP) systems are software solutions that integrate and provide data in real time to users in any part of a manufacturing enterprise. A well-designed ERP system will have separate components to control data related to each aspect of an enterprise’s operations while simultaneously providing an overall or integrated view of the entire enterprise. The components of a typical ERP system are:

- finance/accounting
- manufacturing planning/scheduling
- human resources
- distribution management
- customer order management
- cost management
- shop-floor management
- inventory management
- procurement management
- production control.

Manufacturing control systems have undergone a major transformation since the early introduction of Material Requirements Planning (MRP). The industry standard for computing support of MRP II implementations has been the traditional ‘closed-loop’ material requirements planning (MRP) and Capacity Requirements Planning (CRP) system. The output of the MRP process served as the input for a CRP process. These traditional MRP/CRP systems are still widely available today.

The scope of manufacturing planning systems has increased with each major
generation change. The migration from MRP to MRP II saw a change from a materials emphasis to a wider view of the manufacturing environment. Enterprise resource planning continued this trend. In addition, ERP adds technology aspects to the overall system requirements, lending itself to departmental applications that can more easily extend into customer and supplier environments. As manufacturers evolve to supply chain management operations, mutual access to both the customer's and supplier's planning systems is becoming a requirement.

Manufacturers can no longer operate in a vacuum; they need look at the bigger picture and create a new vision for their business. This vision will help manufacturers make the transition from an order-launch-and-expedite mentality to an integrated flow that links customers with manufacturing processes and suppliers. As companies implement supply chain operations, traditional MRP applications may fail to meet the changing requirements. These applications must evolve to play an integral supporting role in the creation of a 'value chain', where users measure true value in terms of the ability to meet changing customer requirements.

By linking the business processes of a company, ERP connects the parts of an organisation together to form a system of supply chain management. This links all the departments of a business, like accounting, marketing, finance, human resources and distribution, to one main system. One of the goals of ERP was to facilitate and improve cross-departmental communication as part of the same business process. This integration leads to a greater organisational impact. In the long run it may lead to greater efficiency and, in turn, greater profits.

The Internet represents the next major technology enabler, which allows rapid supply chain management between multiple operations and trading partners. Most ERP systems are enhancing their products to become 'Internet enabled' so that customers worldwide can have direct access to the supplier's ERP system. Some systems have workflow management functionality built in, which provides a mechanism to manage and control the flow of work by monitoring logistical aspects such as workload, capacity, throughput times, work queue lengths and processing times.

Companies can extend their ERP software to the Internet, revealing essential data such as manufacturing production schedules and inventory levels to key suppliers. Of course, to reap the benefits of such information provision, SMEs will have to have access to the Internet (see Section 3.4).

### 3.3 Supply Chain Responsiveness

Recent research on supply chain management in general has focused on the subject of closer relationships between customers, suppliers and other relevant parties in the pursuit of competitive advantage. Within any supply chain, companies from raw materials suppliers to manufacturers and even retailers should work together to achieve a level of supply performance that is beyond the capabilities of any individual
The control of a supply chain is usually carried out by the organisation that performs the last significant transformation of the product before it reaches the customer. For the organisation ‘in control’, supplier development is vital to maintain an integrated supply chain. However, SMEs sometimes lack the engineering resources, equipment, information systems and employee skills needed to carry out the suggestions for improvement generated by such supplier-development programmes. Ways in which larger companies are looking to overcome these difficulties include the following.

- **Looking for ‘quick wins’** To minimise investment, high-impact but low-cost areas of improvement should be identified and actioned. The productivity improvement areas listed in this report are areas for consideration.

- **Utilising larger companies’ resources where possible** For example, the larger company may be able to offer personnel support in areas that are lacking in the SME.

- **Building training centres** A further development of the provision of personnel support would be for the larger company to set up a training centre. The training centre could consist of a facility dedicated to providing training to internal groups, customers and suppliers.

### 3.4 The Internet

It has been identified (Spectrum Strategy Consultants 1997) that barriers to the adoption of Internet-based opportunities for SMEs include the following:

- a lack of understanding of the opportunities available to SMEs;
- a lack of understanding of how to implement these techniques;
- a lack of skills amongst the workforce in using them;
- the prices of the technology.

Programmes such as AutoLean, which sought to introduce Internet-based information and communication technologies (ICT) into the business processes of automotive component SMEs based in the West Midlands, have been set up to assist SMEs to exploit the technology available.

The use of both email as a communication medium and the World Wide Web as a source of information are both areas that SMEs need to take full advantage of in order to continue to be effective players in any major supply chain. In addition to the existing supply chain implications, the World Wide Web offers exciting new opportunities for SMEs to extend their customer base into the global marketplace.

Three generic on-line business models that have been identified are:

- virtual face – a primary point of access to the entire business and it’s products;
Fundamental Productivity Improvement Tools and Techniques for SMEs

- virtual alliance – a group of businesses, collaborating and pooling resources; and
- virtual community – a large collection of firms, possibly even including customers

SMEs can participate in one or more of these forms of Internet ‘presence.’
4.0 Perceived Barriers to Tackling Productivity Improvements

Various concerns may deter SMEs from implementing productivity improvements. The following are among them.

