

Strategies for Sustaining Manufacturing Competitiveness: Comparative Case studies in Australia and Sweden

Claudine Soosay
University of South Australia, Adelaide, Australia

Breno Nunes
Aston University, Birmingham, UK

David Bennett
Chalmers University of Technology, Sweden, and
University of South Australia, Adelaide, Australia

Amrik Sohal
Monash University, Melbourne, Australia

Juhaini Jabar
Universiti Teknikal Malaysia Melaka

Mats Winroth
Chalmers University of Technology, Sweden

Abstract: This paper reports an investigation of local sustainable production in Australia and Sweden aimed at exploring the factors contributing to survival and competitiveness of manufacturing companies. In Australia, six companies were studied in 2010, with comparisons being made with three of them from earlier projects. In Sweden, eight manufacturing companies were studied on two occasions 30 years apart, in 1980 and 2010. To provide a valid comparative perspective a common format for data collection and analysis was used. There has been a shift in the nature of competition in both Sweden and Australia due to an increasing complexity of the global business environment as well as changes in technology and customer expectations. Despite the differences in country context, the findings suggest that all the manufacturing companies have a good awareness of the elements of the market environment and the relationships with their competitive strategy. However, in general, the Swedish companies have more experience of managing the risks and benefits from operating in the international environment. The results of the research are based on a relatively small sample of case companies in a limited number of industrial sectors. There are methodology implications for future research in the area. The research results have practical implications for the manufacturing industry, especially for companies operating in a competitive international environment. The paper is based on original case research and comparative analysis of data from different geographical contexts. It contributes to both theory and management practice about the strategic resources, decision choices, competitive environments and firm values needed to address external market demands as well as in building internal capabilities.

Keywords: Swedish manufacturing; Australian manufacturing; manufacturing strategy; case studies; sustainable production.

1. Introduction

In an era of worldwide economic downturn, the survival and competitiveness of manufacturing firms depend on their practices and capabilities to adapt to external environments, which are attributed to changes in customer preferences, government regulations, technology and competitors (Jayanthi, 2001). This strategic alignment of internal resources and external market requirements enables not only survival, but also competitiveness (Bates et al, 2001, Sun and Hong, 2002; Machuca, 2011). Manufacturing strategies determine the deployment of resources to build capabilities for creating and sustaining costs and product advantages in order to maintain a high level of profitability and strong market position. This reflects the ability to successfully define their scope, to manage and coordinate the core functions and operations within the enterprise as well as relationships with suppliers and customers, and to respond to market demand (Bennett and Vaidya, 2005). The central theme of the strategy literature has been the alignment of strategies to the environmental context. The majority of research in this area, particularly manufacturing strategy, has specified and described the strategy development process in specific sectors or particular countries only. There are few studies adopting a cross national analysis within the context of current economic conditions, which led to the development of this research.

This study supplements and builds on other related work, especially into the sources of competitive advantage for companies in traditional industrial economies, and also in smaller population countries facing competition from countries with huge labour and natural resources (such as China, India and Brazil). The aim of this study is to investigate and compare the strategies of manufacturing firms in both Australia and Sweden, which enable their sustained competitiveness despite the recent economic downturn. These two countries were selected as it is evident that many manufacturing firms were able adopt creative strategies to cope with economic difficulties while avoiding widespread disruption to their operations. The findings from this study provide insight to practitioners and to theory, as it is important to discern how manufacturing competitiveness can be sustained given the complexity of global environments coupled with changing technologies and customer requirements.

The study was conducted mainly from the perspective of economic and social sustainability, with environmental sustainability as an additional factor. The international context within which manufacturing companies operate was also an important consideration. The case companies studied were all in industries where Australia and Sweden have traditionally demonstrated manufacturing strength; i.e. in the case of Australia, automotive components, food and drink, and customised engineering products; and in the case of Sweden, automotive, complex engineered products and design intensive home ware. We adopt the market-based view and the resource-based view in line with the strategy literature relating to competitiveness of firms (Makhija, 2003). The market-based view suggests that strategic plans should be derived from a careful analysis of market trends and of the market's potential evolution, while the resource-based view suggests that companies should concentrate on managing internal resources and find markets where these can be deployed. Many authors, such as Slack and Lewis (2008), propose that a balanced approach is preferable, and that market-based and resource-based perspectives should be reconciled.

The paper is structured as follows: the next section reviews the market-based and resource-based theories that underpin our research, together with other relevant literature strands for the study of how firms sustain their competitiveness including the manufacturing strategy

perspective (Hayes and Wheelwright, 1984) and the concept of sustainable competitive advantage (Dierickx and Cool, 1989). Section 3 outlines the methodology undertaken followed by a description of the firms studied and the empirical findings. Lastly, the conclusions and final considerations are set out, highlighting the implications of the research.

2. Theoretical Context

2.1. Market-based and resource-based views

It is relevant within the context of this research to examine how the market-based view (MBV) and resource-based view (RBV) of competitive strategy contribute to explaining the factors underlying the sustained performance of the Australian and Swedish case companies. The MBV is focused on the market environment, where through this lens organisations should align their business strategy to meet market needs; whereas RBV focuses on the firm's internal resources and competencies. The market environment is related with organisations dealing with competitors in fulfilling their customers' needs to enhance performance. Internal resources of organisations comprise both tangible and intangible resources that determine the firm's competitive advantage where intangible resources are the hardest to imitate (Roquebert, Phillips, and Westfall, 1996). For example, to compete globally organisations are increasing their investments in purchasing new and more advanced machinery in order to enhance the efficiency and quality of their production (Yang and Meyer, 2014). Subsequently, it is necessary for these organisations to provide training for their employees as new knowledge and capability are required to operate the machinery.

The MBV and the RBV clearly point to different sources of competitive advantage for firms (Roquebert, Phillips, and Westfall, 1996). The MBV suggests that enhanced end-product market position is the foundation for sustainable future returns and increasing firms' current value (Caves and Porter, 1977, 1978; Porter, 1979; Tallman, 1991). The MBV regards competitive advantage as the barrier protecting against competition arising from market structure. The MBV model is also developed to focus on the firm's inherited market power. Proponents of the MBV advocate that since the transformation process unfolds gradually over time, such market power provides a valuable base for competing in the evolving environment (Makhija, 2003). The increase in labour costs have compelled manufacturers globally to relocate their plant to China in order to be cost effective while sustaining their market share (Dedrick and Kraemer, 2006). Based on the MBV, the sources of firms' values are ingrained in the competitive condition distinguishable in external product markets. It regards firm performance as being related to its market power, mainly through monopoly, barriers to entry, and bargaining power (Grant, 1991). Manufacturers have patented their product or process to protect competitive advantage (Cohen, Nelson and Welsh, 2000). A firm in a monopoly market is considered strong and will achieve higher performance. Nevertheless, there has been an increasing interest in Customer Relationship Management (CRM) and manufacturers are improving their responsiveness to customer demands in terms of product design, services, and manufacturing practices (Ngai, 2005). Consequently, to sustain their performance, manufacturers have introduced product expansion, product diversification and environmentally sustainable products in response to customers' growing and changing demands (Despeisse, et. al, 2012)

In contrast to the MBV, the RBV looks inwards towards the resources available in the firm. According to the RBV, competitive advantage is provided by unique and valuable firm-level resources that are non-imitable by competitors (Barney, 1986, 1991; Peteraf, 1993; Prahalad

and Hamel, 1990). These are often described as valuable, rare, imperfectly imitable and non-substitutable (VRIN); and enable firms to be more successful in the emerging economy. According to Wernerfelt (1984), a firm's resources are those tangible and intangible assets tied semi-permanently to the firm. These include capabilities and knowledge that allow the firm to develop strategies to enhance its efficiency and effectiveness (Barney, 1991, p. 101). For example, a multi-skilled worker is not easily replaced and is considered a VRIN resource. A resource's value also depends on the competitor's view of its importance. Resources that are unique and possess superior capabilities are the source of a firm's competitive advantage. These types of resources are generally tangible, but there are also resources within the firm that are intangible in nature, such as tacit knowledge, which needs to be managed and stored in the organisation through knowledge sharing among employees. This can be achieved by encouraging employees to work in a cross-functional team (Paiva, Roth and Fensterseifer, 2008). The rapid change of the economic environment due to globalisation has forced manufacturing industries to keep abreast with market transformation. In highly competitive markets, manufacturers need especially to strengthen their market position while fully exploiting their resources. Therefore, a strategy that incorporates both market-based and resource-based aspects would be an optimal approach (Thun, 2008). As suggested by Hill (1993), the corporate and marketing strategies are important inputs to a firm's manufacturing strategy.

