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A MANAGEMENT OF TECHNOLOGY FRAMEWORK FOR MSME SUCCESS AND SUSTAINABILITY

Elvira A. Zamora*

In this article, management of technology (MOT) is defined as the application of science, engineering and managerial knowledge for the effective identification, selection, acquisition, development, exploitation, and protection of technologies appropriate for the production and delivery of goods and services necessary for the organization to gain competitive advantage and attain desired levels of growth and performance. This definition serves as the general framework that is used to guide the development of the various sections of the paper. A profile of MSMEs is presented which provides information on the structural features of Philippine MSMEs and key issues concerning this sector, such as competitiveness, productivity, funding, and access to markets. Another component of this paper is a section on government programs for MSME promotion and development, which include the SMED Plan 2004-2010 and the Department of Science and Technology's (DOST) Small Enterprise Technology Upgrading Program (SETUP). Another major part of this paper consists of three case studies that highlight unique and high-performing small enterprises: Innovatronix Incorporated, Digital Infostructure and Consulting Corporation, and MoonDish Foods Corporation. The case studies focus on the identification of strengths, weaknesses, opportunities, threats, and most important of all, the factors that have been identified as critical to their success. The final sections of the article consist of the recommendations and conclusion. The recommendations have been categorized into two: (1) recommendations to enterprises; and (2) recommendations to government.

Keywords: MSME, SWOT, management of technology, critical success factors

I. INTRODUCTION

The definition of management of technology (MOT) used in this paper is based on the definitions of Khalil (2000), the European Institute of Technology Management (2007), Kanz and Lam (1996), and Tabbada (2000). Khalil (2000) defines MOT as an interdisciplinary field that integrates science, engineering, and management knowledge and practice. According to Khalil, MOT connects disciplines that focus on technology creation with those that enable its conversion to wealth.

The European Institute of Technology Management (EITM) (2007), on the other hand, defines MOT as involving the effective identification, selection, acquisition, development, exploitation and protection of technologies (product, process and infrastructural) needed to maintain (and grow) a market position and business performance consistent with company goals.

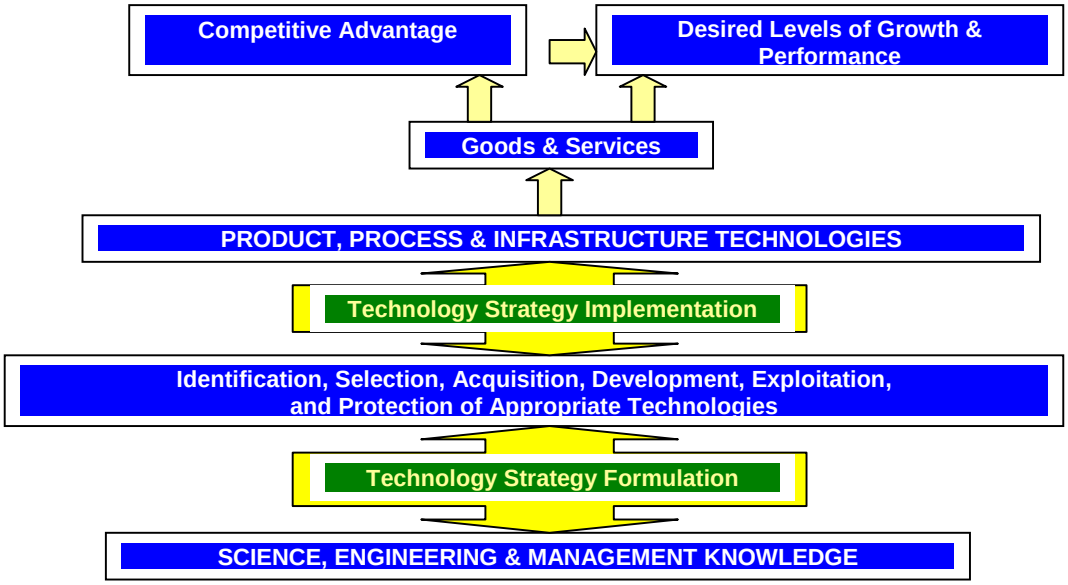
* *Professor of Operations Management, College of Business Administration, University of the Philippines, Diliman, Quezon City. (Email: elvira.zamora@up.edu.ph).*

Kanz and Lam (1996) offer a simpler and more practical definition of MOT. According to them MOT is about getting people and technologies working together to achieve what they want through the use of a collection of systematic methods for managing the process of applying knowledge in order to produce goods and services.

Tabbada (2000) takes on an academic perspective and defines MOT as research and education on how to manage the technology component of individual product life cycles, capitalize on process technology to gain competitive advantage, and integrate product and process technologies.

Assembling together the most important elements of these four definitions yields the integrated framework shown in Figure 1.

Figure 1
General MOT Framework



Thus, for purposes of this paper, MOT is defined as the application of science, engineering and management knowledge for the effective identification, selection, acquisition, development, exploitation, and protection of appropriate technologies (technology strategy formulation) for the production and delivery of goods and services (technology strategy implementation) necessary for the organization to gain competitive advantage and attain desired levels of growth and performance.

II. OBJECTIVES OF THE STUDY

This study has been undertaken to: (1) examine the extent to which selected small enterprises in the Philippines engage in MOT; (2) determine the significance of MOT in promoting enterprise growth; (3) analyze the critical factors for success at the firm level; (4) assess the problems faced by small enterprises in managing technology; and (5) formulate recommendations for enterprises and the government.

III. PROFILE AND STATUS OF MICRO, SMALL AND MEDIUM ENTERPRISES

As of 2006, about 99.7 percent of all registered enterprises in the Philippines are classified as micro, small and medium enterprises (MSMEs). MSMEs account for approximately 67 percent of total employment generated and represent around 60 percent of total exporting firms all over the country (Department of Trade and Industry [DTI], 2007). Unfortunately, compared to other Asian economies, the MSMEs in the Philippines are generally below-average performers. In terms of value-added for instance, local MSMEs contribute only to the extent of 32 percent versus 47 percent for South Korea, 56.7 percent for Japan, 68 percent for China, and 63.11 percent for Indonesia (Small and Medium Enterprise Development [SMED] Council, 2004). The productivity of Philippine MSMEs has trailed behind in comparison with the performance of large local establishments. This is attributable mainly to two factors. First, fierce competition in export markets brought about by globalization, and aggravated by the inability of our MSMEs to update and upgrade themselves in terms of product and process technologies. Second, the domestic business and operating environment is not completely MSME-friendly.

Despite the weaknesses of MSMEs, their overwhelming presence suggests that they represent a significant sector in the Philippine economy. It is, therefore, nationally and strategically important to properly address the issues and challenges facing MSMEs.

Structural Features of Philippine MSMEs

MSMEs in the Philippines are characterized by the following features (SMED, 2004):

- *MSMEs are substantial in number*. Table 1 shows detailed statistics as of 2006 (the latest data available). From this table it can be observed that micro-enterprises in fact account for 92 percent of all firms, while small and medium enterprises account for a total of approximately eight percent.

Table 1
Number of Establishments by Sector and Size Distribution, 2006

Sector	Size of Establishment				
	Micro	**Small**	**Medium**	**Large**	**Total**
Agriculture & Forestry	2,631	1,322	125	121	4,199
Fishery	890	499	30	28	1,447
Mining	217	82	5	15	319
Manufacturing	105,083	10,274	1,004	985	117,346
Electricity, Gas & Water	559	630	106	104	1,399
Construction	1,352	979	84	73	2,488
Wholesale & Retail Trade	373,721	17,110	384	233	391,448
Hotels & Restaurants	90.121	7,677	128	49	97,975
Transport & Communication	7,035	2,133	123	114	9,405
Financial Intermediation	18,679	4,434	90	109	23,312
Real Estate	40,936	3,985	372	429	45,722
Education	6,699	4,712	240	206	11,857
Health & Social Work	29,996	1,266	98	83	31,443
Other Service Activities	42,272	2,336	50	47	44,705
Total	**720,191**	**57,439**	**2,839**	**2,596**	**783,065**
%	**92.0**	**7.3**	**0.4**	**0.3**	**100.0**

Source: National Statistics Office (NSO)

- *Two out of every three employees work in MSMEs.* Table 2 shows that MSME sector employees make up roughly 67 percent of total establishment personnel. Micro-enterprises employ the most people (33.5 percent).