- **Cost** Perhaps the natural for an SME is to react by saying, ‘We just can’t afford it’, but it may be better to focus on cost savings that result from potential improvements when considering a productivity improvement drive. The question should be ‘Can we afford not to improve productivity?’ View short-term cost as a longer-term investment to reduce more significant costs to the organisation.

- **Employee resistance to change** Even though SMEs are identified as having people who are open to change, the reverse can also be true. In particular, if certain employees have been with the SME since the organisation was founded, it may be difficult to persuade them that the way they have always done things is not in fact the most effective way of working. From the perspective of the SME, this way has been successful, so it may be hard to accept that these productivity improvements are not just the latest management fad.

- **Personnel resource** It can be difficult to release employees for training in an SME if they are multi-skilled and cannot easily be covered for by other staff. Larger companies may have staff dedicated to productivity improvement, who can dedicate their time to training and implementing productivity improvement initiatives. One way to get around the difficulty in SMEs is for management to lead by example. If other members of staff see them initiating and implementing improvements as a part of their job, they may get an understanding of what the organisation is trying to achieve.

- **Specialist knowledge** Larger companies may have staff who are dedicated to productivity improvement and have gained the knowledge necessary to champion improvement initiatives. It then becomes vital for senior staff to become acquainted with at least the basic principles of some of the productivity improvement tools and techniques outlined later in this report.

- **Activities not standardised** Larger companies will tend to have industrial engineering departments that have formulated standard operating procedures (SOPs) for each process. This may not be the case for SMEs. A central theme of continuous improvement or kaizen is that the starting point is always a well-documented SOP (see section 5.1.9). The action of drawing up standard procedures itself can identify areas for potential improvements.
5.0 How to Become Responsive, Flexible and Agile through Fundamental Productivity Improvements

In order to stay competitive, manufacturing SMEs need to improve their production processes in an efficient manner. This report attempts to get back to basics and examine fundamental low-cost or no-cost productivity improvement principles, some of which came to the fore in manufacturing industry worldwide as part of the well publicised Toyota Production System in the early 1980s.

5.1 The Toyota Production System

Taiichi Ohno developed the Toyota Production System (TPS) after World War II. It was first seen in the United States in the 1980s, when Toyota and General Motors established the New United Motor Manufacturing Inc. (NUMMI) plant in Fremont, California. The TPS comprises the following components.

5.1.1 JIDOKA

*Jidoka* is a Toyota concept aimed at describing the man-machine interface such that people remain free to exercise judgement while machines serve their purpose. Machine *jidoka* incorporates fail-safe devices on machinery to prevent. Human *jidoka* allows operators to stop the process in the event of a problem. Workers have the ability to stop the line if:

- equipment malfunctions;
- defects are found;
- work delays occur; or
- materials or parts shortages occur.

The following three principles are central to the *jidoka* way of working:

- Do not make defects.
- Do not pass on defects.
- Do not accept defects.

*Jidoka* has two separate meanings – automation and autonomination. Automation refers to changing from a manual process to a mechanised process. The problem with this is that there is often no device for stopping the process if a malfunction occurs. Because this process can lead to a large number of defects in the event of a machine malfunction it is considered unsatisfactory by Japanese manufacturers. ‘Autonomination’, a term coined by Toyota, refers to automation that automatically controls defects. *Jidoka* is often referred to as ‘automation with a human mind’. Autonomination technically refers to a technique for detecting and correcting production defects that combines a mechanism for detecting defects with another for stopping the line or machine when defects occur.
This defect detection system automatically or manually stops the production operation or equipment whenever an abnormal or defective condition arises. Any necessary improvements can then be made by directing attention to the stopped equipment and the worker who stopped the operation. The *jidoka* system shows faith in the worker as a thinker and allows all workers the right to stop the line on which they are working.

### 5.1.2 Heijunka

*Heijunka* is the Toyota planning system, which focuses on achieving consistent levels of production. Toyota officially defines *heijunka* as ‘distributing the production of different [body types] evenly over the course of a day …’ It incorporates the principles of line balancing by attempting to equate workloads, levelling demand out by creating an inventory buffer and replenishing that buffer. For example, more advanced lean plants are using load-levelling boxes to visually represent the levelled schedule.

*Heijunka* is a key operating concept of just-in-time (JIT) manufacturing systems. In practice, it involves load levelling and line balancing, as well as achieving uniform scheduling of production so that as one operation ends the next operation is ready to begin. If perfect *heijunka* is attained in a JIT manufacturing system, a uniform or rhythmic flow of mixed-model production is possible. Although the levelling aspect of *heijunka* typically results in more even production and process work loads, the underlying rule is essentially the rule of *heijunka* – an even work load for all employees.

In *heijunka*, parts must also be supplied to the assembly process in very small lots without delays. It thus necessitates the use of *kanban* (see below). One of its benefits is that the levelled load benefits upstream parts-fabrication processes and parts suppliers too, who are freed from having to maintain high capacities solely to cope with large lots in downstream processes. *Heijunka* also has the capability of reducing lead times by minimising time losses due to changeovers. Multiple products are assembled simultaneously instead of first dedicating the line to one product then changing the entire line to produce another. The entire line is seldom changed over between products.

