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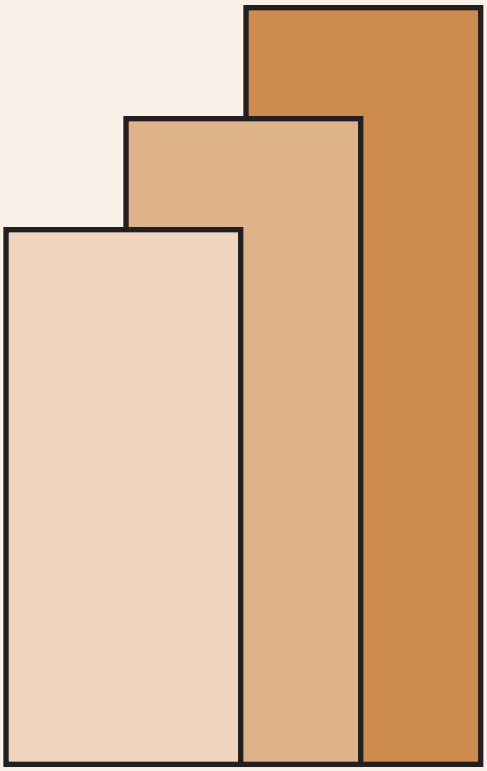

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Technology and Knowledge Transfers in Production Networks: Case Study on Philippine Food Manufacturing Firms[1]

Fatima Lourdes E. del Prado and Maureen Ane D. Rosellon[2]

Abstract

This paper investigates firm-to-firm technology and knowledge sharing in firms from the food manufacturing sector. Traditionally driven by secret recipes and family-grounded procedures, food processing firms are naturally unwilling and indisposed to embrace collaborative undertaking and developing external ties due to perceived risks of leakage of company specific assets. This paper attempts to document the practical experiences of two manufacturing firms and their views on sharing technology and knowledge to their partners in the production network.

Keywords: technology transfer, knowledge transfer, production networks, knowledge sharing, food manufacturing

[1]This case study was written as part of the ERIA Research Project on "Firm-to-firm matching with technology transfers in the local and global economy: findings from Southeast Asia" led by the Japan External Trade Organization (JETRO). This is a slightly modified version of the paper compiled in the project report in March 2015.

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I. Introduction

Innovation is essential to all productive endeavors, but more so in the food manufacturing sectors. In a turbulent and highly competitive global market with fast changing demands for sustainability of production processes, the Philippine food processing sector must continually strive to be innovative in order to be relevant. But food processing firms in the Philippines rarely have the competencies or the capital to innovate on their own. Investments in research and development, technology transfer and upgrading—the widely accepted measures of innovation, have been historically low for food manufacturing industries in the Philippines (Cororaton, 1999; Intal and See, 2008). They need partners who could help them in capital- and knowledge-intensive innovation collaborations, and help them survive in this fast changing environment. However, firms often find it difficult to establish strategic and efficient alliances that would support and foster productive technology transfer and knowledge-sharing. This is particularly difficult in the case of traditional industries like food manufacturing where success is largely driven by secret recipes and family grounded procedures. Forging partnerships and cooperation for innovation and technology transfer create risks for appropriability or leakage of unique and highly specific assets, which effectively deters firms from embracing collaborative arrangements and developing external ties, even though these are seen as viable approaches to business expansion and growth (Dries et al. 2014).

Engaging in production networks, which have become easily the most dominant type of networks in emerging markets, has been known to promote knowledge and technology transfers between partner firms. However, the process and mechanisms through which these are transferred or transmitted to the network, especially in traditional or low technology industries are not detailed in the literature. The practical manifestations of these technical exchanges between firms operating in the food manufacturing sector are scarce and rarely documented.

This paper contributes to the understanding of how food manufacturing firms use their networks to support innovation and technology transfer. It aims to find out what type of technology is transferred, and how it is transferred to and thereafter absorbed by the receiving firm. The study then tries to identify issues and gaps in view of fostering efficient inter-firm relationships through

technology transfer. It also explores the various ways by which benefits are diffused and linkages are forged between or among MNCs, domestic firms, as well as small and medium-sized enterprises.

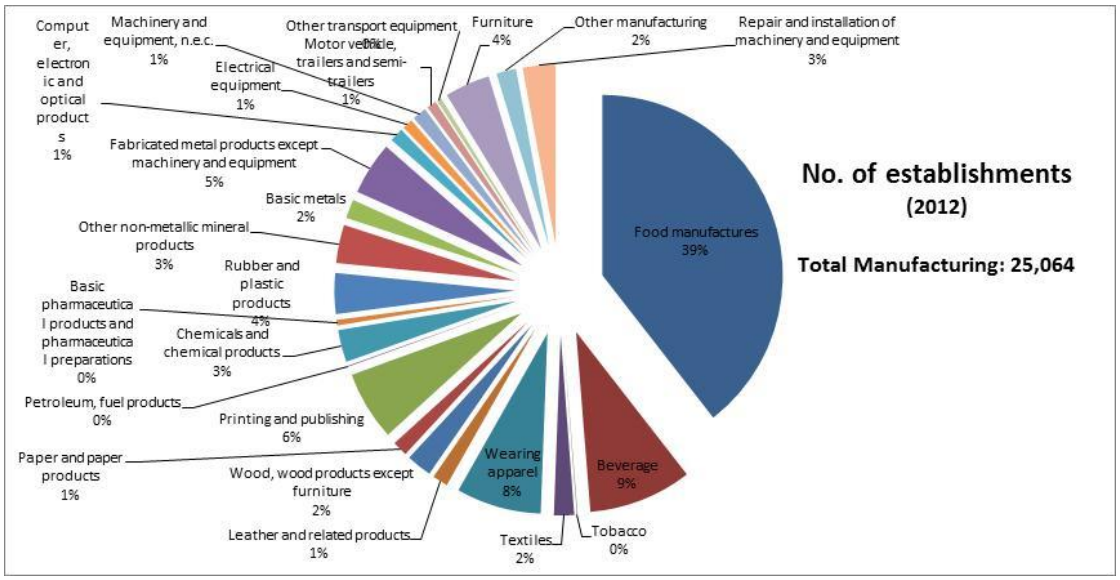
The paper is organized as follows: Section II and III presents a brief background of the food manufacturing industry and overview of technology transfer in the Philippines, respectively. The case study framework and methodology is presented in Section IV, while Section V describes the results and summary of the case studies. Section VI ends and concludes the study.

II. Industry Overview: Food Manufacturing in the Philippines

The food manufacturing industry is the largest subsector of the manufacturing industry in the Philippines (about 39% of total establishments in the manufacturing sector). It is classified under the 'low-technology' subsector because it is considered to be less-capital intensive and more labor/resource-intensive compared to the other subsectors in the manufacturing industry. And while it is considered to be a subsector that has less entry barriers, less skill requirements for workers, and generates huge employment opportunities, the food manufacturing sector as a light industry faces strong competition from lower-cost products from other countries (Batungbacal, 2014). Filipino consumers are also known to have preference for imported products which they perceive to be of good quality and innovative but still appeal to their taste. Hence, it is important for the industry to work towards more efficient production and operations in order to be competitive.

