

ERIA Research Project Report 2010, No. 004

GLOBALIZATION AND INNOVATION IN EAST ASIA

Edited by

CHIN HEE HAHN

DIONISIUS NARJOKO

March 2011

TABLE OF CONTENTS

	Table of Contents	i
	List of Project Members	ii
	Acknowledgements	iv
	Executive Summary	vi
CHAPTER 1.	Globalization and Innovation in East Asia <i>Chin Hee Hahn, Dionisius Narjoko</i>	1
CHAPTER 2.	Sources of Learning-by-Exporting Effects: Does Exporting Promote Innovation? <i>Keiko Ito</i>	20
CHAPTER 3.	Direction of Causality in Innovation-Exporting Linkage: Evidence on Korean Manufacturing <i>Chin Hee Hahn and Chang-Gyun Park</i>	68
CHAPTER 4.	The Link between Innovation and Export: Evidence from Australia's Small and Medium Enterprises <i>Alfons Palangkaraya</i>	103
CHAPTER 5.	Multinational Enterprises, Exporting and R&D Activities in Thailand <i>Archanun Kohpaiboon and Juthathip Jongwanich</i>	141
CHAPTER 6.	Globalization and Innovation in Indonesia: Evidence from Micro-Data on Medium and Large Manufacturing Establishments <i>Ari Kuncoro</i>	193
CHAPTER 7.	Globalization, Innovation and Productivity in Manufacturing Firms: A Study of Four Sectors of China <i>Feng Zhen, Yanyun Zhao, Pierre Mohnen, Jacques Mairesse</i>	225
CHAPTER 8.	Trade Reforms, Competition, and Innovation in the Philippines <i>Rafaelita M. Aldaba</i>	255
CHAPTER 9.	Trade Liberalization and Innovation Linkages Micro-evidence from Vietnam SME Surveys <i>Nguyen Ngoc Anh, Nguyen Thi Phuong Mai, Nguyen Duc Nhat, Nguyen Dinh Chuc</i>	315
CHAPTER 10.	What Explains Firms' Innovativeness in Korean Manufacturing? Global Activity and Knowledge Sources <i>Yong-seok Choi and Ki-wan Kim</i>	341
CHAPTER 11.	Knowledge Flows, Organization and Innovation: Firm-Level Evidence from Malaysia <i>Cassey Lee H. K.</i>	370
CHAPTER 12.	International R&D Collaborations in Asia: A First Look at Their Characteristics based on Patent Bibliographic Data <i>Naotoshi Tsukada and Sadao Nagaoka</i>	410

LIST OF PROJECT MEMBERS

- DR. SHUJIRO URATA (PROJECT SUPERVISOR):** Professor, Graduate School of Asia-Pacific Studies, Waseda University, Japan; Senior Researcher Advisor to the Executive Director, Economic Research Institute for ASEAN and East Asia (ERIA), Indonesia.
- DR. CHIN HEE HAHN (PROJECT LEADER):** Associate Professor, Kyungwon University, Korea.
- DR. DIONISIUS NARJOKO (PROJECT COORDINATOR):** Researcher, Economic Research Institute for ASEAN and East Asia (ERIA), Indonesia.
- DR. SADAO NAGAOKA:** Professor, Institute of Innovation Research of Hitotsubashi University, Japan.
- DR. NAOTOSHI TSUKADA:** Research Associate, Institute of Innovation Research of Hitotsubashi University, Japan.
- DR. YONG-SEOK CHOI:** Associate Professor, Kyung Hee University, School of Economics, Korea.
- DR.. KI-WAN KIM:** Associate Research Fellow, Korea Development Institute, Korea.
- DR. CHANG-GYUN PARK:** Associate Professor, Chung-Ang University, Korea.
- DR. CASSEY LEE HONG KIM:** Senior Lecturer, School of Economics, University of Wollongong, Australia.
- DR. RAFAELITA ALDABA:** Senior Research Fellow, Philippine Institute for Development Studies (PIDS), Philippines.
- DR. ARCHANUN KOHPAIBOON:** Assistant Professor, Faculty of Economics, Thammasat University, Thailand.
- DR. JUTHATHIP JONGWANICH:** Assistant Professor, School of Management, Asian Institute of Technology, Thailand.
- DR. JACQUES MAIRESSE:** Professorial Fellow, UNU-MERIT, Netherlands; INSEE-CREST, France; National Bureau of Economic Research, USA.
- DR. PIERRE MOHNEN:** Professor, UNU-MERIT; Masstricht University, Netherlands.
- DR. NYANYUN ZHAO:** Professor and Dean, School of Statistics, Renmin University of China, China.
- DR. FENG ZHEN:** Postdoctoral Researcher, Bank of China; Chinese Academic of Social Science, China.
- DR. NGUYEN NGOC ANH:** Chief Economist, Development and Policies Research Center, Vietnam.
- DR. NGUYEN THI PHUONG MAI:** Senior Fellow, Development and Policies Research Center; National Institute for Science and Technology Policy and Strategy, Vietnam.

- DR. NGUYEN DUC NHAT:** Executiver Director, Development and Policies Research Center, Vietnam.
- DR. NGUYEN DINH CHUC:** Central Insitute of Economic Management, Vietnam.
- DR. ALFONS PALANGKARAYA:** Senior Research Fellow, Melbourne Institute of Applied Economic and Social Research and the Intellectual Property Research Institute of Melbourne, Australia.
- DR. ARI KUNCORO:** Professor of Economics, University of Indonesia, Indonesia.
- DR. KEIKO ITO:** Associate Professor, School of Economics, Senshu University

Acknowledgements

This report consists of all research papers from *ERIA Microdata Research Project of Fiscal Year 2010*. The project is part of the broader ERIA's research pillar on *Deepening Economic Integration*. It addresses the theme of globalization and innovation, with “**Globalization and Innovation in East Asia**” as the title of the project and of this report. As indicated in the first chapter of this report, understanding the process and determinants of innovation is unarguably a research and policy issue of vast importance. Innovation is important for sustaining a country's competitiveness in a more globalized environment. All of the papers presented in three workshops over the period of September 2010 to February 2011.