### 5.1.3 Just-In-Time

The American Production and Inventory Control Society (APICS) defines just-in-time (JIT) as:

> A philosophy of manufacturing based on planned elimination of all waste and continuous improvement of productivity.

In practice, JIT can be applied at two levels in an organisation:

1. *The manufacturing process*, where the aim is to have synchronised operations with minimum quantities of raw materials, work-in-progress (WIP) and consumables, throughout the process; and
2. Related activities, applied to all functional areas of the business and all levels of the organisation from the board of directors to the shop floor. The philosophical view is concerned with the reduction of waste (i.e. non-value-adding activities) throughout the organisation.

In the factory, JIT continually focuses attention on waste and in particular on the time spent on all aspects of the manufacturing process. The goal is to minimise the standard lead-time by adopting a keep-it-moving approach to manufacturing. This will not be achieved by reacting to latest developments; it requires careful planning, testing and agreement as to how all those involved with both manufacturing and support functions will act.

The basic aim of JIT in a factory is to:
- reduce lead times
- minimise inventory
- reduce the defect rate to zero and
- accomplish all of the above at minimum cost

There are three essential ingredients to effective manufacturing excellence through JIT:
- **JIT manufacturing techniques**, which aim to promote a rapid response to customer demand while minimising inventory – for example, pull systems, short change-over times, small transfer batch sizes and plant layouts that support short movements of materials;
- **a total quality culture**, an approach to running the organisation which pursues excellence in both the product and every area of the business, including customer service, purchasing, order taking, accounting, maintenance, design, etc.; and
- **people involvement**, that is the involvement of all employees in the development of the organisation through its culture and its manufacturing and other business processes.

To maintain continual improvement, appropriate performance measures and targets should be in place. These may include:
- factory lead time
- factory change-over times
- percentage of products right first time
- work-in-progress (WIP) or stock turns
- some measure of people involvement or contribution.

Traditionally, Western manufacturing plants utilise a ‘push’ system of inventory control, whereby work is released and processed at previously scheduled times, typically by a material requirement planning (MRP) system. As a result, work is planned, managed and tracked to provide a finished product which meets required due dates. A push
system can control WIP by limiting the release of new orders to the shop floor. However, the amount of WIP often builds up to provide ‘comfort stock’ between operations. This can lead to:

- long lead times
- the need for additional prioritising systems
- progress chasing
- slow feedback of quality issues.

These problems can be overcome by the use of a ‘pull’ system. Pull-system controls are an integral part of most JIT implementations. Under a pull system, work is performed at an operation only when the next operation is signalling that it is ready to accept it. This can be simplified through the use of kanban systems (see below).

5.1.4 **Kanban**

The word *kanban* literally means visible record. In the *kanban* system, which has been employed as a JIT production control technique since the mid 1970s, flow is controlled by the use of cards. When implemented correctly, JIT and *kanban* can result in reduced inventory and higher efficiency in a manufacturing system.

The Toyota system is a two-card system; it uses so-called move *kanbans* (also known as conveyance or withdrawal *kanbans*) and production *kanbans*. For example, imagine work centre B produces subassemblies using parts drawn from a parts container at B’s inbound stock point. A move *kanban* – one of which is found in each such inbound container – is removed from the container when it is exhausted and is taken to the outbound stock point of the work centre (let it be work centre A) immediately upstream. A full container of the same parts is then found there. The production *kanban* – one of which is found in each such outbound container – is removed from this full container. The move *kanban* from the exhausted container is placed in the full container, authorizing its transport from A’s outbound stock point to B’s inbound stock point. The production *kanban* is then placed near work centre A to authorize production of another container of parts at A for B. When work centre A has finished producing a full container of parts, the production *kanban* is then placed in this container, which is deposited at A’s outbound stock point.

Another *kanban* system is the Kawasaki Heavy Industries single-card system. A single-card system uses a withdrawal or move *kanban* to trigger production. In this system, work centre A produces a part, which is moved to the storage area in containers that hold a certain number of parts. Work centre B pulls a container from storage when it needs the material and may return an empty container to the storage area. When B pulls the container, the move *kanban* is removed from the container and placed in the card rack at A, authorizing A to produce another container of parts.
5.1.5 **KAIZEN**

Imai (1986) defines total quality control as 'organised kaizen activities involving everyone in a company - managers and workers - in a totally integrated effort toward improving performance at every level'. He continues:

*This improved performance is directed towards satisfying such cross-functional goals as quality, cost, scheduling, manpower development and new product development. It is assumed that these activities ultimately lead to increased customer satisfaction.*

*Kaizen* is a Japanese word meaning gradual never-ending improvement in all aspects of life. It represents a Japanese approach to improvement and can be interpreted as continuous improvement in all areas. *Kaizen* is at the heart of quality improvements in Japanese companies.

The classical Western approach to improvement has been one of technology innovation. Large sums of money have been spent on new equipment and systems using the latest technology to give step changes in performance. This has led to dramatic improvements but they have typically not been standardised and maintained. *Kaizen*, on the other hand, relies on an investment in people. It is a continuous series of small improvements made on existing equipment or systems by the people who actually work in that area. It does not rely on specialist involvement but can be used to support those directly involved in making the improvement. Important aspects of *kaizen* are the standardisation and maintenance of the improvement, which are as crucial to the process as the improvement itself. Improvements must become standardised and maintained until further improvements are made.

