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**Miniaturization as appropriate technology**  
by

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## ABSTRACT

Myanmar has striven for its development through the process of industrialization since her independence from the British rule in 1948. Five decades have passed since then, and yet the industrial development achieved is negligible. The industrial problems it has faced throughout these years are similar to the problems, which are being faced by other developing countries.

Countries all over the world are learning from each other in a never-ending cycle and it is evident that these approaches travel easily despite differences in racial or cultural roots, geographical situation, economic status, etc.

Notably in recent years, Japanese production management techniques have gained worldwide interest for high product-quality and high productivity. Even the advanced countries have started employing some of the Japanese techniques into their firms, especially TQM and JIT, and are now achieving promising results.

One may mistakenly determine in haste to apply the Japanese Total Quality Control (TQC) or Just-in-time (JIT) or Quality Control Circles (QCC) and the like, so that they might be able to achieve good outcomes as the Japanese firms. Actually, even the Japanese firms never started with introducing of TQC or JIT or QCC either, but they have started out from the very fundamentals: practicing the basic disciplines thoroughly for reduction of cost and upgrading of quality, studying and discussion in small groups on new techniques and try to put it into action, conducting continuous training courses to enrich the knowledge for not only problem-solving but also for further improvements etc. Incredible results occur after a long endeavor and has achieved worldwide interest in the recent years. One professor mentioned that the Japanese have achieved their current level of manufacturing excellence mostly by not doing simple things but also doing them very well and slowly improving them.

This paper will try to investigate whether it can also be applied to Myanmar.

# **Miniaturization as Appropriate Technology**

## **(Case Study of Myanmar)**

### **Basic Disciplines of Japanese Production Management Techniques**

Japanese industries bear unique expertise in quality development process since the 1940s in rebuilding their devastated country after the Second World War, and also in reinforcing competitive advantages over the previous decades. This has drawn the attention of other countries to find out the cause of its relatively high rate of productivity and high level of quality. Professor Ezra F. Vogel commented that the Japanese have been very successful in finding ways of introducing the best management and organization techniques into their country and they have managed to devise techniques that work.<sup>1</sup>

One may mistakenly determine in haste to apply the Japanese Total Quality (TQC) or Just-in-time (JIT) or Quality Control Circles (QCC) and the like, so that they might be able to achieve good outcomes as the Japanese firms. Actually, even the Japanese firms never started with introducing of TQC or JIT or QCC either, but they have started out from the very fundamentals: practicing the basic disciplines thoroughly for reduction of cost and upgrading of quality, studying and discussing in small groups on new techniques and try to put it into action, conducting continuous training courses to enrich the knowledge for not only problem-solving but also for further improvements etc.,. An incredible result occurs after a long endeavor and has achieved worldwide interest in the recent years. Professor Robert Hayes asserted that the Japanese have achieved their current level of manufacturing excellence mostly by not doing simple things but also doing them very well and slowly improving them.<sup>2</sup>

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<sup>1</sup> Devan Nair, C. V., Vogel, E.F., Nobuyoshi, N., Lim Chong-Yah, 1982, Learning from Japanese Experience, Maruzen Asia

<sup>2</sup> Hayes, R. H., "Why Japanese Factories Work", Harvard Business Review, 1981 July-August,

## **Implementation of Japanese Production Management Techniques in other countries**

Countries all over the world are now learning from each other in a never-ending cycle and it has proved that the approaches travel easily despite the differences in racial and cultural roots, geographical situations, economic status, etc.

As Japanese companies are advancing gradually in Southeast Asia, U.S. and Europe, the implementation of Japanese production management techniques also permeates into these firms, A research group, 'Zen Nihon Noritsu Renmei,'<sup>1</sup> conducted a survey on companies that have foreign subsidiaries and joint venture, in order to find out the extent to which the Japanese production management techniques have been introduced. According to their research methodology, they selected four main activities as the Japanese production management techniques, such as :-(i) Small Group Activities, (ii) Suggestion System, (iii) Quality Assurance within the Process, and (iv) Multi-process handling of Multi-functional Workers. In the overall measures, they generalized that Japanese Production Management Techniques, based upon four factors, have been implemented more successfully in the firms of durable consumer products, assembly type of manufacturing and locationally in Southeast Asia, Korea and Taiwan. On the other hand, implementation seems to be difficult in firms that produce capital goods, firms of processing type and firms in South America. And, the condition for implementation in other types of firms can be placed somewhat between these two situations.

