

**Firm Innovation in East Asia and Pacific Region: The Role of Governance
Environment, Firm Characteristics, and External Finance**

By

ABUMOUSA, Ashraf D.M

THESIS

Submitted to

KDI School of Public Policy and Management

In Partial Fulfillment of the Requirements

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Abstract

Firm Innovation in Asia-Pacific Region: The Role of Governance Environment, Firm Characteristics, and External Finance

This study shines a light on factors that affect innovation activities across seven countries in East Asia and Pacific region for the year of 2015. The study investigates the impact of governance environment, firm characteristics, and external finance on innovation of 4993 firms from Malaysia, Indonesia, Philippine, Vietnam, Timor Leste, Solomon Islands, and Papua New Guinea. The World Bank enterprise survey has been employed as the data source, I take cross sectional data includes public and private firms, large and SMEs in these countries. This paper defines three aspects of firm innovation, core innovation that refers to introducing or developing new product and/or services, innovation activities which include R&D spending, licensing inventions, international quality certificate, licensing new technology from foreign companies, and conducting in innovation training. The third aspect is related to the effectiveness of innovation new outputs whether they have new functions, better quality, new automation, or new process technology. I find that individual firm characteristics are strongly correlated to firm innovation. I also provide new evidence to the positive relationship between corruption and innovation as well as the preference of external finance to the internal finance in the context of firm innovation.

Key words

Innovation, governance, firm characteristics, external finance

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Chapter one: introduction

1.1 overview

An Innovation is one of the most important pillars of economic growth in any country. So, many governments seek to increase the growth rates of innovative activities, either by supporting local companies or through cooperation and partnership with foreign companies (Erdal & Göçer, 2015). Nowadays, there's so much speak about innovation, (Braden, n.d.) defines Innovation as creating something so worthy, widely adopted, and that replacing the prevailed solution in most of appropriate use cases. But, although (Poston, 2017) suggested new innovation measurements such as expected commercial value, development cycle time, and forecast degradation, in this study, the firm innovation refers mainly to firms' ability to introduce or develop new products or processes as well as create R&D outputs and patents.

The recent insights from the top industry influencers in Asia Pacific region believe that latest technology, motivated entrepreneurs, and innovation boosted the region's market to offer an array of opportunities for accelerated growth. the fastest growing innovation in APAC region attracts MNCs and international entrepreneurs to invest in the most innovative sectors of new software and services such as digital banking, cloud services market, internet of things.(Cohen, 2017).

Firm's innovation is affected by a variety of factors, governance environment either external governance like legal system and corruption or internal corporate governance mechanisms like ownership structure and external audit. firm characteristics such as size, age, competition, and legal status also are drivers of innovation in these firms as well. In addition,

external finance plays a significant role in determining the innovation levels in small and large companies. This study provides a particular emphasis on topics are relatively studied in the literatures which are the impact of governance environment, firm characteristics, and finance method on innovation. Therefore, this study tries to answer the following questions:

1. Does governance environment affect firm innovation? If so, to what extent firms in East Asia and Pacific region can practice innovation in scope of legal institutions and corruption constraints? Are innovative firms in this region victims of corruption?
2. Are foreign-owned firms more or less innovative than other firms owned by domestic private firms? Is state ownership in East Asia and Pacific countries correlated with lower firm innovation rates?
3. Which firm characteristics, e.g. legal status, size, age, trade, training, and competition, are associated with firm innovation capability?
4. How does access to external finance and internal finance affect firm innovation activities in East Asia and Pacific countries? And to what extent channels of external finance are different in their impact on firm innovation?

To give answers for these questions, across seven countries, I use a large set of firm level data from the World Bank enterprise survey for the year 2015. The ES dataset includes a diversity of questions regarding individual and general business environment in which firms work. By using several econometrics models and tests, this paper examined the relationship between a diversity of innovation aspects and governance environment, firm characteristics, and external finance channels.

When we look at governance environment, this study provides no evidence of causal relationship between strong court system and firm innovation, hence firms in East Asia and

Pacific countries can practice innovation regardless of the degree to which legal system is partial or uncorrupted. Additionally, these firms are victims of bribes and they are compelled to make informal payments to avoid the bureaucracy and foster their innovation activities.

This paper also find that larger firms are more innovative than SMEs. firms classified as shareholding are more likely to invest in innovation activities without any preference over other legal statues in term of innovating new products and processes. moreover, firms located in the official capital city are more innovative. Furthermore, the more innovative firms are exporting ones with less than 10 competitors for the main product, they also compete strongly against informal sector and they have worldwide marketing networks with no limited to domestic and national markets.

This study provides new evidence to the literature in term of access to external finance and its significant contribution in firm innovation comparing to internal finance such as retained earnings. But, results regarding the channels through which external finance might be the driver of innovation are somewhat different, I find that firms rely on external funds from non-banking system to finance their operation are more innovative than those who are heavily dependent on banks. Furthermore, firms that use informal finance such as friends or families can innovate as well despite the negative impact of such finance channel on their productivity and performance.

Results show new evidence to the positive correlation between access to external finance and firm innovation comparing to internal finance such as retained earnings. But, results regarding the channels through which external finance might be the driver of innovation are somewhat different, firms rely on external funds from non-banking system to finance their operation are more innovative than those who are heavily dependent on banks. Furthermore,

firms that use informal finance such as friends or families can innovate as well despite the negative impact of such finance channel on their productivity and performance.

This topic gains its importance from the globally increasingly attention paid to innovation and how policy makers can adopt national innovation strategies with business environment. Also, Today's competitive environment presents difficult challenges for firm innovation. thus, both SMEs and large firms are in a real need for good governance practices and best finance strategies that together sort out and move forward strategic innovation activities.