We incurred debts of gratitude to all members of the Project's working group who have actively contributed to the outcome of the research. We would like to also express our sincere appreciation for the time willingly surrendered by all members to actively communicate with ERIA and to participate in the three Project's long workshops held in Jakarta, Bali, and Bangkok over the course of the project.

Dr. Hahn and Dr. Narjoko owe a great intellectual debt to Professor Shujiro Urata who provided excellent guidance throughout the course of the project. Professor Urata has always been active in engaging in the research, from the very beginning at the preparation stage, during the discussion of research papers in all three workshops, and at the finalization step of the project.

We express our special thanks to Professor Fukunari Kimura, Chief Economist of ERIA, for his encouragement and support for the project. Professor Kimura has always been, and is still, one of the great supporters of ERIA Microdata Project. His idea of inventing the unique ERIA's Microdata research group is proven to be one of his significant contributions, not only for the ERIA core economic research but also for the academic literature and community in general.

We are greatly indebted to Mr. Hidetoshi Nishimura, Mr. Daiki Kasugahara, Mr. Mitsuo Matsumoto, and Mr. Takeo Tsukuda, who have continuously and strongly supported both the idea and the implementation of Microdata project. A successful output delivery of the Microdata Project this fiscal year would not have been possible without support from ERIA management.

We are indeed grateful for the all reliable supporting staffs of ERIA, in particular Maryclara Pondaag, Noviawaty, and Robertus Herdiyanto, for their tireless efforts to help ensuring a successful delivery of the project. Last but not least, our sincere appreciation to our colleagues, ERIA researchers, for their enthusiasms in the research works of the project.

Chin Hee Hahn

Dionisius Narjoko

EXECUTIVE SUMMARY

Schumpeterian creative destruction or, in other words, innovation is the integral part of a country's economic growth. For developing countries, it would not be an exaggeration to say that the challenges of economic development have been regarded by policymakers as synonymous with the challenges of innovation: how to make indigenous firms acquire new technologies and produce new products that they could not previously. Therefore, understanding the process and determinants of innovation is unarguably a research and policy issue of vast importance.

At the same time, a vast amount of previous studies have examined the causes and as well consequences of globalization. These studies have shown, although with some controversies remaining, that trade and/or investment liberalization has a positive effect on growth and productivity of firms, industries, and countries involved.

Then, how is globalization related to innovation? Is globalization a cause of innovation, or is innovation a cause of globalization, or both? Does increased trade and investment liberalization lead to more innovation, or does it depress innovation activity? In either case, what are the exact mechanisms? These are some of the most important questions that this report aims to address. These are some of questions that this report attempts to answer.

This report, of course, is not the first that explores globalization-innovation linkage. In fact, this topic is at least decades old. Previous studies on trade and growth have examined at least the following main channels through which trade affects growth: knowledge spillovers, increased competition, and larger market size. And these channels are either directly or indirectly related to firm's innovation activity. Traditional argument goes that, for example, if trade or investment liberalization facilitates knowledge spillovers, this will reduce the cost of research and development (R&D) or raise the rate of return to such activity, leading to increased innovation. Increased market size associated with trade raises the rate of return to innovation activity. Enhanced competition through trade may exert pressure on firms to innovate, or it could hurt the incentive to innovate by squeezing out the ex-post profit from a successful innovation. There are numerous empirical studies that examine these

channels in detail. In this regard, this report is, in some sense, a revisit to an old issue.

This report collects many interesting findings based on the papers/studies done to cover many countries in East Asia region. Along with its wide international coverage, this project utilizes micro-level data at plant, firm, or product level. While innovation may be an old topic, there have not many studies in the literature that utilize data at this micro level, addressing the innovation linkage to globalization, and focusing on the most rapidly growing region in the world. There are, therefore, rich insights that one can draw from all papers in this report.

In terms of key findings, there are many papers that confirm the positive impact of exporting on firm innovation activities and performance. While almost all papers in this report provide evidence for this, there are three papers that specifically show this evidence in the context of the role of innovation in the exporting-productivity relationship. In particular, the evidence supports to the existence of ‘learning-by-exporting’ behavior, which is one possible explanation for this relationship. The Japanese case study on this subject shows that the first-time exporters indeed increase their R&D expenditure immediately after they export, albeit the increase depends on the export-market destinations. One of the Korean studies and the Australian study also support the positive exporting-innovation relationship. The former shows that exporting promotes the creation of new product while the latter reveals the behavior that exporters in services sector do indeed increase their process-innovation activities. All of these studies, in addition to establishing the positive exporting-innovation linkage, also show that the positive impact is further translated to superior firm performance.

Firm’s R&D activities are the focus of the other three chapters in the report. As input of innovation outcome, R&D activities provide useful information about the extent of knowledge creation. Key findings within this subject are related to the role of foreign ownership in affecting firm innovation. The first is multinational enterprises (MNEs) tend to import their technology from their parent companies, resulting in rather low innovation activities of these MNEs in their host countries. The Thai and Chinese studies highlight this observation. This rather discouraging finding, however, does not mean that there is no positive effect of MNE presence on R&D or innovation process. In fact, as indicated by the Thai study, as well as the Indonesian study, the presence of MNEs is suggested to stimulate locally owned firms to conduct R&D. In other words,

there exist what so-called the ‘R&D spillovers’ from MNEs presence.