Food manufacturing sector composes 39% of establishments in the manufacturing industry or 9,891 out of 25,064 total establishments in 2012 (Figure 1). The sector is followed by beverage (9%) and wearing apparel (8%). Of the food manufacturing establishments about 95% are SMEs. In this industry, the large local (Filipino) players include San Miguel Corporation and Universal Robina Corporation, and Monde Nissin Corporation. On the other hand, top foreign players are Nestle, Dole and Del Monte. Table 1 presents top food manufacturers in the Philippines based on gross revenues (from data published in 2012).

Figure 1: Distribution of manufacturing establishments in the Philippines (2012)



Source: Philippine Statistics Authority (PSA)

Table 1. Top Food Manufacturers in the Philippines

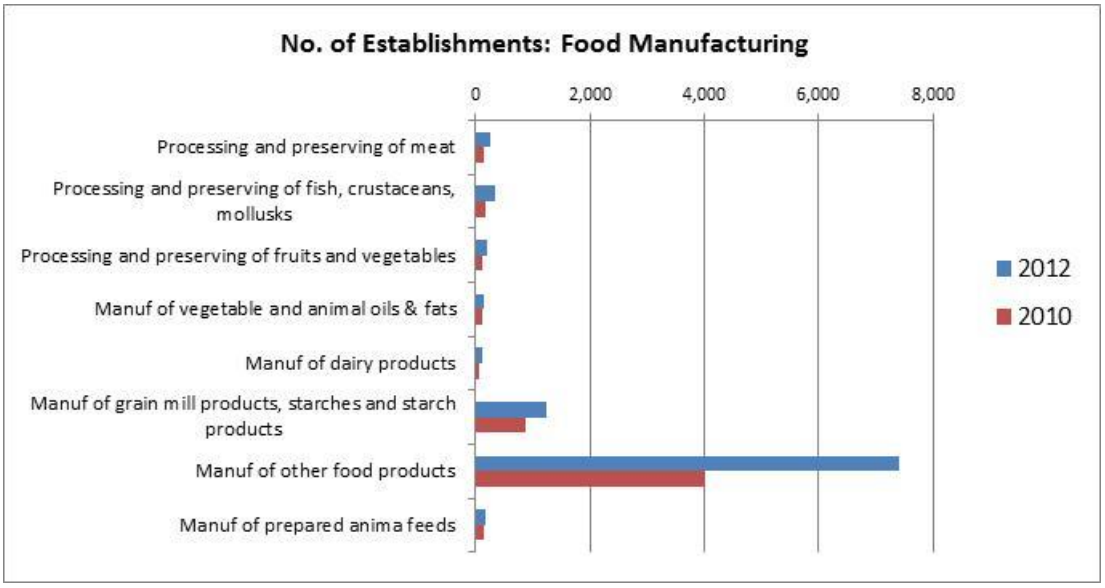
Rank	Company	Gross Revenues (in million USD)	Main Products
8	Nestle Philippines	2,404	powdered/liquid milk, food and cooking aids, breakfast cereals
24	Universal Robina	1,178	snack products (corn, curls, wheat crunchies, etc.)
46	Dole Philippines, Inc.	694	fruits and fruit juices
48	Monde Nissin Corp.	690	macaroni, noodles and other farinaceous products
91	Del Monte Philippines, Inc.	415	fruits and fruit juices
143	Pilmico Foods Corp.	291	flour except cassava flour
144	Purefoods-Hormel Company, Inc.	289	meat and meat products
147	Alaska Milk Corp.	283	powedered, condensed, evaporated milk
161	Kraft Foods (Philippines), Inc.	263	butter, cheese and curd
178	General Milling Corp.	237	flour except cassava flour
181	Philippine Foremost Milling	236	flour except cassava flour
198	San Miguel Mills, Inc.	215	flour except cassava flour
202	Nutri-Asia, Inc.	208	fruit and vegetable sauces and paste

Note: Ranking based on Business World's Top 1000 Corporations in the Philippines, 2012 edition

Source: Lifted from Singian, M.R.C. (2014), p.2.

Figure 2 presents the different food manufacturing subsectors based on the Philippine Standard Industrial Classification (PSIC). The data indicate that manufacture of other food products has the highest number of establishments (7,407) followed by manufacture of grain mill and starch products (1,237).

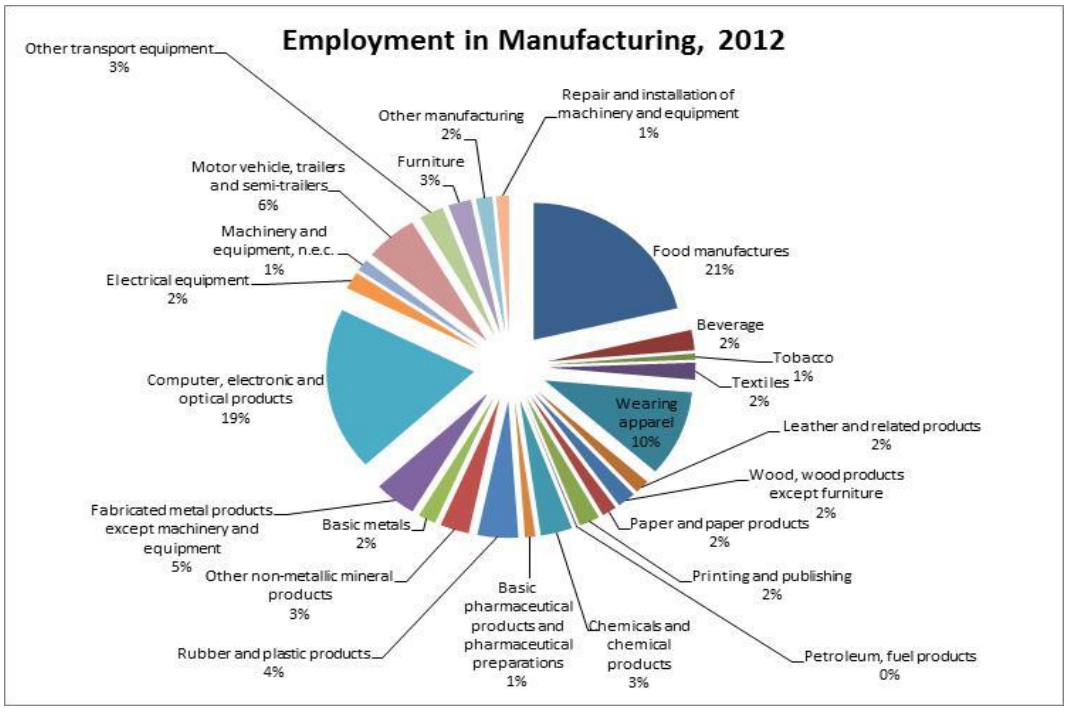
Figure 2: Distribution of establishments in the Philippine food manufacturing sector (2010, 2012)