1.2 Theoretical framework

1.2.1 Governance environment

The governance environment affects the firm growth and performance, it is derived from power of institutions and institutional trust, corruption and transparency, and firm ownership and governance. We can define the trust in institutions as a vital aspect of fostering governance and nurturing development. it is relatively linked with positive consequences of economic growth and government performance. To illustrate, the concept of institutional trust measures the society's trust in public organizations, rules and legislations, and enforcement mechanisms (World Bank, 2017) This trust includes all mechanisms that arrange the human's needs in the community such as political, economic, legal, and educational systems.

Confidence level in the legal system across almost countries has been diminishing gradually due to the deteriorating performance of the justice scheme (Walle, 2009). according to Gallup continually survey conducted in 123 countries in 2013, slightly more than half of adults across these countries expressed their confidence in the judicial systems and courts. residents of 73 of these surveyed countries, the residents confident in their country's judicial system and courts did not exceed (50%). however, Regionally, the survey referred to the highest level of

trust in the rule of law in Asia comparing with other regions, where nearly (65%) of Asians expressed faith in their legal systems and courts, but in Latin America this rate was (35%), Europe (49%), Sub-Saharan Africa (48%), Middle East and Northern Africa (47%), Northern America (47%), and the countries of the former Soviet Union (28%) which was among the lowest in the globe. furthermore, in Asian countries, the survey showed the percentage of trust in Malaysia (70%), Indonesia (53%), Philippine (61%), and Vietnam (66%) (Rochelle & Loschky, 2014).

Bribes and corruption are real threats to economic growth and development as well as institutional effectiveness. OECD defined corruption as “An active or a passive misuse of the powers of Public officials (appointed or elected) for private financial or other benefits”. bribing of government officials, is one of the fundamental forms of corruption. An offence, commonly defined by Legal scholars as the action of "giving, offering, promising, taking, or agreeing to take money or other consideration in order to improperly influence a public official's actions” (Boles, 2014).

The question "*how economic activity is affected by corruption?*" remains a controversial issue in the theoretical and empirical literatures, (Svensson, 2005) argued that corruption curbs entrepreneurship activities and firm investment, hampers the ability of firms to access fit finance, and increases the transaction costs. Thus, hampers economic growth. while, (Hsieh & Klenow, 2009; Dal Bó and Rossi, 2007) argued that corruption causes resource misallocation within firms. Moreover, by using market capitalization as a measure of firms' benefits, (Cheung et al, 2012) found no positive correlation among paying bribes, either in foreign countries or bribing higher ranking public officials and receiving larger benefits.

By contrast, (Dreher & Gassebner, 2013) argued that corruption may act efficiently in bureaucratic regimes, it could reduce the costs of doing new businesses and improve the entire performance. Furthermore, (Weaver, 2016) referred to potentially leading to effective allocation methods of resources, where the most productive and innovative firms may have more incentives to pay. In addition, some new evidence from Brazil is shown in the study of (Colonnelli & Prem, 2018) which confirmed that the corrupt firms have better performance from similar group of unaffected firms. Corrupt firms characterized by higher levels of investments, better access to finance, effective labor reallocation inside the firm, better reengineering of entire structure and transactions by rising the hierarchical layers, less reliance on government contracts, and faster growth.

1.2.2 Business Environment

Innovation strategies vary between firms according to the kind of innovation rather than the decision whether the firm is going to be innovative or not, or the investment spent in innovation activities. The reason behind such theory is that the firms' priority is cost reduction due to high competition or developing existing products to face declining demand. In addition, firms may need to restructure or reengineer practices and sometimes firms prefer to avoid innovation activities at all and that in case of primary markets stability or when the potential innovative technological and organizational activities are limited (Schubert, 2010).

The characteristics of local firms and their environment which are highly various within national boundaries play an important role in fostering technological knowledge and developing innovative capabilities. These characteristics – such as ownership structure and legal status, firm size, firm age, trading and competition capability or the firm's R&D capacity and formal training – and the implementation of different types of innovation remain relatively unclear

from prior evaluation research. In this section I shine a light on a conceptual framework for the empirical analysis to set apart such firm drivers of innovation.

The OECD' innovation framework¹ confirmed that the efficiency of resources allocation within firms could be achieved by fiscal discipline and law. When output growth has strong and stable rates, firms will have incentives to introduce new products and processes or undertake some considerable organizational changes. Also, as a result of this work, as long as the competition is strong and supported by policy makers alongside encouraging open trade and reducing barriers, firms increase their investment towards innovative activities.

Realizing the behavioral additionalities are significantly affected by R&D linked firm characteristics. Research found that these behavioral additionalities in firms with high R&D inputs are less likely to be substantiated, while such additionalities are more likely to be realized in small and young firms and those specialized in technology. therefore, attention of government support for direct R&D promotion should be shifted from firms with high R&D resources - at which such promotion might be misallocated - to lower R&D experience firms such as SMEs and startups, see (Wanzenböck, I & Scherngell, Thomas & Fischer, 2013)

The argument about the relationship among firm's size and exploitation of innovation began when (Schumpeter, 1942) presented his theory, the incentive and ability for spending on R&D are greater in large firms than small ones, thus we may consider larger firms the major driver of economic growth. This influential economist supports his argument by considering the market power of larger firms as one of the main engine of economic growth because they have more resources needed to catalyze technological change. additionally, their fixed cost per innovation could be amortized over a variety of units. consequently, the benefits of innovation