The Indonesian study also finds an interesting fact of a positive relationship between the acquisition of new machinery and the extent of R&D expenditure. In other words, at least for Indonesia in this case, the ups and downs of firm innovation output are closely related to the ability of the firm in acquiring new machinery.

Other chapters examine the impact of globalization on innovation through competition link. The Philippines and Vietnamese studies address this subject. The Philippines study finds that trade reforms increases the extent of competition in domestic markets. Reduction in tariff is related to reduction in profitability. This study further finds that higher competition stimulates R&D. Thus, overall, trade liberalization positively affects R&D through product market competition channel. All these findings are generally the same even after it takes into consideration the firm selection impact as a result of much tighter competition (i.e., firm entry and exit). Consistent finding on the impact of competition is shown by the Vietnamese study. Tight price competition is found to increase the likelihood of Vietnamese small and medium enterprises (SMEs) to engage in R&D.

Globalization and knowledge creation and absorption is closely related. Another Korean paper shows that positive innovation premium can be accounted for by both the utilization of existing knowledge and active investment in new knowledge. The degree of importance for each of these knowledge sources, however, is different, depending on the characteristics of the global activity that a firm involves in. Investing in new knowledge seems to be more important than utilization of existing knowledge in explaining the premium of the non-MNE exporters and domestic MNE parents with export participation. In contrast, foreign MNE affiliates that participate in export markets seems to utilize existing knowledge more than investing in new knowledge in generating their positive innovation premium. The paper utilizing the Malaysian innovation survey, meanwhile, attempts to draw whether there is relationship between various aspect of organization and innovation. This study finds it to be a complex one. Different types of internal and external knowledge flows are likely to be driven by different organizational variables. For example, while knowledge flows from other companies within the same group are determined by whether or not the firm is a subsidiary. Meanwhile, examining the impact of international research collaboration

involving patent registered in Korea, China, and Taiwan, another study in this report finds that international co-inventions are strongly associated with more science linkage, with higher quality of patent, and larger group of research team.

The research conducted by all papers in this project asserts that globalization encourages firm-level innovation. This policy implication is very important in the context of the usual approach that countries rely on R&D subsidies. The key message coming out from this research, therefore, is the existence of an alternative way for a country to promote innovation, which is done by, and through, maximizing the benefit from globalization.

There are more specific policy-implications implied by this broad message. First, policy to promote exports encourages firm innovation; hence, policy to assist firms to export more, as well as to make more firms to engage in exports, seems warranted. A number of findings on the positive relationship between exporting and innovation activities and/or performance support this policy implication. Second, policies for higher foreign involvement should be encouraged. The justification of this comes mostly on the evidence on the existence of ‘R&D-spillovers’ impact on domestically owned firms, from the presence of MNEs.

Third, keeping in track with ongoing trade liberalization and maintaining a relatively open trade regime is suggested. A high degree domestic market competition drives firms to always engage in innovative-enhancing activities, through the ability of the competition to create a contestable market situation. The findings from the Philippine study provide some evidence to support this. Having a liberalized trade regime could even be more beneficial if it is put in a framework of deepened integration of a country in Southeast and East Asia regions. The case study of Thai manufacturing in this report underlines this in the context of linking firms the already-established international production networks in these regions. The Thai study finds positive relationship between participation in the production networks on greater R&D activities by firms.

Fourth, findings from the research suggest that globalization seems to also benefit SMEs – not only large firms. This is encouraging given the common perception of unfavorable impact of globalization on SMEs. But there is more on this; how does one devise policies to materialize this benefit? The Australian study in this report suggests

that, at least conceptually, the policy is to gear SMEs to learn more about process innovation – rather than product innovation – from utilizing globalization forces.

CHAPTER 1

Globalization and Innovation in East Asia

CHIN HEE HAHN

Kyungwon University

DIONISIUS NARJOKO

Economic Research Institute for ASEAN and East Asia (ERIA)

1. Background and Objective

This report consists of the papers submitted to ERIA's research project "Globalization and Innovation in East Asia" in fiscal year 2010. This project aims to examine the relationship between globalization and innovation, as well as the impact of various policies on innovation process and/or its outcomes in a globalized economic environment, utilizing various firm-, plant-, and/or product-level micro datasets for East Asian countries.

As is well understood, the process of Schumpeterian creative destruction or, in other words, innovation, is an integral part of economic growth in every country. Particularly for developing countries in East Asia, but also in other regions, it would not be an exaggeration to say that the challenges of economic development have been regarded by policymakers as synonymous with the challenges of innovation: how to make indigenous firms to acquire new technologies and produce new products that they could not previously. It is therefore clear that understanding the process and determinants of innovation is unarguably a research and policy issue of vast importance.

At the same time, numerous studies have examined the causes and consequences of globalization. These studies have shown, although with some controversies remaining, that trade and/or investment liberalization has a positive effect on the growth and productivity of the firms, industries, and countries involved. Partly as a result of the progress in our knowledge in this field, openness of their trade and investment regimes is considered as a key necessary condition for the economic growth and development of developing as well as developed countries.

So, how is globalization—a process of closer economic integration by way of increased trade, foreign investment, and international labour mobility—related to innovation? Is globalization a cause of innovation, or is innovation a cause of globalization, or both? Does increased trade and investment liberalization lead to more innovation, or does it depress innovation activity? In either case, what are the exact mechanisms? These are some of the most important questions that this report aims to address.

