Technology Implementation Barriers In The Malaysian Herbal Industry: A Case Study

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ABSTRACT

Technology is an essential component in all types of organisations and most organisations have reasons to implement new technology. The most fundamental justification for new technology implementation is that the technology must be able to contribute to strong competitive advantages and also increase or create long-term profit. In most small and medium enterprises (SMEs), there are barriers or obstacles in implementing these technologies. This article report a study aimed in investigating barriers faced by the Malaysian herbal industry in implementing technologies in their factory. Most of the local herbal manufacturing firms are categorised as SMEs which are usually considered to be lagged behind larger companies in technology usage. As this was an exploratory research, a case study method was used as it gave in-depth explanation of the main barriers of technology implementation. The results suggested that the main constraint in implementing technologies are lack of technical specialists and financial, aid commitment from top management, low wage rate, and future demand uncertainties.

Keywords: *Technology implementation; herbal industry; technology barriers.*

ABSTRAK

Teknologi merupakan komponen yang penting dalam semua jenis organisasi. Kebanyakan organisasi mempunyai alasan untuk melaksanakan teknologi baru. Justifikasi yang paling asas untuk melaksanakan teknologi baru ialah teknologi tersebut mesti mampu menyumbang kepada kelebihan persaingan yang kukuh dan meningkatkan atau menghasilkan keuntungan jangka panjang. Di kebanyakan syarikat kecil dan sederhana, terdapat beberapa halangan atau kesulitan dalam melaksanakan teknologi-teknologi ini di kilang mereka. Kajian ini bertujuan untuk menyiasat halangan-halangan yang dihadapi oleh industi herba di Malaysia dalam melaksanakan teknologi di kilang mereka. Kebanyakan firma pembuatan herba dikategorikan sebagai syarikat kecil dan sederhana yang sering ketinggalan berbanding syarikat besar dari aspek penggunaan teknologi. Oleh kerana kajian ini berbentuk penerokaan, pendekatan kajian kes digunakan kerana ianya dapat memberi penjelasan yang mendalam tentang halangan-halangan utama dalam melaksanakan teknologi. Hasil kajian ini menyarankan bahawa kekangan utama dalam melaksanakan teknologi adalah kekurangan pakar teknikal dan kewangan, komitmen dari pengurusan atasan, kadar gaji yang rendah dan permintaan hadapan yang tidak pasti.

Kata kunci: *Perlaksanaan teknologi; industri herba; halangan-halangan teknologi.*

INTRODUCTION

Overview of the Malaysian Herbal Industry

In recognising the country's rich bio-resources, the herbal industry has become another economic engine of growth and has the potential to become a significant industry in Malaysian agriculture. The Third National Agricultural Policy (1998-2010) had identified herbal products under Specialty Natural Products Industry as new and future industry group. Total value of Malaysian herbal industry was estimated at RM4.55 billion in 1999. In 2005, the herbal industry has been identified as a new and future industry group with an estimated market value of RM7.97 billion (Abu Kasim, 2007). It was projected that there would be an increment in the local content from RM500million in 2005 to RM2.5billion in 2010 (Abu, 2004), as illustrated in Table 1.

Table 1: Projected Market Value and Targeted Local Content for Malaysian Herbal Industry

	2000	2005	2010
Projected market value	RM2b	RM3.2b	RM5.2b
Targeted local content	RM100m	RM500m	RM2.5b
Market share (%)	5	15	48

Due to the promising local herbal industry, the players in the industry can be divided into categories such as growers and suppliers (>148), Processors or manufacturers and product development (2), Traditional Medicine manufacturers (131) and others (MHC, 2005). The trend of going back to nature is gaining popularity in Malaysia. Demand for natural health supplements has increase over the years. The market for traditional medicines and other health foods, such as herb, food and beverage are estimated to be worth between US$526-US$790 million with an annual rate of 15 to 20% (Abd. Aziz, 2003; Industry Canada, 2004). Abd. Aziz (2003) mentioned that the key driving forces for growth of the herbal industry in Malaysia were changes in lifestyle, the growing emphasis on health and the growing cost of synthetic medicines. In view of the potential size of the herbal-based market, especially in herbal medicines, Malaysia could builds an industry based on its natural herbal heritage. Currently, among the strengths of Malaysia's herbal industry include diversity of genetic resources, excellent tropical climate, increasing research and development(R & D) interest, increasing demand for specialty natural products, and indigenous knowledge. However, among the industries weaknesses include shortage of local raw materials and lack of large scale cultivation activities, domestic grading and standards, technological mechanisation, skilled human resources, and scientific evidence for health related claims. Despite weaknesses, there are opportunities for development of new and improved products, development of new and improved processing technologies, and use of biotechnology and cell culture technology, which local manufacturers could venture into (Abu, 2004). However, despite its huge potential, the local production of herbal industry in Malaysia is still very low and in its infancy stage (Industry Canada, 2004; Pharmabiz.com, 2004). The local market is still highly dependent on its imports of health supplements especially from United States (US), which brands are well accepted and perceived to be high quality.