Nevertheless, based on the above example, it is assured that the Japanese Production Management Techniques can be applied in foreign firms although the degree of implementation may be different under various circumstances. Moreover, during these days, endeavor to wipe out communication barriers' such as language, value & customs, personal relations, etc., between the Japanese personal and local counterparts has been commencing by way of conducting language courses, preparing operations manual, assisting in educational and training courses, upgrading

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<sup>1</sup> Zen Nihon Noritsu Renmei, Nihon Teki Keiei Kanri Shuho no Kaigai Itten ni Kansuru Chosa Kenkyu Hokokusho, 1982 March

social programs, and so on. All these efforts reinforce the positive cross-cultural understanding that will lead to effective application of Japanese techniques in foreign firms.

### **Prospects and Problems for application of Japanese Production Management Techniques to Myanmar Industries**

To obtain general information, questionnaire survey and interviews have been conducted to the Japanese engineers and related personnel who have been to Myanmar for economic and technical cooperation program. Most of them, under this economic and technical cooperation program, have been in touch with Myanmar technicians, supervisors and workers of the Four Industrial Projects in establishing factories, setting machinery and equipments, giving training guidance, etc. They denoted the problems in two levels: i.e. the factory floor and the industry as a whole.<sup>1</sup>

#### **(a) Factory Floor**

According to their responses, the problems which occur frequently while operating at the factory floor consisted of: - machine break-downs, shortage of raw materials and spare parts, and shortage of energy which make the production line to come to a halt often. Consequently, these produce effects on finished products in low quality, high cost, and relatively high rate of defects. The major causes of these problems, pointed out by the engineers, include poor and inadequate maintenance, improper workplace organization, poor scheduling for supply of raw materials and spare parts, and lack of ideas for further improvement.

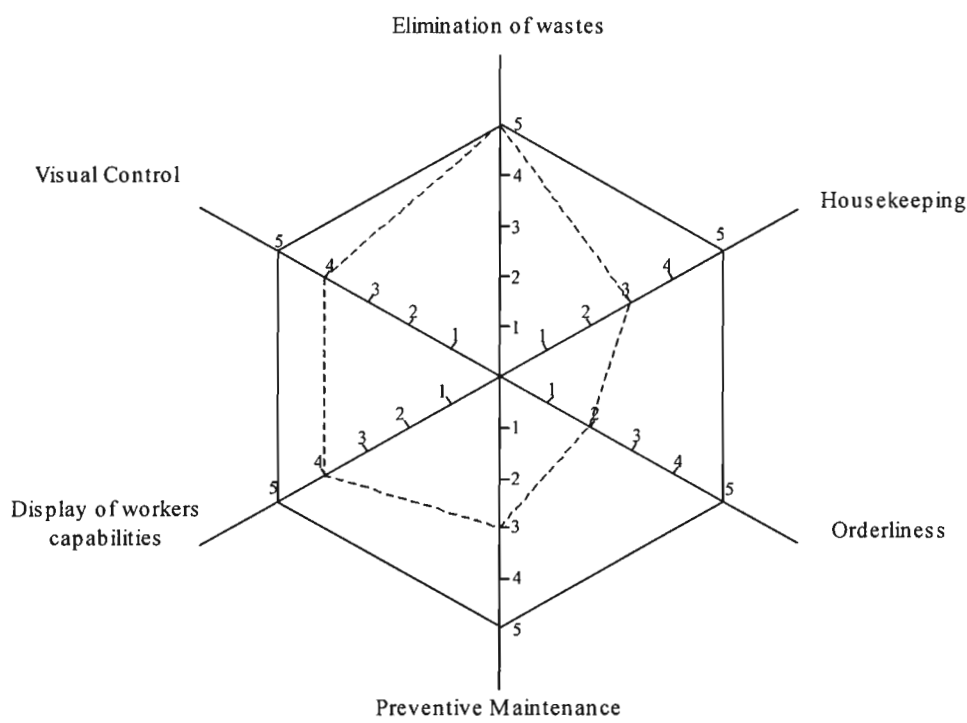
More or less, it has been added that the factories normally aim for meeting the annual production target in quantity, regardless of quality and cost consciousness. This factor will pull back from competing in the international market where there is keen and severe competition in quality and cost nowadays. Non-competitiveness will lead to shortage of Foreign Exchange