There are numerous additional issues that bear on this report. These include, for example, how innovation activity is organized within multinational enterprises (MNEs), and whether, and precisely how, globally engaged firms (either directly through foreign direct investment (FDI) or trade, or indirectly through interactions with foreign firms) differ in innovation activity and innovation outcome. Other issues are the causes and consequences of the globalization of innovation activity itself, and the role of firm characteristics and/or firm-heterogeneity in the trade-innovation linkage. Then there are the roles of competition in the trade-innovation nexus, and of openness policies in innovation policies and vice versa. Then, how a country's level of development, protection of intellectual property, and technical standards and regulations, affect the relationship between globalization and innovation, and so on. Some of these questions are also addressed by the chapters included in this report.

Of course, this report is not the first to explore the globalization-innovation linkage. In fact, this topic is at least decades old.¹ Previous studies on trade and growth have examined the following main channels through which trade affects growth: knowledge spillovers, increased competition, and larger market size. And these channels are either directly or indirectly related to the firm's innovation activity. Traditional argument goes that, for example, if trade or investment liberalization facilitates knowledge spillovers, this will reduce the cost of R&D or raise the rate of return to such activity, leading to increased innovation. Increased market size associated with trade raises the rate of return to innovation activity. Enhanced competition through trade may exert pressure on firms to innovate, or it could hurt the incentive to innovate by squeezing out the ex-post profit from a successful innovation. There are numerous empirical studies that examine these channels in detail. In this regard, this report is, in some sense, a revisit to an old issue.

However, we think that the primary distinguishing feature of this report is the use of micro-data. Although trade and innovation may be an old topic, to the best of our knowledge, there are not many previous studies that utilize firm- or plant-level *micro data* and examine the linkage between globalization and innovation, particularly in East Asian countries. In addition, most chapters in this report use a variety of data sources

¹ See Helpman (2004) for an excellent review of the literature on this topic.

and employ explicit measures of innovation input and innovation outputs (process or product). We think that the use of micro data allows us to clarify further the relationship between globalization and innovation, which studies based on aggregated data were unable to do. Furthermore, we think that using micro data allows us to examine the possible roles of firm characteristics, such as productivity, size, and other technical characteristics, in the globalization-innovation linkage.

The use of micro data, as well as recent developments in academic literature (and in the real world), make this report not just a revisit of the old issue but rather a revisit of the old issue in a new context and with a new approach. It is clear that globalization these days has new features compared with globalization, say, before the 1980s. The prime example of this is the so-called fragmentation of production or internalization of production. It is well known that the evolution of this process has been most pronounced in East Asian countries. So, these days, FDI directed to the developing East Asian region as well as FDI originating from developed East Asian countries, such as Japan, frequently involves the relocation of a certain production process in search of a lower production cost. Although there are increasing numbers of studies on the causes and consequences of this so-called vertical FDI, studies examining the consequences of this FDI on the host and home country firm's innovation activity are rare. Some of the chapters in this report bear on this issue.

Recent developments in heterogeneous firm trade literature also provide new insights and a theoretical framework for some of the chapters in this report. Earlier version of the heterogeneous firm trade theory, pioneered by Melitz (2003), helped not only to clarify the channels through which the benefits of globalization are materialized (reallocation of resources across firms within industries and/or across products within firms and/or across different technologies), but also identified firm-level characteristics (primarily productivity) that matter in shaping the relationship between globalization and aggregate growth and productivity. More recent literature has incorporated the firm-level innovation decision into the model, and examined various dynamic relationships that could exist among trade, innovation, and productivity. For example, this literature implies that there exists a bi-directional causal relationship between trade and innovation and that firm level productivity is both a cause and a consequence of

past trade and innovation activities. Some of the chapters in this report use this theoretical framework in their empirical analyses.

It is our belief that examining the trade and innovation linkage in a new context and with new approach, and addressing the important questions discussed above can provide us with rich policy implications. For example, many chapters in this report provide strong empirical evidence that a firm's globalization activities are at least a determinant of its innovation inputs and outputs or, in some cases, that there exists a bi-directional causal relationship between globalization and innovation. This suggests a strong case for coordination between trade/investment liberalization policy on one hand and innovation policy on the other. In view of the often observed reality that these two policies are separately planned and governed by different ministries, this report's findings have potentially profound implications.

Below, we provide a synopsis of what follows and summarize the main policy implications that arise out of this report.

2. Report Structure and Main Findings

This report consists of eleven papers that address the globalization-innovation issues in nine countries, namely Japan (two papers), Korea (two papers), China, Taiwan, Australia, Thailand, Indonesia, Malaysia, the Philippines, and Vietnam. These papers can be classified into four groups according to more specific themes, that is, (i) exporting, innovation, and productivity, (ii) the firm's R&D decision and globalization, (iii) trade liberalization, competition, and innovation, (iv) globalization of R&D, organization, and knowledge flows.

2.1. Exporting, Innovation, and Productivity

The first three chapters address the role of innovation in the relationship between exporting and productivity, in the context of learning-by-exporting and the self-selection hypothesis. In Chapter 2, Ito addresses the role of innovation in the context of the learning-by-exporting hypothesis. She asks whether the effect of learning-by-

exporting on innovation exists and, subsequently, whether and how the impact of exporting on innovation affects productivity. The paper attempts to find answers to these questions by examining the behavior and performance of first-time exporters in Japanese manufacturing. Ito's paper, therefore, not only seeks evidence for the positive impact of learning-by-exporting on innovation but also moves deeper to find insights on the source of the learning-by-exporting.

In her investigation, Ito finds that the first-time exporters are able to increase their sales and employment growth to a greater extent than those serving domestic markets. More importantly, the decision to begin to export evidently promotes innovation; she finds that the first-time exporters record an increase in R&D intensity and volume. In going deeper into the mechanism of learning-by-exporting, Ito examines whether there are differences in the performance of innovation and other performance variables, arising from engaging in exporting to different destinations. She finds that starting to export to North America/Europe has larger positive effects on productivity than starting exporting to Asia. This difference is also observed for the other performance variables (i.e., sales and employment growth), innovation variables, and some characteristics of the firms. Ito ascribes this to differences in absorptive capacity; i.e., the first-time exporters to North America/Europe have greater absorptive capacity than those exporting for the first time to Asia.