The possible main reason for the above issue is poor manufacturing process technology that could limit the development of the Malaysian herbal industry. In 1998, it was reported that the production system in Malaysian herbal industry is at a low level compared to other industries (NST Quarterly, 1998). The local herbal industry is usually perceived as traditional or manually processed. In order to break away from this

perception, the herbal manufacturers need to be more proactive. With technology, a herbal manufacturing firm could gain improvement in product quality and productivity, and also increase profitability (Sabourin & Beckstead, 1999). The firm must find and utilise technology that can improve the product quality in order to capture the domestic market and also to penetrate overseas market, especially Europe, US, and Japan which have stringent regulations on food and herbal products (NST Quarterly, 1998).

As far as the Malaysian herbal industry is concerned, there is little research done in the technology implementation area. Most of these studies were done in other industries, such as automotives and electronics. This paper focuses on obstacles faced by the Malaysian herbal manufacturing firms in implementing technology, especially in the production system. This research was based on in-depth case study of three selected Malaysian traditional medicine manufacturers. The responses were recorded during comprehensive interviews with the top management and the company site visits. The interview information was tabulated and the findings are presented in the result section.

Technology Implementation and Barriers

In order to maintain or achieve competitiveness and profitability, a manufacturing firm or enterprise must respond to a range of challenges, including rapid improvement in technology, declining employment and output, globalisation of markets, and environmental requirements (Kennedy & Hyland, 2003). New technologies can build new production capabilities and competencies that enable the firm to adapt quickly to changing opportunities (Krajewski & Ritzman, 1998).

Khalil (2000) classified technology in six ways. Table 2 briefly describes the classification of technology. Ramanathan (1994) defined technology as the manifestation of four distinctive embodiment forms: *Technoware*, the object-embodied technology which includes physical technologies such as tools, devices, and equipment; *Humanware*, the human-embodied technology such as skills, craftsmanship, knowledge, and expertise; *Orgaware*, the organisation-embodied technology which includes operational technologies such as methods, techniques, and practices; and *Inforware*, the record-embodied technology referring to facts and formulae, specification, manuals, and theories.

Table 2: Categorisation of Technology

Classification of Technology	Description
New technology	Newly introduced or implemented technology that has an explicit impact on the way a company produces products or provides services
Emerging technology	Technology that is not yet fully commercialised but will become so within five years.
High technology	Advanced or sophisticated technologies.
Low technology	Technology that has permeated large segments of human society.
Medium technology	Comprises a wide set of technologies that fall between high and low technologies.
Appropriate technology	A good match between the technology utilised and the resources required for its optimal use.

In technology implementation, there are three components involved in the implementation process; (a) develop an intricate understanding of the technology, (b) understand the development process of the new technology by studying how other organisations use the technology, and (c)

adaptation of the selected technologies, products, process, and system to meet the specific needs of the organisation. In order to ensure successful implementation, the success factors include firm's absorptive capacity, communication skills, managing expectation, managing risk, and general wisdom (Rouse, 2000).

The implementation of technology brings about many benefits. The most important benefits are reduced cycle time, market share growth, increased or created long-term profit, improved productivity, reduced costs, improved product quality, reduced labour and increased product/ process flexibility (Swamidass & Kotha, 1998; Rouse, 2000; Globadian, O'Regan, & Liu, 2000, Zhao & Co 1997; Sabourin & Beckstead, 1999).

However, according to Kennedy and Hyland (2003), small firms especially will continue to struggle to compete with large companies, and they are either unwilling or unable to invest in improvement programmes and activities, and also new technology. This is due to lack of financial resources, business experience and knowledge, and human resource. Moreover, these small to medium-sized enterprises (SMEs) feel forced to apply these technologies due to pressure from government, associated companies, and customers. Rouse (2000), Walker, Bode, Burn, and Webster (2003), and Sabourin and Beckstead (1999) reported that the main factors that hindered a manufacturing company to implement new technologies despite of the benefits are high equipment cost, cost of capital, lack of skilled workers, management resistance to new technology, lack of adequate technical support, and low number of adequately trained managers to deal with technology-related decisions.

