1. Manufacturing management in theory and practice

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INTRODUCTION

Manufacturing management has a diverse and rich history. The evolution of management thought through the 20th century has been inextricably linked to the practices and theories of factory management. The need to organize, plan and control resources emerged with the development of the Industrial Revolution (Babbage, 1835), though initially the practice was for a very general form of enterprise management with little by way of a theory of production management. This changed with practices introduced by, and later inspired by, the work of Frederick Winslow Taylor (Taylor, 1911) and the emergence of the Scientific Management School (Urwick and Brech, 1945, 1953; Bryson, 2000). Criticized as Taylorism has been for many years, it was clearly the first attempt to derive a set of principles and practices for the management of production and thereby improve efficiency and effectiveness, to replace the general factory management of earlier years.

The emergence of new, often conflicting paradigms for the management of manufacturing occurred progressively throughout the 20th century (Figure 1.1). The Human Relations, or Behaviouralist, School emerged following the early work of Elton Mayo and colleagues, with their famous Hawthorn Studies of the 1920s and 1930s (see Roethlisberger and Dickson, 1939), followed by a set of studies exploring the impact and influence of 'human factors' on production, leading to theories of teamwork, motivation and leadership. These studies relied heavily on empirical research and factory studies, putting manufacturing management at the heart of the development of management theory (the factory studies are expanded upon in the next section). From the mid-point of the 20th century a number of further schools of thought emerged: the Operations Research¹ School with its complementary sets of tools and techniques for optimization of operations and projects (e.g. statistical stock control methods, logistics and transportation solutions, project planning and control); the Computer Science paradigm with manufacturing operations being to the fore in terms of the application of computer-based programmes for the planning and control of operations (forecasting, capacity planning and materials requirements planning systems); and the Service Revolution with its customer focus and lessons from running service operations related back to manufacturing.

However, two paradigms emerged as key influences and still shape our notions of 'best practice' in manufacturing today: 'Japanization and Lean Thinking' and 'Operations Strategy'. Interests in Japanese manufacturing techniques and philosophies gained momentum in the 1980s with the competitive success of Japanese businesses in export markets around the world and later influences of Japanese foreign direct investment. From this paradigm principles of Just-in-Time and Total Quality Management emerged and later evolved in both pure and adapted forms of what is now termed 'lean' and 'agile'

Figure 1.1 *The evolution of manufacturing management*

operations. The Operations Strategy paradigm in some ways went hand in hand with this emergent view of the importance of manufacturing operations and the Operations function as a critical success factor in business – and particularly the need to link corporate and marketing strategies and objectives to manufacturing and operations strategies and activities.

This chapter provides context and explanation of modern notions of manufacturing management. It does this by setting the historical context of classical factory studies which heavily guided early management thought and still provides a legacy for management thinking and practices today, generally and for manufacturing operations more specifically. The theme of Japanization is then explored and it is shown how the principles of ‘lean’ today provide a blueprint and, some would say, clear prescription over the management of manufacturing operations. Finally, exponents from the Operations Strategy School are introduced and it is shown how manufacturing businesses today seek to integrate strategies of production and supply with their broader business objectives.