Chapters 3 and 4 examine how innovation affects the export-productivity/performance link. Unlike the previous chapter, these chapters examine the effect in the context of the two hypotheses. Specifically, these chapters examine the possible two directional relationships between export participation and innovation. Hahn and Park in Chapter 3 utilize a rich combination of plant- and product-level data from Korean manufacturing in their investigation. Unlike the previous studies, however, Hahn and Park adopt a rather different approach in defining product innovation. That is, they use plant-and-product matched data to distinguish two types of product innovations: those that are new to the plant (termed 'product addition') and those that are new to the Korean economy (termed 'product creation'). The former tends to capture the product cycle phenomenon or international knowledge spillover, while the latter reflects imitation by domestic competitors or the process of domestic knowledge diffusion.

Product creation could mean product addition although this does not necessarily work the other way around.

Hahn and Park find evidence to support the learning-by-exporting hypothesis for the role of innovation in the export-productivity relationship. Using propensity score matching, they find a statistically significant positive impact of exporting on product creation. They cannot however infer the existence of this relationship when innovation is defined by product addition; the impact of exporting on product addition is not statistically significant, albeit showing the same (i.e., positive) sign. Hahn and Park meanwhile, are not able to find evidence to support the selection hypothesis. More specifically, they cannot find any significant effect of innovation – for both product creation and addition – on exporting. Hahn and Park extend their investigation by using the vector autoregressive (VAR) method. This route is taken in order to examine the dynamic interdependence between export and innovation, as well as productivity. The key results from it are consistent with the key finding that exporting significantly affects product creation. The finding from the VAR indicates that this impact is quite persistent; it takes more than five years for the impact on product creation to die out. The VAR results, in addition, show that productivity significantly and positively affect both exporting and product creation.

Palangkaraya in Chapter 4 conducts his investigation on the direction of causality using firm level data from Australian small and medium enterprises (SMEs). His investigation also specifically looks at the direction of causality for the group of new exporters and new innovators; this is done to ensure the robustness of his investigation results. It is worth mentioning that Palangkaraya's analysis is rather different from the other research papers in this report in terms of sectoral coverage in that it takes in not only manufacturing firms but also enterprises in the services and other non-manufacturing sectors. This offers a distinct value added to the research on the subject, considering the argument that the lessons from the usual samples from the manufacturing sector may not be valid for the other sectors.

Unlike Hahn and Park, Palangkaraya finds evidence that the relationship between exporting and innovation runs in both directions. However, this only appears for process innovation and in the services sector; not for product innovation and not in manufacturing or other non-manufacturing sectors. The investigation also finds that the

positive two-way relationship varies across industries. In his interpretation, Palangkaraya attributes all these results to the uniqueness of the innovation characteristics of SMEs and the importance of services in the Australian economy. More specifically for the former, process innovation matters more than product innovation because SMEs are usually financially constrained and product innovation is arguably substantially more expensive than process innovation.

2.2. Firms' R&D Decisions and Globalization

Firms' research and development (R&D) activities are the focus of the next three chapters. As an input resulting in an innovation outcome, R&D activities provide useful information about the extent of knowledge creation. The next three chapters examine whether and how globalization affects a firm's R&D performance. In Chapter 5, Jongwanich and Kohpaiboon examine the roles of multinationals (MNEs) and exporting in determining the decision to carry out R&D, and the actual intensity of R&D activities, in firms in the Thai manufacturing sector, utilizing the most recent (i.e., 2006) industrial census data. Unlike the other studies that measure different types of R&D in their total value terms, Jongwanich and Kohpaiboon disaggregate R&D activities into three categories, namely: (i) R&D leading to improved production technology, (ii) R&D leading to product development, and (iii) R&D leading to process innovation. This chapter examines not only the direct effect of MNEs on R&D activities, but also the indirect effect of MNEs on the presence and intensity of R&D in locally owned plants (termed here 'R&D spillovers').

Jongwanich and Kohpaiboon find that globalization, through exporting and FDI, can play a role in encouraging firms to commit to R&D investment. The role played by FDI, however, seems to be different from that played by export. They found that the R&D propensity of MNE affiliates is lower than that of locally owned firms. This suggests that MNE affiliates in Thailand prefer to import technology from their parent companies rather than investing in R&D in the host country (Thailand). Nonetheless, this does not mean that there is no effect arising from MNE presence on firm R&D propensity and intensity. In fact, Jongwanich and Kohpaiboon find evidence that the presence of MNEs stimulates locally owned firms to conduct R&D activities. Jongwanich and Kohpaiboon also find that firms participating in international

production networks are more active than those are not participating. As for the role of exporting, Jongwanich and Kohpaiboon find a positive and significant impact on R&D activities, from being in production networks, although this is limited only to R&D in product development. They do not find a significant impact for the other forms of R&D (i.e. R&D leading to improvement in production technology and R&D leading to process innovation). This finding implies that entering export markets helps firms to learn more from competing products, and from customer preferences, but their information relating to improving production technology and process innovation is still limited.

In Chapter 6, Kuncoro examine the globalization determinants of the decision to invest in R&D and the intensity of R&D expenditure, of medium-and large-sized manufacturing firms in Indonesia. Kuncoro considers export participation, foreign investment, and trade protection as the variables that represent globalization. In addition, he looks at the impact of spatial concentration of MNEs in affecting the firm's R&D investment decision and expenditure. Kuncoro uses data from the period of mid 1990s to mid 2000s in his empirical investigation.