For manufacturing companies in newly industrialised countries (NIC), Zhao and Co (1997), and Nouri (1997) stated that the reasons of low technology uptake in these countries are due to barriers in the transfer of technology, lower wage rate, size of firm, and paradigm of competition. Nonetheless, Balwin and Lin (1994) found there is success in SMEs to be associated with the implementation of an innovation strategy that is often technology based. The decision to apply technologies ultimately rests on the benefits that the technology provides, the costs associated with its implementation, and the barriers that the firms will face. According to Jones, Beynon-Davies, and Geaves (2003), it is not the size of the enterprise that should directly affect success in technology application, but rather the availability and allocation of resources. Sambasivarao and Deshmukh (1995) reported that the problems do not lie in the level of technology but rather in its implementation. To successfully implement AMT in a manufacturing company, the company must reassess its direction, strengths and weaknesses.

METHODOLOGY

As this research was an exploratory research, a qualitative method was used. By exploring the topic, the researchers expected to formulate more precise questions which future research can answer. The case study method gave the authors the necessary depth so that the variables could not only be identified, but also developed, and the importance of the identified variables understood (Eisenhardt, 1989).

The primary goal of the research was to investigate the obstacles faced by the small and medium herbal manufacturing firms in implementing the technologies. Even though there has been much research done in technology implementation, especially in advanced manufacturing technology (AMT) of other manufacturing industries, very few investigations had been done in the herbal industry. Therefore, to understand the barriers of technology application in the Malaysian herbal industry, three herbal firms were selected based on their number of full-time employees, the company's age, and type of market.

The data came from two sources: semi-structured interviews and observations. For semi-structured interviews, we used the same interview protocol at all the plants. This interview protocol is a replication of questionnaires adapted and modified from Sabourin and Beckstead (1999), who did a research on advanced manufacturing technology (AMT) adoption in Canadian manufacturing, covering a wide range of manufacturing industries. The sections which were relevant to the scope

of our study were chosen. Items included in the protocol were company background; technologies used (currently and plan to use within three years), development and implementation of technologies, results of technology implementation, and obstacles of implementation.

The same questions were asked to different interviewees for triangulation purposes (Tellis, 1997). The need for triangulation arises from the ethical need to confirm the validity of data obtained. The interview subjects were questioned with regard to their actual experiences and for consistency in the data and its interpretation, an interview structure was provided. The interviews were conducted for approximately 30 minutes for each respondent. They involved the key personnel in the company that is directly involved in technology implementation decision making, such as Research and Development Advisor, Research and Development Manager, and Quality Manager.

A plant tour was requested at all companies visited. During the tour, the process flow of the main products and its machineries used in the production floor were shown and explained in detail. Whenever possible, the observation was made on what type of technology had been used in the company and the obstacles faced by the company in implementing the technology that was currently used and also in the near future. The information gathered was written down in a log book along with a summary of the interviews. The purpose of these observations was primarily to verify the information collected from interviews.

Selection Criteria for Case Studies

Even though there are about 131 traditional herbal based medicine businesses in Malaysia, the number of manufacturers or processors is very small. According to MHC (2005), there were only two manufacturers at that time. The criteria for selecting case studies were they must be manufacturers, must be capable of penetrating the global market, and must be established in business for more than five years. These three companies were herbal based products manufacturers. The reason for choosing the manufacturers was to examine the status of technology implementation in the factories. The size of the companies varied from small to large. Although they were varied in size, in terms of the selection criteria mentioned, these three companies had fulfilled the requirements.

CASE ANALYSIS AND RESULTS

Overview of the Case Study Background

Case Study Company A

Company A is a network marketing company established in 1995 that focuses on Ganoderma mushroom-based health products. The products were not only marketed in Malaysia but it also has penetrated overseas market, such as Thailand, Indonesia, Hong Kong, Brunei, Singapore, Taiwan, Germany, Saudi Arabia, Philippines, Australia, India, Canada, and very recently US. To date, the company is operating with 500 full-time employees to produce 49 product items. The product series involved are health food supplement, food and beverages, personal cares, household products, and skin care cosmetics. The company's main product is Lingzhi coffee.

For the financial year end February 2005, Company A's revenue increased by 62% to RM169.8 million against RM104.3 million for the previous year. Also for the first quarter of the financial year 2006, the company has reported a 23% rise in net profit to RM7.28 million compared to RM5.94 million in the same period last year.

With products penetrating almost 50 countries worldwide, production is done in one factory, where all the ganoderma mushroom plantation, manufacturing plant, and packaging are located in one place. The production is semi-automated with 30% human labour due to Malaysia's low wage rate. However, with the second new coffee plant that costs RM4 million, it will utilise 100% automatic labouring machine. The company is also in progress to set up a new GMP (Good Manufacturing Practice) factory to manufacture newly developed skin care and personal care series products that will cost RM14 million.