Source: Philippine Statistics Authority (PSA)

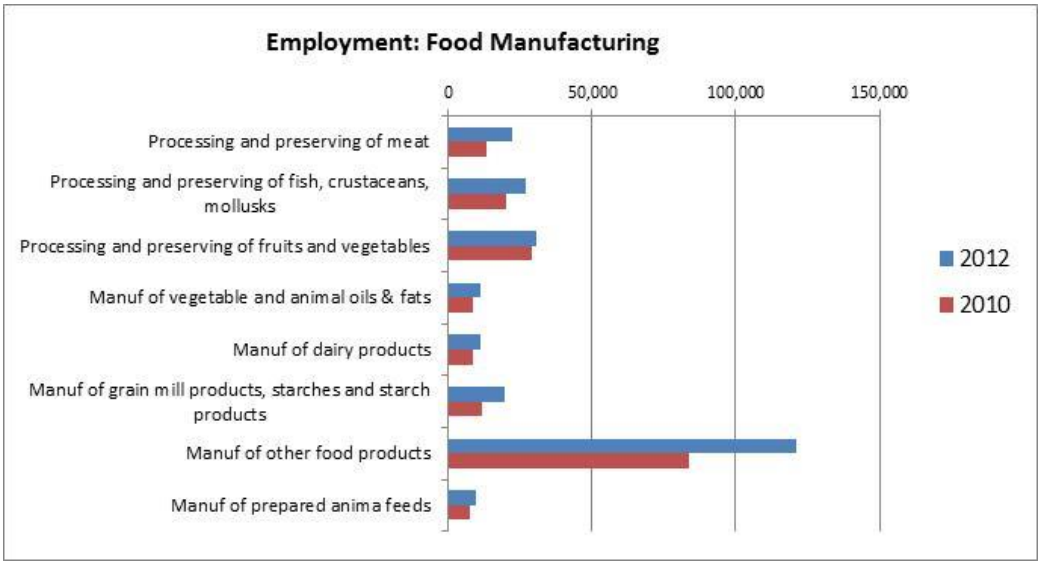
In terms of employment, the Food manufacturing hires the most number of workers with 21 percent of total employment in the manufacturing industry (followed by computer, electronic and optical products, 19 percent [Figure 3]). Meanwhile, under this sector, the subsector on manufacture of other food products has the highest employment followed by processing and preserving of fruits and vegetables (120,963 and 30,670 workers, respectively [Figure 4]).

Figure 3: Percent distribution of employment in Philippine manufacturing, 2012



Source: Philippine Statistics Authority (PSA)

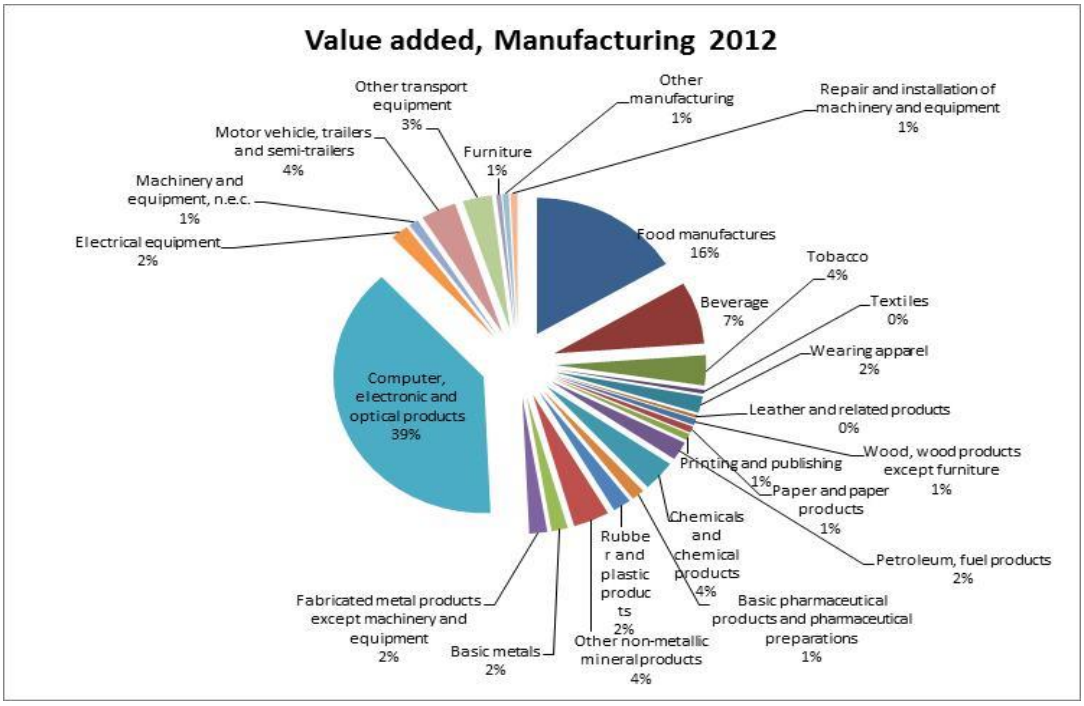
Figure 4: Distribution of employment in Philippine food manufacturing (2010, 2012)



Source: Philippine Statistics Authority (PSA)

The Food manufacturing sector composes 16% of the value added in manufacturing – second to computer, electronic and optical products (39%) [Figure 5]. Under Food Manufacturing sector, the subsector on manufacture of other food products is followed by manufacture of dairy products in terms of value added. A decrease in value added was recorded in fish processing/preserving and manufacture of prepared animal feeds; on the other hand, manufacture of vegetable and animal oils and grain mill/starch products had more than 30% growth in 2010-2012 (Figures 6).

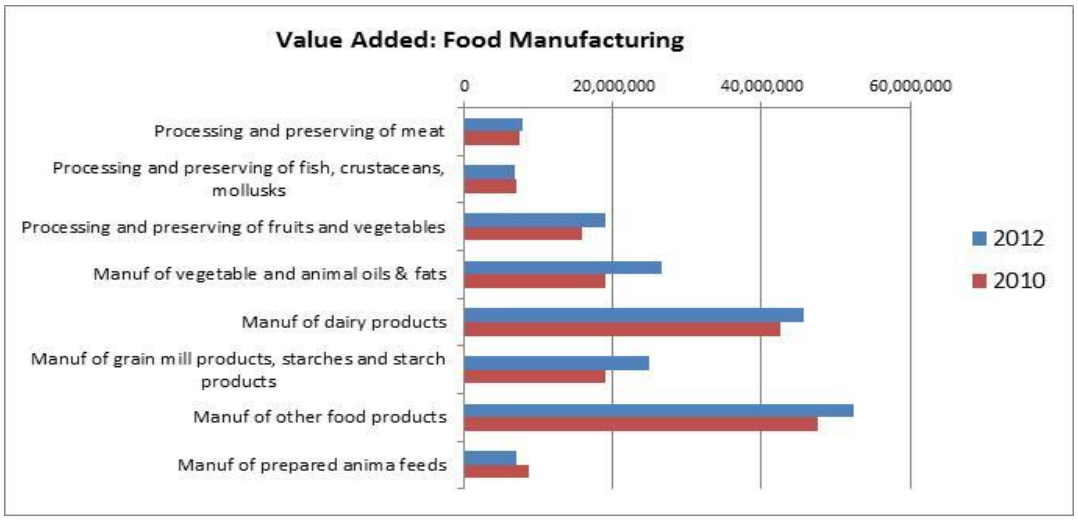
Figure 5: Percent contribution to industry value added by sectors in Philippine manufacturing, 2012