CLASSICAL FACTORY STUDIES

There was a time when no management theory or, more correctly, what we now think of as management theory, existed. The momentum of the Industrial Revolution in advanced economies of the world, including the USA and much of Western Europe, was driven and primarily ‘managed’ by a combination of forward-thinking entrepreneurs and inventive engineers. A factory management style of control over resources was applied by the entrepreneurs, many using a hire and fire approach to exploit (literally) worker and productive resources for return on investment. Note the term ‘factory management’; in the late 1800s this was yet to develop into coherent theories and practices of ‘production management’. The pace of technological change was dictated and accelerated by inventors and innovators, mostly from the rising engineering fraternity. The emphasis was on the displacement of labour, especially skilled labour, and jobs of work were more often denigrated to menial low-skill tasks, with low pay and poor conditions. There were exceptions of course – in the UK George Cadbury’s Quaker beliefs led to the development of Bournville Village in Birmingham (Bryson and Lowe, 2002). Other entrepreneurs who developed their factories with a social conscience include Sir Titus Salt and his mill operations at Saltaire in Yorkshire and, later, William Lever of Lever Brothers’ Port Sunlight factory at the Wirral, near Liverpool (Crawford, 1995). All these paternalistic and enlightened developments featured modern factories, good conditions for workers and model village developments to house employees – a commitment to the workforce and some foresight into the later advocacy of the Human Relations School. However, these examples were the exception to the rule. Not only were most workplaces dire and devoid of social and human concerns but they also lacked methods and organization, relying instead on power and fear over the workforce to ensure they ‘worked hard’ (Braverman, 1974).

The landmark work of Frederick Winslow Taylor sought to place order in the chaotic situation he observed in his work as a mechanical engineer and work methods analyst (Taylor, 1911; Copley, 1923; Bryson, 2000). He was, in fact, one of the first of what we now call ‘management consultants’. Taylor sought to develop a more planned, objective and scientific approach to methods and processes – hence the name he gave to his prescriptions: the ‘Principles of Scientific Management’. Whole narratives have been produced on Taylor’s ideas (often referred to as ‘Taylorism’), most forcibly by Braverman (1974). Criticism centres on the tenor and impact of his work and the work of his later followers. It is without doubt that Taylor’s ideas led to a dehumanizing effect in many factories (Braverman, 1974), but one can argue justifiably that he did attempt to study and improve manufacturing methods and organization from an informed and objective perspective, unlike the approach taken by many factory owners at his time of writing, around 1910. He effectively produced the first theory of production management in properly documented format. He was also keen to base his work on empirical factory study, leading to the development of work, time and motion study. However, the culmination of scientific management principles in practice was represented by Henry Ford’s moving assembly lines and the emergence of Fordist techniques (Haber, 1964). The ‘first commandment of mass production’ was also formed – the economic batch size. Even at the time there were criticisms of these factory systems and forms of manufacturing management, most notably and entertainingly in the Charles Chaplin film *Modern Times* of 1936.

The period from the 1920s to the 1970s saw a continuation of factory-based empirical studies, but markedly critical and diverging in their views and perspective from Scientific Management. The work of Elton Mayo and his team, from the early Hawthorne Factory Experiments, is documented in minute detail in Roethlisberger and Dickson (1939) and formed the impetus for the Human Relations School (Gillespie, 1993; Bryson, 2000). This work showed clearly that people are not mere extensions of the machines they operate – that people can ‘make or break’ systems. Mayo and colleagues also pointed to the impact of teamwork and the general importance of considering the ‘human factor’ and people’s needs. This later led to the emergence of motivation theory and insights into leadership styles in manufacturing businesses (Maslow, 1943; McGregor, 1960; Vroom and Yetton, 1973). Further studies adopting social-anthropological methodologies followed, including Elliot Jacques’ (1951) *A Changing Culture of the Factory* and Wilfred Brown’s (1962) study of the Glacier Metal Factory, *Piecework Abandoned*, – through to the socio-technical studies of the British coalmines (Trist and Bamforth, 1951), and the Volvo studies of the late 1960s/1970s documenting the emergence of autonomous work groups (Gyldenhammer, 1977).

These collections of studies impacted not only on the theory and practice of manufacturing management but also management theory in general. The period from the publication of Taylor’s *Principles* in 1911 through the whole range of factory studies to the 1970s involved a debate on the interplay and prominence of the technical versus the social in manufacturing operations. A criticism one could make is that practitioners and academics alike, in their interest in work organizations, took their collective eye off the need for manufacturing to address business requirements and market needs. The 1970s saw a need for change, and the remainder of this chapter introduces new manufacturing paradigms that were developed from this time and still shape manufacturing management and production practices as they are today.