2.2. The manufacturing strategy perspective

Manufacturing strategy can be viewed as comprising the sequence of decisions that, over time, enables a business unit to achieve a desired manufacturing structure, infrastructure and set of specific capabilities (Hayes and Wheelwright, 1984). Manufacturing capabilities are an indispensable source of competitive advantage. A study in China by Cheng and Bennett (2007) highlights the importance of an organisation's core capabilities such as corporate culture, management, operations and marketing that have a strong relationship with performance compared to ownership or restructuring. This is particularly interesting from a manufacturing technology management perspective given the recent results of the research investigations by Das and Nair (2010) that found both external links to suppliers and internal capabilities are important to the design, planning and use of manufacturing technology.

Skinner (1996) introduced the "Manufacturing in Corporate Strategy" (MCS) theory which relates to 'designing manufacturing systems for purpose'. This approach indicates that manufacturers will focus on a task that leads to strategic advantage. Additionally, other system elements are designed to specifically achieve that task and are required to fit with each other to realise a single purpose. MCS deals with the most important dilemma inherent in managing manufacturing organisations, which includes the costly manufacturing system as well as risk in capital, size and location. Table 1 indicates the core areas of the manufacturing strategy.

(Insert Table 1 about here)

More recent work by Hill and Hill (2011) states that in the phases of manufacturing strategy development and implementation, identifying the solution is an easy task; however, defining the problem and implementing the solution are more difficult. For instance, the subjectivity

embedded in identifying and classifying order-winners and order-qualifiers (Hill, 1993) is highly complex in the current times of hyper competition. According to Lowson (2002), the internal and external contexts will cause an operations strategy to reflect on two main components, i.e. demand trends (pull) and competitive concerns (push). In fact, new criteria can emerge based on evolving customer requirements in a dynamic market, where companies will need to understand the environment in order to determine the level of commitment and role it plays in manufacturing strategy. For example, several authors highlight the increasing awareness about environmental issues in the research agenda of manufacturing strategy, which needs to be aligned now in the context of green manufacturing (Azzone and Noci, 1998; Dangayach and Deshmukh, 2001; Corbett and Klassen, 2006; Nunes and Bennett, 2010; Nunes, 2011; Darnall and Aragón-Correa, 2014).

Manufacturing strategy studies have been criticised for lacking a critical empirical investigation of internal and external contextual factors and influences embedded in the manufacturing strategy process (Barnes, 2002). This view is also shared by Boyer, Swink and Rosenzweig (2005). Corbett (2008) tried to address this by conducting a 10-year longitudinal study with 10 manufacturing firms in New Zealand from 1990 to 2000. He found that these companies did not pursue a stable manufacturing strategy configuration over time, and most of them had been moving towards a price-based configuration. As a result, the companies were more vulnerable to Asian low-cost competition and exchange rate fluctuations. The most successful companies in the sample had invested more in infrastructure activities and assets. Similar views can be found in recent studies with regard to more intangible performance objectives such as agility and flexibility in Australian firms (Fayezi et al, 2015).

Indeed, Manufacturing Strategy needs to include both structural (hardware) and infra-structural decisions (software and humanware) as suggested by Hayes and Wheelwright (1984). It is well reported that “Lean Production” or “Toyota Production System” principles as a strategic choice, can only achieve superior outcomes when combining structural and infrastructural changes in the production system. The importance of permeating the organisation with the vision and philosophy set via a manufacturing strategy is paramount. For instance, the success of Trico in Australia was attributed to visionary management and a co-operative workforce who worked together as a team. This organisation is characterised by a committed management team, effective communication, and collaboration between management and employees, teamwork within the whole organisation where employees are able to embrace change and recognise that structures, practices and decision-making processes provide a solid foundation for work teams (Sohal, 1996). In a broader scope through a large-sample survey, Challis, Samson and Lawson (2005) found that Australian and New Zealand firms that have given priority to ‘softer’ human aspects have achieved better manufacturing performance. The aspects of ‘organisational learning’ through implementation of advanced manufacturing technology are discussed in detail by Sohal, Sarros, Schroder and O’Neill (2006), and they constitute an important development of organisational competences.

Finally, Skinner (1996) suggests that manufacturers need to regularly examine their structural manufacturing policies to promote consistent coordination and management of the whole production process, also known as the ‘value chain’, which for product realisation starts with product R&D and includes design engineering, procurement and production, and runs through to distribution, customer service and warranty repairs. Therefore, MCS needs to expand the focus from only structural decisions of *manufacturing* and a modern manufacturing strategy agenda should pay attention to both market and resource-based views. Three clear trends that recently had to be accommodated in manufacturing strategies are:

globalisation, sustainability and servitization. These have not only added complexity and risk in the management of operations, but also required a drastic mind-set transformation and the development of new competences in manufacturing. While the challenges and opportunities to incorporate these trends are clear, the risks and the transformation path to be followed are still obscure. These three trends are briefly presented and discussed in the following section.

2.3. Major trends affecting manufacturing strategies

An important trend that increases complexity in manufacturing strategy is globalisation and the consequent dispersal of manufacturing networks (Dekkers and Bennett, 2010). When globalising operations, there is a natural increase in the difficulties and complexity associated with defining production capacity, technology choice, logistics routes and risk assessment (Dornier *et al.*, 1998; Hayes and Wheelwright, 2004). Therefore, it becomes critical to establish interfaces and align the home and offshore operations for success (Slepnirov *et al.*, 2014). Through case research, Miltenburg (2009) examines the use of six manufacturing objects within seven generic strategies in order to help companies to develop their international manufacturing network strategies. Other previous research relevant to the Australia and Sweden study is the work on global engineering networks by Zhang *et al.* (2008) and the seminal work in the role of foreign factories by Ferdows (1997).

While location choices have gained higher importance due to globalisation, offshoring, and reshoring trends (Walters, 2014), they are accompanied by environmental sustainability pressures for manufacturing strategy (Pham and Thomas, 2011). This is particularly true for global supply chains (Kuik *et al.*, 2011), which if not well-designed, can lead to higher levels of fragility (Stonebraker *et al.*, 2009). Currently, manufacturing organisations also emphasise reducing (resources, energy, and waste), reusing and remanufacturing (Mani, Lyons, and Sriram, 2008), being challenged increasingly to proactively manage the entire life cycle of a product. Moreover, it has become the goal for manufacturers to promote manufacturing processes and products that minimise environmental impacts while maintaining social and economic benefits (Joung, Carrell, Sarkar, and Feng, 2012). This initiative has been driven by customers, who demand more sustainable products. This situation has challenged manufacturing enterprises globally to remain competitive by developing and implementing sustainable manufacturing tools and techniques. The challenges not only relate to the external environment but also internally by implementing sustainable manufacturing practices (Hibbard, 2009). These include optimising production systems, complying with environmental laws and regulations, and addressing operators' physical safety and mental concerns (Zhang, 2012). Manufacturers are also concerned with seeking more sustainable materials to meet the growing demand for sustainable products and services, good corporate governance and social responsibility (Bonini and Görner, 2011).

Additionally, companies have been adopting at the manufacturing strategy level, the use of product-service systems (Baines *et al.*, 2009). The debate of servitization of manufacturing continues to grow (Baines *et al.*, 2011) and will need the development of new skills in manufacturing organisations in order to deliver advanced services with the required reliability, quality, speed and cost (Baines *et al.*, 2013). One of the main pressures to add advanced services in manufacturing companies reside in the migration of profit streams from manufacturing to services sectors. From a competitive perspective, the existence of affordable technologies is also a reason to servitize manufacturing. Several global companies such as Xerox, Caterpillar, Rolls-Royce, and MAN Trucks have adopted the servitization strategy to better position themselves in the global market place.