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<sup>1</sup> Survey conducted to the Japanese engineers who had been to Burma for the technical cooperation assignments.



earnings and this in turn will hinder importing capital goods and services, which are in great need for Myanmar industry. This also will bar the way for the improvement of industrialization process and economic growth, and all these operate in a **vicious circle** leading to declining economic situations. In order to get rid of this vicious circle, the Myanmar factories should apply basic disciplines of Japanese production management techniques, at the factory floor. These practices do not require much capital expenditure, and some of these practices have been overlooked because of their simplicity. Moreover, these practices are not cure-all remedy, but its properties will surely form the basis to move forward, which provides the wheels that make the vehicle moves. There is much evidence of dramatic productivity improvements and cost savings in the foreign firms that installed them, even with the cultural, geographical, and other differences.



For application, we can evaluate the performances in the factory by using the 'Spider-web Chart' as shown below. Accordingly, six axis are used for *House-keeping*, *Orderliness*, *Preventive maintenance*, *Display of workers capabilities*, *Visual control* and

*Elimination of wastes*, and ratings on them will make clear the size of the web which we are caught in. The web indicates the weak points in the practices at the factory floor, and the smaller the web becomes the better the situation will be. Clean workplace exposes problem areas promptly and distinctly, and organized workplace make possible to work easily, quickly and safely. And, regular maintenance of machines and equipments assure the stability of daily operations without disruptions. Moreover, encouraging the workers to display their full capabilities at work will strengthen their motives and up-raise their efficiency. Quick feedback of information to workers for their performances is of great importance to take corrective action timely, and by letting the workplace data make known to everyone of the workplace enlightens more knowledge of work, and in turn it motivates them to be more involved in the factory affairs. Normally, workers do not want to perform conventional repetitive jobs mindlessly on what they are being told, but they want their work to be involved in creative thinking and want to use their mental and physical capabilities at work. In this manner, it is necessary to install appropriate programs by which previously underutilized workers' capabilities can be used for the development at the factory floor.

Certainly, there are many operations at the factory floor which do not increase additional value to the product such as, rework of defects, double-handling of materials and products, fixing of machine break-downs, producing of unnecessary item, etc. All these operations are being done by workers without knowing that these are the *wastes* that add more cost to the product. Therefore, these wastes must be separated from operations and should be eliminated as much as possible. In this case also, thorough practice of basic disciplines at the factory floor will be a helping hand. These practices do not require much capital expenditure and these are simple enough to practice without difficulty. But problems occurring nowadays are because of its absence in the actual practice. Once it really starts practicing, the wastes will decrease gradually, and that will reflect in reducing of cost also. Therefore, all these simple and effective practice should be implemented, in an incremental approach, at the factory floor. Kiyoshi Suzaki

revealed that *“improvements at the factory can provide about half of the productivity improvements even in high-growth businesses.”*<sup>1</sup>

**(b) Industry as a whole**

In Myanmar, until very recently, since most of the big enterprises and some of medium and small are State-owned, the cooperation among different industries, cooperation between factories within the industry, and cooperation between top management and the employees, are essential for the improvement in productivity of the country as a whole. In the actual practice, it has been commented by the Japanese engineers that most of the problems, which occur in the industry is due to the lack of this phenomenon e.g. long waiting time for parts & components, over-load in warehousing, etc. And, all these are wastes and add more cost to the product. Moreover, they pointed out that most of the local staff, i.e. supervisors and subordinates, seem to be **individualistic oriented** and are not willing to share the technical knowledge they have learnt and they like to be acknowledged by the individual performance. There is no doubt that Japanese engineers mentioned the above situation, because in Japanese firms teamwork dominates and participation of workers is common.