Kuncoro finds that being an exporter significantly affects a firm's decision to invest in R&D, as well as the extent of the firm's R&D expenditure. As for the importance of foreign ownership, Kuncoro finds that it is an important determinant only of the firm's R&D investment decision; he finds that it is not an important factor in determining the amount of R&D expenditure that the firm commits. In terms of testing the potential R&D spillover effect arising from concentration of MNEs in a location, he finds that R&D activities tend to be higher in big urban areas; not in a specialized or agglomerated location. In his interpretation of the findings related to foreign ownership and the presence of MNEs, he asserts that there may be needed a critical mass of MNEs in a location, or in an agglomeration area, for these MNEs to have meaningful impact in terms of innovation or R&D performance. Another element of globalization, trade protection, is found to be negatively related to a firm's R&D investment decision and expenditure. In other words, lowering the protection or trade barrier will create a positive impact on R&D activities. In addition, Kuncoro interestingly finds a positive relationship between R&D expenditure and investment in new machinery. He asserts that investment in new machinery may reflect another indirect effect of globalization on

the firm's innovation performance or R&D activities; it may reflect the desire of a firm to remain competitive, which can be accomplished by installing new machinery, bringing new technology.

Chapter 7 by Mairesse *et al.* examines the determinants of decisions on R&D and its intensity in four major Chinese manufacturing sectors, namely, textiles, apparel, transport equipment, and electrical equipment. The authors examine the determinants in the framework of the Crepon, Duguet, Mairesse (hereafter CDM) structural model that links between innovation input, innovation output, and performance. Hence, in addition to examining the R&D decision and R&D intensity, they also examine how R&D intensity affects innovation output, as well as how innovation output determines performance. Exporting and foreign ownership are included in the determination of the R&D decision and R&D intensity as well as in the determination of innovation output and performance. They use the data from manufacturing censuses conducted in 2005 and 2006.

Mairesse *et al.* find evidence that exporting increases the likelihood of firms making an R&D investment, and the level of R&D intensity; however, they find this to be the case only in the textile industry. They find conflicting evidence in the case of the electronic equipment industry. Given the fact that many firms in this industry have some share of foreign ownership, Mairesse *et al.* interpret this finding as a reflection of the position that much R&D activity is carried out by parent companies located in other countries, not in China as the host country. Their interpretation is consistent with their other finding which suggests that foreign firms tend to innovate less than other firms in China, compared to the state-owned ones. In addition, to all these, Mairesse *et al.* interestingly find that exporting does improve innovation output, and here specifically in terms of improving new products.

2.3. Trade Liberalization, Competition, and Innovation

Chapters 8 and 9 address the impact of trade and investment liberalization on innovation. Aldaba in Chapter 8 examines this issue in the case of manufacturing firms in the Philippines, utilizing firm-level panel data over the period 1996-2006. In her examination, she asks the following questions: what is the impact of the removal of trade barriers on firms' innovative activities? And does an increase in competition

arising from trade reforms lead to increases in innovation? The analytical framework adopted by Aldaba postulates that the trade-liberalization relationship operates through the competition channel; hence, the impact of trade liberalization is examined through a two-stage approach where competition is endogenous. She also takes into consideration the selection, or firm-dynamic impact of competition, in her empirical model.

Aldaba finds that trade reforms (i.e. reduction of tariff and/or non-tariff barriers) conducted several times in the Philippines from the 1990s to the 2000s have had a strong impact on the Philippines' manufacturing sector, by increasing the extent of competition in domestic markets. The tariffs are found to be positively related to the price-cost margin. This is the finding from the first step of her econometric estimation. From the second step of the estimation, Aldaba finds that profitability is negatively related to R&D expenditure. In other words, higher competition stimulates R&D. Thus, overall, trade liberalization positively affects R&D through the product market competition channel. All these findings are generally the same even after she controls for firm entry and exit, which are proxies for the industry selection impact arising from competition. Further, from the results of her estimation in the 'mixed' sector (i.e. a broad sector group that consist of mostly exporting and importing industries), she finds that the net-entry variable is negatively related to profitability. Together with a negative relationship between profitability and R&D expenditure, this indicates that as more firms exit (presumably the inefficient ones), the surviving firms tend to engage in R&D, in order to out-compete the new firms entering the market.

In chapter 9, Nguyen *et al.* examine the determinants of innovation by Vietnamese SMEs in the context of increased competition as a result of rapid trade expansion in the 2000s. Nguyen *et al.* use data of 2007 and 2009 from the Vietnam SME Survey. The years of the data are chosen to capture the period when Vietnam experienced rapid trade liberalization. Unlike the approach taken by other studies, Nguyen *et al.* use information on pricing strategy to capture the extent of competition among firms. The use of this information is really driven by the availability of the information in the data set used.

Nguyen *et al.* find some importance of competition effects, both domestic and international. Specifically, matching the price of competitors has a positive impact on product innovation using the 2007 data and on product improvement using the 2009

data. As for the impact of international competition, they found that the pressure from foreign firms – in terms of price set by them – evidently improves all kinds of innovation activities by the Vietnamese SMEs (i.e. product innovation, product modification, and process innovation). This finding, however, slightly differs when the experiment uses 2009 data. Nguyen *et al.* not only address the globalization impact through the competition channel, but also further test whether linkages with foreign firms help the SMEs to increase their innovation activities. They find rather convincing evidence on this, using both years of the data and the other innovation activities they consider.