There is a structured approach to *kaizen*-based improvements and each step must be followed to ensure lasting improvement. The approach proceeds in the following steps.

1. Define the area for improvement.
2. Analyse and select the appropriate problem.
3. Identify its causes.
4. Plan countermeasures.
5. Implement countermeasures.
6. Confirm the result.
7. Standardise.

Techniques used in facilitating *kaizen* include the following:

- zero defects
- just-in-time (see 5.1.3)
- *kanban* (see section 5.1.4)
- total productive maintenance
- 5S (see section 5.1.8)
The following principles are recognized as essential for continuous improvement.

- **Traceability** In order to identify root causes and prevent them recurring there must be a system in place to trace defects back to their source. In assembly manufacturing, this normally means tracing components by lot and vendor back to the problem assembly stage. In process manufacturing, this means tracing control conditions by critical process step for the lots affected by the defect.
- **Design of experiments** The most effective way of improving process steps in order to increase yield, shorten cycle time or make the process more robust.
- **Stop-in-time** When defects are detected on the production line, the defective material must be stopped immediately. If a second, similar defect is discovered the process step must be stopped immediately and corrective action taken. This prevents adding waste to the defective product and prevents production of further defects.
- **Root cause detection** Statistical data collection is a method of identifying root causes. The five Ws (who, what, where, when, why) and two Hs (how, how much), also help track down the root cause of any problems in complex production environments.

### 5.1.6 **Waste Reduction**

The reduction of waste is a key area in the application of low-cost productivity improvement ideas. Taiichi Ohno originally developed the seven categories of waste concept within a manufacturing organisation. The following list should be considered a complete collection rather than a list of individual categories of waste. Any waste minimisation program should aim to tackle all of the following rather than any one in isolation.

- **Overproduction** The aim of any manufacturing operation should be to produce what the customer requires at the right time and at the right level of quality. Producing more than is required leads to undesirable stock levels. In some situations companies overproduce and move away from the idea of just-in-time to the safety of just-in-case. Some bonus systems that reward performance based on targets exceeding what is actually required will naturally encourage overproduction. In both cases high stock levels and thus waste may result.
- **Waiting** Waste categorised as waiting occurs in situations such as the following:
• when raw materials wait in goods-inwards stock before processing if they are not delivered when required;
• when products wait internally between operations because the flow of production is not smooth or balanced and operators are left waiting for work (and so are not contributing or ‘adding value’ to the product); and
• when products wait for longer than necessary as finished goods to be shipped to the customer if delivery schedules are not optimised.

- *Transport* Product movement within the manufacturing operation is often unavoidable, but adds no value to the finished item and so should be minimised wherever possible. Transporting the product not only wastes time and effort but can also result in damage during transit. Transport waste is visible and can be easily identified through product-flow studies. Drawing a physical diagram of the production flow and clearly marking product movement is one method of revealing transport waste. This simple exercise can often highlight areas of product movement which may have evolved without consideration to the effect on total distance travelled by a product during the manufacturing life cycle. Often, re-location of key operations can yield large savings in transportation wastes.

- *Inappropriate processing* In carrying out a job, it is wasteful to use tools and machinery that are not the most appropriate – for instance, CNC machinery, with its vast capability and flexibility, for producing a simple component. It is often the case that a sizeable investment in such machinery results in pressure to run it constantly, even when it is not the right tool for the job. This type of waste can also be related to machines or processes that do not have the capability to produce the required level of quality.

- *Unnecessary inventory* The ‘evils’ of stock are well documented, and include:
  - unnecessary storage
  - unnecessary transportation
  - interruption to the smooth flow of goods
  - increased lead times to accommodate unwanted items, which when complete will go directly into stock rather than to a customer
  - inability to detect defects through not seeing the ‘wood for the trees’
  - deterioration of ageing stock.

- *Unnecessary motion* Motion does not refer to transport of product but more to the ergonomic aspects of work to be carried out. As well as placing undue effort on the individual carrying out the operation, poor workplace design can lead to inefficient methods of working. As with transport waste, areas for potential improvement can be identified through time-and-motion studies of particular operations.

- *Defects* The production of non-conforming product is a fundamental waste as the output will have to be either reworked or scrapped. Both of these options carry their associated costs and may be affected by any of the above waste categories.
More recently, other categories of waste have been recognised. The following are taken from *The Quality 60: A Guide for Service and Manufacturing* by John Bicheno:

- potential or talent
- energy
- pollution
- space
- complexity.

### 5.1.7 Visual Management

Visual control is an essential part of a lean manufacturing environment. It can be applied to all levels and all departments within an organisation and requires the commitment and involvement of everyone. Constructing a visual factory involves the logical placement of all tools, parts, raw materials, and the prominent display of relevant production information. Everyone involved should be able to see and understand the status of the system. One aim of a visual system is to make the abnormal obvious so that action can be targeted to correct any irregular situations.