JAPANIZATION AND LEAN THINKING

The 1970s and 1980s signalled a sea change in the competitive environment for the majority of Western manufacturers, and particularly those in economies such as the USA and Britain. The years following the Second World War had seen an excess of demand in world markets over the capacity to supply goods, and so Western companies were able to continue to dominate world markets, selling pretty much anything they could produce, and often with scant regard to the need for reinvestment in capital resources and quality. The recovering economies of the world, most notably Japan and Germany, were rebuilding from a low base, but as a result were progressively developing their productive capacity and investing in new machinery and other technologies. At the same time and, in the case of Japan, with very limited access to indigenous natural resources and raw materials, these countries’ manufacturers were devising new production methods enabling them, effectively, to capitalize on their manufacturing legacy and design and manufacture products of reasonable to good quality on, effectively, a shoestring. In such circumstances effective utilization of resources was paramount, and operations needed to be ‘lean’, not wasteful. A number of antecedents were set: Japanese and German goods in particular became increasingly competitive and attractive in

world markets, including the West; world capacity expanded to the point that capacity exceeded demand; many traditional Western producers could not compete with the new competition and increasingly sophisticated customers; and attention also turned to trying to glean an understanding of the somewhat mysterious new Japanese production techniques.

A number of researchers turned their attention to discovering the 'secret' of Japanese manufacturing strategies, and production techniques in particular. Robert Hayes and Steven Wheelwright were prominent in their empirical investigations of 'Why Japanese factories work' (Hayes, 1981; Wheelwright, 1981) and accumulated their findings in a landmark book for manufacturing management practitioners entitled '*Restoring Our Competitive Edge: Competing Through Manufacturing*' (Hayes and Wheelwright, 1984), which also gave an insight into aspects of manufacturing in Germany and presented a framework for manufacturing strategy formulation. Hayes and Wheelwright therefore straggled the Japanization and Manufacturing Strategy paradigms, and presented very lucidly the reasons for the decline of the US manufacturing industry in particular, but also the means to redress this by learning from the Japanese and Germans. Their conclusion: there is no secret – just sound attention to resource management, a close eye on the market and customer needs, and timely investment and reinvestment in capital equipment and human resources. Many Western producers had just become too lazy and focused too much on internal concerns of cost and efficiency, ignoring the rising competition from re-emergent countries and, later, newly emergent economies such as Korea.

In the United Kingdom, Nick Oliver and Barry Wilkinson (1988) produced a seminal work entitled *The Japanization of British Industry*, with a second updated edition in 1993. This book struck a chord across a number of academic and practitioner disciplines in the field of management, including Operations Management, Human Resource Management and Industrial Relations. The work provided an insight into the causes of the decline of British manufacturing from the 1960s onwards, and mapped out the emergent influence of Japanese foreign direct investment on production management techniques, labour management and quality management. This work was timely. There had, for some years, been a fascination with tools and principles associated with Just-in-Time management (Schonberger, 1982; Voss, 1987) and Total Quality Management (Ishikawa, 1985), and the Oliver and Wilkinson publication put these Japanese-influenced approaches into their broader industrial, social and economic context. What is more, they differentiated between what they termed 'direct' Japanization, as found in Japanese transplant factories, 'mediated' forms (e.g. via Anglo-Japanese joint ventures, shared equities and collaborations) and 'emulated' Japanization, those indigenous firms which sought to adopt and adapt Japanese methods. Clearly, the spectrum from direct through to emulated Japanization represents a rough correlation from pure forms of Japanese manufacturing management through to highly modified forms.