¹ OECD (2015), "The business environment for innovation", in *The Innovation Imperative: Contributing to Productivity, Growth and Well-Being*, OECD Publishing, Paris. <http://dx.doi.org/10.1787/9789264239814-6-en>

should be less in small firms. However, the counter argument suggesting small firms have higher productivity with their R&D due to their reliance on governance advantages. small number of employees reveal that decision makers within firms are closer to the technology activities and to the customers, accordingly they can easily adopt technological possibilities with market needs see (Allen, 1977). But, reconciling the coexistence of both viewpoints has been presented in more recent studies that suggest both larger and smaller firms vary in the sort of R&D conducted by them, incremental innovation vs radical innovation or process innovation vs product innovation, and the returns to each type differ with firm size as well, see (Rosen, 1991);(Cohen & Klepper, 1996); (Knott, 2003); (Anne Marie Knott & Vieregger, 2015)

Ownership structure and legal status of firms are from the main factors of firm innovation capacity. The issue of government ownership in firms is crucial for innovation, (Zhou & Gao & Zhao, 2016) believe that even though the state ownership in firms enables them to obtain important R&D resources, it makes them less efficient in employing acquired resources to generate product or process innovation, thus less state ownership in the firms could be most favorable structure for introducing innovation outputs. Also, (Majumdar, 2008) found that relative shrinking of state ownership in Indian industrial firms associated with a significant growth in industrial performance. Another issue related to foreign ownership, the debate is whether local firms owned by foreigners could achieve satisfied level of innovation. Quite early, theories alongside empirical research acknowledged FDI as a possible channel for technology transfer and innovation. Some research concluded that FDI inflows have positive impact on R&D expenditures and innovation outputs in host countries, see (Javorcik, 2004), (Moran, 2006), (Erdal & Göçer, 2015b), (Sekuloska, 2015) (Cheung & Lin, 2004). from the other side, other studies found negative spillover effects of FDI on patents and other innovation

activities, see(Wancio, 2015), (Qu, 2014), (Jaguli, 2011) (Sourafel Girma, Gong, & Görg, 2006).

In recent years, much debate has been risen regarding financing innovation particularly in small firms, where such firms sometimes lack from solvency or have another kind of financial constraints that limit their access to external finance. (Agénor, Canuto, & Jelenic, 2014) referred to key factors of these financial constraints, the first one is limited collateral because assets acquired by companies engaging in innovation are fundamentally intangible. the second is the asymmetry of information among firms conducting in R&D activities and the potential finance providers. The third is high monitoring costs which make external investments in R&D activities less attractive than other probable investment strategies like public subsidies or internal finance.

All the previous issues and arguments gain their importance from the globally increasingly innovation effect on economic growth as well as the attention paid to governance and business environment at the same time. In this study, I will investigate empirically these arguments and theories by testing regression models and other statistical and quantitative correlation to contribute to the research efforts in innovation and development policy making.

Chapter two

2. Prior studies

The innovation act in governance environment has been studied partially in the literatures, the study of (Yang, 2017) used the same data source of our study which is the World Bank enterprise survey, it investigated the association among governance environment and SMEs performance in 14 Latin America and the Caribbean countries by explaining differences between innovative firms and non-innovative ones. The study found a correlation between poor environment and operation performance, it is related to lower profitability and lower sales size for innovative SME than non-innovative. The study confirmed that when court system is apparent to be strong, innovator firms tend to achieve higher sales and profits. By contract, differently, the performance of large innovative and noninnovative firm is not affected by governance environment. bribes have impact on firms' performance as well, by using the instrumental variables method on cross-sectional data and some evidence from panel data.

(Şeker & Yang, 2014) referred to the negative effect of briberies on firm growth in the Latin America and Caribbean region particularly low-sales-generating and startup firms. The annual sales growth of firms that were asked to pay bribes for government officials was lower than firms that had not face such solicitations. Using the World Bank Enterprise Surveys data set for 25,000 companies in 57 countries (Ayyagari, Demirguc-kunt, & Maksimovic, 2010) investigated the influential association between corruption and tax evasion on innovation activities for these firms at their firm-level determinants, a large portion of which are SMEs in developing countries and

they are victimized of corruption. The study found that Innovative firms pay a larger fraction of their sales in bribes to government officials than non-innovative firms. But, the point is that no relation among paying bribes and receiving better services from the government. Also, firms that commit to bribes avoid paying more taxes.

Furthermore, by employing longitudinal data from 64 countries, (Anokhin & Schulze, 2009) found negative correlation between corruption and trust level in the state and market institutions where the transaction costs that can restrain firm productivity and innovation are risen by the absence of such trust. *Moreover*, in the context of firm governance and ownership structure, (Benassi & Landoni, 2017) discussed the argument about the overtaking of State-Owned Enterprises (SOEs) to their specific value chains either in access innovative technologies, obtain technical capabilities, or introduce innovative products and processes exactly because their tasks are to a large scope wide and their assignment challenging. They found that SOEs play an important role in innovation, thus considering the state as a recombinator of knowledge through decentralized structures. (Gubitta & Gianecchini, 2002) investigated the effect of non-family management on governance structure for 83 SMEs in Northeast Italy and presented a definition of flexibility of the firm governance model. They said that if the owner manages of businesses are not intricate or complex to manage, the governance structure is pointless. Another point, (Munari & Oriani & Sobrero, 2010) tested data of 1000 firms from six European countries and found that R&D investment is lower in case of higher shareholding by families and financial institutions. In addition, an executive remuneration system that is linked to the firm's financial performance has a strong negative impact on R&D. thus suggesting the presence of a greater pressure for the sake of reducing R&D in market-based governance systems. (Tan &

Tan, 2004) argued that corporate governance codes do have their implications for SMEs and they do help in value creation of entrepreneurial firms.