Source: Philippine Statistics Authority (PSA)

Note: Value in thousand pesos

Figure 6: Contribution to industry value added by subsectors in Philippine food manufacturing (2010, 2012)

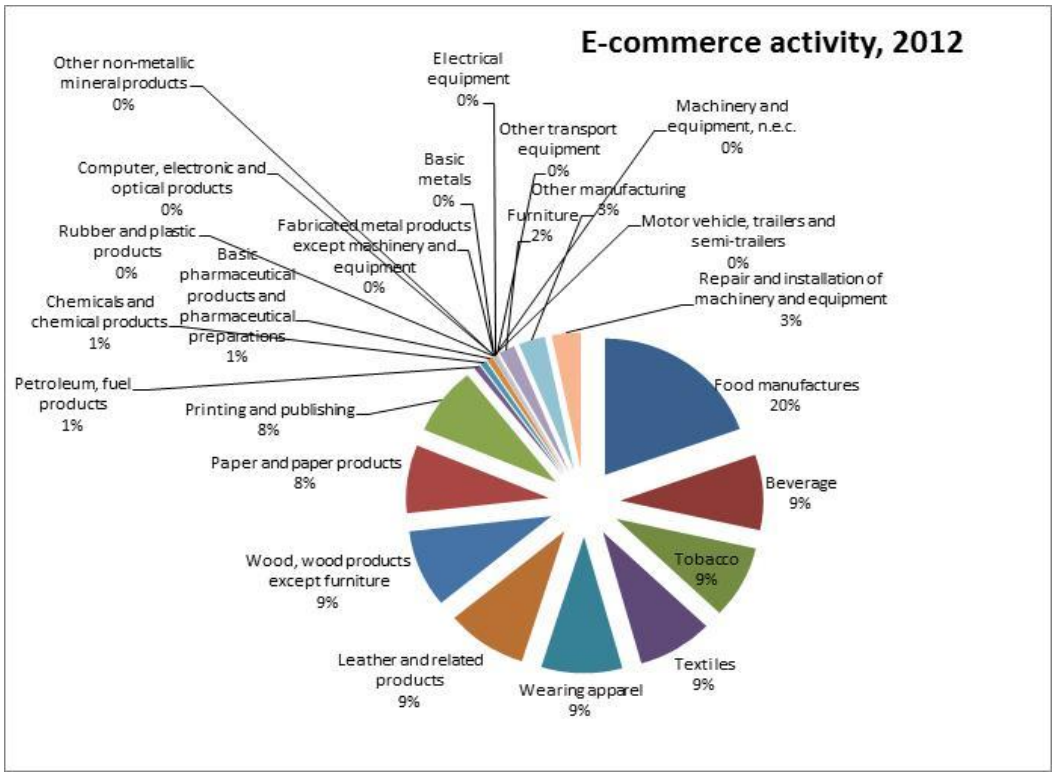


Source: Philippine Statistics Authority (PSA)

Note: Value in thousand pesos

The Philippine Statistics Authority collects data on e-commerce activity. The e-commerce statistics in Figure 7 refers to the selling of products or services over electronic systems such as Internet Protocol-based and other computer networks, Electronic Data Interchange (EDI) network, or other online system. The data in 2012 indicate that Food manufacturing was the top sector that engaged in e-commerce activity in terms of value (20%).

Figure 7: E-commerce activity in the Philippine manufacturing sector, 2012



Source: Philippine Statistics Authority (PSA)

Note: Value in thousand pesos. Economic activity refers to the selling of products or services over electronic systems such as Internet Protocol-based and other computer networks, Electronic Data Interchange (EDI) network, or other online system

III. Technology Transfers in the Philippines

Overview of technology transfer regulations[3]

The Philippines' more formal policy tenets on technology transfer had its roots from the American regime during the 1940s with the introduction of the intellectual property (IP) rights. During this time, the Philippines was under the American occupation and all rules and regulations in the Philippines including those related to IP were promulgated essentially to protect the technologies that Americans brought to the Philippines particularly in the food and cosmetics manufacturing

[3] Draws heavily from Tansinin (2005)

sector. Included in this set of regulations were policies that created the Philippine Patent Office in 1947; the act relating to registration and protection of trademarks; utility model; and Presidential Decree (PD) No. 721 which further expanded the Philippine Patent Office and other pertinent laws, i.e. Republic Acts 165 and 166.

Prior to the various policies and issuances on technology transfer that came into force in the last two decades, the activity was not regulated and the Board of Investments (BOI) and Central Bank were only screening and monitoring the foreign exchange remittances of BOI-registered industries. However, because of the need to protect and control the foreign exchange outflows from these industries, technologies that were transferred to the Philippines must likewise be screened and evaluated. This necessitated the issuance of guidelines that would assess "(i) whether the royalties paid in foreign exchange was commensurate with the technologies brought into the Philippines and (ii) whether the patented technology was still within its patent life-time".[4] All industries were subsequently required to register Technology Transfer Agreements (TTA) in accordance with the BOI and Central Bank policy guidelines, which were later modified by the new Implementing Rules and Regulations (IRR) to conform to the country's IP Code (see Tansinin 2005 for details).

The Technology Transfer Regulations Office (TTRO) under the Intellectual Property Office of the Philippines (IPOPHIL), exercises jurisdiction over the parties in an agreement and a foreign-owned company covering new or renewal of licensing. Tansinin (2005) reported that Technology Licensing Agreements (TLA) which may cover manufacture of a product, application of a process, render of a service, licensing of a software or any forms of industrial property rights, may provide either (i) royalty payments in whatever currency or (ii) royalty-free contracts. The registration of licensing agreements although voluntary or involuntary as per the IP Code provisions, should be done by both parties for their mutual protection. Currently, most sectors, particularly those in the manufacturing, actively follow and advocate the IP Code, IPR and LTA.

[4] ibid

Technical assistance by the government[5]

Technology may be acquired directly and indirectly and from various sources. In addition to vertically linked firms (suppliers and customers) and knowledge pools (e.g., trade fairs, technology fairs and roadshows), firms particularly the small and medium enterprises (SMEs) in the Philippines may avail of the following technical assistance from the government:

(i) Department of Science and Technology - Small Enterprises Technology Upgrading Programme (DOST SETUP) which aims to encourage and assist SMEs to implement technological innovations and improvements in their business operations in order to upgrade their productivity and improve competitiveness.