2.4. Globalization of R&D, Organization, and Knowledge Flows

Chapter 10 by Choi and Park examines the link between the “innovation premiums” from engaging in global activity and sources of knowledge in Korean manufacturing. They first examine whether these premiums exist and, based on their findings on this, they examine what sources of knowledge could explain the premiums. To capture the premiums, Choi and Kim compare the innovation output of various types of firms that engage in global activities with the innovation output of domestically-focused firms. Global activities of the firms are defined according to their export participation and/or their FDI engagement. Choi and Kim measure innovation output in terms of product or process innovation (or both of these) as well as number of patents. They also consider two groups of knowledge sources, namely investment in new knowledge and utilization of existing knowledge (either from inside or outside firms). This paper draws data from Korea’s Innovation Survey conducted in 2002, 2005, and 2008, as well as data from the Kore EXIIM bank.

Choi and Kim show that there indeed exists a premium in terms of innovation output from engaging in global activities. The comparison they make shows that performance in generating innovation outputs is the highest for firms that export and have foreign ownership participation, but is the lowest for purely domestic firms (i.e. domestic firms without any exports and without any foreign ownership). In their further investigation, Choi and Kim find that the positive innovation premium can be accounted for both by the utilization of existing knowledge and by active investment in new knowledge. The degree of importance of each of these knowledge sources, however, is

different, depending on the characteristics of the global activity that a firm is involved in. Investing in new knowledge seems to be more important than utilization of existing knowledge in explaining the premiums of the non-MNE exporters and the domestic MNE parents with export participation. In contrast, foreign MNE affiliates that participate in export markets seem to utilize existing knowledge more than investing in new knowledge in generating their positive innovation premium. Another important finding is that, when Choi and Kim analyze product and process innovation separately, they find that utilization of existing knowledge and investment in new knowledge are equally important in explaining the positive premium for product innovation. However, only information from existing knowledge seems to be important in explaining the premium for process innovation.

Chapter 11 by Lee is another paper in this report addressing the issue of knowledge flows in innovation. Lee uses Malaysian manufacturing as the case study in his paper. In his research, Lee gauges the determinants of knowledge flows in the decision to invest in R&D as well as in the intensity of a firm's R&D activities. This is the first step in his investigation. Measures of R&D activity considered by this paper are: (i) in-house R&D activity, (ii) acquisition of machinery, equipment, and software, and (iii) training. Further, in the second step he attempts to find some evidence on whether the variation in the extent of knowledge flows can be explained by firm organizational factors. He considers various organizational factors classified into three broad groups according to the characteristics of the factor, namely, (i) vertical boundary of firm, (ii) ability to adapt to changing environment, and (iii) collaborative activities with external parties.

Lee incorporates globalization into each of these steps by introducing variables that identify a firm's export participation and the existence of foreign participation in the firm's ownership structure. Lee also differentiates collaborative variables – as one of the groups of organizational variables – according to the domestic or foreign collaborative partners; this is another way of incorporating globalization into his knowledge flows and organization equation.

Lee finds evidence that establishes the relationship between knowledge flows and innovation. However, the extent and direction of the relationship is likely to depend on the type of innovation activities. For in-house R&D, for example, the knowledge flow

from other firms within the same group of companies is negatively related to the decision to undertake this activity. Also, there is evidence of less emphasis on in-house R&D investment if knowledge flows from customers are of high importance. In the case of the acquisition of machinery, equipment, and software, external knowledge flows are important, especially those coming from suppliers, customers, competitors, and consultants. As for the importance of globalization-related variables (i.e. exporting and foreign ownership) in determining these activities, Lee finds them to be relatively insignificant. Lee only finds a positive impact from globalization when the innovation activity considered is training, and the globalization variable introduced is exporting. Specifically, exporting is associated with higher investment in training.

As for the relationship between knowledge flows and various aspects of organization, Lee finds it to be a complex one. Different types of internal and external knowledge flows are likely to be driven by different organizational variables. For example, while knowledge flows from other companies within the same group are determined by whether or not the firm is a subsidiary, as well as by cooperation involving foreign customers and foreign private research centers, external knowledge flows seem to be determined only by some of the variables that reflect the firm's ability to adapt to its changing environment (i.e. improvement in the quality of goods and services, improvement in employee satisfaction and reduction in employee turnover). Despite this complexity, Lee finds evidence to support the positive role of globalization in determining the extent of knowledge flows; the globalization-related variables, i.e. exporting and foreign ownership, are generally found to be important for certain types of external knowledge flows, particularly those originating from customers.

The last of the chapters of this report, by Nagaoka and Tsukada, addresses international collaboration in research. Specifically, they analyze whether and how international research collaboration affects invention in three countries, namely Korea, China, and Taiwan. In their investigation, they focus on patents registered in the patent office in these countries as well as in the US Patent Office.

Nagaoka and Tsukada find that international co-inventions are strongly associated with more science linkage; that is, more references to scientific literature in Korea and Taiwan. A research project with a high degree of science linkage is often based on a basic research, which reflects the extent of absorptive capability. This finding indicates

that Korea and Taiwan have stronger absorptive capabilities for exploiting scientific knowledge than China, at least for the period under the study. Another important finding is that international research collaborations are associated with higher patent quality. This is in terms of forward citation in China and Taiwan, even after controlling for the number of inventors and the literature cited. Thus, the benefits of international research collaboration in terms of creating synergy or exploitation of know-how may be significant for these economies.

3. Implications for Policy

The research conducted in all papers in this project asserts that globalization encourages firm-level innovation. The findings from all papers consistently point to this conclusion. This policy implication of these findings is very important in the context of the approach taken by many countries in their national innovation policy, which relies on what are usually termed R&D subsidies (Herrera and Nieto, 2008). The key message coming out from this research, therefore, is the existence of an alternative means for a country to promote innovation, which is by, and through, maximizing the benefit from globalization.