(Abor & Adjasi, 2007) and (Rachagan & Satkunasingam, 2009) stated that the existence of independent and non-executive external board members such as audit committee members could lead to better management decisions and help growing entrepreneurial firms as well as to obtain more resources and attract additional funding from investors. Also, (Seifert, Gonenc, & Wright, 2005) found that BOD diversity in SMEs ownership proportion can cause the agency costs to go down, hence increase firm performance. (Shapiro, Tang, Wang, & Zhang, 2013) concluded that corporate governance and ownership affect innovation activity when measured by patenting activity, but not when measured by new product sales. (Che Haat, Zulkafli & Rabi, 2010) found that board compensation and frequency of board meeting are considered as important characteristics that would determine the effectiveness of the innovation investment.

There is some empirical literature establishing the importance of Firm characteristics in progressing firm level and regional innovation. For instance, firms' investment in R&D, (Frenkel, Shefer, Koschatzky, & Walter, 2010) concluded that expenditure on R&D is a motivative driver for innovative factories in Germany among all ones in the same sector, regardless of the manufacturing branch to which the factories belong, thus the share of firms that spend on R&D such as the high-tech industries is significantly greater than in the traditional industries. (Lu, Tsang, & Peng, 2008) investigated the association among R&D and innovation in Asia Pacific firms and stated that future R&D derived from strong institutional environment view has considerable potential to accelerate and advance our grasp of knowledge management besides innovation strategy.

Exporting and importing characteristic is a driver of innovation and growth as well, by using firm level data from World Bank's Enterprise Surveys for 43 countries, (Şeker, 2011)

investigated the association between firm growth (innovation is an indirect measure of firm growth) and firm's trade orientation and that by dividing the firms into four categories: only exporters, only importers, two-way traders, and non-traders. the study showed that there is a significant correlation among global engagement of firms and their productivity, capital intensity, and wages rate. it also found that two-way trader firms (exporter and importer) grow faster and have more innovation than other groups. additionally, the best performer firm among those are that import intermediate products.

The relation between market influence and innovation has been a frequent question, (Aghion, Blundell, Griffith, Howitt, & Prantl, 2009) concluded that the market competition intensity, measured by new entry into certain industries, is positively associated with innovation activities between incumbent companies that employ advanced technology and negatively linked with those less efficient incumbents. (Ayyagari, Demirgüç-Kunt, & Maksimovic, 2011) found a positive correlation between competition with foreign firms and higher innovation rates. however, no relationship has been found among competition with state-owned firms and firm innovation levels. in addition, the study concluded that exporter firms are more innovative than non-exporter ones.

The nature of correlation between Innovation, firm size, and firm age is a theory that has been attempted in the range of literatures, (Hansen, 1992) assessed the impact of both firm size and firm age on innovation levels of manufacturing firms. the study used new products introduced and fraction of the last 5 years sales from these new products as indicators of innovation outputs. the results showed that firm age and firm size can work separately in assessing the firm innovation level as well as both size and age inversely linked to innovation outputs. also, (Balasubramanian & Lee, 2008) by using patents data from COMPUSTAT firms and found negative correlation between

firm age and technical quality, especially greater in areas with more active technology. moreover, with each further year there is a reduction in the influence of 10% of growth in R&D concentration by just over 3% on the market value.

Investment in human capital for innovation has been studied in previous research such as the paper of (Macdonald, Assimakopoulos, & Anderson, 2007) which found a positive impact of education and training on desired innovation in some European firms. Furthermore, (Bauernschuster, Falck, & Heblich, 2009) argued that continuous training for firms' staff lead to an increase in leading- edge knowledge which raise a firm's tendency to innovate new products and processes. the paper of (Acemoglu, 1997) confirmed that in case of high workers' expectations about potential firms' innovation, they will be more motivated to invest in their individual skills and accepting the prevailed lower wages rates if they expect higher wages rates in the future. in a similar way, the willingness of firms to innovate is related positively with their expectations about higher quality of workforce in the future.

Given the importance of innovation for firm growth, it is more serious for readers to ask whether financial development is correlated to growth by fostering firm innovation and thus increasing efficiency in Asian Pacific firms. (Girma, Gong, & Gorg, 2008) suggested that FDI financed firms and domestic bank financed firms tend to innovate more than others. Additionally, FDI inwards are positively correlated with domestic R&D activities at the sectoral level. however, the effect of FDI into technology transfer is distinguished from the impact on indigenous credit opportunities. However, (M. S. Freel, 2000) found that no indicators of success in innovation in case of applying for external finance by innovative firms. thus, innovators are less likely to apply for such finance than other less innovative peers. (Hyytinen & Toivanen, 2005) investigated the SMEs behavior in Finland and provides evidence that innovation and growth could be curbed by

capital market limitations as well as the government funding disproportionately helps firms from industries that heavily rely on external finance.

Although financing the R&D activities provides a potentially earnest channel to relate finance with innovation outputs and economic growth, (Fazzari, 2009) found that there are no direct evidences that aggregate R&D activities in U.S. firms are affected largely and enough by finance choice. in addition, the study found significant influence of internal cash flows and external equity in young firms, but not in mature ones.(Freel, 1999) explored the environment of funding product innovative firms in UK and concluded, whilst innovative firms had no desire to search the needed external funds, they had less chances to have successfully accessed bank loans. This could be a kind of seriousness since bank loans is still considered the key source of external finance utilized. (Giudici & Paleari, 2000) tested the innovation finance in 46 small high-tech Italian firms. they confirmed an inadequacy of traditional financial methods for financing innovative projects such as personal finance and short-term bank loans. thus, they are willing to issue external equity only if the new investors also provide non-financial competencies.

Venture capital industry as a finance choice has a significant impact on firm performance and growth. there have been a growing number of studies discussing innovation in venture capital-backed SMEs and other firms over the past decades, (Gonzalez, 2013) believe that venture funding increases the rate of company's innovative activities. (Kortum & Lerner, 2000) found that venture capital investments are more effective than external R&D investment in generating innovation. (Dessi & Yin, 2012) concluded that there is evidence of a substantial impact of venture capital on innovation, measured by patent counts, at the industry level but not on individual firm level. (Kaplan & Schoar, 2005) referred to firms that are funded by more experienced venture capitalists

are more likely to succeed. This could be because top tier venture capitalists are better able to identify high quality firms and entrepreneurs.