Five key areas of information displayed in a visual factory are itemised below, with examples of the data displayed:

1. **Safety**
   - number of lost-time accidents
   - number of near misses
   - details of recent risk assessments
   - personal protective equipment (PPE) stored in a labelled storage area

2. **Quality**
   - defect rate (by shift, by area, by department, for example)
   - details of recent root cause analysis
   - recent quality issues

3. **Production**
   - target production levels
   - actual production levels
   - recent production issues

4. **Cost**
   - key consumables, both direct and indirect
   - utility consumption
   - overtime worked
5. People

- team members
- training records
- team or personal achievements

**Andon**

*Andon* devices indicate where any person or machine requires help. The call for help can be indicated by a lamp or siren as appropriate. The *andon* may consist of a series of lamps at each process or a board of lamps covering a whole production area. The board would be kept as simple as possible to minimise required investment. It also allows the board to present information to team members quickly and in a form that is easy to understand. In order to achieve this, the problem location is identified but details of the specific nature of the problem are not normally displayed.

The simple nature of an *andon* helps the team member by allowing them to undertake the following actions in the most efficient manner:

- identifying the location of the problem
- physically visiting the location
- examining the situation and understanding the problem
- considering the most appropriate action and
- taking action.

In the assembly area, an operator can activate the *andon* via a pull cord or a push button. An *andon* for an automated line can automatically call attention to the machine’s current condition when outside specified limits. Different coloured *andon* lights can be used to signify different operating conditions, for example:

- green = operating within agreed tolerances; no operator intervention required;
- amber = beginning to deviate from normal operation; operator should check the machine at agreed intervals and take corrective action where appropriate to restore normal operating conditions;
- red = machine stopped; urgently requires attention.

The ultimate objective of the *andon* is to prevent problems from occurring.

**5.1.8 THE 5 S’S**

The five S’s stand for five Japanese words:

- *seiri* (proper arrangement)
- *seiton* (orderliness)
- *seiso* (cleanliness)
- *seiketsu* (standardising)
• *shitsuke* (discipline)

The concept was developed by Osada in the early 1980s and is used to establish and maintain all aspects of quality in an organisation. The 5 S’s are explained in more detail below.

**Seiri** (proper arrangement, sorting out)
- Identify what is needed and what is not needed.
- Keep what is needed and eliminate what is not needed.
- Do not produce waste or consume more resources than necessary.
- Introduce measures to prevent the build-up of unnecessary items.

**Seiton** (orderliness, tidying up)
- Put things in order.
- Determine a location for all identified, needed items.
- Make it easy for anyone to find, use and return these items by providing information as to where things are now stored.
- Use standard equipment where possible.
- Find alternative storage for tools, parts, equipment and supplies that are needed but not used daily.

**Seiso** (cleanliness)
- Shine equipment, tools and the whole workplace.
- Eliminate dirt, dust, oil, scrap and other foreign matter to make the workplace clean.
- Adopt cleaning as a form of inspection. Cleaning exposes abnormal conditions and corrects pre-failure conditions.
- Integrate cleaning into everyday maintenance tasks by all staff.

**Seiketsu** (standardising, housekeeping)
This is a state beyond the first three S’s, in which they are thoroughly maintained by sharing information so there is no searching for information such as delivery dates, production schedules and so on. Everything is standardised and standards are made visible so that all abnormalities can be easily and immediately recognised.

**Shitsuke** (discipline)
- Maintaining correct procedures becomes a habit.
- Proper training of all workers has occurred.
- All workers have ‘bought-in’ and a change in work habits has been achieved.
- The workplace is well ordered and run by agreed procedures.
- When applied to the organisation, it could also be applied to external relationships.

The 5S procedure is a process of defining the normal to see the abnormal. Strong 5S
programmes can lead to improved behaviour because the abnormal becomes much more obvious (or visual) on the shop floor. In order to facilitate this visual aspect, a system of identification known as the ‘Red tag’ has been used to aid 5S implementation. A visual tag made from red paper or card is used to highlight problem areas. An example of such a red tag is shown below.

There are two ways to use these red tags:

- to tag an area where non-conformance to the 5S principles has occurred; or
- on a red-tag board, where the problem areas are listed and a red tag attached to each item on the list.

The red tags clearly draw attention to areas that need work to meet the 5S principles. In both cases, when the problem has been rectified the red tag can be removed.

<table>
<thead>
<tr>
<th>5S - The Red Tag for Action</th>
</tr>
</thead>
<tbody>
<tr>
<td>Tag No.</td>
</tr>
<tr>
<td>Name</td>
</tr>
<tr>
<td>Department</td>
</tr>
<tr>
<td>Action</td>
</tr>
<tr>
<td>Required</td>
</tr>
</tbody>
</table>

The 5S principles underpin the low-cost productivity improvements discussed in this report. All five of the five S’s can be accomplished with little or no capital investment whilst the financial returns from the resulting productivity improvements – in the form, for example, of improved storage facilities – can be quickly realised, and will offset any cost involved.