One can elaborate this broad policy implication to some rather specific policy implications, based on the elements of globalization. First, policy to promote exports encourages firm innovation; hence, policy to assist firms to export more, as well as to cause more firms engage in exports, seems warranted. A number of findings on the positive relationship between exporting and innovation activities and/or performance support this policy implication. Among others, and perhaps most importantly is the evidence on the positive effect of ‘learning-by-exporting’ on exporters’ innovation. According to the results of Hahn and Park’s Korean case study (Chapter 3), exporting encourages the creation of new products. The investigation by Ito in Chapter 2 points to the usefulness of promoting exports to a destination, or a region, that has greater extent of absorptive capacity, for the reason that this seems to create a much larger marginal benefit drawn from learning-by-exporting.

Second, policies for higher foreign involvement should be encouraged. The justification for this comes mostly from evidence of the existence of the impact of ‘R&D-spillovers’ on domestically owned firms; that is, the presence of MNEs encourages the locally owned firms to gain technological knowledge and capability from various possible channels, such as the demonstration effect, the competition effect, etc. One of the key findings of the chapter by Jongwanich and Kohpaiboon on Thai manufacturing underlines the importance of this policy suggestion. Moreover, from a more macro and practical perspective, encouraging a higher presence of foreign ownership, or MNE units, requires a policy to sustain excellent infrastructure quality, both physical and institutional. The logic is clear; MNEs certainly would consider investing in host countries if they are able to operate efficiently, and one of the key factors is supportive infrastructure. Moreover, as pointed out by Kuncoro using the Indonesian data, much of the R&D spillover from the presence of MNEs in Indonesian manufacturing exists within industrial agglomerations; if policy makers would like to really maximize the benefit from the spillover effect, the idea of having well connected agglomerations benefiting from well developed and good quality infrastructure is clearly the path to take.

It is worth mentioning that the suggestion of supporting exports and encouraging greater MNE participation can also be justified from the perspective of knowledge absorption and creation by firms in their innovative activities. The findings of two chapters in our research underline this (i.e. Chapters 10, 11, and 12). In Chapter 10, for example, the case study of Korean manufacturing suggests that not only are firms absorbing large amounts of existing knowledge by exporting, or by jointly operating with foreign owners, or both, but they are also able to create more new knowledge themselves. As a direct consequence of this ‘snow-balling’ impact, a country’s stock of knowledge would also grow faster, and, in turn, this may feed back to the firms’ knowledge production function; all these factors should facilitate an even stronger innovation performance by the firms in the future. Globalization therefore facilitates greater knowledge creation. Indeed, this is also consistent with the idea of greater impact of international collaboration in research as pointed by the findings of Chapter 12 by Nagaoka and Tsukada.

Third, keeping in track with ongoing trade liberalization and maintaining a relatively open trade regime is suggested. A high level of domestic market competition always drives firms to engage in innovation-enhancing activities, through the ability of the competition to create a contestable market situation. The findings from Aldaba's study on Philippines manufacturing firms provide some evidence to support this policy suggestion. Having a liberalized trade regime could be even more beneficial if it were put in the framework of the deepened integration of a country in the Southeast and East Asia regions. The case study of Thai manufacturing in this report underlines this in the context of linking firms to the already-established international production networks in these regions. The Thai study finds a positive relationship between participation in the production networks and increased R&D activities by firms.

Fourth, findings from the research suggest that globalization seems also to benefit not only large firms but also SMEs. While this is encouraging, if one considers the affirmative-action type of policy for SMEs in the context of the increased globalization in a country's economy, the more important question perhaps is how one devises policies that could materialize this suggestion. The Australian study in this report suggests that, at least conceptually, the policy should be to gear SMEs to learn more about process innovation – rather than product innovation – from utilizing globalization forces. As pointed out by the study, this policy approach is sensible given the natural disadvantages of SMEs, vis-à-vis their larger counterparts, in terms of financial resources and economies of scale. Further, given the usual 'assistance-type' of policy for SMEs, export promotion policies for SMEs in general would be most effective if they were integrated with policies to promote SMEs innovation activities, which in this case should focus more on process innovation activities.

Notwithstanding the discussion above, it is important to bear in mind that the policy recommendations are at most suggestive in nature. There are indeed other factors that need to be carefully considered for effective policy implementation, in order to maximize the benefit from globalization in terms of innovation. Further, there are a few caveats that policy makers need to always bear in mind for the implementation of these policies. First, it is important not to overdo the competition effect to foster innovation. While a high level of competition can foster progress in innovative activities, one needs to consider the impact on SMEs of having too severe competition. SMEs are financially

constrained and have scale disadvantages; therefore, a sensible balanced level of competition may be needed if innovation is guaranteed to progress but, at the same time, SME growth is not constrained.

Second, given the rather strong policy recommendation to support firms' export engagement and performance, it is important that policy makers do not fall in to the trap of providing export subsidies. This is important because such policies will likely be detrimental and counter-productive, since they will, over time, reduce the competitiveness of the exporters. What policy makers can do with this policy is to ensure improvement in trade, as well as investment facilitation measures. For many developing Southeast Asian countries covered by this research, there are still problems – and hence potential for significant improvement – in the area of trade and investment facilitation. This approach in fact is consistent and in line with the objective of regional integration agendas, such as those promoted by ASEAN or APEC.

Finally, it is important to note that different levels of development and/or industry characteristics across countries lead to the need for careful consideration on the implementation of the policy recommendations suggested above. In fact, even within a country, differences across industry could also call for different innovation policy approaches as highlighted by the Australian and Chinese studies in this report.

References

Herrera, L. and M. Nieto (2008), 'The National Innovation Policy Effect According to Firm Location', *Technovation*, vol. 28:540-550.

Helpman, Elhanan (2004), *The Mystery of Economic Growth*. Cambridge: Harvard University Press.