Table 2
Number of Employees by Sector and Size Distribution, 2006

Sector	Size of Establishment				
	Micro	**Small**	**Medium**	**Large**	**Total**
Agriculture & Forestry	9,970	32,633	17,421	83,568	143,592
Fishery	3,269	9,466	4,305	13,938	30,978
Mining	850	1,877	798	11,320	14,845
Manufacturing	259,664	252,931	132,332	727,984	1,372,911
Electricity, Gas & Water	2,717	18,674	15,157	46,988	83,536
Construction	5,528	25,394	11,564	51,615	94,101
Wholesale & Retail Trade	790,398	339,025	52,102	101,969	1,283,494
Hotels & Restaurants	227,978	182,547	16,628	21,594	448,747
Transport & Communication	25,928	50,484	16,603	92,169	185,184
Financial Intermediation	70,944	78,861	11,556	97,503	258,864
Real Estate	99,752	94,858	47,512	251,487	493,609
Education	26,678	119,137	34,450	90,065	270,330
Health & Social Work	48,718	30,557	14,003	40,367	133,645
Other Service Activities	95,430	42,574	6,582	26,461	171,047
Total	**1,667,824**	**1,279,018**	**381,013**	**1,657,028**	**4,984,883**
%	**33.5**	**25.7**	**7.6**	**33.2**	**100.0**

Source: National Statistics Office (NSO)

- *MSMEs are highly concentrated in certain areas.* Table 3 indicates that there is high concentration of MSMEs in five regions – the National Capital Region (NCR), Region 4 (Calabarzon), and Region 3 (Central Luzon). This pattern has not significantly changed over the past several years.

Table 3
Business Establishments by Size and Region, 2006

Region	*Size of Establishment*				
	Micro	**Small**	**Medium**	**Large**	**Total**
Ilocos Region	42,235	1,805	45	32	44,117
Cagayan Valley	23,218	732	15	17	23,982
Central Luzon	78,837	5,129	209	169	84,344
Calabarzon	106,262	6,828	491	533	114,114
Mimaropa	22,210	966	15	9	23,200
Bicol Region	30,179	1,418	44	25	31,666
Western Visayas	42,982	3,076	137	107	46,302
Central Visayas	39,952	3,906	250	259	44,367
Eastern Visayas	19,814	907	33	15	20,769
Zamboanga Peninsula	24,132	1,075	35	36	25,278
Northern Mindanao	27,287	1,967	79	70	29,403
Davao Region	33,907	2,540	131	130	36,708
Soccsksargen	25,137	1,358	58	57	26,610
National Capital Region	169,202	24,106	1,241	1,083	195,632
Cordillera Autonomous Region	13,915	787	24	18	14,744
ARMM	8,062	199	10	9	8,280
Caraga	12,860	640	22	27	13,549
Total	**720,191**	**57,439**	**2,839**	**2,596**	**783,065**
%	**92.0**	**7.3**	**0.4**	**0.3**	**100.0**

Source: National Statistics Office (NSO)

Key Issues Concerning MSMEs

The challenges facing Philippine MSMEs may be grouped into four, namely: (1) issues relating to competitiveness; (2) issues relating to productivity and structural limitations; (3) issues relating to funding limitations; and (4) issues relating to market access (SMED, 2004).

MSME competitiveness

Issues that relate to the low level of competitiveness of local MSMEs include fierce competition in the export market resulting from the influx of cheaper foreign brands, small domestic markets, the heavy reliance on imported parts/components, limited industrial linkages, lack of basic

operational management knowledge and expertise, lack of funding support, and limited economic activities at the local level.

Productivity and structural limitations

Most of the MSMEs in the Philippines face problems of low productivity and unavailability of appropriate services due to structural weaknesses in the business environment. Specifically, local MSMEs are confronted with outmoded or inefficient operational assets and methods, insufficient technological know-how, inadequate managerial expertise, insufficient and inaccessible funding sources, inadequate professional services, insufficient incentives and inability to comply with regulatory requirements and procedures, and insufficient access to information.

Funding sources

Majority of MSMEs in the Philippines rely mainly on the owner's savings and personal loans for funding requirements. Institutional debt financing is utilized by only a small segment because of the fear of loan exposure, inability to qualify for lack of collateral, and lack of knowledge about credit sources and procedures. This is aggravated by the inaccessibility of trade or supplier credit and little possibilities of customer advances. Extended repayment terms exploited by supermarkets, malls and marketing service networks add to the funding pressure. Most credit facilities also carry burdensome terms that MSMEs find difficult to comply with. This inaccessibility of adequate and affordable external funding results in the predominant use of low-technology processes that consequently restricts enterprise growth.

Access to markets

The main problem is the inadequacy of knowledge among MSMEs about market opportunities and their accessibility. Most MSMEs sell locally, to final consumers. Marketing outside the domestic market is usually limited to trade fairs. Individuals and households are the main users of MSME products. Very few MSMEs cater to volume buyers or can reach regional, national, and international markets. Most marketing problems are associated with the lack of funds, low levels of technology, and the unavailability of market information and services.

IV. GOVERNMENT PROGRAMS FOR MSME PROMOTION AND DEVELOPMENT

The Magna Carta for Small Enterprises and the Barangay Micro Business Enterprises Act

The statutory foundations for MSME development are provided for by the Magna Carta for Small Enterprises (Republic Act No.6977), as amended by the Barangay Micro Business Enterprises (BMBE) Act (Republic Act No.8289). The Magna Carta is a special law that sets down the policies for MSME promotion, provides the definition of MSMEs, and directs the establishment of the institutional framework for the MSME promotion system. The Small and Medium Enterprise Development (SMED) Council and the Small Business Guarantee and Finance Corporation (SBGFC) were created by virtue of this Act. The BMBE Act on the other hand, was enacted to support eligible micro-enterprises as well as the informal sector through incentives to local government registered barangay micro-enterprises (BMBE), exemption from income tax, reduction in local taxes, exemption from payment of minimum wages, financial

support from government financial institutions, and technology assistance from government agencies.

DOST's Small Enterprises Upgrading Program

The Department of Science and Technology (DOST) launched the Small Enterprise Technology Upgrading Program (SETUP) as a nationwide strategy to encourage and assist MSMEs to adopt technological innovations to improve their operations and, thus, boost their productivity and competitiveness. The program enables firms to address their technical problems through technology transfer and technological interventions to improve productivity through better product quality, human resources development, cost minimization and waste management, and other related activities (Small Enterprises Technology Upgrading Program (SETUP), 2006).

SETUP hopes to help MSMEs improve their productivity and competitiveness through the following initiatives:

- *Provision of technology.* This includes technology needs assessment and sourcing of technology. Participating firms are assisted in assessing their technology needs and appropriate technologies are recommended for adoption. Once identified, the source(s) of the technology are determined and negotiations for the acquisition and installation of the technology are undertaken. Although limited, the DOST also provides one-time seed fund to participating SMEs in order to facilitate technology acquisition. This is intended to enable them to access formal credit sources for future technology needs and expand their production activities.

  Manpower training is included under this initiative. Technical training on key production concepts and techniques such as the Hazard Analysis and Critical Control Points (HACCP) for food processing, Good Manufacturing Practices (GMP), Quality and Environment Management Systems (QMS/EMS), as well as training on specific technical skills (e.g., machining for furniture, handloom weaving, sea weed culture and tissue culture production) are also provided.

  To ensure successful adoption of technologies, the DOST – through its network of S&T experts from various agencies and academic institutions – provides continuing technical and productivity consultancy services to participating firms.
- *Product standards and testing.* In order to compete globally and locally, Philippine-made products must meet certain standards. Unfortunately, there are still no local standards for a large number of Philippine products. The DOST is currently working with the Department of Trade and Industry's Bureau of Product Standards (DTI-BPS) in cooperation with the private sector, the academe, other government agencies, and non-government organizations in establishing standards for some products.

  On the other hand, to determine if products conform to standards, these products must be tested in accredited laboratories. For this purpose, the DOST has organized a network of regional testing laboratories in cooperation with the state universities and colleges (SUCs), as well as private testing centers. However, these facilities need to be upgraded to be able to provide as wide a range of testing services as possible, and also to improve testing efficiencies and consistency of results, and reduce turnaround time for tests to be completed.
- *Packaging and labeling.* Products need to be packaged properly to improve shelf life especially for food items, to improve

handling and protection, and ultimately to improve their marketability.

- *Database management and information system.* Databases essential to MSMEs are being built, including a listing of available technologies at the national and regional level, a listing of S&T experts, and a listing of testing laboratories that includes testing services provided and costs. These databases will be accessible on the SETUP web site, and linked with the DOST web site to enable easier access. Agreements with the Development Bank of the Philippines (DBP), the DTI, and other relevant agencies have been made to allow the posting of participating firms in their databases.
- *Linkages and networking.* To remain viable, an MSME upgrading program must have backward linkages with raw material suppliers. The SETUP program has, therefore, taken steps to look into existing policies affecting raw material supply as well as measures to establish linkages with appropriate government and non-government agencies.

The following industry sectors are covered by the program: food processing; furniture; fashion accessories, gifts, housewares, decors, handicrafts, natural fibers and dyes; marine and aquatic resources; horticulture; and metals and engineering. Regional offices of the DOST identify individual firms within these industry sectors that will be the recipient of technology interventions, which will be identified based on the requirements of the firms. Among the expected outcomes of the interventions are: increased production, improved quality, reduced cost of production, and reduced pollution.