Argument raises sound in the literature, (Lee, 2004) investigated the innovation determinants in Malaysian manufacturing sector and resulted that the innovation propensity in large firms is greater than in small firms. additionally, private limited and public limited firms tend to innovate more than sole proprietorship firms. but, contrary to some previous studies we mentioned, the tendency to innovate is affected negatively by the size of exports. in addition, study analysis indicated that innovation is not affected by the foreign and local ownership composition of firms. Also, there are some evidences that the propensity of innovation is positively associated with market power and competition. (Choi, Lee, & Williams, 2011) analyzed data from 548 Chinese firms and found that the number of patents registered are strongly affected by foreign ownership in the firm by increasing the affiliation within the entire group. moreover, even though the innovation performance is correlated positively with state and institutional ownership in these Chinese firms, it seems to be lagged. by contrast, firms with only insider ownership tend to have lower innovation levels, hence it is expected that firms with concentrated ownership have no substantial impact. in term of innovation resources and their relation to firm characteristics, (Hitt , Hoskisson, Johnson,& Moesel, 1996) referred to that producing internal innovation is affected negatively by emphasizing financial controls and deemphasizing strategic controls because of acquisitions and liquidations. thus, gaining short-term rents in competitive advantage could be better strategy and that by seeking external innovation activities.

Chapter three

3. Research design and methodology

3.1 Survey and sample

I used firm-level data from World Bank enterprise surveys (ES)² to investigate the correlation between firm innovation and three drivers of investment climate, governance environment, firm characteristics, and finance choice. These surveys use standardized survey apparatuses to benchmark the investment environment of individual countries across the world and to examine firm behavior and performance. The surveys sample from the universe of registered businesses in each country and follow a stratified random sampling methodology.

One great advantage of the World Bank enterprise survey that providing unique database about firms' behavior and performance during certain periods. In addition, it presents a broad coverage of innovation activities that firms undertake across developing countries³. Innovation has been defined in the survey as introducing new product and whether this product has new function and better quality, introducing new process and whether this process has new technology, obtaining patents, acquitting foreign tech- License, and improved automation.

Furthermore, the survey provides rich data about firm characteristics in term of firm size, firm age, ownership structure, industry, sales and production cost, employees skills, and

² ES gathers information about the experience of individual firms in country's business environment, it's main changes and challenges over time, and different constraints to private sector firm's performance and growth. it is a set of firm-level comprehensive questionnaires of a representative sample of an economy's firms, it covers a broad range of business climate issues including innovation, access to finance, governance and corruption, business competition, infrastructure, security and crime, trade, and performance measures.

³ Previously, rare consistent data on the nature of innovation outputs introduced by firms has been existed across countries. Moreover, these rare data typically involve patents and R&D expenditure only across developed countries

finance methods used by firms in purpose of maintaining performance growth. Additionally, suitable information regarding individual state-governance environment of these firms have been delivered, this includes data about illegal activities such as bribes or informal payments by firms to government officials that help us to understand to what extend these firms are victimized and information on the trust level of firms in court system that help us to understand to what extend the legal system is strong and influential in business environment.

The sample of this paper consists of 4,993 firms from seven East-Asian Pacific countries for the year 2015. These countries are Malaysia, Indonesia, Philippine, Vietnam, Timor Leste, Solomon Islands, and Papua New Guinea. Both manufacturing firm and service firms have been included in the sample as well as small, medium, and large firms have been considered to find size-differences effect on innovation within these firms. The sample includes firms with all kinds of legal structure, shareholding companies with shares trade represent (3.97%) from the panel firms, while shareholding company with non-traded shares are (24.91%), both two types are considered as corporations in the analysis, sole proprietorships denote (39.96%), Partnership (19.65%), Limited partnership (9.55%), and Other (1.68%). however, (0.28%) of the sample considered as unknown based on survey answers. Table (1) shows the distribution of panel firms across countries for the size and industry.

Table 1: distribution of panel firms across countries

Country / ratio-number		Industry/ ratio-number		Firm size/ ratio-number		
Country	Freq/ratio	Manufacturing	Service	Small	Medium	large
Vietnam	20%~ 996	69%~ 685	31%~ 311	39%~ 389	35%~ 344	26%~ 263
Indonesia	26%~ 1,320	81%~ 1069	19%~ 251	34%~ 457	35%~ 458	31%~ 405
Philippine	27%~ 1,335	76%~ 1021	24%~ 314	35%~ 474	36%~ 475	29%~ 386

Papua New Guinea	1%~ 65	35%~ 23	65%~ 42	25%~ 16	54%~ 35	21%~ 14
Timor Leste	3%~ 126	48%~ 60	52%~ 66	53%~ 67	42%~ 53	5%~ 6
Malaysia	20%~ 1,000	59%~ 585	41%~ 415	38%~ 383	32%~ 322	30%~ 295
Solomon Islands	3%~ 151	26%~ 40	74%~ 111	45%~ 68	40%~ 61	15%~ 22
Sub total	4,993	70%~ 3483	30%~ 1510	37%~ 1854	35%~ 1748	28%~ 1391
Total	4,993	4,993			4993	

3.2 Variables

By dividing firm innovation into three main parts, this paper examines innovation using eleven major indicators that represent innovation activities and dynamism in a broader aspect and they are the dependent variables of the study. Two main dummy variables have been constructed from the entire data base in term of measuring the section of innovation outputs, new product innovator and new process innovator. Referring to the section of innovation activities followed by firms, five dummy variables have been developed, acquiring patents, investing in R&D, international quality certificate, foreign tech- license, and formal Training. In addition, four dummy variables have been presented for the third section which is effectiveness of innovation outputs, new function introduced by new product, better quality of new product, new technology from new process, and automation. Furthermore, core innovation index, innovation activities index, and effectiveness innovation index are other three variables have been constructed to combine each section indicators.