**Small group activities (QC Circles)** at the shop floor which share knowledge and cooperation among members for further improvements. **Suggestion system** that creates positive employee participation, close workmanship with the suppliers/ subcontractors and the parent company which provides steady flow of qualified parts, etc., are the special features that can be realized in the Japanese firms. Moreover, with the overwhelming quality consciousness in the firms, **Total Quality Control (TQC)** or Company-wide Quality Control has been emerged and participated by all types of employees from every department, and even the suppliers. Together with this, the above stated factors have shaped the production system to be able to accomplish the Japanese Unique Production System, **Just-in-time (JIT)**. The main reason for these Japanese

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<sup>1</sup> Suzuki, Kiyoshi, "Japanese Manufacturing Techniques: Their importance to U.S. Manufacturers", Journal of Business Strategy, Vol.5, No.3, 1985 Winter



performances stems on the fierce competition, both in domestic and international market, and they have fought the way with high quality and low cost. That is why most of the Japanese observers feel that with lack of competition in Myanmar State-owned enterprises there is no drive for improving the condition. But, with the declining economic situations nowadays, it becomes an urgent need to find ways and means for the development, or otherwise for survival.

### **The Situation of Industries in Myanmar**

As Myanmar is an agricultural country, industrialization is an indispensable element of the socio-economic growth and development. Since gaining independence in 1948, changes in industrialization policies, programmes and strategies have been observed. During 1948 to 1962, Economic plans were formulated and implemented for the rehabilitation, and development of the capitalist economic system was practiced allowing three types of ownership such as State-owned, cooperative, and private ownership. The state sector took responsibility for large enterprises essential for the country requiring large amounts of capital to implement, while the private sector undertook small-and medium-scale enterprises, with short recoupment periods and earning quick profits.

In the state sector, large industries such as steel rolling mills, brick and tile factories, jute and textile mills were established in hopes of rebuilding a country suffering the ravages of war. At the same time, a large private sector developed in almost all processing and manufacturing activities such as food processing, synthetic and cotton textile manufacturing, and the production of rubber, plastics, chemicals, and some personal goods. Some consumer goods were exported to neighboring countries. Private sector participation in the economy at the time was very promising. In 1962, however, the main driving force of industrial and economic development came to a halt with a drastic change of economic system to a centrally planned economy. The number of private industries consequently began to decrease and declined to a small-scale level with heavy emphasis on the processing of raw materials into consumer goods.

With the introduction of a centrally planned economic system in 1962, the state sector was made the government's first priority followed by the cooperative and private sectors as second and third respectively. Almost all privately owned industries were nationalized within the short period of six years from 1962 to 1968. As a result, the number of industries in the state sector increased significantly. Being of top priority, state sector enterprises had all opportunities of financial and technical support from the state, as well as from foreign sources in the form of bilateral and multilateral loans and aid from donor countries and the United Nations.

While state sector industries were growing quantitatively they were not developed qualitatively, mainly because of foreign exchange shortages, organizational inefficiency, managerial weakness, and low capacity utilization. Consequently, the processing and manufacturing sector as a whole showed little progress.

During the twenty-six years of centrally planned economy, public sector investment remained the main driving force for industrial development. Private investment was confined to small-scale activities concentrating on processing natural resources. The government's **import substitution strategy** aimed at fulfilling basic domestic needs within the framework of a virtually closed-door and self-reliant economic system. Ironically, some of the factories built under bilateral and multilateral aid programs were later found to be unmatched by the prevailing weak industrial infrastructure. Industry was shielded from international competition and remained at a low productivity level. By the end of socialist rule in 1986-87, the contribution to GNP of the manufacturing and processing sector was 10.7%, and the sector's labor force constituted 8.7%.<sup>1</sup>

After it took power in 1988, the State Law and Order Restoration Council (SLORC) government adopted a market-oriented economic system. It continued, however to pursue a **resource-based industrialization strategy** aimed at improving the quantity and quality of

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<sup>1</sup> Source – Ministry of National Planning

domestic value-added products derived from processing natural resources in the agriculture, fisheries, forestry, and mining sectors.

Various reform measures were taken to stimulate active participation by the private sector. These measures included the decentralization of central control, the abolition of price controls and the reduction of subsidies, streamlining taxes and duties, the initiation of institutional changes, the privatization of some inefficient state enterprises, the diversification of exports, the establishment of industrial zones, the opening of border trade, and the improvement of infrastructure, including the construction of new sea and air ports. Between 1988 and 1997, twenty-seven new business-related laws were promulgated, including the Foreign Investment Law (1988) and the Myanmar Citizens Investment Law (1989), and nine existing laws were amended.

