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MALAYSIAN ACCOUNTING REVIEW

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PREFACE FROM VICE CHANCELLOR UiTM

It is such a great honour for me to be given the opportunity to preface the inaugural issue of the Malaysian Accounting Review (MAR), the first international refereed accounting journal in this country. I wish to congratulate the Faculty of Accountancy, UiTM and the Malaysian Institute of Accountants (MIA) for their proactive effort in making this journal a reality. In the words of Zig Ziglar, "... if you have a vision for it, you can accomplish it". This marks a new beginning and a significant milestone for the accounting profession: practitioners and academicians at large.

This pioneering smart partnership between MIA and UiTM is timely and hignly commendable. Today, we live in an era where information must be properly managed and strategically used as our competitive tool. To best manage and use the information, we must integrate descriptive and prescriptive applications. Whilst professional journals focus on descriptive and "what is" measures, academic refereed journals provide support to the accounting profession by prescribing the "what should" phenomena through research findings and empirical evidence. Both measures must be embedded and should be in tandem with each other; it is the only way for the accounting profession to stay on the cutting edge. It is without doubt that MAR will act as a catalyst to bridge the gap between theory and practice.

The publication of the MAR is part of UiTM and MIA's mission to make Malaysia a renowned and reputable centre of accounting excellence in this region. Whilst the journal provides an excellent avenue for researchers (both local and foreign) to publish their research findings, it should also serve as a platform for intellectual discourse, for others.

In closing, I wish to congratulate the Faculty of Accountancy, UiTM, for its vision in initiating a smart partnership with MIA. To MIA, I am sure that this partnership is an added value to your role as a regulatory body to the accounting profession in Malaysia.

Datuk Professor Dr Ibrahim Abu Shah
Vice Chancellor
Universiti Teknologi MARA (UiTM)
MALAYSIA

UiTM AT A GLANCE

Universiti Teknologi MARA (UiTM) started as a college known as Kolej RIDA in 1956. Incidentally, accounting programs such as LCCI, Australian Society of Accountants (ASA) and Institute of Cost and Work Accountants (ICWA) were among the pioneer programs offered by the then, School of Accountancy. Kolej RIDA continued to expand and in 1967 it was further upgraded and its name was changed to Institute Teknologi MARA (ITM).

As an Institute, ITM continued to add other accounting programs: Diploma in Accountancy (DIA), Malaysian Association of Certified Public Accountants (MACPA), Association of Certified and Chartered Accountants (ACCA), Chartered Institute of Management Accountants (CIMA) and the Advanced Diploma in Accountancy (ADIA) to its portfolio. What started, as a humble beginning in a small campus in Petaling Jaya was later expanded to other areas throughout the country. In 1996, the ITM Act was amended to allow the institute to offer various programs, viz., first degrees, Masters degrees and PhD programs. To commensurate with the university type of programs that the Institute was offering, ITM was officially conferred the university status in 1999. With effect from 26 August 1999, the Institute was known as Universiti Teknologi MARA or UiTM with 18 faculties and 13 branch campuses to its credit.

Today, being one of the most dynamic faculties in UiTM, the Faculty of Accountancy is also offering other accounting programs such as the Certified Accounting Technicians (CAT-UK), CPA Australia, Institute of Chartered Secretaries and Administration (ICSA-UK), Master of Accountancy and Doctor of Philosophy (PhD Accounting). Within the next year, several new programs such as Accounting Information System (AIS), Taxation, Management Accounting, Internal Auditing, Corporate Governance and Forensic Accounting and the newly known Malaysian Institute of Certified Public Accountants (MICPA) will be offered.

The Faculty's two-tier mission allows it to focus on two important aspects; nurturing of professional accounting graduates as well as becoming a renowned Centre of Excellence in Accounting Research & Consultancy. In tandem with our two-tier mission, the Faculty of Accountancy strives to produce quality graduates and quality research & consultancy.

PRESIDENTIAL MESSAGE

On behalf of the Malaysian Institute of Accountants (MIA), I would like to congratulate Universiti Teknologi Mara (UiTM) for its timely effort in initiating the publication of the 'Malaysian Accounting Review'. The Malaysian Institute of Accountants is indeed pleased to be associated with this publication, which is the first international refereed academic accounting journal in this country. The Malaysian Accounting Review is a vital platform for which various key areas useful to the development of the accountancy profession can be examined, analysed and digested. Indeed, this inaugural publication will serve as a catalyst and act as an important tool for students, researchers, accountants, academicians as well as other relevant parties to enhance their knowledge in these areas.

As the regulatory body for the accountancy profession in this country, MIA recognizes the need to provide continuous support and to be involved in research and development activities relating to the accountancy profession. We believe that this smart partnership between the accounting academicians and the profession will strengthen MIA's position to become a globally recognized and respected business partner committed to nation building. With the continued support and cooperation from all stakeholders and through this publication of the Malaysian Accounting Review, we are confident that the profession will further progress in its commitment towards making the country a center of accounting excellence.

Abdul Samad Haji Alias (Dr)
President
Malaysian Institute of Accountants (MIA)

THE MALAYSIAN INSTITUTE OF ACCOUNTANTS

The Malaysian Institute of Accountants (MIA) is a statutory body set up under the Accountants Act, 1967 to regulate and develop the accountancy profession in Malaysia. The functions of MIA are, inter alia:

- To regulate the practise of the accountancy profession in Malaysia
- To promote in any manner it thinks fit, the interests of the accountancy profession in Malaysia;
- To provide for the training and education by the Institute or any other body, of persons practising or intending to practise the profession;
- To determine the qualifications of persons for admission as members; and
- To approve, regulate and supervise the conduct of the Qualifying Examination

Vision of MIA
To be a globally recognised and respected business partner committed to nation-building.

Mission of MIA
To develop, support and monitor quality and expertise, consistent with global best-practises in the accountancy profession in the interests of stakeholders.

MIA regulates its members who are Chartered Accountants in public practice, commerce and industry, the public sector and academia. A qualified person who wishes to hold himself or herself out as a Chartered Accountant or an accountant in Malaysia has to be registered with MIA.

MIA is responsible for promoting and regulating the accountancy profession in Malaysia. The Institute is actively involved in the development and issuance of approved auditing standards and also participates in the development of applicable approved accounting standards by the Malaysian Accounting Standards Board. Additionally, MIA also actively participates in legislative initiatives and developments, spearheaded by the Securities Commission, the Kuala Lumpur Stock Exchange and Bank Negara Malaysia. These initiatives relate to the regulation of the capital and financial markets, corporate governance, and the Companies Commission of Malaysia, in the regulation of companies pursuant to the Companies Act 1965.

MALAYSIAN ACCOUNTANCY RESEARCH AND EDUCATION FOUNDATION

The Malaysian Accountancy Research and Education Foundation (MAREF), a trust for the promotion, encouragement and advancement of accountancy research and education in Malaysia, was set up in 1990 and received its certificate of registration as a corporate body under the Trustees (Incorporation) Act 1952 on 26 July 1993. MAREF is a trust body sponsored by the Malaysian Institute of Accountants (MIA)

The objectives of MAREF inter alia are:

1. To encourage and promote the advancement and development of accountancy in Malaysia.

2. To pay all or part of the fees payable including other expenses incurred and/or incidental to the education, training and/or maintenance in respect of deserving persons who are being educated or wish to be educated or wish to be trained in the accountancy profession in recognised institutions of learning.