Not surprisingly, the trends we briefly described above are interlinked. Global production networks tend to increase the energy intensity and carbon emission for some products, pushing global companies to develop and transfer green practices in their manufacturing networks. Also, servitization is currently considered as a viable path to reduce environmental impact of products (Tukker, 2008); although it is clearly not a sustainability panacea (Tukker, 2013). Companies will need to consider these trends when formulating their manufacturing strategy for developing global leadership or simply in order to survive. The next section will present the research methodology adopted in this study.

3. Methodology

To undertake the research on local sustainable production in Australia and Sweden, a common empirical method was used in both countries. This comprised a multiple case study approach which allows the researcher to investigate the diversity among the cases and aims to make comparisons between them (Yin, 2003). The same basic format for data collection was used during the visits to all the case companies, i.e. introduction to the company (30 minutes), tour of manufacturing facilities (30+ minutes allowed) and interviews with open-ended questions (approximately 90 minutes).

In Australia, six manufacturing organisations were selected based on purposive sampling. These included four companies in the Adelaide region and two in Melbourne, where managers involved in manufacturing and operations were interviewed. The visits were all undertaken in November and December 2010. In Sweden, eight case companies were all visited in one week during October 2010. The companies were distributed across southern Sweden in various cities and towns. The study of Swedish companies replicated another conducted 30 years previously using exactly the same eight companies. A common visit and interview protocol was used for both Swedish studies and they were undertaken at exactly the same time of year, so the companies were at the same point in their annual business cycle. The interview framework in the 1980 Swedish study was also similar, and actually formed the basis of the data collection methodology used in the later studies. Visual text analysis was also used in both studies. This enabled a longitudinal analysis to be undertaken that has been reported elsewhere (Winroth *et al.*, 2011). There were some additions to the 2010 studies in order to reflect the contextual changes that had taken place during the interim 30 years, such as the influence of globalisation and environmental sustainability considerations. It should be noted that in 1980 case research was still in its infancy, so modern coding and text analysis software was not available.

The research in the respective countries was undertaken according to the ethics protocols of the universities in Sweden and Australia in which the principal researchers were based. The owners or senior managers of firms were contacted via telephone and email seeking their participation in the study. They were briefed on the overall aims, objectives and scope of the research before deciding which managers were appropriate to be interviewed. Details of the managers interviewed in these case studies are depicted in Table 2. Before the visits to case companies in both Sweden and Australia, respective managers were provided in advance details of the data required and areas to be covered in interviews. In addition, before the 2010 Sweden visits, the companies were sent the report from the 1980 study. One of the research team members participated in all the visits and interviews in both countries, including the 1980 Sweden study.

During the visits in both Australia and Sweden, the interviews were also recorded and transcribed as well as written notes being taken. After the visits, the collected materials were shared among the members. The framework for data collection and analysis was based on an adaptation of a methodology previously developed for analysing manufacturing systems (Bennett and Forrester, 1991). This disaggregates the process of production system design into ten components, i.e. Market and Environment; Manufacturing Strategy; Organisation; Justification; Project Management; Physical System Design; Control and Integration; Work Design; Implementation; and Evaluation. This methodology is appropriate because data collection and analysis were undertaken at the level of the factory rather than the company as a whole. Another characteristic of the study is that all the companies within each country were made known to each other, which was possible because none of them were competitors, although no confidential information was revealed. This openness facilitated a better understanding of the study among participants and enabled benchmarking and meaningful comparisons to be made about practice. Although the methodology contains a component called “manufacturing strategy”, in the analysis of the company data, the operation strategy matrix of Slack and Lewis (2008) was also applied. The performance objectives of the companies were analysed by keeping in view the decision areas. Depending on the priorities, the company performance objectives can be ranked accordingly. In other words, it is not necessary that a performance objective is made equally important for all the companies. However, it helps in identifying the most relevant objective and the respective decision area affecting overall company resources. All interviews were transcribed (or had notes taken only for the Swedish study in 1980) and coded into themes for analyses. The findings were cross-referenced not only among the researchers, but also with the companies for reliability and validity.

4. The Companies and Their Operations

Due to the need for commercial confidentiality, the companies are described anonymously. The six Australian companies are referred to as “AU-A” to “AU-F” and the eight Swedish companies are referred to as “SW-A” to “SW-H”.

AU-A is a Computer Numerical Control (CNC) machining engineering company, founded in 1994 by the company’s current Managing Director. Having left his previous job in the recession in 1983, he learnt to program CNC machines when they were in their infancy and subsequently worked as a machinist. The training and experience in sales and business management eventually led him to set up the current business. The company was very successful at the start and within 14 years had expanded to 23 employees and moved to a factory double its original size with 24-hour operations. The company manufactures a

mixture of its own products and sub-contracts parts for customers in various industries (such as mining equipment, hydraulics and cutting tools).

AU-B is a notable Australian winery established in 1849 by a brewer from England, who emigrated to Australia and settled in the Barossa Valley, South Australia, to grow grapes. It is currently managed by the 8th generation member of the family and considered one of the ten largest private wine makers in Australia by volume. The company reflects the development of Australia's modern wine industry, which dates back to the late 1960s when there was a boom in domestic sales of red, and later white, table wines. Sales were largely domestic until the 1980s when exports started, initially in Asia but then to Europe and elsewhere. This led to a massive increase in production from 1986 to 2005. About 640,000 tonnes of grapes were crushed for wine in 1985 and by the mid-2000s it had increased to 2.1 million tonnes. During that time, Firm *AU-B* tripled its output. Of the bottled wine produced in Australia, 55% is exported overseas.

AU-C makes automotive parts for OEMs. It originated in the 1920s when the founders of the company started a brake replacement business in Victoria, Australia. In 1947, the company became an OEM manufacturer of brakes for General Motors Holden, and also made clutches in the mid-1980s. The company underwent many changes in ownership before being acquired by a large Pacific group which was a diversified manufacturer of automotive components, industrial plastics and textiles. Eventually in 2007, the company was acquired by its current European owner. There were several plants set up in Asia, United States, Germany and China. At the time of the study, *AU-C* employed 328 people earning sales of AUD110 million annually.

AU-D assembles and sells windscreen wipers for the automotive industry. The parent company was established in the United States and set up its Australian subsidiary in 1957 in the state of Victoria. It produced and sold products to all the major automotive manufacturers operating in Australia, such as Ford, General Motors Holden and Mitsubishi. However, it lost most of its business to competitors and now sells windscreen wipers as OEM equipment to Ford only. However, firm *AU-D* still retains relationships with other automotive manufacturers by supplying service parts for the aftermarket. In 2005, the local manufacturing plant was closed and production shifted to China. The organisation subsequently downsized from 250 to 29 employees at the Australian site, but is still surviving profitably as a sales company and by assembling customised wipers for special applications using parts supplied from China.

AU-E is a family-owned food business. It was established in 1979, under a discretionary trust with a private company. The business was established in Gawler, South Australia, distributing frozen food products (such as French fries, chicken and seafood) from manufacturers directly to restaurants and hotels. In 1981, the company relocated due to expansion; however in 1992, it was purchased by a large distributor and the family decided to focus on manufacturing instead. The business specialises in a seasoning called "chicken salt", but has diversified to producing other products such as dressing for salads, seasoning and stuffing for chicken. This strategy to focus on a niche market was based on years of experience in the industry and its patience over time. Today, the company employs approximately 50 people with about a third of them involved in administration. It currently produces 150 tonnes of products per week.

AU-F is a paper stationery producer and distributor. It is a subsidiary of a larger paper company and was bought by a Japanese corporation as part of a diversification move in 2009.

It has a long and established manufacturing history since 1939. The firm has two manufacturing plants in South Australia and Victoria with 100 employees. The Victorian plant manufactures envelopes and playing cards, whereas the South Australian plant manufactures all other stationery (everything from exercise books, scrap books, to manila folders, suspension files, duplicate and triplicate books; carbon and carbonless books that is, writing pads, thermal rolls for register machines, and labels; adhesive labels, mailing labels, and a variety of specialty products like exam booklets and café docketts). Both plants produce about AUD300 million of domestic sales and AUD60 million in export sales per annum.