According to the Private Industrial Enterprises law (1990), the industrial enterprises are classified into three groups, large, medium and small based on capital outlay, annual production value, electrical power and number of employees. The larger number of units is found to be small and medium size under the private ownership. Since the adoption of a market-oriented economic system, the private sector has been reactivated and is gaining from strength to strength. Private sector development has been recognized as an important element in striving for economic growth. Moreover, the government has endorsed the five objectives for Myanmar's industrial development. They are: (i) development of agro-based industries (ii) qualitative and quantitative improvement of industrial products (iii) production of new industrial items (iv) manufacture of industrial equipment and (v) the acquisition of good opportunities required for the industrialization of the nation. Accordingly, the government of Myanmar has promulgated various laws and prescribed related rules and regulations to encourage the development of private enterprises. Since the majority of private enterprises are of Small and Medium scale, nobody can deny the fact that the development of SMEs is instrument for the nation's economic growth.



At present, the SMEs are quite varied and scattered all over the country employing various processing types of operations and applying either labour-intensive technology or intermediate technology to manufacture consumer products required for the domestic market. The nature of most of these firms is import substitutions.

Given the importance of acquiring market access on the one hand and resource-based on the other, SMEs can be classified into four types: (1) Domestic market oriented resource based SME, (2) Export-oriented resource-based SME, (3) Export - oriented non-resource based SME and (4) Domestic market-oriented non-resource based SME.<sup>1</sup>

In 1995 in order to give greater impetus to the industrialization process, the Myanmar Industrial Development Council (MIDC) has formed, which comprised of respective Cabinet Ministers in charge of industrial and economic matters. The Objectives of MIDC<sup>2</sup> are: (1) Development of industries with agriculture as the base, (2) Enhancement of quantity and quality of industrial products, (3) Increased production of new types of machinery and equipment, (4) Production of machinery and equipment for industrial use, (5) Creation of suitable conditions for changing over to an industrialized state. A working committee was also formed under the MIDC to implement the decisions of the council. Under the Working committee, there are 9 Sub-Committees and 18 Industrial Zone Supervision Committees.

### **Current Situations of Small-Scale Enterprises**

Most manufacturing firms in Myanmar are small companies with fewer than ten employees. When classified by the management body, 80% of large-scale enterprises with more than 100 employees are state-owned or state-affiliated enterprise, while private enterprises comprise only 18.38%. Small and Medium-scale enterprises with fewer than 100 employees comprise 98.9% of all of enterprises, both state- and privately-owned. With a view to increase

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<sup>1</sup> Paper for workshop on AFTA – “Opportunities and Challenges for SMEs in Myanmar,” Myat Thein and Mg Mg

<sup>2</sup> Myanmar Industrial Development Committee, A Guide to Industrial Investment in Myanmar, May 1996

industrial production, to improve the quality of the products as well as to produce import substitution goods, (257) new large, medium and small sized factories have been established in the state sector. On the other hand, the private sector also constructed (24,293) new factories.

Therefore, the number of state and private owned factories increased from (27,430) in 1988 to (51,980) at present.<sup>1</sup>

Problems currently encountered by the industrial sector include: a small range of products and weaknesses in industrial linkages, weakness in research and development and a low level of technology and technical know-how, insufficient production of basic industrial raw materials and chemical to supply factories manufacturing basic consumer commodities, weak infrastructure, including insufficient supplies of electricity, gas, etc., insufficient foreign exchange to invest in new technologies and import plants, machinery, or parts, lack of international entrepreneurship, lack of full capacity utilization of state-owned factories, overvalued exchanged rate problem and high reliance on imported raw materials in producing consumer commodities.

Myanmar joined ASEAN in 1997 and ASEAN Consultative Committee for Standards and Quality (ACCSQ) in 1999. The ASEAN countries agreed to create Free Trade Area (AFTA) to cope with the gaining momentum in globalization of world trade. In this manner, ACCSQ facilitates the elimination of technical barriers to trade - related to standards and conformity assessment for all member-countries. Myanmar's membership in ASEAN and ASEAN Free Trade Area (AFTA) will have an impact on its future growth, and AFTA's plan to abolish tariffs in 2008 will have impact on the country and region. When planning for future economic development, Myanmar must consider the economic dependence, particularly on ASEAN, that will further develop in coming years. Myanmar currently has only a few industries in the manufacturing sector capable of competing with ASEAN's more advanced members. Moreover, Myanmar is gradually losing its advantages other to latecomers to ASEAN in such processing

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<sup>1</sup> The New Light of Myanmar, 31 August, 2003, Prime Minister General Khin Nyunt's speech

industries as sewing, decoration, jewelry, food, drinks, and timber. Now, we need to answer the question - How can Myanmar overcome these threatening issues?