3. To carry out such other legally charitable purposes for the advancement of education and training in the accountancy profession.

4. To carry out research in and to promote development of the profession of accountancy in general and in particular the development of accounting and auditing standards.

5. To publish and disseminate literature in advancement of the accountancy profession.

JAPANESE MANAGEMENT ACCOUNTING SYSTEM AS A COMPETITIVE TOOL: A CASE STUDY OF A NATIONAL AUTOMOBILE SUPPLIER IN MALAYSIA

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ABSTRACT

In its effort to become a "world class" supplier, comparable to its Japanese counterparts, the company chosen for the current case study had successfully emulated the Japanese management accounting technique known as the "lean production system". This system encompasses a combination of techniques such as Just-in-Time (JIT), Total Quality Management (TQM), Continuous Improvement, Zero defect, Statistical Control Analysis, Kaizen and Supply Chain Analysis. Lean production system reinforces the emphasis of competitiveness in the culture of this company. The study found that the lean production system had provided a solution for the company to pursue a manufacturing-based competitive advantage by creating order winners and differentiating the company from the competitors. The technique was also found to support the company's competitive strategy.

INTRODUCTION

In the 1980s researchers had turned their attention to Japanese firms in the hope of identifying the key to their success. The rise of Japan as the world's largest maker of automobiles was worthy of investigation, but conclusions were based mainly on particular operating methods such as "Just-in-Time (JIT)" and "Total Quality Management (TQM)". Ailing firms discovered too late that there was no single solution but instead discovered that singular technique required a combination of sophisticated support systems. For example, it is difficult to have discussion of JIT separately from TQM. The Japanese manufacturing system is now widely regarded as having evolved from one concept but with many titles, and is best known as lean production.

The manufacturing function within any manufacturing organization is the major consumer of resources and, for success to be achieved, its operations must align with the overall corporate strategy and with the business winning objectives of the company. Consequently, it is becoming widely accepted that a competitive manufacturing strategy can give a company a distinct competitive advantage in the marketplace and provide operational support for the corporate strategy. Hence, manufacturing management would have to think and act strategically about the manufacturing process.

In the wake of the success of Japanese automobile companies, automobile assemblers worldwide are embarking the "just-in-time (JIT) production" and "total quality management" to achieve the competitive edge over their competitors. This requires components suppliers in the industry to adopt just in time and quality assured supply of components. With this new development, component supplier had to revise or adopt new strategies in order to meet the changing customer expectations and achieve competitive edge. To meet these objectives, most component suppliers seek to improve their relationship with the automobile assemblers and adopt a contemporary process choice and production infrastructure as the "manufacturing strategy" to support the business objectives.

RESEARCH QUESTIONS

Due to the failure in understanding the principles of JIT and quality assurance (QA) and the pressure for performance on quality and delivery, components suppliers often adopt the conventional optimizing approach of mass production system that result in existence of "trade-offs" which mean that optimum solution must be sought within the constraints of the production system. Such a trade-off assumption is that holding high stocks of work in progress can only achieve improved delivery and that low stocks will make delivery performance worse. The existence of trade-offs means that there will be inherent limits or constraints in the production systems and this will be accepted as part of the system (Bennet and Forrester, 1993).

The contemporary approach to managing operations strategically is by adopting "the lean production concept", a term coined by the International Motor Vehicle Programme (IMVP) as the production method that will reinforce the emphasis of competitiveness in the culture of the company. This approach is widely practiced in Japan and allows the Japanese automotive industry to develop a highly trusted and long-term relationship between the automobiles companies and their suppliers. The main emphasis of lean production is continuous improvement, which seeks to expose and remove the constraints in the production system rather than optimizing them. However, the implementation of lean production in environments outside Japan, which are familiar to the optimization approach of mass

production system, can be a difficult task and may not be feasible (Oliver and Wilkinson, 1992).

THE CURRENT STUDY

This study aims to investigate the feasibilities and effectiveness of lean production system to support the manufacturing strategy of an automobile component supplier in Malaysia. The study explores the achievement of the company in accomplishing the qualifying criteria of JIT supply and quality assured product whilst achieving strategic competitive advantages in the automobile supplying industry by adopting the lean production system. It is hoped that, through this study, the researchers would be able to recommend lean production system as the most effective and feasible strategic choice for the component manufacturer to improve company competitiveness.

PURPOSE OF THE STUDY

This study considers issues relating to strategic decision making for the components manufacturing company in the automotive industry and the strategic choice of the lean production system to achieve the competitive-edge-criteria in its relation with the customer. Three specific objectives of this study are:

- To investigate the environment of the company's operation and products, and relate this to the strategic selection of the production system
- To identify implementation problems of the selected production system
- To investigate the company's achievements in term of order qualifying and order winning criteria, and the competitive advantages that the company gains from these.

PREVIOUS STUDIES

The Strategic Role of Manufacturing

To trace back the original manufacturing strategy, it was Skinner's (1969) work, in particular "Manufacturing: Missing Link in Corporate Strategy" which aroused the awareness of the needs of manufacturing strategy and its relationship with corporate strategy. He suggested that manufacturing function could be either a competitive weapon or a millstone. He concluded that all too often it has become a millstone, with top management's failure to recognize the importance of manufacturing to the corporate strategy. As a result, many manufacturing policies reflect incorrect assumptions about corporate strategy.

Following the contribution by Skinner, more research was conducted on the strategic approach to manufacturing (e.g. Andrews, 1972; Collin, 1982; Dent, 1990; Cunningham, 1992; Barbee, 1998; Shank, 1999; Cooper, 1999; Sheidan, 2000). Various approaches had been formulated which provide framework to incorporate the changing role of the manufacturing function with regard to business strategy. The need for these frameworks as the guidelines to businesses is further amplified by the emergence of the Japanese competition.

Competing Through Manufacturing

When examining the Japanese approaches, it is found that manufacturing has a key role in their success. Their emphasis in aspects like cost effectiveness, quality and reliability, customer services and product package has contributed greatly to their competitive position. The Japanese experience indicates that a competence-manufacturing base can enhance a company's prosperity. Manufacturing can have strategic impact to the success of a company and contributions from manufacturing should be in the agenda of the corporate level.

STRATEGIC MANAGEMENT OF THE MANUFACTURING FUNCTION

Order Winners and Order Qualifiers

Hill (1985) pioneered the concept of order winning criteria, which identify how products win orders in the market place today and in the future. It is described as the link between the marketing and the manufacturing functions, through which marketing should reflect the customer preference, while manufacturing use it as guidance in setting its objectives. Hill also differentiates the product order qualifying from order winning criteria. : "Order qualifying criteria" (order qualifiers) refer to criteria which get the product into the market-place and keep it there but they do not win orders. "Order winning criteria" (order winners) refer to criteria which provide an important edge over competition. Failure to achieve certain appropriate levels will lead to loss of orders and eventually loss of market share. Order qualifying criteria, will help the company to gain entry to a market but that is only the first step. The problem is then how to win orders against competitors who have also qualified within the same market.

Having identified and decided on the order winning criteria, the company should then translate it into an appropriate manufacturing strategy that would enable the qualifying criteria to be converted to winning criteria.