In 2009, the DOST funded under SETUP more than P114 million worth of projects for MSMEs, provided 25,562 jobs, gave technical assistance to 1,239 companies, and served 473 startup enterprises. It also transferred 20 patented technologies from DOST's research and development institutions to private firms for commercialization (Balita-dot-ph, 2010).

DTI's Support for MSMEs

The Department of Trade and Industry (DTI) is the country's key agency charged with creating a business-friendly environment conducive to the growth of enterprises and supportive of fair and robust trade in goods and services, both within and outside the Philippines. Among the functional groups under the DTI is the Small and Medium Enterprises Development Group (SMEDG), which assists in the development of entrepreneurs and small and medium-scale businessmen through various programs. The SMEDG is composed of eight offices (DTI, 2007).

- The Bureau of Small and Medium Enterprises Development (BSMED), which promotes and develops MSMEs by initiating and implementing programs and projects addressing specific MSME needs in technology development and transfer, financing, marketing and training, and market promotion through trade fairs.
- The Bureau of Domestic Trade (BDT), which promotes efficient marketing and distribution of local products and services in the domestic market and expands and strengthens linkages among and between small, medium and large enterprises through information exchange and market matching.
- The Center for International Trade Expositions and Missions (CITEM), which assists exporters by developing their core competencies in the area of marketing, promotion, and capability building through professionally managed and well selected programs and activities, such as organizing international trade fairs.

- The Product Development and Design Center of the Philippines (PDDCP), which promotes industrial design as a tool for improving the quality and competitiveness of Philippine products.
- The Cottage Industry Technology Center (CITC), which provides production-related training and technical assistance to furniture, gifts and housewares, fine jewelry and leather footwear industries all over the Philippines.
- The Construction Manpower Development Foundation (CMDF), which oversees the development of human resources of the construction industry (craftsmen, engineers, supervisors, managers and contractors), draws up an overall construction manpower development plan along with the relevant strategies, and develops and implements manpower training and certification programs.
- The Philippine Trade Training Center (PTTC), which designs and implements training programs on export marketing and management, entrepreneurial management, quality management and productivity, and trade exhibition management and participation.
- The Small Business Guarantee and Finance Corporation (SBCorp), which supports the development of small enterprises by promoting various modes of financing and credit delivery systems.

The SME Development Plan 2004-2010

The overall vision of the SME Development Plan 2004-2010 is *"to create globally competitive SMEs in the new industrial economic environment. These are SMEs that acquired distinctive competencies from harnessing efficient technologies and establishing strategic relationships with partners, market forces, suppliers (even competitor producers). The envisioned breed of dynamic SMEs shall propel the nation into the world-class business sphere. These priority SMEs shall also showcase the country as a people, its richness in resources, as well as the boundless possibilities available to create and offer products and services to seamless global markets"* (SMED, 2004).

The Plan has four strategic developmental goals, namely: (1) increased productivity; (2) increased production output and sales; (3) contribution to growth of exports; and (4) new creative enterprises. To achieve these goals, eight key strategies have been formulated:

- Providing SMEs access to comprehensive and focused support for enhancing managerial and technological capabilities, tapping business opportunities, and becoming competitive in the local and international markets.
- Providing support for identifying and developing business opportunities through the development of business ideas that promote the expansion and diversification of the country's industrial structure.
- Strengthening support to the growth industries that are active in the international markets in order to sustain and enhance their competitiveness and improve their access to the domestic market.
- Providing support for industrial linkages of SMEs with leading Philippine industries to strengthen the country's industrial structure.
- Developing SME financing support programs and strengthening the institutions that provide direct and appropriate financial services to SMEs.
- Streamlining the systems that provide support programs and incentives to SMEs.
- Streamlining the implementation of SME policies and regulations.
- Strengthening and building the capabilities of institutions that generate

and implement programs for SME development.

Evaluation of the SMED Plan 2004-2010 was completed during the first quarter of 2010 through the joint efforts between the Philippine and German governments (Jenders, 2010). Among the most significant conclusions of the evaluation were: (1) the business environment for MSMEs has improved since the SMED Plan was launched in 2004, and (2) the MSME sector is now more open about its desire to invest in modern technologies, skills and quality.

V. CASE STUDIES

In choosing the subjects for the case studies, the primary consideration was that the resulting case study is able to: (1) demonstrate the significance of MOT and innovation; (2) highlight critical factors that promote growth and high performance; (3) identify major problems and difficulties at the enterprise level; and (4) identify and describe successful approaches and practices.

An Internet search was made for SME success stories and best practices. The search yielded several leads, from which were chosen three, namely: (1) Innovatronix Incorporated, (2) Digital Infostructure and Consulting Corporation, and (3) MoonDish Foods Corporation. Owners of these companies signified willingness to share information about their firms' history and operations, another important consideration in the selection of case companies.

Materials for the write-up were mainly gathered through personal and telephone interviews and electronic mail exchanges conducted between December 2007 and April 2008, and supported by Internet research. Since the three subject companies differed significantly in terms of the nature of operations, the interview questions were open-ended and not structured. Nonetheless, gathering of information was guided by the SWOT framework.

Innovatronix Incorporated

The enterprise

Innovatronix Incorporated was established in 1987 as a single proprietorship, with only PhP200,000 starting capital. It was eventually incorporated in 1991. It is a Filipino electronics company, engaged in the design, manufacture, and distribution of electronic devices. It also offers engineering services in industrial automation and controls. The company's product lines include household devices, electric bicycles (ebikes), and LED display systems. Its team of engineers is also capable of developing PC-based software according to customer specifications.

Innovatronix has gained expertise from its various projects over the years. Backed by its strong marketing force and highly trained R&D and production staff, it has served hundreds of customers, both in the private and government sectors. Among its major clients are Philips Semiconductor, Johnson & Johnson's Philippines, Intel Philippines, the Metro Manila Development Authority (MMDA), several universities and colleges, as well as local government units (LGUs).

When it was starting, the company faced a lot of problems due to the absence of a track record, which made it difficult for Innovatronix to obtain loans from banks and to penetrate the market. The first real break from the company came from Intel Philippines, who needed an automated link between individual production stations that would automatically load and unload computer chips into the machines. For the next two years, Innovatronix relied heavily on projects with Intel. Soon after, the company obtained contracts with Motorola,

Telefunken, and companies from other industries.

The entrepreneur

Innovatronix was put up by Ramon Castillo, who graduated from the University of the Philippines with a Bachelor of Science degree in electrical engineering. He placed 5th in the board examination he had taken after graduation, and was hired immediately by Intel Philippines, a multinational company manufacturing computer components and integrated circuits. When he was a boy, Mr. Castillo wanted to be a doctor, like his father, but discovered that his true interest and talent was elsewhere. It was at the Philippine Science High School where he was inspired by his electronics teacher to pursue a career in electrical engineering.

Mr. Castillo, who is currently president of Innovatronix, joined Intel as design automation engineer, and soon became senior design engineer. He left Intel after four years in spite of the good pay and opportunities for training in major electronics centers in Hong Kong, Singapore, Malaysia, and the United States. His leaving was motivated by a strong desire to help his country. His dream was to be the first Filipino to create and lead a successful home-grown technology company. He believed this was possible if he could put up a business and show people that even without much money, it could be done. As far as Mr. Castillo was concerned, the most important factors for success are dedication and discipline.

Mr. Castillo also believes in sharing his blessings through the corporate social responsibility program of Innovatronix. In 2007, the company donated computers and power supply sets to Tanay high schools. Two remote communities also benefited from the project: Sto. Niño and Sta. Ines are 14 kilometers and 11 river streams apart and are located at the foothills of the mountains of Tanay. The company continues to embark on similar projects.

Strengths

The main strength of Innovatronix lies in a competent workforce, characterized by high levels of engineering skills and enhanced through continuous upgrading. The company is also backed by highly trained R&D and production staff. As a result, Innovatronix is able to generate products and product ideas in time to meet customer requirements.

Logistical operations management support is another plus factor for the company, along with an efficient distribution channel. The company's network of outlets has grown rapidly since it was founded, now covering the entire Metro Manila area and nearby provinces. Innovatronix also markets its products using the Internet.

Weakness

The main weakness of Innovatronix is the inadequate attention given by its personnel to quality. To date, no formal quality management program is in place. Although no serious complaints have been made by customers, Mr. Castillo still thinks that this issue requires serious attention.

Opportunities

Using the Internet as a marketing medium has contributed significantly to the company's profitability. Still, Mr. Castillo believes that much more can be achieved with extensive use of Internet marketing. Geographical expansion, both locally and internationally, would be facilitated.

Threat

The biggest threat to Innovatronix is competition from low cost producing countries, like China and other ASEAN economies. Although the company's products are currently priced lower than existing competitors, trends in the Philippine economy may not be helpful in addressing

this expanding competition. Sadly, the prices of labor and energy alone make the cost of production in the Philippines relative higher.