**5.1.9 STANDARD OPERATIONS**

*Where there is no standard, there can be no kaizen.*

Taichi Ohno

The first three S’s of proper arrangement, orderliness and cleanliness can be relatively straightforward to introduce but not so easy to maintain. Key to the successful implementation of the 5S methodology is the fourth S of standardisation. In order to maintain the good workplace arrangement that has been created by the first three S’s,
there is a need to share information concerning not only the method of production, but also delivery dates and production schedules.

Visible standardisation of everything allows abnormalities to be easily and immediately recognised. To achieve this, standard operations must be set for all sections of the organisation and adhered to utilising the best combination of machines and people working together to produce a product or provide a service.

Standard work is the starting point for improvement. Standard operations can be used to train new people, as a visual indicator of proper work sequence and work in progress, and have helped organisations to minimise the variability of a given process and thus improve reliability.

Standardised work is a tool to support the manufacture of quality products. The application of standard working results in working methods that are centred on human movements. They improve efficiency by highlighting and eliminating waste from the process and hence reducing unnecessary costs.

Standardised work forms the basis of lean production (see section 3.1) and without it consistent process improvements are difficult to implement. It clearly defines the actions needed to complete an operation, but should not be considered immutable. The consistent update of standard operations is the cornerstone of continuous improvement initiatives. Improvements to standard work should be arrived at based upon suggestions for improvement from operators and possibly from changes in customer demand, which would result in takt time changes as described below.

Standard Operating Procedures (SOPs) are used:

- to ensure that an operation is carried out in the same way by all operators who carry out a particular process, whether in a team or across multi-shift operations;
- to train new operators to carry out the process;
- as a starting point for kaizen-type continuous improvements (see section 5.1.5); and
- as a means of monitoring the standard to which work is being performed.

The three key elements of standardised work are takt time; work sequence; and standard work-in-process stock. These are described in more detail below.

- **Takt time** A German term used to describe the time in which one product or component needs to be produced in order to satisfy the demand for that component. Takt time is used as the basis for calculation of production loadings, and may be expressed as:

  \[
  \text{Takt time} = \frac{\text{Net daily operating time}}{\text{Daily customer requirement}}
  \]
The takt time determines the frequency at which products must be made in order to satisfy the customer.

- **Work sequence** formally lists the order in which work should be carried out to ensure that work cycles are completed in the most efficient manner. The consequence of not conforming to standard work sequences can be seen in the fluctuation of cycle times, work being forgotten or missed and the misuse of equipment or machinery. Possible results of not conforming to standard work sequences could be a reduction in quality performance, increased equipment breakdown or the creation of an unsafe working environment.

- **Standard work-in-process stock** Standard work-in-process stock is the minimum quantity of incomplete or part-complete product that is required in any process for the work to be completed without leading to any unnecessary waiting time for the operator.

Standardised work is based around a set of work sequences and operator movements that are repeatable. It is based on the assumption that equipment provided to the operators is reliable and well-maintained. If that is not the case, then stoppages or breakdowns will occur and disrupt the workflow. This kind of interruption will make it very difficult, if not impossible, for the same standard work sequence to be repeated, and production efficiencies will be lost. The effective maintenance of all machinery and equipment is therefore a vital prerequisite of the application of standard work.

To facilitate the consistent application of standard work, standard work charts (SWCs) are often displayed at the point where the work is carried out. SWCs do not need to be elaborate computer-generated documents but can be created by using tools available to everyone. SWCs are intended to be live tools, updated as operations sequences and methods are refined and improved upon. This means that the easier they are to draw up, the better.

The four basic steps in the construction of a SWC are as follows.

- Observe the actual work being carried out and record the basic steps.
- Construct a floor layout drawing of the work area – not necessarily to scale, but as representative of the actual set-up as possible.
- Add the location of each work area to the layout in sequence.
- Add the standard work-in-process stock at each location where it is kept.

An important point to note is that if at any time the actual work being carried out does not reflect the displayed standard (or vice-versa) then standardised work will not provide the benefits of control and structured improvement that can otherwise be expected. Standardised work relies on the effective control of the displayed standards.
6.0 Future Demands on SMEs

The future production environment is increasingly driven by globalisation and the reach of information and communications technologies). As such, there are a number of new challenges that manufacturers must face.

6.1 Agility

At the start of this report, we referred to *UK Manufacturing: We can make it better* (Foresight Manufacturing 2020 Panel 2000), and the quote:

... manufacturing is becoming the provision of complete service over the whole product lifecycle. This new service provision requires manufacturers to get much closer to their customers and to operate far more responsively than they have in the past.

In order to achieve such responsiveness, the organisation must become and remain agile. Many definitions of agile manufacturing exist. Here are a few.

a manufacturer’s ability to thrive in a continually and unpredictably changing environment while operating profitably in a competitive climate

Moskal 1995

Agile manufacturing is the solution to meeting customer demands for products in less time at lower costs.

Sheridan 1993

Agile manufacturing implies breaking out of the mass-production mould and producing much more highly-customised products in an attempt to satisfy a wider spectrum of customers.

Sheridan 1993

Ideally, [agile manufacturing] is the ability to deliver the right quantity of a unique product to the customer when and where required – all for a price equal to mass production conditions.