(ii) APEC Centre for Technology Exchange and Training for Small and Medium Enterprises (ACTETSME) which was initiated by the Philippine government to harness the resources of APEC member economies to support the growth and sustainability of SMEs in the region. The program, which is managed by the College of Economics and Management of the University of the Philippines in Los Banos, aims to promote and facilitate technology exchange and training among SMEs in the APEC region through the provision of timely and relevant information to individual firms and SMEs via the ACTETSME website.

IV. Case Study Framework and Methodology

On a micro-level (business model), technology transfer may be generally defined as "a transaction or a process through which technological knowhow is transferred normally between businesses or agencies representing businesses", with the transaction or collaboration taking place "because both the parties (the supplier and the acquirer) perceive gains" (Bennett, 2002). Technology, defined by UNIDO as "a system of knowledge, techniques, skills, expertise and organization used to produce, commercialize and utilize goods and services that satisfy economic and social demands", can be transferred in the form of expertise, training and software or embodied in purchased equipment (Bennett, 2002). Ramanathan (2000, as cited by Ramanathan, 2008) pointed out that different

[5] Draws heavily from Aragon et al (2004)

modalities of technology transfer have become available, with the variation depending on the attributes and intended use of the technology and motivation of the transfer, and not limited to procurement of equipment or licensing. Technological knowledge has also been classified as 'explicit' and 'tacit'. Explicit knowledge can be transferred and acquired from a combination of written instructions, design drawings and prototypes. On the other hand, tacit knowledge cannot be readily acquired because it is "embodied in the skills and knowledge of persons in an organization", thereby requiring "closer and long term collaboration between partners" (Ramanathan, 2008).

Several studies have also provided different definitions and facets of technology transfer, such as: relocation and exchange of personnel; movement of a specific set of capabilities; movement of technology from the laboratory to industry, developed to developing countries, from one application to another; application of information into use; movement of knowledge, skill, organization, values and capital from the point of generation to the site of adaptation and application. In addition, researchers have characterized technology transfer as vertical and horizontal. In a vertical transfer, technology is transferred from research to development to production; in a horizontal transfer, an established technology is transferred from one place, organization or context, to another (based on review of literature in Ramanathan, 2008).

Small and medium enterprises (SMEs) have started utilizing technology transfer as a strategy to cope with the challenges of globalization (Mayer and Blaas, 2002, as cited by Ramanathan, 2008). Their resource constraint could not support the creation of an internal R&D; hence, technology transfer has become a venue for the flow of new technology which they need to be able to compete in the global market.

Multi-national companies (MNCs), on the other hand, have been the subject of research on technology and knowledge transfers to local firms, especially in less developed countries. The forward and backward linkages with local firms are one of the key channels through which MNCs (as foreign direct investments) generate knowledge spillovers to the host country. The positive effects include higher efficiency among local firms brought about by the expansion of demand for local inputs. In addition, MNCs also voluntarily transfer "important knowledge assets in their

efforts to increase the efficiency of their local suppliers (and to obtain access to local competencies on a reciprocity basis)" (Saliola and Zanfei, 2007).

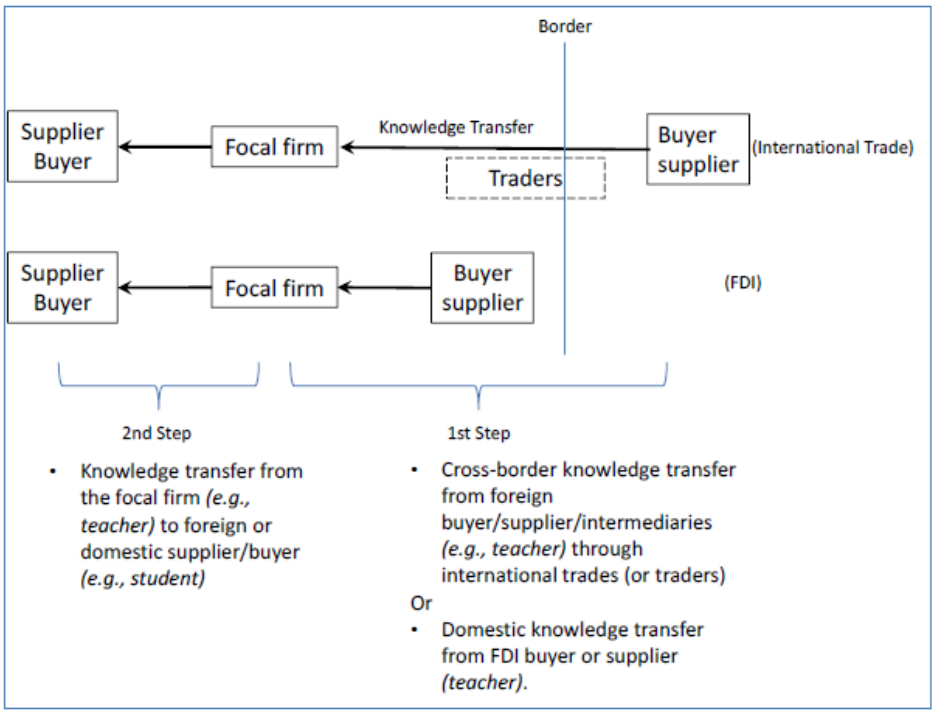
The interaction between international and local firms is evident in a global production network (GPN). GPNs link together an international company's subsidiaries, affiliates and joint ventures with its subcontractors, suppliers, service providers and strategic alliances/partners. In such a setting, technology and knowledge transfer can be accomplished through different mechanisms (Ernst and Kim, 2002). Formal mechanisms include FDI, foreign licensing and technical consultancies where the knowledge transfer is with local firms/suppliers that are subsidiaries or joint-venture. An informal mechanism is through original equipment manufacturing (OEM) arrangements, where the knowledge transfer to an independent local supplier (mostly free of charge) is in the form of blueprints, technical literature, production specifications and technical assistance, to ensure that the supplier meets the specifications of the buying firm. Other mechanisms illustrate implicit technology and knowledge transfer, for instance, when independent local firms/suppliers invest in process innovation (e.g. purchase of sophisticated machinery) to be capable of meeting the needs of their buyers/customers. Other means by which firms upgrade their production capabilities include the use of reverse engineering, observations and human mobility (e.g. tour of foreign firms, repatriation of top engineers trained abroad, hiring of foreign personnel even for short periods). These improvements in production capabilities allow the supplier firms to provide their customers with competitive products and services (Ernst and Kim, 2002).

With reference to the information and concepts from the literature discussed above, this case study uses the diagram in Figure 8 in examining technology and knowledge transfers. The border in the diagram indicates that the study looks at both domestic and international knowledge transfers via buyers (customers/clients) and suppliers.

The first step in this framework is to examine the technology/knowledge transfer to the focal firm from (1) a buyer or supplier from abroad (cross-border), which can be via a trader and (2) an MNC/foreign buyer or supplier located in the domestic market. The second step looks at technology/knowledge transfer from the focal firm to the supplier or buyer (locally- or foreign-owned) in the domestic market.