Thus, Myanmar should learn from the Japanese success story of how it has managed to wipe out the image of 'cheap & shoddy' by cooperation and participation of everyone, and become the best in the quality concern.

### **TQM Dissemination Activities**

In the times of fierce international competition and speedy technological advancements, organizations are paying more emphasis on quality-improvement and changing customer expectations. Organizations, therefore, need to set up objectives to successfully provide its customers with the highest quality goods or services. In this aspect, we should refer to the Japanese experience with its expertise in quality development process. Japan has proved its success factors with a goal of continuous quality improvement (Kaizen). Tremendous amount of work to improve their operations management system such as Total Quality Management (TQM) and Just-in-time (JIT) systems have been conducted by the Japanese firms. These approaches refer to a quality emphasis that encompasses the entire organization together with suppliers and customers. It calls for a commitment by the Management to have a consistent company-wide drive toward excellence in all aspects of products and services that are essential to its customers. In other words, it may be said that there has been a radical transition from '**quality control**' to '**quality management**.'

Ministry of Economy, Trade and Industry (METI) Japan, in cooperation with the Japanese Standards Association (JSA) and United Nation Industrial Development Organization (UNIDO) provided technical assistance to enterprises in ASEAN countries for the implementation of TQM system. ASEAN – Japan TQM Project started in 1995.

Starting with TQM awareness building seminars, followed by the company diagnosis on the implementation of TQM, model companies have been selected and instructed. In the case of



Myanmar, the first TQM Seminar was held on 24<sup>th</sup> November 2000 and the Second TQM Seminar on 18<sup>th</sup> December 2001. JSA dispatched two Japanese experts in order to conduct survey for model company selection. Firstly, four companies were nominated and out of them two companies were selected as models:

- (i) Proven Technology Industry Co. Ltd.
- (ii) Pahtama Hteik Tan Production Cooperative Ltd.

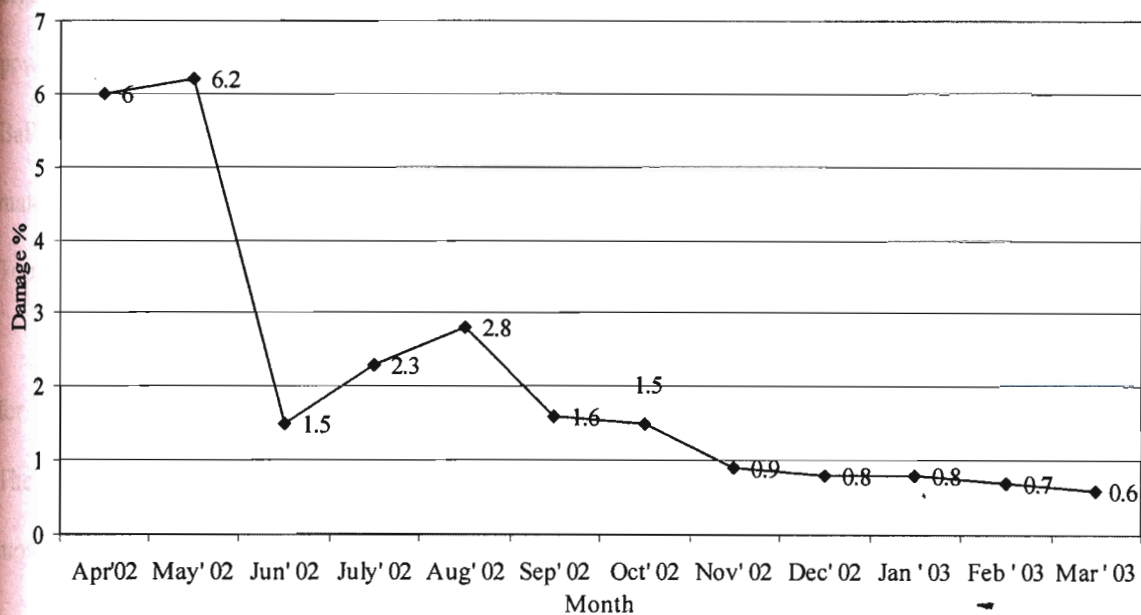
Two Japanese experts were sent at a time to give instructions for TQM practices. Until now, they have visited five times to these model companies. For training materials (21) Handbooks have been used.