Critical Success Factors

Unique vision

During the company's early years, Mr. Castillo announced the IX Guiding Principles[1] of Innovatronix (Abiad, 1997):

1. We believe in lifetime employment opportunities for everyone.
2. We believe in providing opportunities for both professional and financial growth for each and everybody, with the help of the individual himself.
3. We strongly encourage people to suggest new ideas for our continuous growth. Ideas do not only come from the top but also from below.
4. We believe that changes are inevitable. We must continue to promote, adapt, and accept changes for our continuous growth.
5. We nurture and promote honesty, concern for our property, excellence, thrift, unity, and camaraderie as our prime virtues.
6. We believe in sharing. Our bonuses and increases depend on the company's performance and our own individual performances.
7. We believe in quality. Let IX and quality be synonymous.
8. We believe that a business has social obligations. We commit ourselves to helping the country and our fellow Filipinos.
9. We believe in *total customer satisfaction*. We will work to ensure this. We survive and grow because of this.

These principles continue to guide the company in the formulation of its strategies and action plans. Innovatronix has made refinements on these principles, as embodied in its mission and vision statements.

Mission

- To provide opportunities both for professional and financial growth for every member of the Innovatronix family;
- To encourage people to suggest new ideas for continuous growth;
- To nurture and promote honesty, loyalty, concerns for property, excellence, thrift, unity, and camaraderie as prime virtues; and
- To help, by realizing its social obligation, communities in uplifting the quality of life.

Vision

- To strive for quality, believing in synonymy of quality and Innovatronix;
- To ensure total customer satisfaction, realizing that the survival of the business depends on customers' support; and
- To become one of the top technology firms in the country and the world.

Resilience and innovation

Over the years, Innovatronix has chosen to remain small, but this has not prevented the company from obtaining contracts with industrial giants who need Innovatronix services for productivity improvement. The company employs innovation in engineering to transform itself into a technology-exporting firm starting 2000. During the same year, Innovatronix entered the photo-imaging business, which led five years later to the offering of photo printing and export of products to over 50 countries. Innovatronix also developed the EVO3 machine, which is strongly competing with major brands such as Kodak and Fuji. Innovatronix engineers and programmers worked together to produce this machine, which combines the capabilities of a digital mini laboratory in the form of a photo

printing kiosk. With EVO3, Innovatronix has brought down the cost of photo printing to as low as PhP1.30 per print, putting the company in direct competition with the world's top players in the photo printing business. Innovatronix has also entered the business process outsourcing (BPO) arena through photo retouching and picture-to-oil painting services (Reyes, 2007).

In 2004, the company also started producing and selling e-bikes and e-trikes in limited numbers. The e-bikes are mostly sold to security agencies that employ roaming guards to patrol subdivisions and large factories and compounds. The e-trike, on the other hand, is an e-bike with a sidecar, marketed to small environmentally-friendly entrepreneurs. The e-trike can carry a load of up to 200 kilograms (Salazar, 2007).

Along with a number of its original products that have now become more complex in terms of design and technology, the company carries the following innovative items: the ref clock saver, a gadget that allows the refrigerator to run for only 10 minutes every hour during *"save"* mode and reduces the need for defrosting from one to two times a month to four to six times a year; the electric ballast, another energy saver that is an improvement over the ordinary magnetic, choke-type ballast; the aircon timer which protects appliances from power surge caused by power outages; the photo-printing machine that accepts and processes digital images from cell phones and digital cameras; and the power surge protector that protects appliances from power surges during power outages by delaying electrical connection until power stabilizes.

Optimal utilization of core technology

Being the only Filipino firm experienced in making electronic displays, Innovatronix was contracted to make the scoreboards for the Southeast Asian games held in Manila in November 1991. This was a big break for the company, which opened bigger opportunities in succeeding years. In fact, just a year after the scoreboard project, the company was contracted to develop and supply the Chess Piece Identification System at the World Chess Olympiad. It allowed the public to view the players' moves through a giant TV screen and a VGA monitor, which is now a common practice not only in chess, but also in other sports events.

From scoreboards, the company's *Tronix* brand of consumer electronic products was launched. To date, Innovatronix has reached Filipino households with its Power-on-Delay (POD10), electronic ballasts, AVRs, and ACT20 for window-type air conditioners. In 1997, during the Asian financial crisis, Innovatronix pioneered and ventured into another business concept, in line with the advent of digital cameras: Tronix Imaging Centers.

The Tronix line has expanded significantly over the years and currently includes Tronix Explorer 1200Ws-115Vac/60Hz, Tronix Explorer 1200 Ws-230Vac/60Hz model, Tronix Explorer 1200 Ws-230 Vac/50Hz model, Tronix Ultra-lite-115Vdc model, and Tronix Ultra-lite-230Vdc model. The Tronix Explorer series offers portable power supply that allows the user to carry flash outdoors, making a "studio" extremely mobile. It is a pure sine wave inverter that works with most brands of flash units. The Tronix Ultra-lite models, on the other hand, offers mobile energy packs for inkjet printers, recommended for photographers who wish to print their photos (and other documents) immediately. The packs are versatile enough and can be used for other devices that use switching power supply (Innovatronix, Inc., 2007).

Calculated risk taking

Mr. Castillo quit a high-paying job at Intel to put up Innovatronix (innovative electronics). He started out with a ping pong table for work space, a mere PhP5,000 capital, a best friend's support, and assistance from one technician. Since then, the company has undergone numerous

reinventions – from providing services to major industry players like Intel, Motorola, and Telefunken, to making electronic displays and setting up digital photo shops. In spite of all the obstacles and setbacks, the company fought back and survived. When the company was just starting, it generated only PhP400 for eight months, but Mr. Castillo did not give up. He pawned his car, borrowed money from relatives and friends, and even went to the extent of asking his mother for his inheritance in advance.

During the Asian financial crisis of 1997, Innovatronix almost closed down, but Mr. Castillo opted not to retrench its 18 workers and, instead, opened a retail outlet in 1998 so as to keep them employed. He took out a bank loan using the company's last building as collateral and used the money to develop electronic photography products and services, including one that retouches pictures and another that converts them into oil paintings. The services were eventually offered online, making Innovatronix an unwitting leader in the BPO industry.

As Mr. Castillo puts it, *"People don't understand that in this country, people don't make money out of a good idea, but by implementing it. That's why you have to take risks"* (Manalo, 2006).

Mr. Castillo completed his MBA degree at the University of the Philippines Diliman. However, he has this to say, *"In business or MBA schools, analyzing a case seems easy to students. But put yourself in the shoes of the business owner making a decision at that moment. It's not that easy. Guts is what differentiates an entrepreneur from a manager. My point is you cannot eliminate risks, especially those that are brought about by uncertainties. Sometimes that risk will reward you greatly, and sometimes these will penalize you terribly. The company willing to take risks has a greater chance of succeeding than one that never dares"* (Manalo, 2006).

Strong marketing program

Innovatronix has an Internet-based marketing program that attracts orders for its EVO3 machine from countries such as Kosovo (Serbia) and Namibia. By using the Internet, the company's products are able to reach overseas markets without the need for dealers, which was not possible before. The company targets 50 percent of its revenues to come from its Internet operations.

The marketing strategy of Innovatronix is to go into markets that are big enough for the company, but too small for big players. This explains why the company has not gone into popular electronic consumer products, such as televisions and stereos.

Competitive advantage

Innovatronix faces heavy competition, but it has the distinct advantage of being able to offer products and services at much lower prices. The company is able to accomplish this through the continuous improvement of its designs, the development of its systems, and the reduction of materials cost. Innovatronix continually assesses and revises the design of its products to bring down the cost of production and delivery.

A major factor that has substantially contributed to the lowering of production cost is the company's innovative purchasing-bidding scheme, which was conceptualized by Mr. Castillo. Under this scheme, the company requests several favored suppliers to bid for specific raw materials and the lowest bidder gets the contract. Since the system is highly transparent, with all bidders getting to know why they were or were not chosen, suppliers are encouraged to bid again the next time. This scheme has persistently reduced the cost of materials.

Digital Infostructure Systems and Consulting Corporation

The enterprise

Digital Infostructure Systems and

Consulting Corporation is an all-Filipino, family owned corporation founded in January 1992. It is a software company that designs, develops, and markets its own brand of packaged business applications. Among Digital Infostructure's leading products is DIET_HCM (Digital Infostructure Enterprise Technology_Human Capital Management) Paperless HR, which is currently being used by over 75 large organizations in the country, including banks, pharmaceutical companies, local subsidiaries of multinational corporations, and university systems. Digital Infostructure offers technology solutions to companies wanting to transform into digital enterprises (Digital Infostructure Live, 2007).

The company has been the recipient of various awards: the 2004 IT Excellence Award from the Philippine Internet Commerce Society (PICS); Grand Prize Winner of the eBusiness Category for iBOS/e WebShell; and runner-up, Mobile/Wireless Category for mBOS/e SMS Server from the CITEM eServices 2005 Awards Committee.