Case Study Company B

Company B was first established in 1986 by a local who had a keen interest in Malaysian herbal research and scientific analysis. In 1999, with the help of 13 graduates from Malaysian universities, the company started its first factory and Multi-Level Marketing (MLM) business.

To date, the company is operating with 110 full-time workers to produce 67 products. The products are marketed in Malaysia, Indonesia, Singapore and Thailand. The company also intends to penetrate Middle East and Europe markets in the near future. Currently, the company owns three manufacturing plants in the northern states of Malaysia and 500 acres of herbal farms to provide sufficient herbal supplies. The manufacturing plants are estimated to be worth RM1.4 million with RM2.6 million modern facilities inside. In the production process, Company B uses mostly semi-automated machines in all manufacturing plants. However, due to the remarkable increase in demand for the company's health drink, the company is planning to adopt 100% automatic labouring machine to one factor. The herbal drink has shown a tremendous increase of total sales of RM4 million a month from RM2 million a month before the drink was introduced.

In 1997, the company was recognised by the Malaysia Ministry of Health, with the Good Manufacturing Production (GMP) status. With this status, it is an assurance that the company could market its products to other countries. In 2006, Company B has introduced e-commerce in its business operations. The main objectives of e-commerce application are to facilitate the business operations between customers and company, and also for future strategy to penetrate the global market. E-commerce enables the company to exchange business information via email, facsimile transmission, and online funds transfer, which could increase the speed of business transactions.

Case Study Company C

Company C is one of the oldest Chinese traditional herbal medicine manufacturers in Malaysia. It was established in 1936 and owned from generation to generation. The company is also known to be the largest traditional medicinal herb factory in Malaysia and has 63 permanent employees to manage the factory operation. Before the investment of new and advanced machines in 1999, the number of employees was almost 130. With more than 60 years of operation in Malaysia, the product of Company C has established a strong following among Malaysians and consumers from countries in South-East Asia and Hong Kong. The total products of Company C are 25 items consisting of traditional and over-the-counter (OTC) medicines. However, the main products were Chinese traditional medicine, which were made from imported Chinese herbs.

The herbal medicines of Company C are manufactured in accordance with the GMP standard set by the Malaysian Ministry of Health. Quality and safety are the highest priority in the manufacturing process. The raw materials are from selected high quality Chinese herbs and roots. Several tests and inspections were done in the company's laboratory with new and advanced equipment.

However, in terms of production planning and control, the company did not apply any systematic planning such as MRP or JIT. As well as network communication, the company also did not use any computer networks such as LAN or Intranet, or even have a company website. The most recent technology investment was done in 1999, and due to internal management conflicts, the company did not have further technology planning or investment for the next three years. The strength of Company C was placed on its famous brand name and main product. The product reputation, its efficacy, and high quality of herbs and roots make the company one of the established herbal manufacturing companies in Malaysia.

Results of the Case Study

From the plant tour and observation made by us, we could divide the technology used by the three case studies into three categories; the process technology, the integration and control technology, and finally, network communication technology. Process technology is technology applied for

processing products in plants while integration and control technology is technology used to integrate one function to another functional area as well as to control the manufacturing process. Finally, network communication technology is used to enhance the communication of the companies with their suppliers, customers, and internal staff. The status of technology implementation of the three cases is summarised in Table 3.

Table 3: Types of Technology Implemented at the Three Companies

	Company A		Company B		Company C	
	Current	Future	Current	Future	Current	Future
Process technology Programmable Logic Control (PLC) machines		Y	Y		Y	
Part identification for manufacturing automation (e.g. bar coding)	Y	Y		Y	Y	
Automated vision-based systems used for inspection/testing of inputs and/or final products		Y		Y		
Other automated sensor-based systems used for inspection/testing of inputs and/or final products	Y	Y		Y	Y	
Packaging: • Encapsulation • Bottling	Y Y	Y Y	Y		Y Y	
Material handling (Please state)				Y		
Integration and control Material Requirement Planning (MRP)	Y	Y				
Manufacturing Resource Planning (MRP II)/ Enterprise Resource Planning (ERP)	Y	Y				
Computers used for control on the factory floor		Y				
Use of inspection data in manufacturing control	Y	Y		Y		
JIT			Y			
Network communication						
Local area network (LAN) for engineering and/or production	Y	Y		Y		
Company-wide computer networks (including Intranet)		Y			Y	
Inter-computer networks (including Extranet and EDI)		Y				
Internet (website, etc.)	Y		Y			