The study uses six dummy variables represent the measurements of governance environment, fair court, court obstacle, bribed firms, expected informal payments, foreign ownership, and state ownership. Furthermore, seven variables have been created for firm characteristics, firm's age, firm size (small, medium, and large firm), exporter, R&D firm

investment, using foreign tech- license, formal training, manager experience, competition against informal, and international business. Finally, in purpose of measuring financing working capital within firms, the paper use four variables to determine the finance method firms follow to finance their working capital, internal finance (returned earnings), bank and financial institutions borrowing, on credit from suppliers, and informal finance from families or money lenders. These 16 independent variables are the main drivers of the correlation among innovation and the three factors. Country fixed effect and macroeconomic indicators have been employed as control variables for each section. Table (2) illustrates the study variables explanation and table (3) shows the summary statistics for all these variables:

Table 2: variables explanation

Dependent variables - innovation	
Variable	Definition
product Innovator	A dummy variable equal to one if the firm introduced or developed any new or significantly improved product and 0 otherwise.
process Innovator	An aggregate dummy variable includes 5 dummies and equal to one if the firm introduced any new or significantly improved manufacturing method, logistics, management practices, marketing methods, supporting activities and 0 otherwise.
Patents	Dummy variable equal to one if the firm purchased or licensed any patented or non-patented inventions or other types of knowledge for innovation, and 0 otherwise.
R&D investment	Dummy variable equal to one if the firm spent on R&D activities, within the establishment or other companies contracted and 0 otherwise.
Quality certification	Dummy variable equal to one if the firm has an internationally-recognized quality certification, and 0 otherwise.
Foreign Tech-License	Dummy variable equal to one if the firm uses technology licensed from a foreign-owned company and 0 otherwise.
Formal Training	Dummy variable equal to one if the firm runs formal training programs to any of its employees specifically for innovation, and 0 otherwise.
New function	Dummy variable equal to one if the new innovated product has completely new function compared with all other products in the firm, and 0 otherwise.

Better Quality	Dummy variable equal to one if the new product has better quality compared with all other products in the firm, and 0 otherwise.
Automation	A dummy variable equal to one if the main new or significantly improved process automate manual processes, and 0 otherwise.
New technology	A dummy variable equal to one if the main new or significantly improved process introduced new technology, and 0 otherwise.
Core innovation index	An aggregate dummy variable consists of two dummies and equal to one if the firm has introduced any core innovation output, new or developed product or process, and 0 if it has not introduced both.
innovation activities index	An aggregate dummy variable consists of five dummies and equal to one if the firm has undertaken any of the 5 different innovative activities described above, and 0 if it did not all.
Innovation effectiveness index	An aggregate dummy variable consists of four dummies and equal to one if the firm has achieved any of the 4 different innovative effectiveness indexes described above and 0 if it did not all.
First independent variable set: Governance environment	
Fair court	Dummy variable equal to one if the court system is fair, impartial and uncorrupted, and 0 otherwise.
Court obstacle	Dummy variable equal to one if the firm consider the court system is either minor, moderate, major, or sever obstacle, and 0 if it is not obstacle.
Expected informal	An aggregate dummy variable consists of seven dummies and equal to one if the firm was asked to pay informal payments or gifts for obtaining electrical connection, water connection, construction permit, taxes reduction/exemption, import license, operating license, or cleaning customs, and 0 otherwise.
Bribed firm	Dummy variable equal to one if the firm paid any amount or percentage of sales as informal payments or gifts, and 0 if it paid nothing.
Foreign ownership	Tow dummy variables equal to one if more than 10% and less than 50% of the firm is owned by private foreign individuals, companies or organizations and 0 if less than 10% and more than 50%. (additional one variable for 50% level of ownership).
Government ownership	Dummy variable equal to one if more than 10% of the firm is owned by the state, and 0 if less.
Auditor	Dummy variable equal to one if the firm's financial statements checked & certified by external auditor, and 0 otherwise
Largest owner %	Percentage of the largest Owner from whole ownership in the firm.
Second independent/control variables set: Firm characteristics	
Exporter	Dummy variable equal to one if the firm derives at least 10% of the sales from direct exports, and 0 otherwise.
Number of establishments	Number of Establishments in The Firm.

Small firm	Dummy variable equal to one if the firm has ≥ 5 and ≤ 19 employees, and 0 otherwise.
Medium firm	Dummy variable equal to one if the firm ≥ 20 and ≤ 99 , and 0 otherwise.
Large firm	Dummy variable equal to one if the firm has ≥ 100 employees, and 0 otherwise.
Firm's age	Survey year minus the year in which the firm started operation.
Corporation	Dummy variable equal to one if the firm is a shareholding with shares trade in the stock market or shareholding with non-traded shares or shares traded privately, and 0 otherwise.
partnership	Dummy variable equal to one if the firm is a partnership or limited partnership, and 0 otherwise.
sole proprietorship	Dummy variable equal to one if the firm is a sole proprietorship, and 0 otherwise.
Capital city	Dummy variable equal to one if the firm is located in the capital city, and 0 otherwise.
Manager experience	Years of experience of top manager working in the sector.
Competitors	Dummy variable equal to one if the firm has more than 10 competitors for the main product, and 0 otherwise.
Competition against informal	Dummy variable equal to one if the firm compete against informal or unregistered firms, and 0 otherwise.
International business	Dummy variable equal to one if the firm's main product is sold mainly in international markets, and 0 otherwise.
third independent variables set: External Finance of working capital	
External finance	% of working capital financed from external sources rather than Internal finance (retained earnings)
Access to bank loan or line of credit	Dummy variable equal to one if the firm has a line of credit or bank loan and 0 otherwise.
banks Borrowing/ non-banks Borrowing	Two contentious variables represent % of working capital financed by the sum of financing from banks and financing from other financial institutions.
On credit purchase	Contentious variable represents % of working capital financed by purchases on credit/advances from suppliers /customers
Informal finance	Contentious variable represents % of working capital financed by other (money lenders, friends, relatives, etc.)
Firm performance dependent variables	
Productivity t	Sales per worker for the last year
Log Sales t	Log sales of last year
Log operating income t	Log sales – log production cost