Linking Corporate Policy and Manufacturing Strategy

Hill (1991) developed a framework for the translation of corporate policy and market strategy in "process choice" and the development of the manufacturing "infrastructure". The framework assisted in developing a strategy that embraces the interface between marketing and manufacturing. The steps taken provide an analytical and objective structure in which corporate debate and subsequent actions can be taken. Table 1 depicts Hill's framework.

TABLE 1
Framework for Analyzing Production/Operation Strategy

1	2	3	4	5
Corporate Objectives	**Marketing Strategy**	**Win Orders (variables)**	**Process Choice**	**Infra-structure**
• Growth • Survival • Profit • ROI	• Product segment • Range • Volume • Innovations	• Price • Quality • Delivery • Speed • Reliability • Technical support • Design leadership • Product range	• Choices of process • Capacity Trade-offs in process chosen	• Operation system • Organizational structure • Work structure • Quality assurance

Hill's framework demonstrates how market and competitive decisions should be linked to decisions on the production designs. The framework can be used for the assessment of the effectiveness of manufacturing operations in relation to corporate objectives and product market, and can also be used as a guide for developing new, market-focused strategies in manufacturing

New (1992) in his manufacturing strategy framework for analysis proposed that when a company has decided on the competitive-edge criteria to compete, this choice must be translated into an appropriate marketing and manufacturing strategy. The manufacturing strategy is supported by a set of manufacturing mix consisting of plant, process, people and product.

OPTIMIZATION APPROACH PRODUCTION SYSTEM

Trade-offs in the Conventional Mass Production Systems

The concept of trade-offs within the production operation management system was put forward by Skinner (1969). He stated that an operation process inevitably involves trade-offs and compromises. Thus, conventionally it is assumed that the manufacturing systems selected to achieve the competitive edge criteria will often result in a set of trade-offs.

Bennet and Forrester (1993) identified the following set of trade offs that often exists in the conventional production system.

- Delivery performance versus material cost: Improved delivery can only be achieved by holding high stocks of work in progress where low stocks will make delivery performance worse.
- Quality versus overhead cost: Better quality is achieved by investing inspection equipment and procedures and reducing the inspection overhead will have an adverse effect on quality
- Response versus equipment cost: Greater customer response can be obtained by investing in more flexible machinery. Reducing the capital investments leads to poor response.
- Overhead versus material cost: Machine related overheads could be reduced by increasing their utilization and building stocks of materials. Reducing materials stocks adversely affect utilization and increase overheads.

This optimization approach is used as the basis of mass production system, which was first, pioneered by Henry Ford. Typical scene of the environment in the mass production companies was illustrated by Womack et al. (1990), which described the condition at General Motors' Framingham assembly plant. They observed that the shop floor were crammed with indirect workers who do not add value to the product, enormous work area full of finished cars riddled with defects waiting for repairs, large buffer of finished bodies awaiting for further process, and massive stores of part awaiting assembly.

Development of Alternative Production System

The optimization approach in the mass production system led to the uncompetitiveness of an organization as evidenced in the study by IMPV (1989) and Womack et al (1990) as depicted by Table 2.

TABLE 2
Summary of Assembly Plant Characteristics, Volume Producers, 1989

Performance	Japanese in Japan	Japanese in North America	American in North America	All Europe
Productivity (hour/vehicle)	16.8	21.2	25.1	36.2
Quality (Assembly parts defect/100 vehicles	60.0	65.0	82.3	97.0

Source: Womack, et al. (1990)

The survey illustrated that the performance of the assembly plants in Europe and North America, which practiced the conventional mass production system, lagged behind their Japanese competitors.

An alternative production system was developed to overcome the deficiencies of the conventional production systems while maintaining its beneficial features. Bennet and Forrester (1993) termed the new approach as "continuous improvement approach", which is based on the idea of deliberately exposing the constraints in the production system and finding ways of continually reducing or removing them rather than simply optimizing within them.

Schonberger (1986) called the new approach, World Class Manufacturing (WCM), in which the motto is continual and rapid improvement. If the conventional production system tackled the problem with trade-off analysis, WCM tackled the problem through continual improvement in quality, cost, lead-time and customer service. The WCM percepts for treating the ailments associated with the conventional production system are JIT, total quality control (TQC) and total preventive maintenance (TPM).

LEAN PRODUCTION SYSTEM

Elements of Lean Production System

Womack et al. (1990) wrote on the five years research project by IMVP on productivity and management practices in the world of motor industry. The study compared the management practices and relates this to the productivity and quality of different car producers. The main finding was that one model of production organization which the researchers termed "lean production" was systematically related to superior quality and productivity. This form of production was a dominant form of production used by Japanese manufacturers. They noted that lean production system is drawn upon the ultimate objective of "perfection" which can be translated into goal such as declining costs, zero defects, zero inventories and endless product variety. Harrison (1992) noted that the reason for the Japanese productivity advantage is that their manufacturing practices allow them to eliminate waste, optimize manufacturing process using the talents of their people, and minimize investment levels in plant space requirement, inventories and equipment.

Oliver and Wilkinson (1992) described that one theme that runs through Japanese manufacturing practices (lean production system) is the central significance of quality, and the control of processes to achieve it. Considerations of quality are linked to customer satisfaction and to the efficiency of the process.

The elements of lean production system as practiced by the Japanese are described in subsequent sub-sections.

Total Quality Control

Total quality control (TQC) was first introduced by Feigenbaum (1961) where he expressed the view that quality is not just about manufacturing, but also applied to all other departments. TQC is a concept whereby quality is a responsibility to be shared by all in the organization, especially the workers who make the product. Deming and Gray (1981) urged that quality should be considered as an integral part of management control. He emphasized that management should embrace the philosophy that mistakes and defects are no longer acceptable and should be eliminated.
Juran and Gryna (1970) defined quality as "fitness for purpose", which emphasized on meeting of customers' needs and expectations. This customer orientation extends inside the organization as well, where a particular process or department will have internal customers, such as the next process whose requirements they have an obligation to meet. This emphasized that quality has to be built into each process and cannot be inspected on a finished product. In this way, quality of the products and services is regarded as a fundamental determinant for business health, growth and economic viability. Total quality control thus comprises of the systems that enable marketing, engineering, production and service at the most economical level, which allow customer satisfaction (Feigenbaum, 1993).

Continuous Improvement (Kaizen)

Knowles (1993) defined continuous improvement as the attempt to better meet customer requirements and expectations by progressively reducing process variation. He stressed that continuous improvement is so powerful that if fully embraced by an organization, will improve all of its processes in its determination to become the organization against which others benchmark performance.

Kolm (1985) comments that the continuous improvement idea come from the belief in the possibility and desirability of achieving 100 percent perfection. Continuous improvement approach enables the organization to achieve the objective function by progressively improving the product quality and reducing process variation. An organization that is continually improving its processes will eventually equal or exceed the performance of its competitors. In the lean production system, the process of continuous improvement spirals towards a customer target. The process of continuous improvement, giving the ownership of change to the workers, can be satisfying and constructive.

Workers are given the responsibility and encouragement for on-line quality control and a chance to participate in a continuous process of innovation and improvement. Improvement group is set up to do continuous improvement activities of cost reduction and quality improvement (Hiromoto, 1988; Morgan and Weerakoon, 1989; Hariman, 1990; Knowles, 1993). Each production step is analyzed in detail so that the cost-critical steps can be identified and targeted for further work to reduce costs still further.