Research and studies of Japanese companies in Japan and their transplant operations overseas, combined with context-bound adaptations of this alternative approach to manufacturing, progressively lifted the lid off the 'secrets' of Japanization and enabled new theories and philosophies to replace traditional manufacturing based upon Fordism, economies of scale and technology-push. What emerged was a more market-, customer- and design-oriented approach prescribed by writers such as Bennett and Forrester (1993) and Browne *et al.* (1996). The shift was more towards 'economies of

scope', with flexible manufacturing solutions and market-pull-based enterprise resources planning systems. These pull-based principles reflected down to the level of the shop floor and system chains, with the adoption of kanban-pull systems, right-first-time attitudes to quality and service, and more intelligent management of inventory through the value stream. In short, a progression transition for the more successful manufacturers from mass production through to 'lean production' and 'mass customization'. In limited cases this represented direct adoptions and near copies of the Toyota Production System which, if truth be known, is at the heart of what many observers viewed as Japanization, but more often those manufacturers that continued to thrive managed to be selective and innovative in their choice of methods and the development of context-specific solutions.

LEAN, AGILE AND MASS CUSTOMIZATION IN MANUFACTURING

The Toyota Production System was considered in the highly influential work of Womack, Jones and Roos in their analysis of *The Machine that Changed the World* in 1990, alternatively known as the 'Lean Production Thesis', the machine being the 'car'. Womack *et al.* (1990) provided the thesis that the era of mass production was now over and pretty much defunct, and that a small number of successful Japanese producers had developed a new world of 'lean production'. The book was based on a large international research project investigating the worldwide automotive industry, both assembly and supply plants, run by the Massachusetts Institute of Technology, but with researchers located around the world. The book is in three parts: a historical perspective mapping the rise and emergence of the automotive industry, from its craft and coach-building origins through Fordism and ending with Toyotaism – incidentally and contentiously debunking socio-technical solutions such as Volvo's autonomous group working along the way as merely an anachronism, an unsustainable return to craft production. Though not the originators of the term 'lean' (this was first used by John Krafcik in 1988), this book certainly popularized the term, ensuring it entered the lexicon of manufacturing management practice centre-stage.

A further concept which is often associated with lean is the notion of 'agile' manufacturing. Agile manufacturing is often wrongly viewed as the latest updated version of lean – a further refinement. However, the use of lean and agile in conjunction can be a very powerful tool, and has enabled many of today's successful manufacturers to continue to flourish. In fact, it is highly likely that most of the products purchased today, by discerning customers demanding some choice and variants in product offerings of manufacturers, have been produced through a combination of leanness and agility. A very useful distinction between lean and agility was provided by Marshall Fisher (1997) and centred upon the distinction between functional products and innovative products. Functional products are those that serve a particular and continuing purpose, are not prone to constant design change and so can benefit from large-volume production. The example used was Campbell's Soups – only incremental changes in the decades since their introduction and so benefiting from volume production using lean production methods. Innovative products, however, are those that are constantly subject to design change, each design version having only a short life-cycle and meaning it is virtually

impossible to establish standardized production lines. Agile operations focus on the need to deliver products with speed and flexibility, cost not being the prime driver. The example used was innovative IT products. But the differentiation between lean and agile is more subtle than this, and in the last 20 to 30 years some manufacturers have revolutionized manufacturing approaches in terms of process and product design, as will now be explained.

Systems of mass customization have now emerged which use lean and agile manufacturing principles in tandem. The notion is to strive to benefit from economies of scale and lean/low-cost production in upstream operations, back in the supply chain. Further downstream, and as close to the customer as possible, the idea is then to benefit from the speed and flexibility offered by agile operations. Agility implies the ability to customize and provide a wide range of product offerings to customer demand, but this is clearly more costly. The notion of mass customization is to ensure standardization of products and manufacturing operations as far downstream as possible, but then customize, or more accurately configure, downstream. Thus customization and individual configuration are offered, but are 'postponed' until as late in the process as possible (for more on this see Cousins *et al.*, 2008). The secret behind this lies in developing 'modular' product designs in the first place – developing standard platforms for products and components which can then be applied across a varied product range and/or configured for individual customers through a process of 'mass customization'.