Willis 1998

In order to respond quickly to changes in a dynamic market environment, manufacturers must become agile in order to grow and prosper whilst remaining responsive to customer demands. Agile manufacturing allows the design of production systems and processes that facilitate adaptation in order to meet the demands in true production environments quickly. One of the main purposes of agility is to get the product from concept to the marketplace as quickly as possible. Agility takes lean manufacturing further by making work teams, tools of production, and products reconfigurable.

Agility in manufacturing involves a wide array of ideas and philosophies, including:
• doing things right the first time
• customer response
• the voice of customer
• self-managed teams and
• quality-related ideologies.

An agile company can, for example:
• rapidly bring to market products that are variable combinations of hardware, information, and services;
• design products that are easy to re-configure and upgrade;
• produce goods and services to individual customer order in arbitrary order quantities;
• bring out a continually changing array of models within longer-lived product families;
• fragment mass markets into niche markets;
• create continuing, rather than single-instance, sales relationships by continually adding value for current customers; and
• co-operate intensively with other companies, including competitors, to create global production resources.

6.2 Mass customisation

Our vision of manufacturing in 2020 is of a customer-driven, high value-added environment with an emphasis on the manufacture of individual products to meet individual requirements.

(Foresight Manufacturing 2020 Panel 2000)

Traditionally, manufacturing has been closely identified with systems of keeping production costs low through economies of scale, that is mass production. However, recently mass-production concepts have evolved and mass customisation techniques have developed. Stan Davis first conceived mass customisation in 1987. (See his book Future Perfect). Joseph Pine further developed the idea in his book Mass Customisation - The New Frontier in Business Competition published in 1993. Mass customisation aims for variety in products and services so that customers can buy a tailored product at prices near to that of a mass-produced item. This involves manufacturing customised products using mass-production tools and techniques. (See PRIME Faraday Technology Watch review Utilising Rapid Product Development and Late Customisation Methodologies within Manufacturing SMEs.)

A mass-production organisation is often hierarchical or bureaucratic, exhibiting the following characteristics.
• Workers are closely controlled and supervised.
• Work tasks are repetitive.
• Products are low-cost and standardised.

A mass-customising organisation is different. It is flexible and responsive and consists of independent individual workers.

6.2.1 METHODS AND BENEFITS OF MASS CUSTOMISATION

According to Joseph Pine, the five fundamental methods of mass customisation are these:

• customising services around standard products and services
• creating customisable products and services
• providing point-of-delivery customisation
• providing a quick response throughout the value chain and
• modularising components to customise end products and services.

The benefits of mass customisation include the following.

Higher profits

By providing tailored products to meet particular needs, comparative sourcing is made difficult and the focus is shifted from price to benefits. Whilst it is possible to manufacture at a mass-produced price, there is the option of charging a premium whilst still retailing below the price of a custom product. This opens wider market opportunities.

Value for money products

Mass customisation allows customers to acquire a product that has been produced to meet their own particular needs at a competitive price, thus providing exceptional value for money.

Market Exploitation

Personalised and customised products and services will differentiate against commodity-type products. Lead customers will provide a rich source of new ideas that can also be exploited with other customers or with new prospects. As a result, new product development has a lower risk of failure and a higher chance of beating the competition. On-going service can be adapted throughout the customer's life because it can be linked to the unique product. Companies should establish closer relationships with their suppliers, distributors and customers as they return for further unique products.

A number of technologies, including ERP and the Internet, are enabling improvements
to be made to the total supply chain in such areas as ordering, manufacturing, delivering and servicing products. These improvements will help to support a move towards mass customisation. Mass customisation is not ideal for every company, and any organisation will have to consider the supply chain and likely market developments before implementing any change programme.
7.0 Conclusions

The basic concepts of continuous improvement highlighted in this report are fundamental to the improvement of productivity. That they have their roots in Japanese management techniques and have been proven in larger organisations such as Toyota and Kawasaki should not be a barrier to the SME. Companies of any size can apply these techniques to realise the benefits.

The productivity improvement tools highlighted in this report are all low-cost; indeed some incur no direct cost at all. They are about working smarter rather than harder. In particular the 5S principles are easy to apply and do not require major capital investment other than training, and they should quickly identify possible areas for further productivity-improvement drives.

A gradual implementation of selected tools and techniques should lead to reduction in production waste and improve the morale of employees involved as they see the immediate visual impact of their productivity improvement ideas.

The challenge for the SME is to overcome barriers to the adoption of productivity tools and to understand and implement some of the productivity improvement tools and techniques identified in this report. The application of such tools should mean that SMEs can become – and remain – preferred suppliers in the ever-developing agile supply chains of which they are a key element.
8.0 Further Sources of Support Available to SMEs

There are numerous sources of help and guidance available to businesses on the subject of productivity and process management. One of the main sources of assistance available to SMEs is the network of business-advice providers which come under the umbrella of the Small Business Service, an agency of the UK Government. Companies can get advice and information from their contact centre and from their network of local providers, which includes many of the Business Links. These organisations have Innovation and Technology Counsellors, Design Counsellors and other specialist staff, available to provide local advice.

The Small Business Service aims to:

- help all small businesses realise their potential, especially by minimising the burden of regulation;
- promote world-class business support services to enhance the performance of small businesses;
- promote enterprise across society and particularly in under-represented and disadvantaged groups; and
- achieve the highest standards of service delivery and provide value for money.