When Digital Infostructure was founded, its owner made it clear that the company will *"do nothing but create software products and make them big in the market."* Unfortunately, company funds were not enough to sustain a drawn out development effort. In order to survive, the company had to set aside its dream and proceeded to do exactly what other software companies did: do custom development projects.

Digital Infostructure's first project was the development of a small clinic program for the Human Resources (HR) department of Motorola Philippines. This was followed by a payroll project for Assistco, a small engineering company, and some projects for J. Walter Thompson and Manila Pavilion Hotel.

From these early HR/payroll projects, it became clear that most companies shared similar needs, for which a standard solution may be the answer. Digital Infostructure scanned the market and found no such solution available, except for imported products which were priced excessively. This inspired the company to focus on HR-related projects, and to reject those which were not (Poso, 2004).

The company encountered many difficulties during its initial years: dealing with the intricacies of huge systems, persistent bugs, never-ending user complaints, and a lawsuit threat at one point, to name a few. However, by 1997 Digital Infostructure already had two best-sellers in the market: PayFast, a no-frills payroll software, and PeopleWare, a software that allowed full automation of the payroll process.

A challenge which came the company's way in 1996 was the creation of an HR system for the 100,000-strong organization of the Philippine Army. Digital Infostructure did this from the ground up using client/server technology over a period of one year. It was during this same period that the company noticed of the advantages of the Internet in making its HR software accessible to all client personnel, at a lower cost. By the year 2000, the company launched BOS/e PeopleWare and iBOS/e WebShell.

The entrepreneur

The company's founder, who is also presently the chief executive officer (CEO) and chief software architect (CSA) is Nilo Poso, a graduate of the Master of Technology Management (MTM) program of the University of the Philippines. He is also the vice-president for knowledge channel and a founding director of the Knowledge Management Association of the Philippines (KMAP). Before founding Infostructure in 1992, he was involved in various audit, management, and IT consulting engagements, while employed at SGV & Company and SGV Consulting/Andersen Consulting. He was with SGV for more than four years.

Strengths

Core technology

Digital Infostructure's core technology is the award-winning BOS/e iTechnology, consisting of three platform product line architectures: BOS/e, iBOS/e, and mBOS/e. BOS/e is the Window-based client/server platform, iBOS/e is the web-based platform; and mBOS/e is the mobile GSM-based platform.

.NJiTechnology, also developed by Digital Infostructure, is the next generation BOS/e iTechnology. It is as an infostructure system that provides essential building blocks and programming interfaces that enable infostructure architects, developers, and administrators to compose web services with minimal programming effort, organize corporate databases, and orchestrate the flow of data, information, knowledge and intelligence between databases and end users.

For instance, the .NJ WebShell provides a robust Infostructure system consisting of a platform, building blocks, adapters, connectors, and application programming interfaces among other technologies for programming-free composition of workflow-oriented business solutions that cut across processes and operations. It provides a universal online, self-service experience for business applications, corporate databases, internal communications, knowledge databases, among others, with unique access rights securely configured.

.NJ WebShell is the J2EE-based technology upgrade of iBOS/e WebShell, Digital Infostructure's award-winning web-based Infostructure platform that currently runs the HR Self-Service of major companies in the Philippines.

Customer relations

Clients are kept constantly abreast of news and trends that are relevant to them, particularly those that pertain to their investments in Digital Infostructure's products. The services group of the services & consulting division provides *SoftCare Services*, which is a line of technical services covering installation, configuration, user and administrator training, implementation, and post-implementation support services for the software products that the company licenses to customers.

Moreover, Digital Infostructure has a sales & marketing group whose sales team handles product inquiries, processes customer orders, evaluates customer requirements, and crafts appropriate solutions. A prospect & customer specialist, on one hand, is specifically assigned to undertake the round of discussions with the client and to eventually draft the appropriate licensing agreement. The marketing team, on the other hand, formulates marketing campaigns, manages marketing events, handles direct marketing activities, and implements brand campaigns, promotions, and related activities.

Research, development & engineering

Digital Infostructure has an RD&E division that invents, develops, innovates, models, and prototypes all of the company's products, solutions, and technologies, which are eventually introduced in the market. It crafts frameworks, architectures, and models from its synthesis of leading thoughts, paradigms, concepts, discoveries, innovations, and inventions in enterprise management and enterprise computing. These frameworks and models eventually get embedded in the architectures of the underlying technologies of Digital Infostructure's software solutions.

Weaknesses

Absence of international marketing capability

The company's revenue potential is limited because it has no international or global marketing capability. This confines Digital Infostructure to the local market for business software that, unfortunately, is not mature enough. To address this weakness,

the company plans to enter into partnerships with firms such as Sun and Avaya, in order to build global presence through .NJiTechnology.

Low capitalization

In spite of its success in the domestic market, Digital Infostructure in unable to raise R&D capital. The company attributes this to the absence of a local venture capital market for software companies.

Opportunities

Partnerships and Alliances

The company participates in R&D partnerships or technology-based strategic alliances. Digital Infostructure's strategic alliances with leading IT companies enable it to create software solutions that work with their products and technologies. These alliances also allow such solutions to deliver expected results to customers who acquire licenses. Its partnerships with Microsoft and Oracle assure its customers that its BOS/e iTechnology applications work well with Microsoft technologies, such as Windows 2000, SQL Server, and Exchange Server; and with Oracle's 9i Technology. Its partnership with IBM Philippines assures its customers that Digital Infostructure products work well with IBM servers and applications. The company's partnerships with service providers, such as the Bank of Commerce Value Payroll Plus Outsourcing Unit and Synergia, add value to its market offerings.

Digital Infostructure's strategic alliances with leading technology providers enable the company to develop digital enterprise solutions that exactly meet, if not surpass, the expected return on investment (ROI) targets of its customers. The company's partnerships with Microsoft and Oracle assure its customers that its DIET line of business solutions work well with Microsoft's technologies and Oracle's products. It's partnership with IBM Philippines assures its customers that Digital Infostructure products are compatible with IBM computer servers and applications. Meanwhile, the company's partnership with business process outsourcing (BPO) providers, such as Bank of Commerce, allows it to expand its market offerings.

Threat

Digital Infostructure is confronted with one major threat coming from business process outsourcing firms, where R&D capital appears to be moving towards. This may be attributable to the fact that BPO companies pay R&D personnel two to three times more than software companies.

Critical success factors

Unique vision

When the company started operations it had the vision to become the market leader in digital enterprise software technologies in the Philippines. Today, 16 years later, the company envisions itself as one of Asia's leading providers of enterprise software solutions and the number one provider of infostructure systems in the country. Its mission is to "incessantly discover, invent, and innovate the kind of infostructure systems that matter most to enterprise customers". The company's vision and mission are supported by the following core values:

- Deliver more value than what clients pay for in the long run
- Choose, mold, motivate, nurture, reward, organize, and lead the company's talents well
- Run the business like no other
- Share the company's expertise, technology, and success with the community, and the larger society

Competitive advantage

Digital Infostructure attributes its success to innovations based on the DIET (Digital Infostructure Enterprise Technology) framework, a system that the company created in-house. It guides the design of software architecture and evolution of solutions into a new generation Infostructure technology. This technology is fully integrated with the Digital Infostructure Business Process Methodology (BPM), the company's bible in designing business systems. The DIET framework provides a basis for running the business of an enterprise and at the same time, for architecting and building its Infostructure system. The framework consists of three layers, namely: strategy, orchestration, and leadership. Leadership connects with people (for example, associates and partners); orchestration connects with vendors at the inbound section, moves on to production, and then connects with customers at the outbound section; and strategy connects with the market, government, and competitors.

Using the DIET framework, business stakeholders can quickly see the big picture of their enterprise's business processes, and the interplay of the different elements involved in it. Therefore, they can easily appreciate hot spots and possibly figure out effective enterprise management and enterprise computing interventions.

Niche business domain

During the conceptualization of the business, it was in the area of software architecture that the CEO and chief software architect (CSA) believed he would differentiate the company from all other packaged software businesses around. Today, Digital Infostructure is effectively positioning its DIET solutions in their respective markets to drive sales:

- DIET_HCM Top 500 Philippine corporations
- DIET_FINEST Mid-market
- DIET_S3 Small businesses
- DIET_TO GO Micro businesses
- DIET_LIVE Non-profit organizations, educational institutions

Included in Digital Infostructure's 2008 3B Strategy is the crafting of a distinctive, effective DIET campaign centered on "cool themes, such as fitness, environment, corporate health, and corporate culture".

Optimal utilization of core technology

Initially, the company wanted to develop software that would fully systematize any organization by completely automating that organization's processes and operations regardless of the nature of the business, the number of business units, locations, customers, suppliers, and employees. However, due to limited funds at that time, the company could not venture immediately into developing its envisioned software. It cracked the market with a Clipper-based payroll software instead, and a Paradox-based human resource software. In 1996, it created a client/server HR software with the combined capabilities of its first two products for the Philippine Army, and then kicked off R&D efforts towards its dream software. In no time, the architecture for the envisioned business operating system was completed.