Table (3) Summary Statistics

Variable	Obs	Mean	Std. Dev.	Min	Max
Innovator product	4,937	0.2402269	0.4272644	0	1
Spending-R&D	4,923	0.1730652	0.3783421	0	1
patents	4,897	0.1108842	0.3140208	0	1
training	4,939	0.305325	0.4605916	0	1
technology license	3,355	0.1997019	0.3998359	0	1
quality certificate	4,767	0.2122928	0.4089739	0	1
foreign ownership10%	4,993	0.1624274	0.3688794	0	1
government_~	4,993	0.0186261	0.1352139	0	1
court fair	4,553	0.5996047	0.4900323	0	1
exporter	4,993	0.204286	0.4032193	0	1
exporter	4,993	0.204286	0.4032193	0	1
manager experience	4,677	16.28694	10.1251	1	70
Competition with informal	4,806	0.4500624	0.4975518	0	1
new function	1,177	0.57774	0.4941295	0	1
quality	1,163	0.9527085	0.212353	0	1
International market	3,414	0.1511424	0.3582401	0	1
automation	1,952	0.8002049	0.3999487	0	1
process technology	1,942	0.6560247	0.4751553	0	1
small firm	4,993	0.3686014	0.4824742	0	1
large firm	4,993	0.2750907	0.446605	0	1
medium firm	4,993	0.3563079	0.478956	0	1
loan access	4,642	0.3804395	0.4855472	0	1
borrowings	4,972	14.70294	23.61099	0	100
Corporations	4,979	0.2896164	0.4536299	0	1
partnerships	4,979	0.2928299	0.4551067	0	1
sole proprietorship	4,979	0.4006829	0.4900861	0	1
Other structure	4,979	0.0168709	0.1288005	0	1
Innovator process	4,981	0.4408753	0.4965418	0	1
informal expected	3,109	0.2245095	0.417326	0	1
core innovation	4,960	0.4814516	0.4997062	0	1
Innovation activities	3,986	0.6141495	0.4868566	0	1
Innovation effectiveness	2,231	0.5347378	0.4989037	0	1
foreign50%	4,993	0.0999399	0.2999499	0	1
Government 50%	4,993	0.0070098	0.083439	0	1

bribed firm	2,967	0.3828783	0.4861709	0	1
External finance	4,972	25.37751	30.58846	0	100

3.3 Summary statistics

Table 3 summarizes the proportion of firms in each country conducted different types of innovations outputs and activities. Core innovation in the table refers to the main innovation outputs, introducing or developing new products or services and introducing or developing new processes. However, innovation activities index indicates the main efforts made by firms to generate innovative outputs. Also, some indicators have been selected to measure the innovation success represented in innovation effectiveness index.

Analysis across countries shows a degree of difference in term of three innovation indicator as well as the detailed measurements of innovation across the variety of categories for each country. Nevertheless, sample from Papua New Guinea ranks the highest rates in the context of innovation outputs and activities indicators while just under other countries in regard of effectiveness index. Even though the increasing economic growth, Indonesia and Malaysia records the lowest proportions in introducing new products and they are between the last ranks in introducing new processes as well as both countries, with Vietnam, state lower ranks of innovation generating efforts. Table (4) presents the percentages of firms in each country of the sample engaged in all innovation categories:

Table (4): the percentages of firms in each country undertaken innovation indicators

country	product Innovator	process Innovator	Core innovation index	Patents	R&D investment	Quality certificate	Foreign Tech- License	Formal Training	innovation activities index	New function	Quality	Automation	Process technology	Innovation effectiveness index
Vietnam	0.31	0.52	0.83	0.04	0.22	0.18	0.12	0.26	0.82	0.46	0.98	0.87	0.57	2.88
Indonesia	0.12	0.21	0.33	0.07	0.05	0.20	0.28	0.13	0.73	0.58	0.91	0.75	0.77	3.01
Philippine	0.35	0.54	0.89	0.09	0.22	0.21	0.15	0.48	1.15	0.57	0.96	0.84	0.67	3.04
Papua New Guinea	0.60	0.91	1.51	0.17	0.27	0.20	0.30	0.74	1.68	0.49	0.95	0.73	0.71	2.88
Timor Leste	0.40	0.67	1.07	0.29	0.22	0.05	0.25	0.47	1.28	0.82	0.92	0.81	0.76	3.31
Malaysia	0.10	0.54	0.64	0.21	0.20	0.30	0.20	0.29	1.2	0.78	0.91	0.72	0.63	3.04
Solomon Islands	0.42	0.76	1.18	0.22	0.20	0.06	0.33	0.44	1.25	0.70	0.98	0.79	0.69	3.16

Table (5) shows the analysis across firms according firm size and legal status, large firms in the sample seem to be more innovative, see also (Ayyagari et al, 2010). The analysis reflects the acquisition of large firms on the greatest shares of three aggregate innovation indicators comparing with other two types. although, the fractions are semi similar amongst the three firm sizes in the context of effectiveness index, large firms have 0.83 core innovation index, 1.61 innovation activities index, and 3.02 Innovation effectiveness index. In addition, corporations and partnership firms are more innovative than sole proprietorship, the sample shows that corporations rank the highest aggregate innovation indexes with 0.92, 1.46, 3.03 respectively comparing with sole proprietorships which have 0.57, 0.57, 2.93 respectively.