#### **Proven Technology Industry Co. Ltd.**

Proven Technology Industry Co., Ltd., 100% locally owned company, established Toyo Battery Factory in 1996 on a 1.9-acre-land located in Shwe Pyi Tha Industrial Zone, Yangon. The company has employed 150 employees, manufacturing a number of different models of lead-acid battery for automobiles and inverters. The factory was set up with machines and technical support imported from Japan and Korea with a capacity of 8000 batteries per day using raw materials imported from Singapore, Thailand, Malaysia and USA. It is the only factory in Myanmar, which produces lead-acid batteries directly from the raw materials. At present, Toyo battery enjoys 10% share of local market, competing primarily with imported batteries such as 3K and GS. The rapid impact of TQM training resulted in increase of production volume and increase in number of suggestions, as shown in the figures.

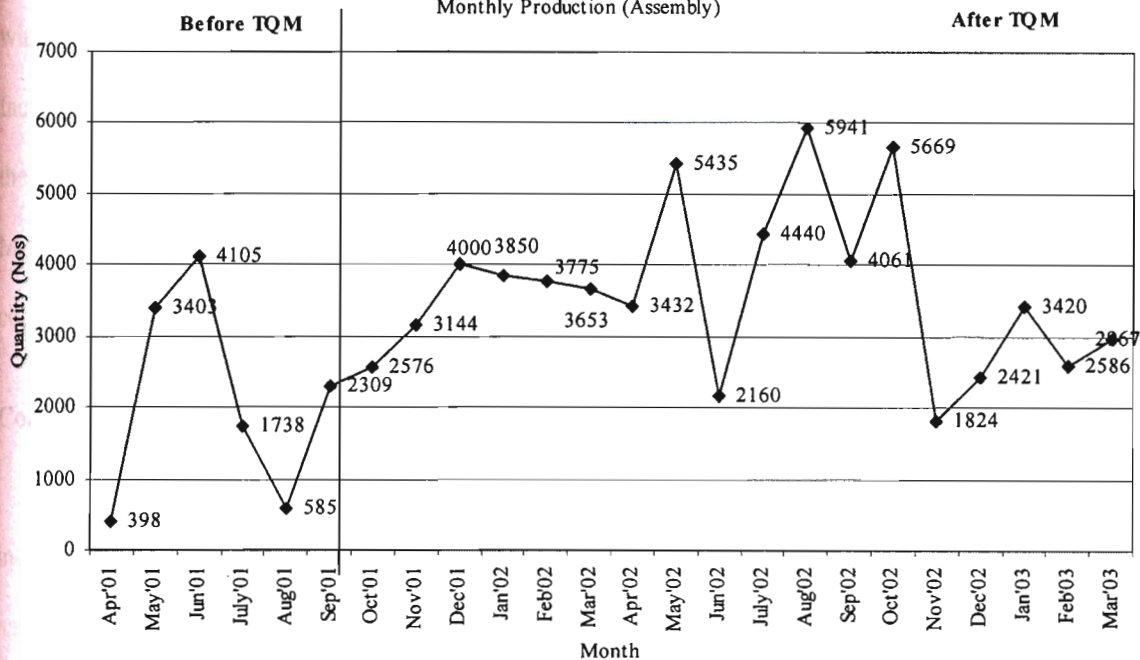
# PROVEN TECHNOLOGY INDUSTRY CO., LTD (TOYO BATTERY)

## Damage Percentage (Brushing Machine)



# PROVEN TECHNOLOGY INDUSTRY CO., LTD (TOYO BATTERY)

## Monthly Production (Assembly)



## Pahtama Hteik Tan Production Cooperative Ltd.

Top Detergent Plant was founded in 1999 by a 100-percent locally owned Pahtama Hteik Tan Production Cooperative Ltd. The plant was established with an initial investment of US\$ 1.5

million plus K 30 million and it was located in Hlaing Thar Yar Industrial Zone, Yangon. The organization has 80 employees running the plant to produce two main products—detergent powder and detergent cream. The 1000 kg/hour-capacity plant, built with machines from Ballestra Spa, Italy, uses the low-density Dry Tower system. Up to 65% of the required raw materials are imported from foreign countries while the rest are purchased from local suppliers. Top Detergent has dominated 35% of local detergent market.