Just-in-time Production (JIT)

Bicheno (1991) states that the aim of JIT is to continuously eliminate wastes and eliminate delays at every stage from raw material to final customer, and from product concept to product launch. This is a two dimensional view; that is reducing lead-time and moving the product from concept to market place as quickly as possible.

Toyota Corporations identified seven types of waste, which have been found to apply in many different types of operation; that is over-production (causing stock accumulation); waiting time; transport (multiple handling of work-in-progress); process (unnecessary process); inventory (excess stock); motions (unnecessary movements) and defective goods (Harrison, 1992). JIT seeks to eliminate waste and this typically involves removing any non-value-added operation from the process. The net effect will be reduction in inventory, workers, space, investment and production time.

To achieve the goal of minimum waste in manufacturing, JIT system adopt a "hand-to-mouth" mode of manufacture, which aim to produce the necessary products in the necessary quantities, at the necessary time. It is a system in which stocks of components and raw materials are kept to an absolute minimum, and are delivered in a matter of hours before use in the production process. To achieve this, the production process must be inherently very responsive. By reducing inventory level, problems previously unnoticed when inventory level was high will be encountered and solved. Through continuous reduction in stocks and elimination of problems, there will be continuous waste removal and quality improvement in the process. This will enhance responsiveness and precise coordination of resources involved in the production process.

A further outcome of JIT production is heightened awareness of defects or quality problems. When components are produced in small quantities through JIT, any defects are discovered quickly and production of substandard work is avoided.

Statistical Process Control (SPC)

Harrison (1992) comments that prevention of defect is the basic philosophy of modern approaches to quality control. It is far better to find defects during the process than in the products of that process. This is the foundation for statistical process control, which aims to eliminate special causes of variability and to ensure that the process remain under control (Anon, 1986). SPC helps to control processes within specified limits by sampling measured process outputs and recording the results on control chart. The purpose is to find out whether the process in under normal statistical control, or whether changes need to be made (Harrison, 1992; Oliver and Wilkinson, 1992).

SPC thus involves operators periodically sampling their own production, in order to produce a chart of how the process is behaving. The information gained is used to trigger corrective action before the process generates products that fall outside the specification (Oliver and Wilkinson, 1992). This will help to minimize the variation in the components and improve the products performance so that customer requirements are more closely met than before.

Flexible Working Practices

Flexibility refers to an organization's capability to react to change. Slack (1990) has referred to two aspects of flexibility of most concern to manufacturing companies: Variety of products, processes and activities; Uncertainty of system to predict the demand placed upon it. To cope with low inventory and high product variety, which is increasingly difficult to forecast demand accurately, require highly flexible manufacturing facilities. Harrison (1992) comments that high product variety means that a single piece of equipment will be used to produce many components of different configurations and this will result in set-up time problem. Flexible facility must be able to reduce set-up time and allow smaller batches of components to be produced more frequently without losing overall system capacity.

To cope with uncertainty in demands, the organization should be able to allocate resources to meet the changes in demand and any excess will result in waste. Oliver and Wilkinson (1992) comment that elimination of waste necessitates flexible working, which mean that human resources should be deployed as required by production demands, reducing source of inefficiency in resource utilization.

In the manufacturing industry, flexibility was mainly achieved by the use of overtime and, most significantly, through functional flexibility. Functional flexibility refers to an organization's ability to move its people around between grades, according to when and where they are needed (Atkinson, 1987). True flexibility is only gained over time as a result of a long-term programme of training people in new skills. By using the flexible manufacturing process and the ability to flexibly use the resources, the organization would be able to supply the product variety that the customer wanted with little difficulties.

Team Approach to Work Organization

The most significant source of uncertainty in most manufacturing companies are the people who work in the organization. How many people will be available at any time and how much will be produced by the people are typical uncertainty questions associated with workforce (Graham, 1988). In reacting to such situations, companies tend to hold stocks to buffer against the effect of uncertainties. In conventional practice, tasks are sometimes split into their smallest elements with workers specializing in carrying out the same activity, which were tediously repetitive, with little opportunity for the workers to use their mind.

Lean production system overcomes these by organizing members into teams. Team approach to work organization can be found from the shop floor to the designing team (Womack, et al. 1990). At the shop floor, workers are divided into teams where each member is responsible for the team performance such as achievement of production target, quality level and attendance rate. Multi-skills in the team are encouraged where members will be able to rotate jobs and make collective decisions on how tasks should be done. The team will also benefit from multi-skills in terms of achieving flexibility and increased motivation (Graham, 1988). Developing group objectives further fosters teamwork. Group objectives can form the bond necessary to get people from different departments to work as a team in meeting their customers' objectives.

Team-work is further enhanced through the formation of quality control circle groups and small-group improvement teams which voluntarily work on quality improvement project. Harrison (1992) comments that the claimed benefits of these are generation of improvement ideas by workers; improved ownership of the process; increased morale due to job enrichment and improved team-work by removal of barriers..

Team-working is used as the basis for "cellular manufacturing system" where machines are categorized by family (a cell) managed by a team of multi-skilled workers. The balancing of the various operations on the line can be achieved via the flexibility of deploying the multi-skilled labour, rather than by having buffers to accommodate fluctuations in work rate at the various stations along the line (Monden, 1983; Skinner, 1985).

Buyer-Supplier Relation

Oliver and Wilkinson (1992) noted that buyer-supplier relationship in Japan is characterized by longer-term commitment, which is based on cooperation. Conventional buyer-supplier

relationship is based on competition where both buyer and supplier attempt to secure the best deal for themselves, typically at the expense of other party. They commented that in a cooperative relationship, both parties have a sense of obligation to assist each other and protect the others' interest. Sako (1992) termed these changes in her spectrum of relationship from arm's-length contract relation to obligation at contract relation. One of the key dimensions differentiating the arm's length relation from the obligation as seen by Sako is the degree of interdependence between the two parties, which was analyzed by Sako in terms of "goodwill trust" and "competence trust". Failure to develop these trusts and comply with the customer's expectations will result in the latter looking elsewhere for alternative supplier.

Implementation of Lean Production System

Oliver and Wilkinson (1992) examined the implementation of the Japanese manufacturing practices (lean production) in the British industry. They conducted two surveys, one undertaken in 1987 and the other in 1991. In the 1987 survey, work teams and flexible working practices were the most widely used followed closely by quality circles and statistical process control. The 1991 survey, which was designed to develop and extend the 1987 survey, shows that the "operator responsibility for quality"; continuous improvement and JIT production were most popular. In the survey, total quality control shows almost no change in terms of proportion of companies implementing or planning to implement it, suggesting that implementation may be a longer and slower process than anticipated. Oliver and Wilkinson noted that although continuous improvement is one of the most difficult to implement, a high proportion of companies have programmes of continuous improvement. The more difficult-to-implement aspect of the package such as set-up time reduction and cellular production are less in evidence.