SW-A is a bearing manufacturer situated in Gothenburg, where the company headquarters is also located. Founded in 1907, production initially took place at the owner's own workshop but soon a separate factory was built in Gothenburg. By 1980, the company was the world's largest producer of ball and roller bearings. There were 55,000 employees in 1980 and 41,000 employees at the time of the recent study. After 1980, there were a number of acquisitions and joint ventures. Currently, the company has five product platforms, three major divisions and 40 customer segments. Around 2 - 3% of the annual budget is allocated to R&D. The company has 218 applications of patents which reflect R&D progress over the passage of time. Currently, there are four factory divisions within the overall premises and 30% of the factory personnel are engineers. The average level of education in the factory is about the same as in the offices. There have been many environmental improvements over the past 30 years. Over the past decade, sustainability and service have become the key focus areas of the company's strategy.

SW-B is located in Tranås and manufactures lawnmowers, although when it was established in 1938, the company made table tennis equipment. Lawnmower production started in the 1950s and this was the beginning of its venture into garden machinery. For a long while, it pursued a strategy of diversification and made products such as snow blowers, children's sledges and table football games. There were 680 employees in 1980 and there are 300 now employed. The company's ownership has moved from industrial groups to financial investors, which had some positive effects from the factory perspective because the owners were willing to provide money for improvements and increase the asset value of the company. It is now part of a garden equipment group based in Italy. All its other product businesses have been sold off except for forest and garden equipment, with the Tranås factory focusing on lawnmowers. The sales turnover was SEK 212 million in 1980 and SEK 1.2 billion in 2010. The cost of living in Tranås is quite low but the company still has difficulty in attracting employees with the right competencies. The main development in production has been the installation of a new line for making domestic lawn mowers in high volumes. The main external competition in lawnmowers comes from another Swedish company, which is located fairly close by.

SW-C is located in Mullsjö and produces automotive parts. It was established in 1946 as a small manufacturing company and in the early 1950s obtained its first direct order from the automotive sector. In 1980, there were 160 employees and sales turnover was SEK 6 million. In 2010, there were 387 employees and turnover was SEK 622.8 million. In 1980, 80% of the company's production went to the Swedish companies Saab and Scania, but now it sells to most of the world's major automotive manufacturers, with Volvo being its most important Swedish customer. The company's competitive advantages include market leadership in a market segment with strong growth opportunities, global presence and local execution, a diversified product and customer portfolio, a high degree of customer orientation, high levels of quality and commitment to continuous improvements. The company now has 50 locations

worldwide and it is part of a larger group with a focus currently on the Asian region and China especially. Delivery performance was not so important in the 1980s, but due to competition in the market, the company is now stricter about delivering the right quantity at right time. There are a number of environmental initiatives, but mainly these are in response to legislation.

SW-D is based in Mjölby and produces materials handling equipment, mainly manual and powered fork lift trucks. After 1980, the company made a number of acquisitions, but in 2000, it became part of a large Japanese industrial group with 13 separate corporations. It had only 1,250 employees compared with 3,156 in 1980, although productivity had increased by two and a half times in only a few years. There were 130 people in product development and added value was 30%. The sales turnover was SEK 894 million in 1980 and SEK 15 billion in 2010. All products were built to customer orders but suppliers varied in JIT philosophy with the products having longer lead-times being delivered to a forecast. In a recession, the demand for smaller hand trucks reduced more quickly than for powered trucks since there was no urgency for their replacement. The factory at Mjölby has been reorganised consistent with the “Toyota Production System” (TPS) principles of Kaizen, Challenge, Teamwork and Respect. The main focus areas include safety, quality, new product development and TPS. It was emphasised that product quality should be sustainable, and that quality-focused production also support improved productivity. Orders for some products are seasonal, especially in the Christmas period because customers want new products in the second quarter of the year.

SW-E is located in Motala and produce electric cookers. It is part of a group that had 82,000 employees (worldwide) in 1980 and 51,000 employees (worldwide) at the time of the study. The company’s manufacturing system was introduced around 2005 (i.e. a lean production concept based on the Toyota Production System). The manufacturing system took the company from a white-collar driven environment to being blue-collar driven. Until 1998, the Motala company’s core business was manufacturing household appliances, professional appliances and outdoor products. In 1991, an innovative low energy refrigerator was developed and became an important part of its product range, but in 2001, refrigerator production was moved to another plant in Sweden, and the company then focused only on cookers and kitchen modules for caravans (trailers) and motorhomes. In January 2010, it was announced that the company would close its facility at the site and production of cookers would move to Poland. However, the efficiency and condition of the plant at Motala made it an attractive asset acquisition, and therefore it was sold to a Swedish company that makes solar panels and tanks for heating systems. The new owner assumed ownership of the plant in November 2010. Some existing employees were retained to make the new company’s products. For around six months, the new company helped Company *SW-E* to phase out production of cookers.

SW-F, situated in Orrefors, is the oldest remaining manufacturer of glass products in Sweden. There were 350 employees in 1980 and 80 employees at the time of the recent study. For much of the 20th Century, the company was renowned for its technical innovations and decorative aesthetics, producing both everyday household and artistic pieces. A number of tourist attractions were also developed, including outlet stores for the glassworks, independent outlets and a hotel with glass as a theme. At one time, there was a big supporting infrastructure for the Swedish glass industry, so anything the firms could not do for themselves was easily outsourced locally. But this has changed and all glass companies now need to be self-sufficient. The company’s three glassworks have been reorganised so they

share costs where possible, and each specialises in particular products and process. There is a production technology and logistics department at the site that serves the other two glassworks. There have been a number of environmental initiatives in recent years. In contrast with traditional glassmaking, the materials used now are mainly organic and less hazardous.

SW-G is situated at Braås and makes wheeled haulers for moving construction materials. It is part of a much larger group that had 44,500 employees in 1980, and 90,210 employees at the time of the study. Its core values are quality, safety and environment. The company is responsible for the hauler business area within the wider group, which ranks number 3 in the world after Caterpillar and Komatsu. The group has made a number of acquisitions in the USA, China etc in order to increase the size and to achieve the economies of scale necessary to compete with the big companies in the construction equipment industry. In 2008, the Braås plant introduced a new production system based loosely on the Toyota Production System (TPS). It has five principles: teamwork, process stability, built-in quality, JIT and continuous improvement.

SW-H is a Swedish automotive manufacturer situated in Trollhättan. It had 11,000 employees in 1980 but only 3,400 employees in 2010. Its products can be described as “premium” cars. The main difference concerning the company since 1980 relates to changes in ownership. In March 1990, a major US multinational bought a 50% share from the previous owner, but it continued to be run as an independent company. Then in 1999, the US multinational acquired the remaining 50% and incorporated it into its global operations. However, during 2009, driven by the economic downturn and the need to rationalise its operations, it started looking for a buyer for the Swedish company, and in January 2010, eventually came to an agreement with a Dutch company that allowed it to acquire the Swedish car manufacturer with other overseas financial support. The sale was subject to regulatory and government approval but was completed in February 2010 and this was the ownership situation at the time of the study.

5. Empirical Findings

5.1. Findings concerning the Australian companies

Two of the Australian companies had adopted a strategy to remain economically sustainable and competitive. Firm *AU-F* had accumulated capital assets and machinery over the years, which allowed it to diversify and expand the range of paper stationery products, thereby maintaining production. However, it manufactured these products primarily for the local market and exported very little. Still, the managers were optimistic about sustaining production levels since the brands represented ‘Australian made’ products which gave consumers some confidence of quality stationery, despite minimal barriers to entry for stationery products by competitors. Similarly Firm *AU-B*, the wine producer, invested considerably in wine production equipment and packaging machinery, so consequently was able to produce large volumes at a very low cost per unit. It could diversify wine products using consumer and market research and by offering different vintages, varieties and blends of wine to sustain its market share. For instance, the introduction of Pinot Grigio and Cabernet Sauvignon blends especially for export markets provided an everyday affordable wine for UK and other European consumers during the economic crisis. This strategy was based on careful market analysis and development work by its winemakers to cope with the economic turmoil. The only barrier to entry in the UK and European markets was the large retail supermarkets’ choice of wine and fixed price points. However, the company indicated

that it was facing competition from wine producers in Chile and Argentina, who were also exporting to the same markets.