In both steps, the study examines knowledge transfer in terms of: the characteristics of the focal firm and its partners that receive the knowledge (firm-to-firm matching); what type of knowledge is transferred (skills, knowhow, etc.); how the knowledge is transferred and absorbed (e.g. training, coaching, etc.); issues and gaps; and the benefits of knowledge transfer.

Figure 8: Technology/knowledge transfer mapping[6]



This research involves the interview of 2 focal firms: one small enterprise and one large enterprise. The interview used a semi-structured survey instrument that contains questions on a simple profile of the firm, the relationship of the focal firm with its partners in the production network (buyer, supplier), their experience on knowledge transfer with these partners, and the perceived benefits of such transfers. The interview results were analyzed following the framework presented above.

[6] This diagram is taken from the project's terms of reference.

V. Case Study Results

A. Profile of Case Study Firms

Table 2 presents a short profile of the firms that were interviewed for this case study.

Table 2: Profile of interviewed firms

Firm A	Firm B
- Manufactures fruit purees and concentrates (raw material for other food companies) - fruits processed: mango, guava, soursop (guyabano), etc.; also processed red beans (export to Japan) - Locally-owned - Large enterprise - Established in 1984 - 500 employees (regular and contractual) - Market: 15% of production for local; 85% for export - Export destination: Hong Kong, China, Japan, Korea, US, EU, ASEAN (Thailand, Singapore, Malaysia), Australia, New Zealand	- Manufactures fruit juices (ready to drink), concentrates, purees and frozen extracts (packaging: PET bottle, PE bag) - fruits processed: Philippine lemon (calamansi), Philippine orange (dalandan), mango, soursop, and mangosteen (for products with added flavoring) - Locally owned - Small enterprise - Established in 1998 - 20 employees (regular and contractual) - Market: 40% of production for local; 60% for export - Export destination: US, Canada, UAE, Pacific Islands (Guam, Hawaii), Korea

B. Technology/knowledge Transfer Diagrams

This section illustrates through diagrams and discusses the technology and knowledge transfers experienced by the three firms as the focal firm.

Firm A: Fruit Processor (Large firm)

Firms A is a wholly owned Filipino company established in 1984 and currently operating in an economic zone and employs 500 employees. Of which, 102 are regular employees while about 400 work on a contractual basis. The firm manufactures processed fruits for local and international markets. Although all of its 15 local clients belong to the Philippine's Top 7000 corporations

including popular fast food chains, processed food conglomerates in the country, the firm caters purely to international markets in ASEAN in particular Thailand, Singapore and Malaysia as well as countries such as Australia, New Zealand, Hong Kong, China, Japan, Korea, US and EU.

The company's main products are tropical fruit purees and concentrates, i.e. mango puree and concentrates, guava puree, soursop and other tropical fruit purees, as well as processed red beans which are being exported to Japan. Through its state-of-the-art manufacturing facility, the company was among the first fruit processing firms with the capability to process a wide range of tropical fruit purees. It is also one of the first to introduce Individual Quick Freeze (IQF) products and tropical fruits solids in the country. These product innovations were launched 5 years ago, but were made commercially available only in 2014. The firm is predominantly export oriented with only about 15% of the firm's total outputs sold to local customers.

Relationship with Customer

The company has a long list of clients across the region, most of which were obtained through referrals (word of mouth), online (suppliers learned about them through the company website) and through participation in food fairs. It was able to establish long-term partnerships with many of its clients, the longest according to the interviewee is 10 years (a Korean firm) although a separate source claimed it has a long-held business relations with a Japanese firm for over 20 years.

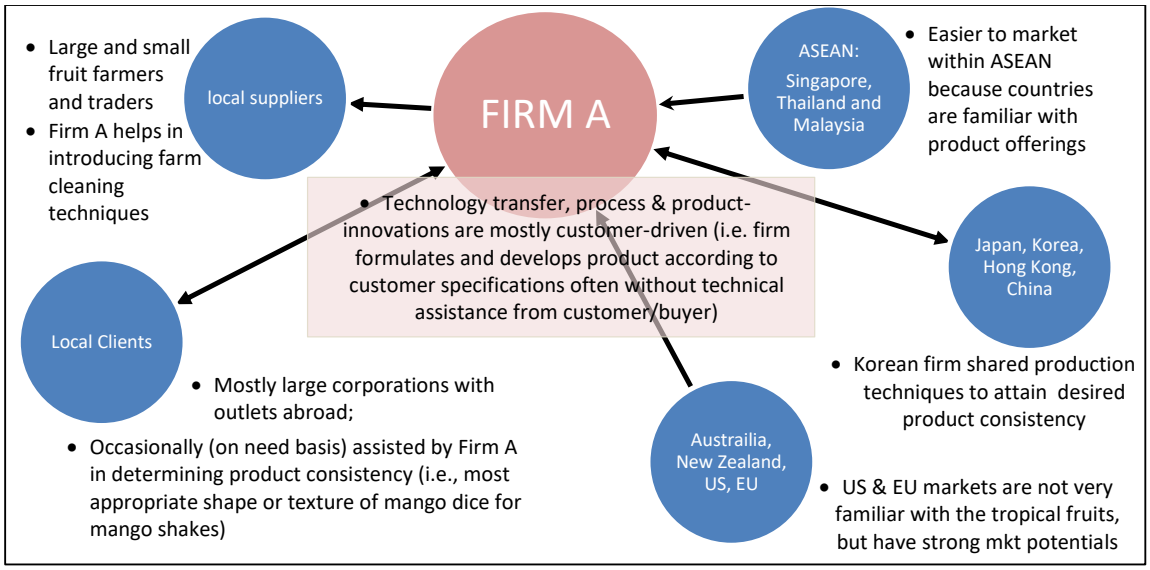
According to the interviewee, the company's competitively-priced products have helped keep and maintain these partnerships with their clients. Most of which, particularly the Korean firm, has sustained and at times even exceeded their regular orders of 200 tons per year. Business exchanges with customers generally involved client product formulation, client process parameters and new product development.

Production and technology/knowledge sharing

Production and technical/technology knowledge sharing is not obvious; production techniques are hardly shared and innovation strategies are kept confidential. As indicated in Figure 9, product and

process innovations are mostly customer-driven, i.e. the company formulates or develops products upon the request and specifications of the customer. Typically, the customers provide the brix or customer taste profile to Firm A, who will then work on the request order until the desired specifications are achieved sans customer technical support. While the set-up is far from ideal, this was interpreted by the interviewee as one way of determining the firm's capability to meet customer demand. The interviewee also cites some cases wherein the clients themselves (e.g. client from Korea) shared production techniques in order to attain the desired product consistency.

Figure 9: Technology/knowledge transfer, Firm A



Moreover, while the contracting parties may send agents to their partner's offices/plants, these are not meant to share technical ideas, but to discuss price or contract negotiations. A more meaningful exchange is likely to happen with local partners (Figure 9), since Firm A has been reported to provide, on need basis, technical support to their local partners particularly in terms of determining the most appropriate product variants

Process and product innovation

To remain competitive, the firm is strongly motivated to comply with the relevant international or global standards certifications. The process requires yearly quality audit and periodic (every 3

years) quality and safety accreditation requests. As a business practice, customers with global brands deploy representatives from their respective audit departments to their suppliers and Firm A is no exception.