On the context of change, Womack et al. (1990) had observed that the moves toward lean production are facilitated by a sense of crisis. Oliver and Wilkinson (1992) observed the same phenomena where two-thirds of the companies participated in the survey had experienced a sense of crisis in recent years. Respondents to the survey were also asked to indicate the single most important impetus for the change to lean production system. Table 3 demonstrates that, manufacturing reform was engaged in for "defensive" reasons such as increasing competition, the need to reduce cost, and inadequate profitability.

TABLE 3
Impetus for Change in UK Companies (1991)

Nos	Factor	Percentage Reporting (%)
1	Competitive Pressure	25
2	Cost Reduction	17
3	Inadequate Profitability	15
4	Severe Loss/Survival	8
5	Quality Improvement	8
6	External Pressure	5
7	Improved Delivery	5
8	Productivity Improvement	4
9	Increasing Volume/Market Share	3
10	Others	10

Source: Oliver and Wilkinson (1992)

Concerning the adoption of JIT, Voss and Robinson (1987) based on their survey in 1987, conclude that "many companies are implementing individual aspects of JIT rather than the whole concept". However, despite this, many companies reported benefits from their use of

JIT. WIP reduction was ranked as the greatest benefit, followed by increased flexibility, reduction in the use of materials and improved quality. With respect to cellular manufacture, Ingersoll Engineers (1990) in their study of 235 companies found that half claimed to be using some form of cellular manufacture. Improved delivery, responsiveness and inventory figure are the three main objectives cited in moving towards Cells. Oliver and Wilkinson (1992) observed that the shift towards teamwork and cellular manufacture was often made problematic by the dispersal of specialist departments, visibility and accountability of production process, and "flatter" organizational structure.

Oliver and Wilkinson's (1987) survey shows that about a quarter of the responding companies considered flexible working to be highly successful. Anecdotal evidence suggests that the problem in implementing flexible working is managing the transition from traditional working practices to more flexible systems. Oliver and Wilkinson (1992) also reported that in one company, a number of techniques is adopted to support flexibility: an open communication system, improvements in working environment and a single status policy.

Regarding obstacles in implementing the new production system, Oliver and Wilkinson (1992) cited human factors, the existing culture being the single most frequently mentioned obstacle to change. This is followed by the existence of labour unions and lack of support at senior levels. Technical constraints and the availability of resources did not appear to be prevalent as obstacles. Oliver and Wilkinson conclude that the data appear to support the idea that the success of the major Japanese corporation cannot be assigned to any specific set of practices. Instead, it was the fit between a set of business strategies and a set of supporting conditions (lean production system).

SUMMARY OF PREVIOUS STUDIES

In general, previous studies recognized the potential role of lean production system as strategic tool within manufacturing companies. However, due to lack of understanding as well as minimum literature available on its current practices has caused misconception among practitioners. As a result, companies are reluctant to adopt lean production as a manufacturing strategy. The "cost of failure" are usually perceived to be very high. This study hopes to "break the ice" among manufacturers in Malaysia. If lean production system is implemented with full commitment and belief, companies may use this system as a competitive strategy. The current study is undertaken to describe the procedures used by a local manufacturer on how lean production system was successfully used by the company. As a result of its success, the company was chosen as the main supplier to the automobile industry in Malaysia.

RESEARCH DESIGN

The current study examines and assesses the implementation of the lean production system by a local automotive components supplier. As a result of its success in meeting the stringent criteria put forward by the Malaysian Automobile manufacturer, it was chosen as a major supplier; supplying automobile components to the Automobile plants

The research design of the current study is divided into two distinct phases. Phase 1 was the distribution of a questionnaire survey to selected employees of the company. Through the questionnaire, simple descriptive statistics were presented (Anon, 1986). Phase 2 was the actual case study itself. Basically documents were analyzed and managers were

interviewed and observed. The information gathered was later synthesized to achieve the research objectives.

THE SAMPLE COMPANY

The case under study is an actual supplier of the Malaysian Automobile Company (to be referred here as AUTOMOBILE). For this research, the supplier's name is disguised as Lean Production Sdn Bhd (LPSB). LPSB is a joint venture company of AUTOMOBILE, its sister Japanese company in Nagoya, Japan (to be called as NAGOYA) and a local Holding company (disguised as HOLDING). NAGOYA Company is an association of automobile component manufacturing companies in Nagoya, Japan whereas HOLDING is the leading heavy industries company in Malaysia. LPSB specializes in producing small and medium size automobile body components.

In 1992, the company employed approximately 180 personnel and by 2001 the number employed has risen to 812 personnel. Out of 812, 107 were employed as contract workers since December 2000. This is part of the company's effort to cushion the possible impact of a recession caused by the current US economic slowdown.

LPSB plant is located in one of the biggest industrial zones in Malaysia. The plant location is less than a kilometer to its major customer, AUTOMOBILE and within 50-kilometre radius to other potential customers. The close proximity to the customers will facilitate the just in time supplies. Annual sales growth rate had increased from 2.2% in 1995 to 4.2% in 2000, implicating some level of success of its competitive strategy.

The company was selected for the case study since it represented one of the most established components manufacturing company in the automotive industry outside Japan, which has successfully adopted the Lean Production System to achieve its competitive edge.

The Product and the Technology

LPSB main products are the stamped and assembled automobile body components that constitute about 30 percent and 70 percent respectively. An assembled part may consist of several smaller stamped components, which are assembled together by welding process. The number of components produced by the company currently is 500 types of parts, making it the largest supplier stamped and assembled body panel to AUTOMOBILE.

The raw material mostly had to be imported from Korea and a small quantity could be purchased locally through the steel processing company. Since the components are generally for the inner parts of the automobile, most of the materials used are not coated with antirust material before the painting process at the customer site. This creates potential problem in terms of stockholding period for the raw material and finished goods since most of the products had to be supplied to the customer untreated and rust free.

The technology used in this industry is steel forming and welding technology. The company used medium and small sized tandem press machines for the blanking, forming, trimming and piercing process of the stamped components. These are the processes involved in stamping activities whereby except for blanking, the other process would form a pattern on the raw materials. The blanking process only involves cutting of material in a square shape. The steel raw materials, which are supplied in coil form, had to be blank at the blanking

machine before being sent to the press lines for other stamping processes. After undergoing the stamping processes, the components to be assembled are sent to the welding assembly lines.

In terms of personnel skill, the most important skill required in this industry are the die and jig designers, die and jig maintenance workers and press maintenance workers. Initially, due to scarcity of skilled workers in related industry in Malaysia, new intake from various vocational schools were recruited and trained for about a year prior to commencement of production.

LPSB uses a combination of batch and flow manufacturing. At each press line, parts are produced in batches, where the parts to be produced had to queue before the production starts. However in the press lines, flow process is used. Each stamping product requires several processes in which the parts flow from one process to another along the press line. After completion of stamping processes, parts are assembled in batches at the assembly lines according to the lot size as required by the customer. The assembly productions are triggered by the kanban from the customer. Kanban stands for Kan-sign, Ban-board. It refers to a simple parts-movement system that depends on cards and boxes/containers to take parts from one workstation to another on a production line. The essence of Kanban concept is that a supplier or the warehouse should only deliver components to the production line as and when they are needed, so that there is no storage in the production area.

Strategic Decision Making

LPSB business objective is to achieve profitable growth as the largest and most efficient automobile body components manufacturer in Malaysia. To achieve this "growth objective", the company adopts a "focus strategy". The focus strategy allows the company to concentrate its resources to build a core competence in stamping-related components manufacturing.