This leads to another important factor that impacts market conditions for these firms: changing consumer purchase patterns during periods of economic downturn. Changes to their perceptions of the value of lower-and higher-priced products may fundamentally alter what consumers (and retailers) choose to buy. One manager felt that firms producing packaged consumer products tend to be more affected than those producing commodity or industrial products. The shift of most consumers away from more expensive products is a widespread trend. The food manufacturer (Firm *AU-E*) reiterated the trend towards evolving manufacturing strategies based on consumer dynamics and how well positioned their products need to be for recovery.

Another area of concern with managers during the interviews was the competitiveness of China and impact on markets. For instance, Firm *AU-D* moved most of its Australian manufacturing to China in 2005 for cost reasons, which resulted in a huge downsizing of the local operation. One manager interviewed indicated that China has been experiencing a process of capital accumulation, including new technologies and new production equipment that made it hard for Australian firms to compete with. The managers in Firms *AU-C* and *AU-E* stressed how low wages have been contributing significantly to China's manufacturing competitiveness. However, labour productivity was still low and affected the quality, and ultimately the confidence in products produced there, which made these factors become issues of concern for the food manufacturer. On the other hand, the general manager in Firm *AU-F* saw China's increasing labour costs as a trend that would create issues for most suppliers located there.

Quality was a major performance objective for many Australian companies in the study, especially when operating in periods of recession. Firm *AU-A* (CNC machining) was striving to provide both product and service quality to its customers. According to the owner, the company could beat the competition from China on customer service and quality, but not on price. In Firm *AU-B*, the main strategy for overcoming competition in the wine industry has been to develop new varieties of wine and sell these to customers. It had taken 27 years for the company to establish its position in the market as a producer of good quality wine. Firm *AU-C* focused on manufacturing quality automotive brakes and was the sole supplier to Toyota in Australia. As a food product manufacturer, Firm *AU-E* ensured quality ingredients from its suppliers to meet quality standards, where food specifications and bacteria count are important. Most of Firm *AU-E*'s suppliers are located in Europe and their Quality Assurance staff occasionally visit these suppliers' premises to ensure compliance with standards. The business sees its manufacturing operations as value adding in food products, especially in their patented process of manufacturing cylindrical rolls of seasoned stuffing for chickens. In Firm *AU-F*, the strengths of the business lie in its service capabilities from a distribution perspective, its brands, its local manufacturing, environmental practices, and customers' willingness to pay a premium for quality Australian-made products. Another important aspect of its strategy is the integrated service offering to customers, which provides a broad range of quality services and products.

With regard to speed of delivery as an element of operations strategy, Firm *AU-D* assessed what could be delivered in terms of value and being on time. In the 1990s, the company had a reputation for performing excellently in the manufacturing area with Just-in-Time competencies. Firm *AU-A* also emphasised quick delivery, but with the approach of timely response being in line with "Just-in-Case" (JIC), rather than the "Just-in-Time" (JIT) system.

It represents the long-term planning of supplies and the active role inventory plays in the process. While JIT is based on a more horizontal hierarchy, which consists of strong cooperation and interaction between workers, and workers' initiative, teamwork and multi-functionality, Just-in-Case may imply a rigid, vertical hierarchical structure, requiring workers to specialise, which has been explored in other sectors by Alfasi and Portugali (2004).

Dependability was also found to be a key strategic objective in the Australian firms. In Firm *AU-E*, although there were minor issues with the shelf life of products, the firm was considering moving away from 3-shift, 24-hour production and investing heavily in more machinery to run parallel production instead. This method of running two production lines concurrently is more reliable and avoids problems with machine wear and breakdowns. The idea of parallel production runs is more cost effective when considering the premium paid in salary for night shifts or overtime labour. Furthermore, there is less start up time and more scope for continuous runs. Most machinery and equipment are sourced from overseas, particularly from China because of their lower cost. The company appreciated the lower quality of such machinery and equipment compared with that from traditional suppliers in Germany and Australia, but explained that the business needed to survive using inferior machines because many of the high quality machine manufacturers had gone out of business competing with their Chinese counterparts. Firm *AU-C* on the other hand, formally adopted quality systems and lean production methods to ensure its provision of expected service to customers.

Improvement of flexibility was found to be an important capability for competing during the financial crisis in 2008. Firm *AU-E*'s operations and strategy were affected by the economic downturn and it had to change the product mix and increase the volume of products for lower end prices (rather than high end prices such as exotic products). Although volumes had increased, the value was still lower – but this strategy managed to sustain the business. This was an effective move since the recession badly affected high end food producers and restaurants. Apart from the manufacturing operations, Firm *AU-E* had also diversified and maintained a relatively small retail function in the business selling other dry food products. This is based on previously established relations and ability to purchase direct from manufacturers, and therefore the ability to sell at competitive prices. The strategy for Firm *AU-E* for the coming 10 years is to increase its efficiency and outputs by about 10 – 15 per cent a year and to adhere to a feasible product range. Similarly, Firm *AU-F* is continually growing its product range and taking opportunities to make new products. But the strategy was to expand the range through the brands that they have established in the last five years, rather than making different products that required buying new machinery. The company finds it difficult to compete with cheap competitive products imported into Australia. Although its product brands have some value in the marketplace coupled with its strong relationships, distribution, and service capabilities, a lot of the products are commodity items. Firm *AU-A* had adopted a different approach by ensuring that most of its employees were multi-skilled machinists. Since the CNC machines operate automatically, one person can operate up to four machines at a time.

As companies faced the current economic downturn, they tended to launch cost reduction initiatives as one of their strategies to sustain local production. When the global recession happened in 2008, it quickly affected Firm *AU-A* because as well as previously helping the company to grow fast, its type of customer base was also among the first to cut or reduce orders. The Managing Director expressed regret about having to make good employees

redundant but he was able to rehire some of them subsequently. The firm does not export to any overseas markets other than New Zealand because of the high costs of shipping. In Firm *AU-D*, when the previous plant in Melbourne closed, most of the products were at the end of their life anyway, so it was a logical time to move production. Moving manufacturing to China was a strategic move and only saved around AUD1 or 2 per unit. It was not simply a case of moving offshore just to save money as many people had thought at the time. Today, around 90% of Firm *AU-D*'s products supplied to the Australian market come from China, and 10% are from the Australian facility. However, nearly all the component parts are made in China and what is done in Australia is only simple assembly without any pressing, machining, or plastic moulding.

5.2. Findings concerning the Swedish companies

At the time of the study, all the Swedish companies had several units or divisions in their business area. The organisational structures were functional and all business functions such as manufacturing, administration, product development, sales and marketing were located on the same site, which enables cross functional collaboration in development and production at a single premise. Market shares of the companies had increased in the long-term and they all sold into overseas markets. Besides cross-functional involvement in development projects, supplier and customer involvement were also principal areas of concern in decision-making. There had been a number of acquisitions and mergers during the 30-year period since the previous study, which is natural, due to expansions in business activities or changes in ownership, as well as due to the pressure coming from local and foreign competitors. All companies are ISO 14001 and ISO 9001 certified. The product life cycle of the existing main products is between 10 and 15 years.

Compared with 1980, the companies were more concerned with sustainability issues, especially Company *SW-A*, which during the past eight years had started a number of programmes related to sustainable production and the drive for continuous performance improvement. These have covered business processes, environment, employee involvement, and community care issues. It is recognised as the best company in Sweden for environment and human rights by Folksam, the major Swedish insurance company. Company *SW-A* also launched a crisis management programme in response to the financial crisis. It now ensures the development of ecological, durable and repairable products. The company is more concerned with using harmless chemicals in both production and packaging; for instance biodegradable plastic boxes are now used for shipping finished products. Also, efforts have been made to cut down energy consumption on a yearly basis. Its concerns are not only with environmental issues, but with social and economic issues as well, including initiatives that have helped enhance workers' efficiency and creativity, developed ergonomically and non-hazardous workplaces, and promoted diversity at the work place resulting in hiring employees from different backgrounds. Some of the companies considered incentive schemes as a means of compensation, while workers are encouraged to participate in decision-making processes. In all eight cases, the location of the plants was still the same as 30 years ago, i.e. mainly in small towns, which demonstrates that the companies are still important parts of the local community and was the incentive for Company *SW-E* to sell the plant to another Swedish firm. Similarly, it is worth noting the lower labour turnover rates that shows the loyalty of the employees to the organisation, even during hard times.