Recently, the company has formed (9) QC Circles, functioning as learning place for PDCA practices and 5S implementation. They used to have **5 minutes meeting** everyday. The company has introduced suggestion system and until now the collected suggestions are mostly related to reduction of wastes.

Although both companies are dealt with import substitution products, they have plans for future exports to the neighboring countries. At present, the quality of their products is not in line with the international standards. Therefore they need to put more effort in quality improvement factor in order to provide quality products to the customers. Since they are now at the onset of the TQM project, it is undeniable that they are on the right track of the successful path. Moreover, they will become the TQM disseminators in the industrialization process of the country.

## Conclusion

Almost every country has striven for its development through the process of industrialization, and Myanmar is no exception. Myanmar joined the ranks of industrialized nations since her independence from the British rule in 1948. Five decades have passed since then, and yet the industrial development achieved is negligible. The industrial problems it has faced throughout these years are similar to the problems, which are being faced by other developing countries. Thus, ways and means to overcome them are desperately needed in order to catch up with the developed countries. In order to survive in the current world, every business



organization is required to produce either tangible goods or offer intangible services. Hence, the operation system for generating goods and services has become the heart of an organization. Nowadays where competition is severe all around the world, one cannot stay aloof from it. Every country has to keep up with the competitive edge by way of emphasizing on quality improvement and changing customer satisfaction.

Notably in recent years, Japanese production management techniques have gained worldwide interest for high product-quality and high productivity. Even the advanced countries have started employing some of the Japanese techniques into their firms, especially TQM and JIT, and are now achieving promising results. The Japanese companies also tried to implement their operations management practices into their overseas manufacturing firms, together with the transfer of technology. To this moment negative results for implementing these techniques have not been detected, instead the high level of performances has been often reported. Therefore, it is necessary to consider the advisability of taking steps to investigate these techniques and apply them.

It is very simple to say that organizations should produce goods of perfect quality, but it is much more difficult to achieve this in practice. One obvious approach is to use more rigorous inspections for quality control, but this is not a perfect solution as it can miss some defects. In recent years there has been a more radical approach, represented by the view that 'you can't inspect quality into a product', 'you have to build in the quality into a product'.

Traditionally, organizations have had a separate quality control department to inspect the work of production departments. These two functions had completely different objectives: production would try to make products as quickly as possible, while quality control inspected products to make sure they met specifications, possibly by slowing down production. This inevitably led to damaging conflicts, with one department seen as benefiting only at the expense of the other.

More recently, organizations have changed their approach to quality management, and moved the emphasis from inspections at the end of production to focus on operations during the process itself, to make sure no defects are made; and in the planning stages, to make sure the design of the product and the process allow high quality.

Therefore, quality management is no longer a separate function of QC Department, but an integral part of the process, it is the responsibility of everyone in the organization. The target is not to meet specifications but to have continuous improvement. The emphasis should change to prevention of defects from detection of defects. Above all the attitude of everybody should be changed to build in quality not to inspect quality and to perceive that quality is a strategic issue not a technical issue.

Donald Waters noted that devolving responsibility to lower levels of the workforce can lead to problems.<sup>1</sup> It requires a well-educated workforce that is capable of recognizing, analyzing and solving problems; people who are able and willing to exchange ideas; people who see themselves as working for the good of the organization; and a management that is willing to share information.

After all one should realize that although ideas, techniques and systems are essential factors, what actually generate results are the people with their energy, skills and values. Without human effort nothing can be achieved. To attain outstanding results coordinated efforts of people and techniques is indispensable. Especially we need to learn from the Japanese success story that the most valuable resource is not the natural resources but is human resources. It is the concerted efforts of the people and techniques, which form the competitive power of the country.

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<sup>1</sup> Donald Waters, Operations Management, Crest Publishing House, 2001