One of the most poignant examples of mass customization was the emergence of Dell computers. In the early days of personal computing, having a customized or highly configured PC was an expensive undertaking. The product was configured at the factory at a considerable price premium, and had longer delivery lead-times and a higher potential for quality issues than the purchase of a standard PC. Then Dell entered the market – and customers could order a PC configured to their individual needs (by phone and then online), which was competitively priced and often less expensive than standard PCs provided by established companies, and which could be delivered within a day or two. Cheaper, faster, better quality – how did they do it? The answer is simple: the deployment of mass customization and postponement. Dell developed a series of PCs with standard platforms and modular designs. They could build the standard platform machines in volume, using lean techniques and economies of scale. These 'platform' machines would be shipped as core products to depots located close to customers. When a customer order for a configured machine was received, the local depot would add the necessary components; machine configuration or customization was undertaken close to the customer and the completed product delivered rapidly to the customer. This approach virtually wiped out the competition, including major computing companies. The concept was simple, but revolutionary, and has now been widely adopted. Consider the automotive industry and the ease with which a car can be individualized (e.g. a BMW Mini or Fiat 500) with some configuration processes undertaken by dealers. End-user configuration also occurs, for example with smartphones, with producers such as Apple, Samsung and Sony leaving the user to complete the configuration with the selection of Apps and aesthetics such as phone covers. These companies essentially sell standardized units which have been produced in high-volume lean manufacturing operations, and postpone the configuration to after the sale to the consumer. This approach also enables incremental redesign and the continuing development of the product, with individual component

modifications and some final design configuration and detail postponed until as near to the product launch as possible.

This attention to leaning the process and ensuring fast response through downstream agility has also spurred a further set of developments, categorized under the term ‘business process reengineering’ (BPR). Taken from the work of Hammer and Champy (1993), this perspective argues that the operation of manufacturing firms (or any other operation, for that matter) is best viewed as a series of processes – upstream to downstream – which should be analysed for waste and inefficiencies and subsequently be removed. Any new processes should be designed with these principles, to ensure that only value-adding activities take place, and that non-value-adding and wasteful operations are removed. This approach has seen a resurgence of process mapping tools and techniques, derivatives of the tools developed by early practitioners of scientific management and systems analysis, and the term ‘value stream mapping’ has emerged as a popular phrase and process. It is clearly the case that efficient operations should be ‘leaned’ as much as possible to ensure the delivery of competitive products with speed and accuracy, and with the minimum of cost. But this has been a contentious area and critics have accused BPR practitioners of a return to an era of Taylorism, of dehumanizing work, of using BPR as a veil to downsizing and exploiting the workforce (Knights and Willmott, 2000). Nonetheless, mapping tools are now once more in wide usage and offer valid tools if used appropriately as manufacturing firms strive to implement lean principles in their operations.

MANAGING OPERATIONS STRATEGICALLY

Alongside Japanization and the convergent development of lean and agile operations, the period since 1970 has seen the emergence of the Manufacturing Strategy paradigm. This has resulted in a set of frameworks and methodologies to help manufacturing managers analyse their existing position and to develop effective manufacturing strategies. The starting point for these arguments goes back to the seminal article by Wickham Skinner (1969) in the *Harvard Business Review*, where he challenged the increasingly prevalent view at the time in corporate America that manufacturing operations were merely operational in nature and of very little or no strategic importance. Skinner accused most Western companies of viewing their factory operations as ‘millstones around their corporate necks’ – they constantly held the organization back in their strategic and market ambitions, using vast resources and constantly resisting change. The role of manufacturing managers was viewed as one of fire-fighting and sorting out problems often of their own making. In fact, should the firm not simply divest production operations altogether? Skinner challenged this, developing a stepwise plan to assist manufacturers to develop responsive and supportive operations processes and so compete effectively in world markets. The article’s title indicates the main tenor of his argument: ‘Manufacturing – Missing Link in Corporate Strategy’.