The SBS National Improvement Service is a range of activities to help SMEs to improve different aspects of their business management and operations.

- The SBS Benchmark Index is a way that SMEs can measure their performance against that of other firms of similar size, location and type of business.
- SBS Inside UK Enterprise is an arrangement that enables SMEs to visit other companies and exchange ideas with them about how to improve particular aspects of their business.
- SBS Connect is an easy to use series of programmes (provided on CD-ROMs) that brings together the latest proven techniques and thinking to help SMEs to improve a range of different aspects of their business.

Further information on these services is available at http://www.businessadviceonline.org/.
9.0 References and Further Reading

9.1 References


Davis, Stan (1987) Future Perfect, Addison Wesley, Boston, MA


9.2 Further Reading


Appendix 1

A COMPARISON OF THE CHARACTERISTICS OF LARGE VS SMALL AND MEDIUM ORGANISATIONS
(based on Ghobadian and Gallear 1996)

<table>
<thead>
<tr>
<th>Large organisations</th>
<th>Small and medium organisations</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hierarchical with several layers of management</td>
<td>Flat with very few layers of management</td>
</tr>
<tr>
<td>Clear and extensive functional division of activities</td>
<td>Division of activities limited and unclear</td>
</tr>
<tr>
<td>High degree of specialisation</td>
<td>Low degree of specialisation</td>
</tr>
<tr>
<td>Corporate mind set</td>
<td></td>
</tr>
<tr>
<td>Activities and operations governed by formal rules and procedures</td>
<td>Activities and operations not governed by formal rules and procedures</td>
</tr>
<tr>
<td>High degree of standardisation and formalisation</td>
<td>Low degree of standardisation and formalisation</td>
</tr>
<tr>
<td>Mostly bureaucratic</td>
<td>Mostly organic</td>
</tr>
<tr>
<td>Extended decision-making chain</td>
<td>Short decision-making chain</td>
</tr>
<tr>
<td>Top management a long distance away from the point of delivery</td>
<td>Top management close to the point of delivery</td>
</tr>
<tr>
<td>Top management’s visibility limited</td>
<td>Top management highly visible</td>
</tr>
<tr>
<td>Wide span of activities</td>
<td>Span of activities narrow</td>
</tr>
<tr>
<td>Multi-sited and possibly multinational</td>
<td>Single-sited</td>
</tr>
<tr>
<td>Cultural diversity</td>
<td>Unified culture</td>
</tr>
<tr>
<td>System dominated</td>
<td>People dominated</td>
</tr>
<tr>
<td>Cultural inertia</td>
<td>Fluid culture</td>
</tr>
<tr>
<td>Rigid organisation and flows</td>
<td>Flexible organisation and flows</td>
</tr>
<tr>
<td>Many interest groups</td>
<td>Very few interest groups</td>
</tr>
<tr>
<td>Incidence of fact-based decision making more prevalent</td>
<td>Incidence of ‘gut feeling’ decisions more prevalent</td>
</tr>
<tr>
<td>Dominated by professionals and technocrats</td>
<td>Dominated by pioneers and entrepreneurs</td>
</tr>
<tr>
<td>Range of management styles — directive, participative</td>
<td>Range of management styles — directive, participative, paternal</td>
</tr>
<tr>
<td>Meritocratic</td>
<td>Patronage</td>
</tr>
<tr>
<td>Individuals normally cannot see the results of their endeavours</td>
<td>Individuals normally can see the results of their endeavours</td>
</tr>
<tr>
<td>Ample human capital, financial resources and know-how</td>
<td>Modest human capital, financial resources and know-how</td>
</tr>
<tr>
<td>------------------------------------------------------</td>
<td>------------------------------------------------------</td>
</tr>
<tr>
<td>Training and staff development is more likely to be planned and large scale</td>
<td>Training and staff development is more likely to be ad hoc and small scale</td>
</tr>
<tr>
<td>Specified training budget</td>
<td>No specified training budget</td>
</tr>
<tr>
<td>Extensive external contacts</td>
<td>Limited external contacts</td>
</tr>
<tr>
<td>High incidence of unionisation</td>
<td>Low incidence of unionisation</td>
</tr>
<tr>
<td>Normally slow response to environmental changes</td>
<td>Normally rapid response to environmental changes</td>
</tr>
<tr>
<td>High degree of resistance to change</td>
<td>Negligible resistance to change</td>
</tr>
<tr>
<td>Potentially many internal change catalysts</td>
<td>Very few internal change catalysts</td>
</tr>
<tr>
<td>Low incidence of innovativeness</td>
<td>High incidence of innovativeness</td>
</tr>
<tr>
<td>Formal evaluation, control and reporting procedures</td>
<td>Informal evaluation, control and reporting procedures</td>
</tr>
<tr>
<td>Control oriented</td>
<td>Result oriented</td>
</tr>
<tr>
<td>Rigid corporate culture dominating operations and behaviours</td>
<td>Operations and behaviour of employees influenced by owners'/managers' ethos and outlook</td>
</tr>
</tbody>
</table>