By pursuing a manufacturing-based competitive advantage, the marketing drive for the company is to market the efficient capability of the company to meet customer demand at a competitive price. In terms of production volumes, the company plans its machine and resources capacity to allow flexibility to meet variation in customer demands.
LPSB then identified the orders winning criteria, which specifies how do the products win orders in the market place. The company order winners are in the order of "quality consistency", "delivery reliability". "delivery lead time", "demand flexibility" and "price".

The order winner of quality consistency specifies the product consistency in conforming to the customer specification. To achieve delivery reliability and delivery lead-time, LPSB adopted "make-to-order" policy. Delivery reliability refers to how reliable the company is in delivering the customer's order while delivery lead-time refers to the waiting time between order placement and receipt. The order winner of demand flexibility concerns the capability to meet variations in customer demand without affecting the lead-time. The price order winner is the money actually paid by the customer and the company believes managing the operation efficiently can support this.

The company's manufacturing strategy was developed based on the company's objectives and the order winning criteria specified earlier. Japanese production system (lean production) was selected as the operation system that would support the manufacturing strategy. By adopting lean production system, the company believes that the strategy could help the company in achieving the order winning criteria and surpass the customer's expectation of quality assured and just-in-time supply of components.

THE CASE STUDY DATA

Following the review of the literature, the LPSB case study was drawn upon eight (8) years period data (i.e 1992-1994, 1995-2000) from the company's official records, and from the research interviews. Emphasis is given for the period 1992 to 1994 as it represents the time where the top management consists of Japanese expatriates from Nagoya. The method was identified as the most appropriate method as it could efficiently generate substantive data within the constrained time period available.

Official records would allow historical comparisons and trend analysis by using graphical techniques and provide some means for measurement of the success of the lean production system implementation in the company. Trends can be observed from the graph, which would indicate the substantial changes in the company performance. Data from the official record are the average monthly figure of the following variables for eight years period from June 1992 to May 1994 and from 1995 to 2000.

a. Inventory level of work in progress and finished goods
b. Quality status – defective and rejection rate
c. Production volume
d. Batch production control – average set-up time and batch size
e. Number of employee suggestions
f. Employee turnover rate

DATA ANALYSIS

From the case material, the basic approach in analyzing the data were pattern-matching and theory-testing; explanation generating and time series analysis. The findings from the data were analyzed in relation to various aspects of the selection, implementation and maintenance of the lean production system. Obstacles encountered, actions taken to overcome the problems and achievement of the products' order winning criteria through adopting the lean production system were also analyzed and understood. In some areas, the success of implementing lean production system could be evaluated through comparative analysis of lean production system with the Japanese practices in the British industry by comparing results to the survey of Oliver and Wilkinson (1992).

RESULTS AND DISCUSSION OF FINDINGS

Implementation of Lean Production System

Elements of lean production system implemented at LPSB as elaborated earlier are the just-in-time production and components supply; total quality management; continuous improvement activities; statistical process control; team approach to work organization and flexible working practices. These are supported by other practices such as set-up time reduction and total preventive and periodical maintenance. Other lean production elements being planned for implementation are the kanban system and quality control circle.The survey result in Phase 1 is shown in Table 4. LPSB rated lower degree of success in implementing just-in-time production; total quality management; statistical process control and flexible working. The practices of continuous improvement; group working; preventive maintenance and single status facilities were rated as highly successful.

TABLE 4
Degree of Success of Implementing Elements of Lean Production

Nos.	Elements	Level of Success		
		Not Successful	Quite Successful	Very Successful
1	Just in Time production		✔	
2	Total quality management		✔	
3	Continuous improvement			✔
4	Quality Control Circle		✔	
5	Working group			✔
6	Preventive and periodical maintenance			✔
7	Statistical process control		✔	
8	Flexible working		✔	
9	Single status facilities			✔
10	Kanban System		✔	

In practicing **JIT production**, during the initial stage due to the immense pressure to meet the customer delivery instruction, the production batch sizes, the inventory level and the lead-time were increased. This was seen as the right move to ensure smooth delivery. As a result, there were acute shortages of storage spaces and storage pallets. At this stage, numerous production problems and workers' skill inadequacy were undetected and the productivity level remained below target. When the management decided to solve the storage problems by reducing inventory level, various process-related problems and workers skill constraints problems were encountered and these affect the delivery performance. These problems were solved in stages until the company reached a satisfactory delivery performance whilst maintaining inventory at a target level. Continuous challenges to further reduce the inventory level were done together with gradual improvement to the process to improve production response time. At the current stage, the company was able to achieve about 6 shifts (3 days) stock level of stamping parts; 1.5 shift stock level of assembly parts and 1 shift stock level of WIP.

Total Quality Management concept was not well understood and practiced by the company personnel. Although the responsibilities for inspecting the WIP and products are being passed over to the operators themselves and defect prevention activities are being carried out, these were largely due to the operation standards. The responsibility for quality was still perceived by many employees as the responsibility of quality control and production group. Thus, the support and voluntary contribution toward quality from other sections had been lacking. The management thus had planned to do total quality campaign to promote total quality activities.

Continuous Improvement (kaizen) activities had been successfully implemented in LPSB. A kaizen group had been formed to undertake the responsibility of checking and implementing improvement suggestions from the operators. The company also reported an increasing number of employees improvement suggestion. Various improvements had been done to the processes and the tooling based on the employees suggestion. Process variations were reduced in stages by eliminating the most critical problems first. Problems to be eliminated include problems relating to safety, quality, productivity and workability.

Quality Control Circles implementations had not been successful in the company with only 17.5% of the work force joining the voluntary quality control circles. The company is planning to promote further quality control circles as part of the total quality management drive.

Preventive and Periodical Maintenance activities on all machines and production tooling were successfully implemented. Machines were periodically inspected by the maintenance personnel and regularly serviced following the manufacturer's guidelines. The operators, before production start-up also conducted daily inspections. The dies and jig maintenance follow a set periodical maintenance schedule. Total inspection of the dies and jig workability were done and comparisons were made against the parts statistical process control chart. Replacement of the tooling and machines parts follow the parts' life guidelines. As a preventive measure, feedback from the operators on improvement ideas or any deviation in the process were promptly investigated and improved. These periodical and preventive maintenance measures help the production group in maintaining the response level to the production demands and improve the production capacity.

Although the company practiced **Statistical Process Control** since commencing operation in 1992, the practice remain restricted for corrective action and provide data during periodical tooling inspection. The control chart was not fully used to improve the process except when the data shows any "out of tolerance" dimensions. Any abnormal behaviours were not investigated and improved as long as the data is within the lower and upper quality control limit.

Group Working had been well received by the shop floor employees. Supervisors are used as the communication channel by the management and the workers. The presence of group supervisors provides means for the workers to air grievances and improve industrial relations in the company. Group working is further encouraged through the recognition of best group rather than best employee. Most of the workers also readily identify themselves with the group they are in.

LPSB practices **Single-Status** employment and provide single-status facilities to all employees. The practice of single status had been well accepted by all the employees. All company employees are required to wear a common company's uniform. Single-status facilities provided include parking lots, canteen, recreation room, sport facilities and prayer rooms. The lower level employees appreciated more the single-status practices since it ignore the status distinction and create team spirit.