Skinner and later authors, including Hayes and Wheelwright (1984) and Terry Hill (1993), directly accused strategic managers and national policymakers in the USA and UK of having misconceptions about the role of the manufacturing function in businesses, one which saw operations as of little or no strategic importance. In fact, manufacturing

managers often viewed their role as primarily reactive rather than proactive. Of course, compare this view with manufacturers such as Toyota and businesses such as Dell which used their supply chains, manufacturing operations and distribution systems to actively gain competitive edge over their rivals. These writers, amongst others, beat the drum hard to draw attention to the importance of manufacturing in business and to the economies of the USA and UK, to try to ensure that manufacturing was appreciated at all levels in business and government.

Hayes and Wheelwright (1984) built upon their observations of Japanese and German exemplars to present their four-stage 'Framework for Manufacturing Effectiveness' approach. The stages describe a progression, from the 'millstone'-type manufacturing operations defined by Skinner (1969) through to those manufacturing operations where the manufacturing strategy provides the company's core source of competitive advantage, the best example probably being Toyota. The stages are:

1. *Internally neutral: minimize manufacturing's negative potential.*
The business views the manufacturing function as neutral, incapable of influencing competitiveness. In these circumstances the main concern is to minimize any negative influence that manufacturing may have upon the business. It is merely a 'millstone'.
2. *Externally neutral: achieve parity with competitors.*
Manufacturing is perceived as important only in so much as it matches the effectiveness and efficiency of (i.e. it 'benchmarks') competitors in the same industry. The emphasis is on replicating industry practices and avoiding large step innovations in the design of products, processes or work organizations. Economies of scale and efficiency are the most important drivers in production.
3. *Internally supportive: provide credible support to the business strategy.*
Manufacturing is expected to support and strengthen the competitive position. Manufacturing strategies and objectives derive from corporate and market objectives. Decisions made in manufacturing are consistent with corporate and marketing strategies and manufacturing managers are proactive in developing forward-thinking manufacturing strategies at the functional and factory levels.
4. *Externally supportive: pursue a manufacturing-based competitive advantage.*
Manufacturing capabilities significantly influence competitiveness, and this is undisputed in the organization. Manufacturing strategy is not merely determined in a top-down cascade from higher strategies and marketing strategies, but manufacturing managers have a meaningful role contributing to the development of key corporate strategies as a whole. In some cases manufacturing is the key 'competitive weapon' for the business.

The notion is not that all manufacturers strive for stage 4. For some stage 2 or 3 is sufficient, given the relevance of manufacturing within the overall context of their business. But managers should be able to identify which stage their manufacturing operations are at in this framework and therefore identify changes that need to be made within the organization to progress, if need be, to the next stage. Hayes and Wheelwright reported, critically, that much of US industry at the time of writing in the early 1980s was based at stage 1. They argued that the best businesses would have manufacturing operations at

stage 3 or 4. At stage 3 manufacturing managers and personnel are encouraged to come up with new product ideas and new methods, and suggest these to their customers, whilst stage 4 manufacturers redefine industry expectations. Consider the examples above, where Toyota was the original exponent of what is now termed lean production, and Dell completely reshaped the PC industry with the development of a mass customization approach.

Skinner's (1969) original approach to manufacturing strategy formulation and the Hayes and Wheelwright (1984) 'Effectiveness Framework' are both largely prescriptive. Though timely in the development of the Manufacturing Strategy paradigm, they are limited in the extent to which they provide a meaningful practical methodology for manufacturing strategy formulation. Developing Skinner, Hayes and Wheelwright's ideas, two notable contributions are now presented which bridge this gap: Hill's (1993) framework and the Platts and Gregory methodology (Department of Trade and Industry (DTI), 1988).