The BOS/e iTechnology evolved into BOS/e and iBOS/e platforms. mBOS/e, the mobile/wireless BOS/e platform has just passed the R&D stage and is ready for commercialization. In early 2000, Digital Infostructure launched another R&D project aimed at radically reengineering BOS/e iTechnology into an open enterprise computing technology code-named J2.NET. During its soft launch on 27 March 2003, J2.NET was renamed .NJiTechnology (NJ Open City, 2007).

Digital Infostructure's software architecture is a distinctive software

architecture that they have developed for their major products. Many foreign packaged software companies do have distinctive software architecture for their products, but very few Filipinos do. However, among these various software architectures, some can be classified as based on a similar architectural style or some have developed a style of their own. Whatever the case, a CSA's output is uniquely his, unless he copied other well-publicized and well-documented software architectures down to the smallest detail, which is not the case for Mr. Poso. In the packaged software business, well-publicized and well-documented software architectures are hard to come by.

Resilience, strategic outlook, and innovation

Over the years, Digital Infostructure has assumed a strategic view of the business, focusing on its long-term goals, innovating and introducing changes in its paradigms, and always on the lookout for opportunities that would improve its competitive position. Recently, Mr. Poso announced the company's 2008 3B (Bigger, Bolder Breakthroughs) Strategy, centered on achieving the following goals for the period 2008-2012:

- To become the dominant leader in the Philippine market for HR solutions
- To establish substantial customer base in the Philippine market for industry solutions, such as hospitality, staffing, BPO-HR/payroll, and healthcare
- To go global with the help of Sun, Avaya, and other partners by creating a unique position for the upcoming .NJ iTechnology which the company will refer to as "The World's First Pure-Web Infostructure System."

An essential component of the 2008 3B Strategy is the implementation of a new organizational structure consisting of four groups: business, services, innovation, and strategy.

Technology strategy (Maneja, Poso & Ramoso, 2004)

Identification of technology needs and solutions. At Digital Infostructure, the identified technologies essential in developing packaged business software products are grouped into two categories: frameworks and tools. On one hand, frameworks include world-class concepts, product ideas, enterprise management thoughts, software architectures, designs, and best practices that are synthesized and applied in the conceptualization and architecting of particular Digital Infostructure solutions or technologies. These are gathered from many sources, such as management and technology journals, competitors' publications, conferences, and technology vendors' training and events. Tools, on the other hand, include world-class software technologies and tools in the development, testing, installation, and implementation of Digital Infostructure solutions or technologies. These are normally provided by Digital Infostructure's technology partners, such as Microsoft, Sun, Oracle, and IBM.

For each of the phases in Digital Infostructure's business, the following have been identified as the company's major technology needs.

Business Phase	Major Technology Needs
Conceptualization	Product architecture frameworks & tools
Development of the business plan	Software development frameworks & tools Quality assurance frameworks & tools
First three years of operation	Software installation, implementation & project management frameworks & tools
Stable period	Software evolution frameworks & tools
Future operation	Software innovation frameworks & tools

Perceived and validated market needs trigger the identification of the technology needs of the company. Validation of the technology needs is assumed upon validation of the market need that has triggered the technology need. A market need is validated using business case analysis.[2]

Thereafter, the company's innovation management team spearheads the gathering and synthesis of frameworks. It follows the SureProduct! methodology, Digital Infostructure's approach for product innovation, development, and evolution efforts. The key stages of SureProduct! are research, architect, engineer, and evolve. Under research, the steps are: scan, synthesize, conceptualize, and quality assure. Under architect, the steps are: prototype, code, code review, build, quality assure, and release to SureRun!. Under evolve, the steps are: optimize codes, enhance features, quality assure, and release to SureRun!.

The technology management team takes over and identifies the appropriate tools to be used in formulating the product architecture, following the SureTechnology! approach, Digital Infostructure's methodology for identifying, selecting, acquiring, and assimilating technologies necessary in its product development and process improvement efforts. The key stages under SureTechnology! are: research, select, and assimilate. Under research, the steps are: scan, synthesize, and verify. Under select, the steps are: assess cost versus benefit, negotiate, and acquire. Under assimilate, the steps are: learn, explore, and exploit.

The innovation management team subsequently conceptualizes the products that will be created and defines their functional and technical specifications, then writes the source code and conducts unit testing using the relevant tools. The innovation management team's outputs are turned over to the product management team, which conducts quality assurance testing, packaging, and product positioning. The market management team, on the other hand, handles marketing, advertising, and promotions. Finally, the prospect management team handles event management, direct marketing, lead generation, prospecting, account closing, and customer relationship management.

Planning for technology acquisition. Digital Infostructure formulates a 10-year dream for each of its product line. Each product line has an underlying product architecture and technology. This 10-year dream is essentially a roadmap of how a product line is planned by the company to evolve, considering many aspects, such as current status and emerging trajectories of its underlying technology, current and emerging requirements of customers and market, among others. The 10-year horizon is used because it is the normal product life cycle of enterprise software applications. It takes at least three to four years to develop an enterprise software, two to three years to stabilize and create a sizeable market base, and the remaining years to fully realize its market potential before it starts to decline. A technology upgrade or a totally new product

must be conceptualized before the fifth year of the existing product. Product development should start not later than the sixth year.

Digital Infostructure's acquisition thrust is to select technologies that best fit the product architecture of the solutions that it intends to develop. For framework technologies, Digital Infostructure's intended direction is to build and not buy, because this is where it differentiates itself from its competitors. For tool technologies, it has always been on a non-acquisition setup: buying the tools as products, but not the technology behind the tools.

Digital Infostructure develops close linkages with its vendors for the non-acquisition decisions, as this provides several advantages for the company. It partners with the local offices of major global technology providers, such as Microsoft, Oracle, IBM, and Sun Microsystems, as an independent software vendor (ISV). As an ISV, Digital Infostructure enjoys liberal access to and the use of the latest and emerging technologies of these vendors. For instance, the company gets to receive continuous stream of CD installers for the latest and upcoming technologies of its global partners. Moreover, Digital Infostructure gets continuous training and education on these technologies by the vendors at minimum charge, if not for free. The company objectively evaluates each technology and assesses its impact on current and planned product architecture before making any commitment.

Technology acquisition process. In the case of external acquisitions, SureTechnology! is Digital Infostructure's methodology for identifying, selecting, acquiring, and assimilating technologies necessary in its product development and process improvement efforts. It provides a systematic way for the company's technology acquisition process. The key stages under SureTechnology! are: research, select, and assimilate. Under research, the steps are: scan, synthesize, and verify. Under select, the steps are: assess cost versus benefit, negotiate, and acquire. Under assimilate, the steps are: learn, explore, and exploit.

Continuous improvement

Digital Infostructure conducts continuous research of leading and emerging thoughts, practices, paradigms, methods, and techniques in the field of enterprise management and enterprise computing. In the process, it is able to raise important questions on the frameworks and tools that it had crafted or adapted. The company also conducts quality audits on its products, processes, people, and projects that provide insightful feedback on the appropriateness of the frameworks and tools adapted.

Digital Infostructure benchmarks its frameworks and tools with the world's leading enterprise software developers and technology/management consulting firms, such as SAP, PeopleSoft, Oracle, IBM, Microsoft, and Accenture. Through this approach, the company is able to establish its parity level vis-à-vis the best in class in key success factors (e.g., strategy, technology, product architecture, software engineering technology, and project management methodology).

Every five years, Digital Infostructure hires an independent business auditor to do a due diligence study on the key elements of the company's business as if there is a company that is interested to buy Digital Infostructure. Aside from estimating the market value of the company's intellectual property, the purpose of the study is to measure the depth and breadth of each business element, its evolution since the previous study, and its prospective value and relevance. The study provides the strategy management council insightful findings and recommendations, which trigger pertinent changes in the company's strategic plans.

MoonDish Foods Corporation

The enterprise

In 1991, Mr. Jun Manrique and his wife, Ana, put up a small neighborhood bakery that they called MoonBake Breadhouse. The bakery had offered different varieties of bread, but it eventually specialized in the manufacture of chocolate crinkles, which were well-distributed and reached as far as the province of Quezon in southern Luzon, and Bataan in the northern Luzon. In 1999, when the couple diversified their product line to include canned dishes, prompting them to create a separate entity which they called MoonDish (MoonDish, 2007).

MoonDish Foods Corporation was the first company to adopt the canned *laing* (taro leaves in coconut cream) technology developed by the Food and Nutrition Research Institute (FNRI) of the DOST. Operations started in a space leased from the Industrial Technology Development Institute (ITDI), also of the DOST.

The company's biggest break came in November 1999, when it joined the first Asian Ethnic Food Festival and received an order for 700 cases or over 30,000 cans of *laing*. The Manriques have found trade shows as the best way to market their products; trade shows guarantee that the sellers meet legitimate (Balboa & Lutanco-Chua, 2006).

MoonDish now employs more than 50 workers and has a capacity to produce 12,000 cans per day.