Availability of skilled workers was not an issue for most of the Swedish companies; they found people with appropriate skills relatively easily. During the last decade, sustainability has become one of the key focus areas for all the companies. The "lean philosophy" has taken

the place of the “Swedish way of work organisation” i.e. abandonment of autonomous work groups that was a feature in the 1980s. So, the companies have changed from a “Swedish way” of production to the “Japanese way”, prompting a number of improvement programmes to be launched since 1980. The “road to lean” is being followed leading to continuous improvements rather than radical changes. This was especially evident in Company *SW-B* that had rationalised its diverse product lines since 1980 and concentrated only on the manufacture of lawnmowers using lean methods adopted from the automotive sector. Similarly, in Company *SW-C*, the old batch production systems based on functional layouts have been replaced by product-focused lines and cells dedicated to individual automotive industry customers. To some extent, this has reduced the product range of some of the Swedish companies studied, although the need for more variants and mass customisation remains high. In the case of Company *SW-G*, volume flexibility became important to its survival during the global economic crisis in 2008 when demand for construction equipment declined dramatically.

In most of the Swedish case companies, as a part of continuous improvement programmes, manufacturing and testing capabilities have been increased. The tools within the Toyota Production System (TPS) have also been exercised, which resulted in increased labour productivity and production effectiveness. Company *SW-D* exemplified this trend. Automation levels in these companies have increased during this time. The driver for lower cost has increased the level of automation and reduced the craftsmanship element. Over the passage of time, process technology helped in improving the specification of the product, which resulted in increased customer value. However, core processes in *SW-D* remained the same as in 1980. The basic or core products are also the same, but some changes in their capacity and specifications have been made in order to meet today’s market demand. Delivery performance was not so important in the 1980s, but due to competition in the market, it is stricter now to deliver the right quantity, on time, to the right location, and at the right quality.

There are several challenges for all the Swedish companies. For instance it was noted in every case that there was a continuous need for cost reduction in a high-skilled and mass customisation environment, which in the case of automotive production has driven a shift in competition towards Asia, resulting in strong challenges for Swedish industry from international competitors. There is therefore a need to maintain economies of scale and reduction in cost. Since the study, Company *SW-H* has succumbed to this pressure and closed all its high volume production of automobiles. After another change of ownership, it subsequently announced plans to diversify into the design and manufacture of electric vehicles.

5.3. Analysis and discussion

The nature of competition for the Australian manufacturing firms has changed because of the business environment being more complex with changes in technology and customer expectations. The findings suggest that these Australian companies have a good awareness of the elements of the market environment and the relationships with their competitive strategy. These firms adopted a strategy, or a combination of strategies, to maintain economically sustainable operations. Australian firms tend to have a number of different competitive priorities compared with counterparts in other industrialised countries, resulting from unique features of the domestic market and geographical context. The companies did not have a long

heritage, which is a common characteristic in the Australian manufacturing industry, and this tended to make them more flexible and adaptable to change. It appears that in Australia, successful organisations pursue a portfolio of manufacturing strategies to make their offerings distinctive in the market place, and that while a firm may choose multiple ways to differentiate it from competitors, its manufacturing resources may be used to selectively enhance some of its strategic thrusts. Nonetheless, the Australian manufacturing firms are largely dependent on domestic demand and their reduced opportunities to diversify into other markets means they remain vulnerable to local economic conditions and high-level decisions that threaten their ability to remain sustainable. For example, the recent decision of three multinational automotive manufacturers to close their Australian manufacturing operations in the next few years will clearly have adverse direct or indirect consequences on the economic sustainability of some of the case companies.

In recent years, the Swedish companies had been striving to remain competitive and sustainable. There are several factors leading to sustainable production systems. The longitudinal aspect associated with the study of the Swedish companies provides a holistic view regarding their efforts to be economically, environmentally and socially sustainable in the competitive world. Each company has its own performance objective as a priority which interacts with the decision area. For instance, quality is a main performance objective for all companies. But considering the cost factor and with international competitors, one must consider cost as important as quality. Particularly in the automotive sector, the supply network plays a vital role (in this multi-case study there were four automotive manufacturing companies or automotive parts manufacturers). By considering cost and dependability as their performance objectives, they can still compete in the marketplace with companies in China and South-East Asia. Cost was a major issue that made company *SW-E* move its cooker production to Poland, which also strengthens this argument. However, company *SW-F*, which is the oldest glass manufacturer in Sweden, was able to depend on its famous brand name and the worldwide reputation of its designers. In this case, quality and flexibility as competitive priorities play a major role while making decisions regarding process choices. It was noted that the reduction in product cost drove decisions to partly implement automated machinery in an effort to remain competitive in the market. However, since the study was undertaken, the parent company announced the closure of the Orrefors factory in 2012 with future production being concentrated at another of the group's factories located in the same part of Sweden. Similarly, Company *SW-B* produced a brand of lawnmower that was especially strong in Sweden and it had also acquired a famous UK brand. Nevertheless, despite these factors and a large investment in manufacturing equipment, the group decided to rationalise and move its Swedish production facilities to Italy in 2012.

Despite the more recent strategic restructuring decisions taken by the owners of these two Swedish companies, there is still a surprising level of economic sustainability among all eight companies during the 30 years between 1980 and 2010. This was due to the following reasons. Firstly, at a national level, the Swedish economy was generally quite stable except during the late 2000s recession, and by focusing on their principal product lines the companies also ultimately enabled concentration on their core competencies. Secondly, the companies have been consistent about keeping their skilled employees and accessing global markets. Acquisitions and mergers also allowed the companies to sustain and extend their brand names since their new owners normally kept the core products and processes. Thirdly, the companies focused on lean philosophy and used the tools developed in the Toyota Production System. This was a major shift in the strategies because it drove them to continuous improvement, making long-term decisions, developing their employees etc. At the

factory level, they focused on waste management, teamwork, changed production systems to “pull” flow in order to avoid overproduction, used visual control and techniques in order to solve the problem at first stage, i.e. following a 5S programme etc.

5.4. Australia - Sweden comparisons and country contexts

Table 2 summarises the main features of the case companies based on the findings from the studies.

(Insert Table 2 about here)

From Table 2, it can be seen that three of the Australian manufacturing companies pursued a resource-based strategy and three pursued a market-based strategy. By comparison, most of the Swedish companies pursued a resource-based strategy with only two of the eight pursuing a market-based strategy. This reflects Sweden’s strong tradition in manufacturing with supportive government policies that help companies to strengthen their human and technological resources. The emphasis in Australia has traditionally been on its agricultural sectors and more recently its mineral industries, with a consequent strengthening of the Australian dollar against other currencies. Many manufacturing companies have therefore sought to find market niches where local and especially international competition is weaker. As far as the companies’ main competitive priorities are concerned, these vary considerably and there is less connection with the host country. Quality is, not surprisingly, most prevalent among the priorities, with design, cost, delivery, innovation, service, productivity etc. all featuring across the different cases in both Australia and Sweden. It also appears that both the cost and productivity priorities are clearly evident among companies whose survival is most under threat.

All except one of the Australian companies have some sort of international connection through ownership, or supply, or sales. However, the majority of Australian companies depended mainly on domestic sales and international supplies. The Swedish companies all have international connections on all three dimensions of ownership (two of them Nordic), supplies and sales. Finally, considering the main challenges and constraints on manufacturing, these again vary widely and are not connected with the host country. They tend to be specific to the individual company and industry situation. The threat to company survival comes from low cost international competition, the conflict between internal and external pressures and low product demand.