Hill summarizes his arguments and discussion within his 'framework for reflecting corporate and marketing strategy issues in corporate decisions'. Fundamental to the Hill framework is the concept that any manufacturing business has to have a clear understanding of 'how its products win orders in the market-place'. These could be on criteria related to price, quality, delivery, service, responsiveness to change, technical performance, and so on. The order-winning properties derive from both marketing activities as reflected in the marketing strategy, and from the manufacturing strategy in terms of the choice and operation of processes, supply chain and delivery systems plus the inherent manufacturing infrastructure, that is to say the planning and control systems. The Hill framework provides a means for determining how market and competitive decisions should be linked with decisions on manufacturing systems design. It also explores the potential for the proactive, bottom-up contribution of manufacturing reflecting, in effect, the third and fourth stage of the Hayes and Wheelwright framework. The framework can be used both to assess and to evaluate the effectiveness of manufacturing operations in relation to corporate objectives and product markets, but also, and more importantly, serves as a guide for developing innovative market-focused activities (Hill and Hill, 2011).

The Platts and Gregory Manufacturing Strategy Methodology explores how to determine market requirements, analyse competitor threats and measure the performance of existing systems, and then combine these into a comprehensible new strategy. The original methodology was creatively presented in 1988 as a workbook, enabling the user to work through a series of worksheets, performing an analysis of the market and competitive environment and then conducting an audit of existing operations facilities and competencies. The emphasis was to explore where manufacturing operations' performance may be improved to better align them to corporate and customer needs. The methodology involves three main phases:

1. *Stage 1: understanding the market position.*

Gather data on all 'product families' in the manufacturing business and then indicate the relative importance of each family and its strength within the market. The key competitive criterion for each family is determined, whether price, delivery performance, and so on, and the current performance against these criteria is assessed. Potential areas of product profitability and vulnerability are also identified.

2. *Stage 2: understanding manufacturing operations.*
Produce an assessment of the existing manufacturing strategy within the key areas of facilities, capacity, span of process, process design, human resources, quality, operations control, supplier management and new products.
3. *Stage 3: develop new strategy.*
Taking each product family in turn (starting with the more 'important'), compare the current performance of manufacturing operations with that desired by the business strategy and market. Guidance is provided on integrating this into a coherent manufacturing strategy.

The Platts and Gregory methodology was a significant contribution to the manufacturing management literature and, in line with the sector where Platts and Gregory conducted their research, was relevant to, and applied by, engineering businesses in particular. Similar to Hill (1993) they suggest that the methodology can be applied both to audit existing manufacturing operations and as a framework for reviewing existing manufacturing strategies and for developing new strategies.

The contributions of Hill (1993) and Platts and Gregory (DTI, 1988) have been applied and used widely and have clearly been very significant in the development of the Manufacturing Strategy paradigm. It would appear bizarre today for any business which has not subcontracted or divested its manufacturing function to consider its manufacturing operations as unimportant and inconsequential. The approaches developed by Hill (1993) and Platts and Gregory (DTI, 1988) provide a useful insight into the process of operations strategy formulation and also provide practical guidance for the development of effective manufacturing strategies.

CONCLUSIONS

This chapter has reviewed the development and main principles underlying the management of the manufacturing function within business. It has taken a historical perspective through identifying some of the key contributions made by practitioners and academics alike to arrive at models and frameworks for manufacturing strategy formulation as practised today. Early contributions to understanding manufacturing and management were at polar opposites – from the scientific management principles of Taylor to the Human Relations School initiated by Elton Mayo and his colleagues.

This chapter has demonstrated how a rich heritage of factory studies, often adopting socio-ethnography as the investigative style, enabled these discussions and debates to develop, right through to studies of Japanization. Japanization, or more precisely the development of lean, agile and mass customization principles, has had an important influence on what is currently considered best manufacturing practice. The chapter ended by presenting some of the frameworks that are employed today to assist companies in the analysis and development of effective manufacturing strategies. Central to these debates has been a concern with understanding the efficient management and organization of manufacturing processes and operations.

NOTE

1. Generally termed 'Operations Research' in the USA, though in other places (e.g. the UK) the term 'Operational Research' is widely used.

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