The entrepreneurs

The Manriques had to think of something to increase the income from the family bakery, which had been falling as a result of soaring sugar prices. They wanted export and had to find a product that had long shelf life and whose ingredients could be sourced locally, so they would not have to spend so much. They decided on *laing* in August 1999, when they put up MoonDish Corporation and the researched with the DOST before investing PhP500,000 to train staff and rent equipment from the Department. They eventually acquired their own equipment and put up their own facility in Taguig. Social development workers turned entrepreneurs, the Manriques have reaped success through the power of perseverance.

Strengths

The following company attributes enable it to achieve its goals successfully:

- A healthy sense of crisis that allows the company to think ahead, be proactive, and confront obstacles head on
- Unique products that are convenient, of high quality and HACCP-certified, and highly sellable among Filipinos abroad because they remind them of home
- A culture of continuous learning that pervades the whole organization, from top management down to the rank-and-file, and which enables the company to quickly adopt new management tools
- Quality orientation, manifested in its TQM program and applied not only to its products, but in all aspects of operation (MoonDish has a TQM program.)
- Patience and perseverance

Weaknesses

MoonDish faces two major limitations: limited financial capital and weak marketing program, specifically in terms of advertising and promotions.

Opportunities

Partnership and Alliances

Having internationally recognized products, MoonDish is aware of the value of a good image. This motivated the company to seek assistance on cleaner production (CP) and on its Environmental Compliance Certificate application. More than just enhancing its image, these initiatives helped the company to significantly reduce its environmental impacts and to realize major savings.

ITDI's Food Processing Division, which was already providing MoonDish with technical assistance, endorsed the company for the mock assessment of a Cleaner Production Assessment Training. As a volunteer facility, MoonDish benefitted from having a CP production program. A full facility assessment successfully reduced manufacturing and treatment costs by reducing wastewater and solid wastes (Department of Science & Technology [DOST], 2004).

According to the Manriques, exporting is a stressful business, with many regulations to follow and documents to fill out, as the company deals with buyers from various countries. The firm's collaboration with the DOST, the DTI, and the Philippine Trade Training Center has made it possible for MoonDish to be kept informed and updated.

Trend in healthy products

Following the global trend, more Filipinos are moving towards healthier lifestyles and are, therefore, favoring healthier food products. Since all MoonDish products are certified monosodium glutamate (MSG) and preservative-free, they would more likely be preferred by more consumers over rival brands.

Increase in Filipino migration

Since the primary target market of MoonDish outside the Philippines are migrant Filipinos, the increase in Filipino migration is an opportunity for expansion.

Threats

Among the external factors that pose a threat to the company are increasing manufacturing costs and the trend towards stricter food safety regulations. MoonDish is also worried about the sustainability of local sources of agricultural raw materials because of the damage being done by climate change and government intervention.

Critical success factors

Unique vision

Through the years of struggles and success, MoonDish continues to operate with the basic philosophy of business and public service. This philosophy is embodied in the following statements.

Mission

- To satisfy customers by producing quality Filipino foods using environmental-friendly technologies
- To be socially responsible for providing employment and livelihood opportunities to people to help alleviate poverty
- To introduce healthy food products made of natural ingredients taken from indigenous crops
- To adhere to principles of fair trade and equal opportunity for all gender in the workplace

Vision

MoonDish Foods Corporation envisions to create value in vegetable dishes and other indigenous products for the local market, and create a niche in the international scene by bridging the Filipino exotic blend with Asia and the rest of the world, based on convenience, wellness, and affordability.

Environmental policy

MoonDish commits to a clean, green, safe and healthy environment for the

sustainable development of the company, its employees, the community, and its other stakeholders.

Corporate philosophy

MoonDish is a socially responsible corporation that aims to create value in Philippine products trough the wise utilization of its resources and enhancement of the full potential of its people towards sustainable growth and development.

Quality policy

MoonDish is committed to the pursuit of excellence in the conduct of its business, putting emphasis on efficiency and effectiveness in operations, and adopting Total Quality Management (TQM), continual improvement, innovations, and HACCP accreditation as top priority.

Core values

To support its corporate philosophy, the company advocates the following core values (HEART and MIND):

- **H**umility
- **E**nvironment-consciousness
- **A**lertness
- **R**esourcefulness
- **T**rustworthiness

- **M**otivation
- **I**nnovativeness
- **N**ationalism
- **D**iscipline

Innovation and optimal utilization of core technology

By participating in various product exhibits, MoonDish was able to successfully promote its first product and obtain orders for export. To cope with the increase in demand, the company established its own canning plant at the Food Terminal Incorporated (FTI) Complex in Taguig, Metro Manila, which started operations in 2001. Since then, MoonDish has diversified to other canned vegetable products. Along with canned *laing*, the company now manufactures and sells Bicol express (green chili pepper in coconut cream), *camansi* (breadnut fruit) and *puso ng saging* (banana heart) to the local market, as well as to the Middle East, Canada, Guam, Chinese Taipei, and the United States. MoonDish now currently employs more than 50 workers and has the capacity to produce 12,000 cans per day. The company continuously innovates to address customer needs.

Competitive advantage

Solid waste generation and high production costs, due to heavy use of water and fuels, were the company's predicament. With the introduction of CP and the installation of an environmental management system (EMS), MoonDish found that manufacturing its products does not have to be costly. Being conscious of the importance of conserving resources has made it possible for the company to realize substantial savings.

As much as possible, MoonDish maintains its products' costs despite the present economic situation. To achieve this, the company continually devises options that further minimize wastes and consequently reduce production costs.

VI. RECOMMENDATIONS TO ENTERPRISES

Critical Success Factors

Below is a tabular summary of the critical success factors identified from the three case studies.

Critical Success Factor	*Case Study*		
	Innovatronix	**Digital Info.**	**MoonDish**
Unique vision	✓	✓	✓
Optimal utilization of core technology	✓	✓	✓
Competitive advantage	✓	✓	✓
Resilience & innovation	✓	✓	✓
Calculated risk taking	✓		
Strong marketing program	✓		
Niche business domain		✓	
Strategic outlook		✓	
Technology strategy		✓	
Continuous improvement		✓	

All three case study subjects may be considered unique and high-performing. In spite of the challenges that these companies have faced, they have all continued to succeed in their respective lines of business. For each of these enterprises, critical success factors (CSFs) have been identified. The CSFs common to all three companies are (1) unique vision, (2) optimal utilization of core technology, (3) competitive advantage, and (4) resilience and innovation. These critical success factors may be considered as best practices.

Clearly, it is possible for these firms to learn from each other. For instance, having a strong marketing program is a factor for success for Innovatronix, and both Digital Infostructure and MoonDish have cited the weakness of their respective marketing strategies as a major obstacle. On the other hand, both Innovatronix and MoonDish can learn from Digital Infostructure's strategic outlook and its focus on technology strategy.

Challenges

The SWOT analysis for the three case studies yielded the following major problems and difficulties.

	SME Case Study		
Weakness	**Innovatronix**	**Digital Info.**	**MoonDish**
No formal quality program	✓		
Weak marketing capability		✓	✓
Low capitalization/limited capital		✓	✓
Threat			
Competition from low cost producing countries	✓		
High manufacturing costs	✓		✓
BPO companies		✓	
Sustainability of local sources			✓
Trend toward stricter regulations			✓

It is clear that there are not many commonalities among the case companies in terms weaknesses and threats. This is understandable because the firms studied do not belong to the same industries; the issues that confront them are also expected to be different. Digital Infostructure and MoonDish share two common weaknesses (i.e., inadequate marketing capability and limited capitalization). On the other hand, Innovatronix and MoonDish share one common threat (i.e., high manufacturing costs).

Suggested Strategies

At the beginning of this paper, MOT is defined as:

> "…the application of science, engineering and management knowledge for the effective identification, selection, acquisition, development, exploitation, and protection of appropriate technologies (technology strategy formulation) for the production and delivery of goods and services (technology strategy implementation) necessary for the organization to gain competitive advantage and attain desired levels of growth and performance."

The question to ask is whether MOT figured in the success of the enterprises presented in this paper. The obvious answer is 'yes.' All the critical success factors identified above are consistent with the definition of MOT. None of the factors are strictly science, engineering or management knowledge alone. Each one of them – unique vision, optimal utilization of core technology, competitive advantage, and resilience and innovation – are all collective concepts, a blend of tools, techniques, learnings, and practices from all three knowledge areas.

Knowingly or unknowingly, the enterprises included in this research have benefited from MOT, thus their ability to attain high levels of growth and performance. Of course, higher levels of growth and performance could be achieved if a more deliberate MOT strategy is formulated. Below are some suggestions for all MSMEs.