6. Conclusions and implications

From the study undertaken in Australian and Swedish manufacturing companies using a common methodology and analysis framework, there are evidently interesting comparisons and contrasts to be made concerning how manufacturing competitiveness can be sustained. In both Sweden and Australia, the increasing complexity of the global business environment together with changes in technology and customer expectations has led to a shift in the nature of competition. These firms are propelled to consider the long-term implications of manufacturing strategy for the firm’s continued survival and competitiveness.

The manufacturing strategies evident in the firms highlighted each of the two management theories (RBV and MBV), varying in specific conditions, requirements and outcomes. The

findings from the studies reveal the factors and approaches undertaken by the Australian and Swedish firms to achieve economic and environmental sustainability and disclose the influences of a resource-oriented or a market-oriented supply-side policy on manufacturing. We predicate that both external and internal factors have to be considered for strategy implementation, in line with the goals of the organisation and how manufacturing competitiveness can be achieved. It can be established that, in general, the Swedish companies have, through adopting mainly resource-based strategies, acquired more experience of managing the risks and benefits from operating in the international environment. The Australian companies, on the other hand, have more of a mixture of resource-based and market-based strategies, which may be due to the macro economic conditions that are heavily affected by the size and influence of the non-manufacturing sectors.

The findings also provide practical implications for managers in manufacturing organisations through the insights obtained about the strategic resources, decision choices, competitive environments and firm values ingrained in the competitive condition distinguishable in external product markets as well as internal capabilities. By building on these capabilities cumulatively over time, firms will be better equipped for the continuously increasing and changing demands from the marketplace. It is also important for managers to discern that this requires a long-term vision and commitment to ensure sustained manufacturing competitiveness. Although there are limitations due to the relatively small sample of case companies in a limited number of industrial sectors, these can be lessened through adopting a longitudinal approach to data collection as has been shown in all the eight Swedish companies and partly in some of the Australian companies. This suggests a promising direction for future avenues of research.

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Table 1. Manufacturing strategy; Adapted from Skinner (1996).

1.	Manufacturing systems are constrained by available technologies of equipment, processes, materials and management. A given system, like an airplane, boat, bridge or building, is limited in its performance. The manufacturing system structure must therefore be designed for its appropriate purpose.
2.	Structure consists of decisions concerning what is to be made rather than purchased, the number, size, capacities and locations of facilities, the choices of equipment and process technologies and the major, expensive, time-consuming-to-change infrastructure elements such as human resource management, production planning and controls, and information systems.
3.	Top managers can best manage manufacturing by making certain that the structural decisions are internally coherent and focused on objectives that will create competitive advantage.
4.	Objectives are usually best expressed as customer-oriented criteria such as delivery, quality, price, and service, but may also be in strategic corporate measures such as investment, risk, flexibility, organizational learning, and financial viability.
5.	Choices must be made; tradeoffs are inevitable; one system cannot be outstanding enough at meeting all criteria to create competitive advantage.
6.	A “manufacturing task” should be set forth explicitly, describing both what must be accomplished to achieve clear competitive advantage and what facts of economics, technology, or management must be overcome in order to be successful.
7.	Focus is critical: focus the entire designed system on the strategic manufacturing task, avoiding excessively broad tasks of different product/market combinations, or an unmanageable unfocused mix of products, markets, technologies, or volumes that result in excessive complexity of management.

Table 2. Main features and findings of the case companies

	Managers Interviewed	Manufacturing strategy	Main competitive priorities	International connections (main focus)	Main challenges and constraints on manufacturing
AU-A CNC machining	Managing Director; Manager	Strongly resource-based	Service / quality	Domestic company / domestic sales	Uncertainty of demand
AU-B Wine	Director of Production	Mainly market-based	Design / quality	Domestic company / domestic supply / international sales	Cost and delivery pressures from retailers
AU-C Brakes	Value Stream Manager; Quality Manager	Strongly resource-based	Delivery / quality	International group / domestic supply / domestic sales	Dependence on small number of OEM customers
AU-D Wipers	Engineering and Quality Manager	Mainly market-based	Cost	International group / international supply / domestic sales	Low cost international competition
AU-E Food	Managing Director	Mainly resource-based	Innovation / quality	Domestic company / international supply / domestic sales	Compliance and accreditation
AU-F Paper	General Manager Operations	Strongly market-based	Brand reputation / quality	International group / international supply / domestic sales	Asset utilisation
SW-A Bearings	Managing Director	Mainly resource-based	Quality / service	International group (Swedish HQ) / domestic supply / international sales	Diversifying away from commodity products
SW-B Mowers	Managing Director; Product Group Manager	Strongly resource-based	Cost / quality	International group / international supply / international sales	Seasonality of demand
SW-C Auto parts	Plant Manager; Director Sales; Manager Marketing Europe	Strongly resource-based	Delivery / quality	International (Nordic) group / international supply / international sales	Finding labour competencies locally

SW-D Material handling	President; Vice President; Director, Production Control	Mainly resource-based	Productivity / quality	International group / international supply / international sales	Implementing new parent company's production systems
SW-E Cookers	Plant Manager; Assembly Manager	Mainly resource-based	Cost	International group / international supply / international sales	Managing changeover to new owner and products
SW-F Glassware	Production Manager; Production Leader	Strongly market-based	Design / cost / quality	International (Nordic) group / domestic supply / international sales	Reconciling conflict between internal and external pressures
SW-G Haulers	Manufacturing Engineer; Quality Manager; Assembly Manager; Product Directors	Mainly resource-based	Cost / quality	International group / domestic supply / international sales	Managing large demand variations
SW-H Cars	Plant Manager; Supply Chain Manager; General Assembly Manager; Environmental Manager	Mainly market-based	Productivity / quality	International owner / international supply / international sales	Focus on survival in face of low product demand

Appendix 1: Questions for Interview

1. Market and Environment
 - a. Analysis of the socio-governmental (changes in attitude, fashion & taste, legal changes, political trends & effects of diminishing natural resources, labor market, familiarization with governmental aspects)
 - b. Analysis of the customers
 - i. What customers is the company serving:
 1. Who are your target customers?
 2. What are the needs of these customers? (How do you get information about your customer needs (Hint: market research, direct interaction for customers)
 3. How do your products & services satisfy these needs?
 - ii. Demographics:
 1. Retail channel- where does the consumer actually purchase the product?
 2. Is this customer base growing or decreasing?
 3. What are the average revenues / income of these customers?
 4. Where are these customers geographically based?
 5. Consumer information source-where does the customer obtain information about the product?
 - iii. Drivers of customer decision-making:
 1. Do customers find price to be more important than the quality of the product or service? (Motivation behind purchase; value drivers, benefits vs. costs?)
 2. Are customers looking for the highest level of reliability, or will they have their own support and just seek a basic level of service?
 3. Will customer consult others in their organization/family before making a decision? (decision maker or decision-making unit)
 4. Will the customer seek multiple bids?
 5. Will the product/service require significant operational changes?
 6. Benefits that consumer is seeking, tangible and intangible?
 - iv. Frequency of purchase, seasonal factors
 - v. Trends- how consumer needs and preferences change over time
 - c. Analysis of the competitors
 - i. How do you evaluate your competitors? (Hint: market research, bench marking for competitors)
 - ii. Companies competing in a related product /market?
 - iii. Companies using related technologies?
 - iv. Companies already targeting your prime market segment but with unrelated products?
 - v. Companies from other geographical areas and with similar products?
 - vi. New start-up companies organized by former employees and/or manager of existing companies?
 - vii. Strategic partnerships?
 - viii. Mergers & acquisitions?
 - ix. Promotional campaigns?
 - x. R&D projects?
 - xi. Hiring activities?