Every year, the firm is subjected to quality audits from their clients. Different clients have different quality audit requirements. This is on top of the internationally accepted certifications, like Halal, Kosher and ISO. The firm absorbs all the costs related to these safety and standards accreditations. Firm A has adopted the following quality assurance and safety standards: SGS/ISO 22000: 2005 Certified, 5S, Kosher certification, USFDA accreditation, Halal, HACCP and GMP certifications.

Firm B: Fruit Processor (Small firm)

Firm B is a Filipino-owned, fruit processing company established in 1998. It is a small enterprise with 25 employees (regular and contractual). It manufactures fruit juices (ready to drink), concentrates, and purees and frozen extracts (in PET bottle and PE bag). Fruits that are process include: Philippine lemon (calamansi), Philippine orange (dalandan), mango, soursop and mangosteen (for products with added flavoring). Firm B exports around 60% of its production to the US, Canada, UAE, Pacific Islands (Guam, Hawaii), Korea; and sells 40% to the local market.

Relationship with Supplier

Local supplier (LS-B) is a machine supplier/fabricator that Firm B has been transacting with for over 10 years. Some of the machines that Firm B has purchased include a double jacketed kettle, heat exchanger, and pump, among others. These are machines/technologies used in large companies but the fabricated machines supplied by LS-B operate on a smaller scale. The relationship or contract with LS-B is 'by demand', i.e. they transact whenever Firm B needs a machine or requires repair of a machine that was purchased from LS-B. The contract for machine purchase is short-term, about 30 days in particular, which is approximately the time it takes LS-B to produce/fabricate the machine.

According to Firm B, there was another machine supplier that was referred to him, that produced 'better looking' products but were more expensive than those produced by LS-B. Firm B chose to buy from LS-B because the machines are cheaper but provide the same results.

LS-B was referred to Firm B by the Industrial Technology Development Institute (ITDI) under the Department of Science and Technology (DOST) of the Philippines.[7] The owner-manager of LS-B was a former employee (engineer) of ITDI who set up his own small machine fabricating shop after retirement. The owner/manager of Firm B sees the LS-B's owner as a skilled and smart fellow who is very much knowledgeable about food processing machines, given his experience at ITDI and his many works at the fabricating shop. Firm B shares that LS-B would know what the mechanisms are in a machine, how to fabricate it and how much it would cost just by looking at a picture of a prototype and what its functions are.

Technology and knowledge transfer

Figure 10 presents a diagram on the technology and knowledge transfer between Firm B and the local supplier LS-B. The arrows at both ends of the line that is connecting Firm B and LS-B indicate that the transfer is two-sided, i.e. there is an exchange of knowledge.

For Firm B, knowledge transfer to LS-B is illustrated by the information that it shares in terms of what new machineries or equipment are being used or offered by suppliers in the food processing industry. When Firm B decides to upgrade its machines, it contacts LS-B. Firm B usually gets ideas on improving its production process (machines or equipment) from the trade shows where new technologies in machineries are showcased.

On the other hand, LS-B transfers knowledge by sharing its expertise on producing food processing machines. While Firm B provides the parameters for the machine, LS-B proposes on what mechanisms can be incorporated into the machine (without providing details that are too technical) and how much the machine would cost. Likewise, LS-B informs Firm B on what is feasible and

[7] Firm B's machine suppliers are all referred by ITDI. ITDI helps the Firm B in plant lay-out and product development and introduces/provides machine suppliers to contact.

not feasible. The owner of LS-B uses its technical background as a mechanical engineer and experience with other clients in providing inputs to Firm B. LS-B also gives suggestions on the design of the machine, what other machines have been designed by the DOST or offered in the market, and other production process upgrading (e.g. shortening production time by use of a boiler).

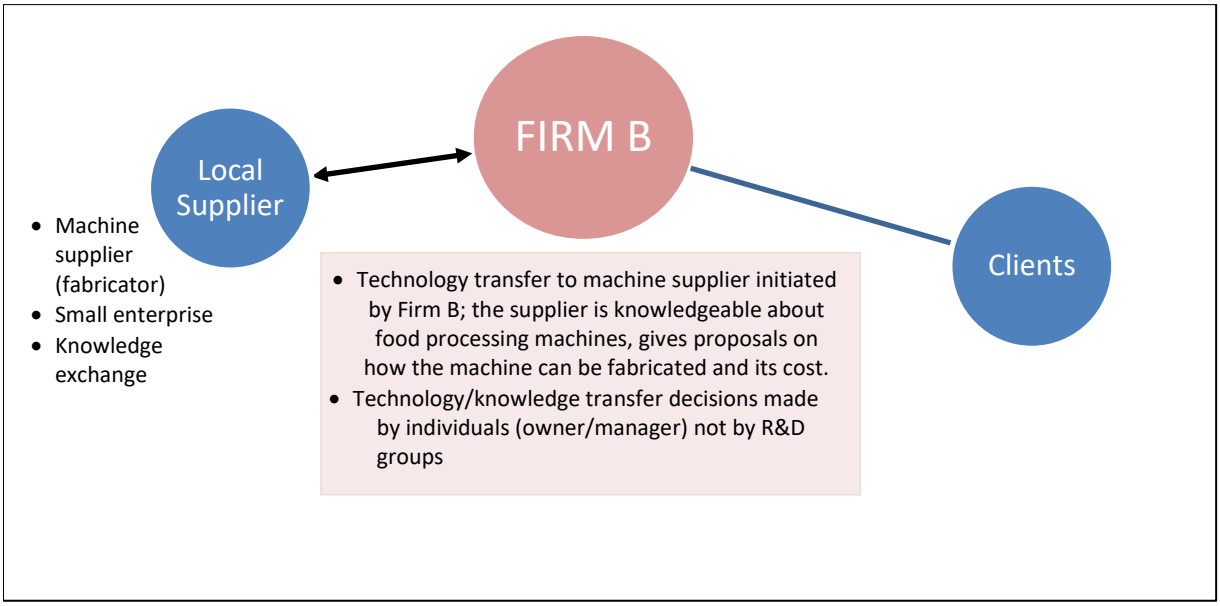
Another form of knowledge transfer is the training of machine operators. Plant visits involve teaching/coaching the operator of the purchased machine. Oftentimes, the LS-B owner together with a staff delivers the machine to Firm B and demonstrates how the machine is operated and what should be done in basic troubleshooting. The coaching also involves teaching on safety precautions. Thereafter, as part of after-sales service, the staff of LS-B visits Firm B when there are problems with the machine. Expenses for transportation are paid by LS-B, but are minimal because both firms are located in Metro Manila. There are also no charges on the repair/service unless the damage was the client's fault (not machine defect). Firm B shares that one downside of having a machine fabricator as a supplier is that almost all parts/components of the fabricated machine are also fabricated, i.e. no similar parts can be found in the market. Hence, only the LS-B staff can repair and reproduce parts of LS-B fabricated machines.