LPSB had achieved **Flexible Working** mainly through functional and temporal flexibility. Temporal flexibility refers to flexibility in the use of working time (Atkinson, 1985). Since the company practiced a 5-working day week, temporal flexibility is achieved through a normal two-hour daily overtime and Saturday overtime. The overtimes are used as the buffer to overcome fluctuation in working hours required as a result of fluctuation in demands. However, reception of the operators for Saturdays overtime had not been promising. Functional flexibility is much facilitated by the availability of skilled workforce and continuous cross training of operators in other related areas.

The **Kanban System** is practiced slowly within the company. For internal production, weekly press and welding programmes are used to trigger production. These programmes are based on the monthly production plan and consolidated weekly based upon the customer's delivery instruction (DI) and the stock status.

Implementation Problems and Counter-Measure Action

Numerous problems and obstacles had been encountered during the implementation of the above practices. In the early stages of implementation, LPSB found that the personnel were inadequately trained and did not fully understand the principles of lean production

elements implemented in the company. Hence during the initial stage of plant operation, improvements to the implementation, periodical reviewing and auditing of the operation system were performed. The management staff were required to brief regularly the operation system to the employees under their control. The degree of success were usually measured based upon the productivity level, quality status, safety level, inventory level and delivery performance. Results were discussed between peer groups and among the management staff. Through periodic meetings at the shop floor level and at the management level, performance was analyzed and problem areas were identified. Countermeasure actions were discussed with target set for the implementation date. Action taken follows the "Plan, Do, Check, Action (PDCA) Cycle" path, where the plan, activities and the results were being constantly checked to ensure that implementation had been effective.

OTHER FINDINGS

Quality Status

The quality status is measured based upon the rejection rate from the customer and the product defective rate. Rejection rate refers to the rate of components rejection at the customer premises while the defective rate refers to defect detected in the company during the process or before delivery.

Effective 1998, the company has changed the benchmarking used for computing defective parts that is from usage of percentage to parts per million (ppm). This is in line with international practice on benchmarking for defective parts as opposed to in percentage in order to give a tangible measurement on the actual defect level. This is especially important in a case where the defect rate has achieved a very low level (i.e. 0.01%) whereby workers would tend to be complacent and do not strive for further improvement. But if measured in parts per million, the defect parts would be 100 parts. Thus, there is still room for improvement to reduce to 50 parts per million. The usage of parts per million has proven to be a step in the right direction whereby the defect rate has further improved. Table 5 depicts this result.

TABLE 5
Percentage of Defects (1995-2000)

Year	Parts per Million	Percentage of Defect
1995	NA	0.34%
1996	NA	0.11%
1997	NA	0.18%
1998	2713	0.27%
1999	5347	0.53%
2000	1119	0.11%

The defective rate as at year 2000 has reduced to the 1994 level, which is below 0.2% even though it was quite alarming in year 1999 due to high percentage of new workers, which was identified as the major contributor in increasing the defect rate. Apart from the usage of parts per million, to further rectify the situation, a special team was formed to analyze on rejects to ensure effective actions are taken, preventing recurrence or eliminating potential of the same defect to occur elsewhere.

Customer Rejection Rate 1995-2000

In line with the effort to increase the image of LPSB's product, equal emphasis had also been placed in analyzing the Defect Countermeasure Request Sheet (DCRS). The DCRS is a complaint form filled in by AUTOMOBILE whenever there is a rejected LPSB's part received by AUTOMOBILE. The target set by AUTOMOBILE is a maximum of 4 DCRS per month for its vendors effective from 1998. The average number of DCRS issued by the customers for the period of 1998 to 2000 is shown in Table 6.

TABLE 6
Actual Rejection (1998 - 2000)

Year	Average Number of DCRS per Month
1998	9
1999	12
2000	4

Turnover Trend from 1995 - 2000

Table 7 depicts the turnover trend of the company from 1995 – 2000. The higher turnover rate of 5.6% in 1999 has resulted in increase in the defect rate for 1999 due to additional intake of new workers because of immediate increase in volume. However, immediate measures have been implemented whereby the selection process of new workers has been improvised to select candidates with similar experience in the manufacturing environment.

TABLE 7
Turnover Trend (1995 - 2000)

Year	Turnover rate (%)
1995	2.2
1996	4.7
1997	7.5
1998	3.4
1999	5.6
2000	4.2

The measures implemented had proven to be effective based on the low turnover rate of 4.2% in year 2000 as compared to 5.6% in 1999. This had also contributed much in improving the quality performance in year 2000. A market study conducted by Maxis HR department showed that in Malaysia, company norm turnover rate is estimated to circa around 3.5%. Taking this Malaysian industry standard figure, organization should not be alarmed if their turnover rate is less or close to this norm.

The overall industrial relations climate is healthy. The Union has always been very supportive to the company's programs, which include the achievement of ISO 9002 certification and the implementation of cost-down activities for the austerity drive. There had been no major issues and all concerned items had mainly been resolved through formal and informal meetings. Currently, preparations are being made for company wide sports and recreational activities for the year to promote harmonious work environment.

Achievement of Order Winning Criteria

LPSB's order winning criteria as described in earlier section are quality consistency, delivery reliability, delivery lead-time, demand flexibility and price. The result of the quality status indicated that the company had achieved the order winners of quality consistency. In-house defective rate has dropped below 0.2% and rejection rate from the customer around 0.05%. Through continuous effort to improve the process and the operators' skills, the company was able to consistently conform to the customer specification and reached close to a perfect quality assured supply.

Delivery reliability and delivery lead-time to some extent can be deduced from the inventory level data. Despite the inventory level reduction and maintaining the level within the targeted range, the company showed that it was able to maintain the reliable supply of components to the customer. Since the introduction of new components in July 1993, the response rate gradually improved and further reduction in inventory level was possible. This proves that despite low level of inventory, the delivery reliability to the customer was maintained.

Stock level of finished goods indicates the delivery lead-time to the customer. It determines the response period between receiving of order to supply of goods. Reduction in stock level implies that LPSB was able to consistently reduce the delivery lead-time. The response rate gradually improves and the delivery lead-time can be shortened and hence the stock level can be reduced. The achievement of the company to achieve delivery reliability and maintain the delivery lead-time at a certain level of inventory shows the effectiveness of lean production system in achieving the order winners of delivery lead-time and reliability. Ability to reduce the set up time and production downtime also improved the company's productivity. This will increase the production lines capacity, which is required to meet the changing in demand. Through increase in capacity, the company was able to achieve the order winner of demand flexibility.

Price order winner's achievement cannot be measured in this study since the appropriate data was not available. However some insight can be obtained through operating data of inventory level, quality status and set up time. The improvement of quality status, reduction in inventory level and set up time shows that the company was able to minimize waste and attained a leaner operation in which operating cost can be lowered and thus to some extent the order winner of price can be achieved.

Currently LPSB is pursuing the order winning criteria of technological support. The engineering personnel were increased especially in the die design and die making areas. Personnel were sent for training in Japan and other vocational institutions. Achievement of this order winner would make LPSB attractive to the customers since it would be able to provide technological support in the components tooling design and making.
Other aspects that can be used to gauge the implementation success at LPSB is the set up time for press machines, which is the criteria for controlling batch production as shown in Table 8. Although the comparison figure from Burbridge (1982) is rather outdated, a degree of comparison can still be determined based on the following results.