- xii. Capital investment?
 - d. Corporate policy
 - i. Corporate objectives
 - ii. Profitability element
 - iii. Growth element (growth plans)
 - iv. Quality element
 - v. Customer service element
 - vi. Personnel element
 - vii. Mission statement
 - e. Market strategy
 - i. high volume i.e. standardized versus low volume i.e. high variety manufacture
 - ii. customization i.e. customers-driven or predetermined range by the manufacturer
 - iii. product and geographical nichemanship i.e. small groups of consumers with a particular common interest
 - iv. integral versus modular product designs
 - v. product (design) and manufacturing lead-times
- How often do you conduct an internal audit of market competencies? (Hint: review existing polices & market strategy)
- Where are established markets?
2. Manufacturing strategy (based on *The Operations strategy matrix*, Slack & Lewis, 2008.)
 3. Organization
 - a. Structure
 - i. Hierarchical
 - ii. Functional
 - iii. Matrix
 - iv. Process-oriented
 - v. Product-focused
 - vi. Temporary
 - b. State
 - i. Harmonization
 - ii. Training & development
 - iii. Appraisal scheme
 - iv. Financial versus nonfinancial incentives (compensation, benefits)
 - v. Co-determination (employees moral and retention rates))
 4. Justification
 - a. New, modified, production system
 - b. Financial arguments
 - c. Strategic needs
 - d. New projects approval
 - e. Capital expenditure
 5. Project management
 - a. Steering committee
 - b. Project team structure and composition (working party, task force, full time membership., part time membership)

- c. Project management control (hierarchical structure, matrix structure, centralized structure, decentralized structure)
- d. Simultaneous engineering (product & process design)
- 6. Control and integration
 - a. Production planning and control
 - i. Statistical stock control
 - ii. Material requirements planning
 - 1. The master production schedule (MPS)
 - 2. The bill of material (BOM)
 - 3. The inventory status file
 - 4. The MRP algorithm
 - iii. Just-in-time management
 - iv. Optimized production technology
 - b. Information control
 - i. Data collection and analysis
 - 1. Paper logging
 - 2. Shop floor data collection terminals
 - 3. Bar coding
 - 4. Automatic process monitoring
 - ii. Production planning and control
 - 1. Push (MRP)
 - 2. Pull (JIT/Kanban)
 - 3. Centralized control
 - 4. Decentralized control
- 7. Work design
 - a. Product oriented
 - b. Autonomous working
 - c. Process oriented
 - d. Group technology
 - e. Task oriented
 - f. General training and development
 - g. Quality training and awareness
 - h. Quality group / teams
 - i. Single status employment

Other Questions (or from secondary sources):

- 1. Introductory Questions:
 - a. Background:
 - i. History, key personalities, dates, events and trends
 - ii. Location of headquarters/corporate office, other offices, plants & online access etc
 - iii. Ownership, corporate governance and organizational structure
 - iv. Business areas, division and segments
 - v. Sales turn over
 - b. Facilities:

- i. Plant
 - 1. Capacity
 - 2. Utilization rate
 - 3. Age
 - 4. Efficiency
 - 5. Capital investment
 - 6. Location
 - 7. Supply chain network
 - 8. Product mix by plant
 - c. Employees:
 - i. No. of employees
 - ii. Key employees
 - iii. Skill level
 - d. Products:
 - i. Product portfolio
 - ii. Time line of the product launches?
 - iii. Brands, brand portfolio, loyalty, awareness
 - iv. Patents and licenses
 - v. QC conformance
 - vi. Reverse engineering
 - e. Collaborators:
 - i. Distributors
 - ii. Suppliers
 - iii. Alliances
 - f. In which extent do you believe that stakeholder's opinions & ideas are important in rapidly changing world? (i.e. key focus on stakeholder engagement)
 - g. Certifications?
 - h. Awards & achievements?
 - i. Acquisitions?
 - j. Future outlook plans?
2. Questions regarding Production System:
- a. Follow lean philosophy? In which extent?
 - b. Production capacity?
 - c. Measure OEE?
 - d. Sites & facilities locations and size/area?
 - e. In house production, how many %? And outsourcing parts, how many %?
 - f. Level of automation?
 - g. Ongoing projects?
 - h. Facility investment /expansion plans?
 - i. Global outsourcing?
3. Questions regarding Product Development System:
- a. Lean Product Development perspective:

- i. In which extent do you consider that customer- defined values (i.e. to align objectives, focus energy on the customer & eliminate waste from system) must be established in product development?
- ii. In order to reach at optimal solution (i.e. achieving basic stability in engineering & design challenges) in which extent do you explore alternatives by using available methods/techniques i.e. 'set-based' approach?
- iii. Did you create a leveled product development process flow in your last product development (i.e. waste free process to speed the product to market)?
- iv. In which extent did you manage to reduce variation (i.e. by standardizing design, process & engineering skill set) in product development process?
- v. Who is responsible for telling the exact status of any project, to whom the difficult decisions are brought for resolution & the person who holds the whole product development system together?
 1. Project manager
 2. Project leader
 3. Development manager
 4. Chief engineer / chief technical architect
- vi. In which extent do you believe that the synergy between functional excellence & seamless integration of those experts across department is required for the success of any individual program?
- vii. Did you encourage newly hired engineers & provide them technical training which focus on core engineering (i.e. deep technical skills acquisition within a specific discipline that are required for engineering excellence)?
- viii. In which extent do you consider the suppliers as a fundamental part of a product development process (i.e. by taking suppliers onboard from start)?
- ix. Do you consider that 'learning' & 'continuous improvement' is your sustainable competitive advantage (i.e. as a basic part of day to day operations)?
- x. Do you consider your organization culture support excellence & improvement?
- xi. In which extent do you consider the newly adapted technology fits & enhances already optimized and disciplined processes and highly skilled and organized people?
- xii. Do you use some visual communication methods in order to see high level corporate goals after breaking in to meaningful objectives at the working level?

4. Questions regarding Sustainable Production:

a. Questions based on Lowell Center for Sustainable Production:

- i. How do you evaluate that the products/services are safe and ecologically sound throughout their life cycle?
- ii. Do the products are designed to be durable, repairable, compostable, or easily biodegradable?
- iii. How do you make sure that the products produced and packaged using minimal amounts of most environmentally harmless material and energy?

- iv. Do the products are designed and operated such that waste and ecological incompatible byproducts are continuously reduced, eliminated or recycled on-site? If yes, how?
 - v. Do the products are designed and operated such that chemical substances or physical agents and conditions that present hazards to human health or the environment are continuously eliminated? If yes, how?
 - vi. Do the products are designed and operated such that energy and material are conserved, and the forms of energy and materials used are most appropriate for the desired ends? If yes, how?
 - vii. Do the products are designed and operated such that work spaces are designed to continuously minimize or eliminated chemical, ergonomic and physical hazards? If yes, how?
 - viii. Do the workers are valued and their work is organized to conserve and enhance their efficiency and creativity? If yes, how?
 - ix. Do the workers are valued and their security and well-being is a priority? If yes, how?
 - x. Do the workers are valued and they are encouraged and helped to continuously develop their talents and capacities? If yes, how?
 - xi. Do the workers are valued and their input to and participation in the decision making process is openly accepted? If yes, how?
 - xii. Do the communities related to any stage of the product lifecycle (from production of raw material through manufacture, use and disposal of the final product) are respected and enhanced economically, socially, culturally and physically? If yes, how?
 - xiii. In which extent do you believe that the continued economic viability does not depend on ever-increasing consumption of material and energy?
 - xiv. In which extent the management is committed to an open, participatory process of continuous evaluation and improvement, focused on the long-term economic performance of the firm?
- b. Have you set target to cut energy consumption? And how much have you saved in this context & since when?
- c. How do you handle hazardous materials & waste generation in manufacturing?
- d. Do you stand in Dow Jones sustainability world index?
- e. Do you have a group strategy pertaining to climate?
- f. Did your net sales of climate friendly / resource efficient products increases in the past few years?

- g. How did you integrate sustainability into your business culture? (i.e. by vision statement etc)
 - h. In which extent your products complete their life cycle i.e. by leaner manufacturing & analysis in order to reduce its environmental impacts & recognize business opportunities?
 - i. Which kind of tools do you used to make your vision of innovative corporate culture & go beyond in delivering on the group's strategy & performance objectives?
 - j. Health, safety & environment policy?
5. Questions regarding Globalization:
- a. In which extent you took advantage from the following:
 - i. Labor / people
 - ii. Capital (inward and outward direct investment)
 - iii. Technology
 - iv. Informational
 - v. Competition
 - vi. Ecological
 - vii. Cross cultural contacts
 - viii. Brain drain