Firm B relates that it has other machine suppliers, and they are also small enterprises. It is common in Firm B's transactions that the machine suppliers (machine fabricators) share specifications of materials (e.g. high grade materials) that can be used in producing the machine/equipment. Firm B also gives suggestions on ways that the quality of the machines' output can be improved, based on its first-hand experience in using food processing machines. Firm B and its other machine suppliers also share ideas on the cost implications of producing the machine that would yield the desired results. As in LS-B, Firm B's other suppliers also send technical personnel to their plant/facility that provides coaching on machine operation (start and shut down), standard sanitation and care, as well as the design and installation of a maintenance calendar for the next 12 months.

Transaction with suppliers improved Firm B's awareness and developed its appreciation of trends and developments in food processing, especially citrus fruits. The suppliers also happen to be

contractors of other companies, including the leaders in the same industry. Firm B continues to procure machines from local producers/fabricators, because rather than buying machinery from Japan or EU, the firm is able to save on costs and use it for other necessary expenses such as raw materials, packaging, operating expenses, and others.

Figure 10: Technology/knowledge transfer, Firm B



C. Summary of Case Studies

Table 3 presents a summary of the interview with the case study firms. The summary for each case study firm includes a description of their partner in technology/knowledge transfer, the type of technology/knowledge transferred and how it is transferred and absorbed, and the benefits of technology/knowledge transfer.

Table 3: Summary of interviews with case study firms

	Firm A	Firm B

Partner in technology/knowledge transfer	- Customers are large companies located domestically and internationally, length of relationship 10-20 years - Sells to a few small local customers but only as a way of support (they order in small amount)	- Machine supplier is a small enterprise producing small scale machines. Firm B is a small enterprise and would not fully utilize big machines
Type of technology/knowledge shared	- Production/process techniques not shared; Firm is presented with samples coming from the customers	- Machine parameters; Firm sharing of specific details not too restricted, Firm trusts supplier who was formerly employed in the ITDI-DOST. The plant set-up was designed with the help of ITDI. Although, there are specific mechanisms (technical) in the machine that are not anymore shared with the Firm
How is technology/knowledge shared	- With local customers it is more of an exchange/two-sided; Firm more familiar with local taste -- Customer's executives and/or R&D personnel visit the plant but involves presentation of samples and price/contract negotiation, with the Firm sharing some ideas on the product development (for the	- With local supplier: two-sided transfer (exchange of ideas) - Products are more commercial (compared to Firm A); Firm focuses on introducing its product to the market under its brand and introducing product variants. In this regard, sharing of

	consumer) but without providing technical details - With international customers, transfer is one-sided, i.e. knowledge transfer comes from the customer -- Customer's executives and/or R&D personnel visit the plant, and vice-versa, but mostly involves presentation of samples and price/contract negotiation	knowledge and new technology with the machine supplier becomes important to be able to get the targeted results. - Plant visits involve teaching/coaching the operator of the purchased machine (including safety); after-sales service
How is technology/knowledge absorbed	- Based on order specifications by the customer, Firm will do some adjustments in their production process if needed	- With the machine supplier, knowledge acquired is tied to the purchased machine and cannot be used for other equipment in the production line
Benefits of technology/knowledge transfer	- With local customer: Firm and customer become partners in cost-effective measures, and offering better products to the end consumer - With foreign customer: Firm learns about the taste preferences of consumers in the country where customer is from; Firm's production process is upgraded as it caters to the need of the customer	- With local supplier: the continuous exchange of knowledge had brought about good partnership in developing the Firm's production process - Trust built; what the Firm asks, the supplier delivers; Firm understands if demands are not feasible

VI. Summary and Conclusion

Based on findings this case study, the authors present the following insights as well as possible policy implications and lessons for more efficient inter-firm relationships in production networks through technology transfer.

- Technology/knowledge transfer in the case firms is customer-driven/initiated. The company formulates or develops products upon the request and specifications of the customer. Transfer happens only when there are business transactions/product orders.

- Technology/technical knowledge sharing is not obvious; it is hidden in the transactions wherein the customer sets product specifications to the supplier. It depends on how the receiver of the knowledge recognizes, absorbs/learns and utilizes it.

  This was illustrated in the case of Firm A which had introduced adjustments in the production line to meet the product requirement of its foreign customers. This knowledge transfer has made the firm knowledgeable about the taste preferences of the foreign end-consumers. In addition, this has allowed the firm to upgrade its production system.

- The type of technology/knowledge that is transferred or shared is not technical in nature. The knowledge seems to be more on what new products/product improvements are there or will be introduced. To be able to transact, a supplier is assumed to have the technological knowledge or expertise to meet the customer's demand/requirements.

  In a sense, a company will transact (will match) with another company whose level of technology/knowledge meets the level that is expected. And for as long as the expectations are met, or the supplier can keep up or show its potential, the business relationship will continue.

  For small establishments such as Firm B, (continuous) technical support from the government (e.g. ITDI) as well as the industry associations will help them improve on their technological capability level and gradually catch up with new technologies.

- It is possible that more knowledge, albeit not highly technical knowledge, can be shared when the customer and supplier have built long and trusted relationship. This is illustrated

by the case of Firm A wherein its Korean customer for almost 10 years shared some technical specifications of a product they require – a knowledge transfer that is not common in Firm A's transactions with local and foreign customers. Likewise for Firm B, its business relationship of over 10 years with a machine supplier resulted in an efficient exchange of technical knowledge by both parties. Keeping up with new technologies by upgrading not only machinery but skills and capability will contribute to long business relationships.

- The case study results indicated that the motivation for the knowledge transfer was the objective of producing a certain product or improving a process. On the side of the customer/client, the transfer is expected to provide the supplier with relevant knowledge and information that will produce the desired result (product), minimize the risk and make the transaction successful. On the side of the supplier, knowledge transfer from the client controls for possible risks/costs involved in developing and producing the product/process. In addition, under such setting/arrangement, the supplier modifies/adjusts its production system to meet the customer's needs, resulting in enhanced technological capacity building and upgrading.
- In the Philippines, there is great potential for businesses to share knowledge and upgrade the capability of local firms. The transfer can be from a big foreign company to a big local company (case of Firm A), or from one small firm to another (case of Firm B).

  In the case of Firm A, the large firm, support from the government may not be expected, but the policy environment for large firms should be conducive to technology transfers. For a small firm like Firm B, support from the government is needed, especially on getting access to technological knowledge.
- From a more macroeconomic standpoint, it has long been recognized that the Philippines face the greatest challenge in the area of technology development and acquisition, and this is particularly true in the case of the Philippine SMEs. Taking off from the observations of Aragon et al (2005), we restate that small entrepreneurs in the country need technical support especially in terms of selecting appropriate technology, implementing technical collaboration both at the local and international levels.
- There is also a need to intensify and harmonize information dissemination activities particularly those related to the availability of technologies as well as the existing activities and programmes. The prevailing impression is that promotional activities of different

government agencies are fragmented, hence, a central online repository of technology information similar to that offered by ACTETSME should be encouraged.

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