TABLE 8
Comparison of Set-Up Time for Heavy Power Press

Items	Toyota	USA	Sweden	W. Germany	LPSB
Set Up time (hours)	0.2	6.0	4.0	4.0	0.22
Set up per day	3.0	1.0	-	0.5	3.0
Lot Size	1.0	10.0	31.0	-	3.0

Source: Burbridge, 1982

The result indicated that the set-up time practice at LPSB is comparable to the practice as in 1982 of the originator of lean production concept, Toyota Corporation. This shows that in term of control of press lines production, LPSB was considerably successful in emulating the practice of the Japanese manufacturer. Success in this aspect is vital since it would provide support to the implementation of JIT production which require reduction of non-value added activities such as set-up time; small lot sizes to keep inventory level low and more set-ups per day due to the smaller lot sizes.

CONCLUSIONS, RECOMMENDATIONS AND FUTURE RESEARCH

The adoption of the Japanese management technique and the investigation of LPSB's operation and products environment show that manufacturing was recognized as a strategic weapon, which could form part of the company strategy. The lean production system had been strategically selected to support the company's manufacturing strategy.

The data reported appear to support the idea that the company's success cannot be readily assigned to any specific set of practices. For instance, even though JIT was only partially successful, the company was able to achieve delivery reliability and delivery lead-time. Some major elements of the lean production system seemed to support the successful implementation of the others. JIT could not be successful if the quality level is low and if set-up time reduction practices have not been implemented; SPC should be practiced together with total preventive maintenance activities; group working will facilitate the practice of flexible working. Thus continuous success can only be assured by improvisation of all elements of the lean production system.

What appears to be critical in the lean production system is that the essence of all these elements should be the continuous improvement approach. It requires the implementers to expose the constraints in the operation and continually find ways to remove them. This is proven in the practice at LPSB where delivery reliability was achieved not by optimizing the inventory level using conventional economic lot theory, but by improving the process and hence improving the response rate. This is in line with the thoughts of Schonberger (1986) who said "the improvement journey requires clearing away obstacles so that production can be simplified". Adopting the lean production system will lead to the ambition of having leaner operation.

It is recommended that the implementers should expose the constraints in the operation and continually find ways to remove them. Lean production system had also helped the company to pursue a manufacturing-based competitive advantage by creating order winners and differentiating the company from its competitors.

Future research should also focus on the service industry. Understanding the environment of the industry in which a company competes would also help in the successful implementation of the lean production system.

REFERENCES

Andrews, K. (1972). The Concept of Corporate Strategy. Homewood. Illinois, Irwin.

Anon (1986). Guidelines to Statistical Process Control, Society of Motor Manufacturers and Traders.

Atkinson, J. (1987). Flexibility or Fragmentation? The United Kingdom Labour Market in the Eighties. *Labour and Society*, 12(1): 87-105.

Barbee, G. (1998). Product Costing to Win Profit Margin. *www.findarticles.com, July.*

Bennet, D. J. and P.L Forrester (1993). Market Focused Production Systems: Design and Implementation. London, Prentice Hall.

Bicheno, J. (1991). Implementing Just-in-Time. Bedford, IFS.

Burbridge, J. (1982). Japanese Kanban System. *International Journal of Production Control,* January/February : 1-5.

Collins, F. (1982). Managerial Accounting Systems and Organizational Control: A Role Perspective. *Accounting, Organizations and Society*, 7(2): 107-122.

Cooper, R. (1999). Develop Profitable New Products With Target Costing. *www.findarticles.com, Summer.*

Cunningham, G. M. (1992). Management Control and Accounting Systems Under Competitive Strategy. *Accounting, Auditing and Accountability,* 5(2):85-102.

Deming, W. E. and C. S.Gray (1981). Japan: Quality Control and Innovation. New York : Business Week.

Dent, J. F. (1990). Strategy, Organization and Control: Some Possibilities for Accounting Research. *Accounting, Organizations and Society*: 3-25.

Feigenbaum, A. V. (1983). Total Quality Control. New York, McGraw Hill.

Feigenbaum, A. V. (1961). Total Quality Control: Engineering and Management. New York, McGrawHill.

Graham, I. R. (1988). Just-in-Time Management of Manufacturing. Oxford, Elsevier Advanced Tech.

Hariman, J. (1990). Influencing Rather than Informing: Japanese Management Accounting. *Management Accounting (UK)*, March: 44-46.

Harrison, A. (1992). Just-in-Time Manufacturing in Perspective. London, Prentice Hall.

Hill, I. (1985). Manufacturing Strategy – The Strategic Management of the Manufacturing Function. London, McMillian

Hill, T. (1991). Production and Operation Management. London, Prentice Hall.
Hiromoto, T. (1988). Another Hidden Edge: Japanese Management Accounting. *Harvard Business Review*, July-August: 22-26.

Internal Report (1990). Produced by Ingersoll Engineers Ptd., U.K.

International Motor Vehicle Program (IMVP). (1989). A Report Produced by Toyota Corporation.

Juran, J.M. and F.M .Gryna (1970). Quality Planning and Analysis. New York, McGraw Hill.

Knowles, G. (1993). Quality Management. Warwick Manufacturing Group: Warwick.

Kolm, S. C. (1985). Must One be Buddhist to Grow? An Analysis of the Cultural Basis of Japanese Productivity, in Koslowoski, P. (ed), *Economics and Philosophy*, Mohr. J and Tubingen, C.B: 221-242.

Monden, Y. (1983). Toyota Production System. Georgia, Industrial Engineering and Management Press.

Morgan, M. and P. Weerakoon (1989). Japanese Management Accounting: Its Contribution to the Japanese Economic Miracle. *Management Accounting (UK)*, June: 40-43.

New, C. (1992). World Class Manufacturing Versus Strategic Trade-Offs. *International Journal of Operations and Production Management* 12(6) : 19-31.

Oliver, N. and B. Wilkinson (1992). The Japanization of the British Industry. Oxford, Blackwell.

Sako, M. (1992). Prices, Quality and Trust: Inter-firm Relations in Britain and Japan. Cambridge, Cambrige University Press.

Schonberger, R. J. (1982), Japanese Manufacturing Techniques: Nine Hidden Lessons in Simplicity. New York ,The Free Press.

Shank, J. K. (1999). Target Costing as a Strategic Tool. *www.findarticles.*com, Fall.

Sheidan, J. H. (2000). Growing with Lean Investment. *www.findarticles.com,* October, 2.

Skinner, W. (1969). Manufacturing – Missing Link in Corporate Strategy. *Harvard Business Review: May-June.*

Skinner, W. (1985). Manufacturing: The Formidable Competitive Weapon,Chichester, Wiley.

Slack, N. (1990). Flexibility as Managers See it, in Warner M. Wobbe, W. and Brodner, P. (eds.). *New Technology and Manufacturing Management,* Chichester,Wiley.

Voss, C. and S. Robinson, (1987). The Application of Just-in-Time Techniques. *International Journal of Operation and Production Management* 7(4): 46-53.

Womack, J. P., D.T Jones, et al. (1990). The Machine That Change the World. New York: Rawson Associates.