Currently, Company A uses process technology for part identification, an automated sensor based system used for inspection or testing of inputs and/or final products, and for packaging, encapsulation and bottling. Company B only implemented process technology for controlling process using the Programmable Logic Control (PLC) machines and for packaging purposes, encapsulatian. Next, the third company adopted process technology to control process, identify part, test and inspect inputs or final products, and handle material. Of all the three companies, Company A extensively used the process technology in its factory compared to the other two companies. In terms of integration and control technology, only two companies stated that they used technology for planning production, integrating with other functional areas in the companies, and to control inventory by using Just in Time method. Finally, for the network communication technology, all of the three companies utilised technologies to enhance their communication with their customers, suppliers, and internal employees. The visible difference from the three case studies was size of the companies determined their capability in adopting technology in the manufacturing plants.

DISCUSSION

The level of technology application in all three herbal manufacturing companies is mostly semi-automated. None of the case studies had utilised advanced manufacturing technology (AMT). However, most of the companies are going for AMT in the future. According to Khalil's technology classification, the technology level in these firms can be grouped as appropriate technology since there is a good match between the technology utilised and the resources required for its optimal use (Khalil, 2000). These companies use more medium-level technology due to lack of necessary infrastructure and skilled personnel but are still able to meet local and overseas market demands. Quoted by Company C's Quality Assurance Manager:

> *With the current technology, we still can afford to supply the customer demands. At the moment the capacity is not fully utilszed as we only operating one shift.*

By utilising the appropriate level of technology, this will result in better use of labour resources and better production efficiency especially for manufacturing firms from developing countries (Khalil, 2000). Consistent with Nouri (1997), the technology level in Malaysian manufacturing firms are at their maturity stage. This is also applicable to local herbal manufacturing. One of the main reasons of less sophisticated technology applied by companies is the low labour cost (Nouri, 1997; Zhao & Co, 1997). Due to this low cost but highly motivated workforce, often it makes the economic justification of automation in newly industrialised countries difficult.

The finding of low technology uptake by the interviewed companies is also consistent with Swamidass and Kotha (1998) who found a positive relationship between size of firms and the level of applied technology, especially AMT. The investigation showed that small plants usually lagged behind the larger plants in terms of technology usage.

Despite the high benefits of technology implementation, a firm may still feel reluctant or unable to invest in improvement programmes and activities, and also new technology, especially for SMEs (Kennedy & Hyland, 2003). As for Company A, B, and C, even though these companies are very ambitious in their future plans and strategies, they have to admit the barriers that hinder them from applying the technology. The main obstacles mentioned by the interviewees were financial constraints due to costly and expensive equipment and outside technical support, and also insufficient skilled labour to improve the companies' processes and systems.

Financial support is seemed to be the critical barrier in implementing new technology in these herbal manufacturing companies. Since all the corresponding companies are categorised

as SMEs, finance is a major issue. As mentioned by Kennedy and Hyland (2003), smaller firms usually lack the financial and human resources, which result in lower levels of adoption of more costly technologies.

Expensive technical support also hinder these companies from acquiring high and advanced technology. Since these companies lack employees with experience and necessary skills to implement some new technologies, technical support is very important. However, due to costly consultations and maintenance services, some of these companies had to postpone or reject the ideas of utilising new technology in the companies' processes and systems. As a result, these companies are very dependent on staff knowledge and experiences, which will limit the success of technology implementation. As quoted by Company B's R&D Manager:

> *At the moment, we get the advice and ideas from our experienced Production Manager and technicians. The outside consultations are too expensive and we can't afford it.*

Other than technical support, management support is also crucial in technology implementation. SME managers know their products, markets and customers, and are often the ones who make the decision in technology implementation. As revealed by Company C's Quality Assurance Manager, at the moment, the company has no immediate technology implementation plan due to management problems. All the planning and new ideas are being kept aside until the problem is solved. This statement shows that problems in management level will affect technology implementation decisions.

CONCLUSION

Generally, all the herbal manufacturing companies interviewed believed the positive impact of technologies in their respective businesses especially in improving their productivity and product quality, and continue to improve the firms' processes and systems. However, with all the constraints and obstacles in implementing fully integrated advanced technology, the aim of achieving high technology implementation level is still a long way to go. Before making any technology investment, Company A, B, and C need to consider several constraints. The main restrictions are (a) commitment from top management, (b) financial and human resources, (c) low wage rate that make hiring more workers seems more favourable than investing on high technology machines or equipment, and (d) risk in future demand.

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