- Formulate a vision that is anchored on the unique characteristics of the enterprise and have a clear understanding of the role of technology in realizing this vision.
- Know your core technology. The starting point in managing technology is to identify the technology and sub-technologies that will become the basis for defining the core business of the enterprise. Knowing your core technology also implies that you have an understanding of the relationship of this technology with other technologies in your company's value chain. Pay particular attention to the technologies for developing technologies.
- Focus on the optimal utilization of your core technology, with the objective of differentiating the enterprise from all others in the industry. Remember to keep track of the path of change your core technology, as well as related technologies, are likely to take. Do not hastily assume that your core technology is mature. Its sub-technologies may be changing, but maturity may only be a sign of the lack of effort in technological innovation.
- Even as you focus on your core technology, be on the lookout for potentially relevant or emerging technologies in other industries. Useful technologies often come from outside an industry, and these can be a source of innovation and competitive advantage for the firm. Promising technologies are those with a major impact on the firm's ability to reduce costs or achieve differentiation.
- Formulate a technology strategy, encompassing all important technologies

that reinforce the firm's overall competitive strategy. This technology strategy should have the following key components, among others: an R&D portfolio, a technology acquisition plan, and a choice between technological leadership or technological followership. Make sure that the technology strategy reinforces the overall corporate strategy and supports business unit strategies.

- Explore partnerships and alliances, particularly those that would introduce new technological skills to the company or complement and strengthen the firm's existing technological capability (hardware, software, and peopleware).

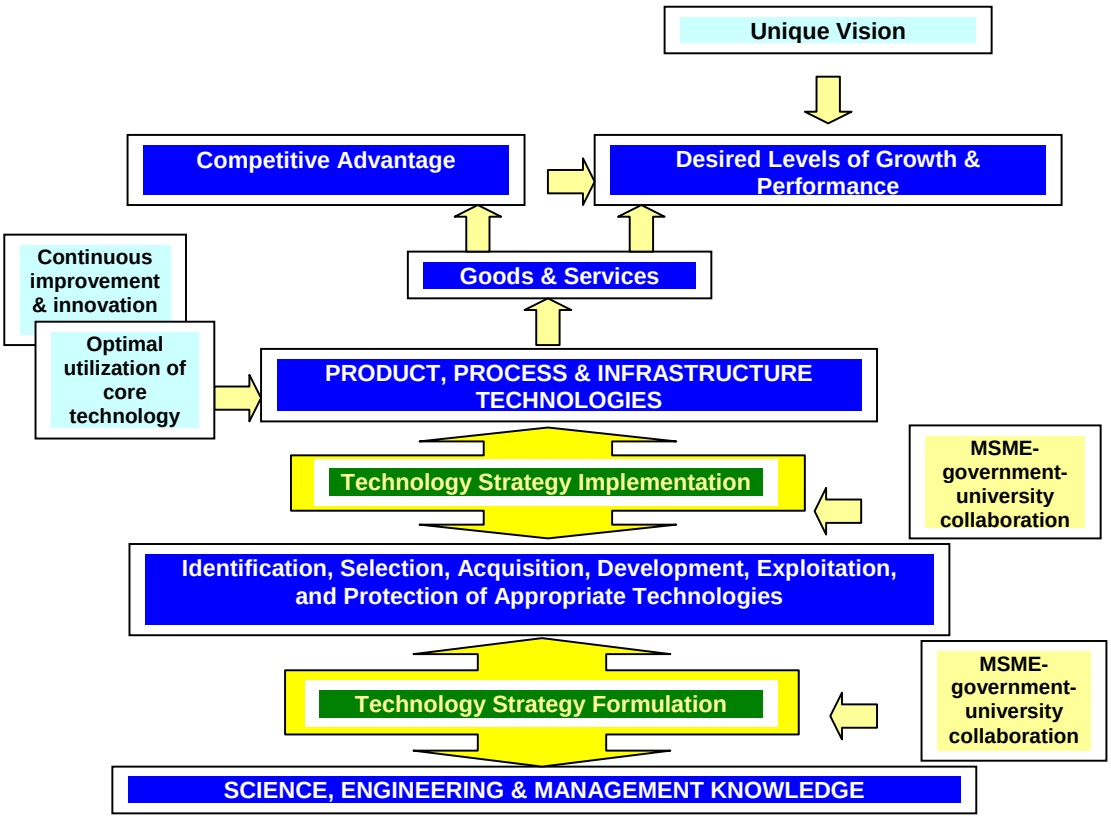
MOT Framework for MSME Success and Sustainability

Success will favor those firms who will learn to manage technology properly. The most likely to survive are:

- Those who correctly recognize the needs of the market and develop product or process technologies that address such needs;
- Those who can perform a proficient technology foresight or forecast and direct resources to such technological path;
- Those who can devote resources to R&D and use them efficiently and effectively;
- Those who can conduct technology intelligence and have the information for faster dissemination than their competitors;
- Those who can build on and perform incremental innovations to existing products or processes in order to exploit unrecognized demand and deliver products to the market before obsolescence and competitors set in; and
- Those who can take advantage of the resources offered by the government, industry and academe, mainly through collaboration.

Incorporating these elements in the general MOT framework presented in Section I produces the modified framework shown in Figure 2, referred to as the MOT framework for MSME success and sustainability.

Figure 2
MOT Framework for MSME Success & Sustainability



VII. RECOMMENDATIONS TO GOVERNMENT

Addressing MOT Problems and Issues of MSMEs

MSMEs do not seem to be thinking about technology management seriously enough. Their interest in MOT is at best lukewarm. Thus, the first step for technology development is building the awareness of technology management at the national, sectoral, and firm levels. The next step is to do the actual management.

Unlike in developed countries, government participation and intervention is still necessary in the Philippines because the MSME sector is relatively weak and unorganized, and market mechanisms are slow to react. However, it must be emphasized that the government should act only as a facilitator.

The proper role of government is to formulate policies that would *stimulate* dynamism and upgrading among MSMEs. These policies should encourage firms to enter new sectors where higher productivity can be achieved. The government should aim to create an environment in which MSMEs can improve competitive advantages in established industries by introducing more sophisticated technology and methods and penetrating more advanced segments,

perhaps supported by SETUP and other similar programs, which have proved to be effective. Government policy should have a direct hand in improving the pool of advanced and specialized human resources, scientific knowledge, economic information, infrastructure, and other factors of production.

The SMED Plan has been an effective instrument for MSME promotion and development. In spite of some significant gaps in implementation, the Plan has been a good framework under which programs and projects for the MSME sector can be organized and executed. However, issues such as adequacy of budget and mandate have to be addressed in order to guarantee effectiveness of the SMED Plan implementation. This is recommended for future versions of the Plan and the corresponding mechanisms.

Collaboration between Government, Universities and Enterprises

Technological cooperation between the government, industry, and the academe is vital in addressing the MOT problems of the country. We can follow the Japanese model for collaboration: the government serves as motivator and facilitator for industry and the universities by building research and innovation centers, and providing scholarships to pursue S&T/R&D careers; the universities provide the brain power and facilities for basic research; and industry provides the commercial impetus as R&D investor, technology developer, manufacturer, and marketer.

In defining the terms of collaboration, it is important to understand the motivations and interests of the key players. The university is primarily interested in doing basic research; industry is mainly interested on return on investment from technologies with commercial value. In order to take advantage of the resources from these two players – brain power from academe and commercial machinery from industry – the government must be able to provide each player with the proper incentives. The government should harness its resources to direct academic research toward commercializable outputs, and to encourage businesses to provide support for university research.

Nevertheless, academe should take the lead in addressing issues directly related to developing skills for technology management. The university houses a multitude of disciplines that are necessary for this job. If the academe is able to maintain its strong linkages with the government and industry, there should be little problem putting together the resources to develop the appropriate MOT educational programs.

VIII. CONCLUSIONS

The Philippines still has a long way to go before it catches up in terms of technological development. Management of technology is a process that requires a change in mindset and outlook. The process of shifting to this strategic mindset starts with the admission that there is need to improve and that effective management of technology is the answer. Unfortunately, not all sectors of the economy would appreciate this reality with the same level of enthusiasm. High-performing enterprises and institutions would most likely rise up to the challenge and move along in accordance with the MOT framework with ease. Sadly, majority of our enterprises and institutions that are rigid and closed to the idea of changing and adapting new paradigms would be unable to follow.

On one hand, much work needs to be done and the pressure remains with the government to create the right environment for effective MOT among all organizations,

MSMEs in particular. The challenge to academe, on the other hand, is to initiate curricular reforms that would address the MOT needs of the Philippines. Meanwhile businesses should be more open to collaboration where immediate monetary benefits may not be apparent.

NOTES

[1] 'IX' stands for two things: first, the Roman numeral nine, which refers to the nine Guiding Principles of Innovatronix, and second, the short name for Tronix.

[2] A *business case* is similar to a business plan, except that the focus of a business case is on a particular solution that is perceived to address a market need. It is a complete documentation which is created prior to the kick off of the product research and development effort. The business case is then communicated to all teams and councils involved in the product R&D process. An indication that the business case was clearly defined is when the flow of work and communication among the innovation, technology, product, program, project, and market management teams is cohesive all throughout, and the solution is warmly accepted by the market during the soft launch.

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