Table (5): the percentages of firms undertaken innovation indicators according the size and legal status

Size & status/indicators	product Innovator	process Innovator	Core innovation index	Patents	R&D investment	Quality certificate	Foreign Tech- License	Formal Training	innovation activities index	New function	Quality	Automation	Process technology	Innovation effectiveness index
Firm size														
Small firm	0.19	0.40	0.59	0.07	0.12	0.08	0.11	0.21	0.59	0.58	0.96	0.78	0.63	2.95
Medium firm	0.26	0.46	0.72	0.09	0.18	0.18	0.17	0.30	0.92	0.58	0.95	0.81	0.65	2.99
Large firm	0.28	0.55	0.83	0.18	0.24	0.43	0.32	0.44	1.61	0.57	0.95	0.81	0.69	3.02
Legal status														
Corporation	0.33	0.59	0.92	0.16	0.28	0.34	0.20	0.48	1.46	0.58	0.96	0.85	0.64	3.03
partnership	0.20	0.47	0.67	0.14	0.16	0.29	0.29	0.29	1.17	0.63	0.95	0.73	0.71	3.02
sole proprietorship	0.21	0.36	0.57	0.06	0.11	0.07	0.14	0.19	0.57	0.54	0.95	0.82	0.62	2.93
Other status	0.25	0.50	0.75	0.00	0.12	0.18	0.06	0.26	0.62	0.40	0.95	0.73	0.65	2.73

Table (6) illustrates the correlation between all innovation variables, most innovation aspects are significantly correlated at 1% level. The coefficients of correlation matrix are ranged from 1% to 45%. The greatest coefficient of 45% refers to that firms that introduced or developed new processes are also highly likely to innovate or develop new products.

Table (6): Correlation Matrix between the Firm Innovation Indicators

indicator	product innovator	process innovator	spending RD	patents	training	Tech-license	quality cert	new function	quality	automation	Process tech
product	1.00										

innovator											
process innovator	0.45	1.00									
Spending RD	0.34	0.40	1.00								
patents	0.20	0.31	0.32	1.00							
training	0.36	0.43	0.40	0.35	1.00						
technology license	0.13	0.13	0.18	0.22	0.21	1.00					
quality cert new function	0.12	0.17	0.23	0.23	0.25	0.25	1.00				
quality	.	0.06	0.04	0.09	0.10	0.04	0.06	1.00			
automation	.	0.04	0.06	-0.01	0.07	0.04	0.01	0.00	1.00		
Process tech	0.09	.	0.07	0.00	0.06	0.01	0.03	0.04	0.01	1.00	
	0.10	.	0.07	0.10	0.13	0.17	0.05	0.11	0.03	-0.35	1.00

According to the analysis of firm characteristics within the selected sample, small and medium firms are dominant – small firms represent 37% of the sample, medium firms make up 35%, and large firms constitute 28% of the overall sample. Regarding the legal status, sole proprietorship ranks the highest in the sample with 40%, corporations and partnership firms equally denote 29% for each, and the other proportion 2% for other firm structures. The average age of the firms in the sample is 18.85 years. The sample also illustrates that only 20.57% of the firms are direct exporters. The same statistics show that the average mean of managers' experience is 16.29 years. 15.11% of the sample firms confirmed that the international market is the main market for their products and sales in the last year while, the majority of firms operate in the local and national markets. In terms of competition, the survey asked firms to state the number of competitors in the local market whether they are domestic, foreign, or state firms, the sample shows that around 2% of respondent firms have no competitors, 63% have more than 3,000 competitors and too many to count, 33% have competitors less than 100, and 2% of firms have competitors more than 100 and less than 3,000. In addition, 45% of firms compete against informal or unregistered firms in the local markets.

Table (7) shows the correlation coefficients between firm characteristics and aggregate innovation indicators, most aggregate indicators and firm characteristics are significantly correlated at 1% level. The positive coefficients of correlation matrix are ranged from 1% to 41%. The greatest coefficient of 41% refers to that firms that conduct innovation activities are also highly likely to innovate or develop core innovation outputs. Additionally, the results state the significant role of firm age and exporting in firm innovation.

Table (7): Correlation Matrix between aggregate innovation indexes and firm characteristics

indicator/firm characteristics	core innovation index	innovation activities index	Innovation effectiveness index	Firm size	Age firm	exporter	Manager experience	competition with informal	international business
core innovation index	1.00								
innovation activities index	0.41	1.00							
Innovation effectiveness index	.	0.07	1.00						
Firm size	0.12	0.27	0.03	1.00					
Age firm	0.05	0.11	0.03	0.22	1.00				
exporter	0.14	0.21	0.06	0.25	0.06	1.00			
Manager experience	0.04	-0.03	-0.04	0.07	0.40	-0.04	1.00		
competition with informal	0.05	-0.02	-0.06	-0.10	-0.04	-0.12	0.01	1.00	
international business	0.10	0.16	0.04	0.23	-0.02	0.57	-0.01	-0.14	1.00

The sample analysis institutes that around 60 % of firms believe that the court system is fair, impartial, and uncorrupted, the highest trust level in legal system has been shown in Timor Leste with 86.51% and the lowest level has been noticed in Solomon Islands with 33.33%. in term of informal payments, there were 38.29% bribed firms that made gifts or informal payments to public officials to “get things done” with regard to customs, taxes, licenses, regulations, services etc. the greatest proportion of bribed firms has been found in Papua New Guinea, it is 92.31% of whole respondent sample, also, firms in Timor leste, Vietnam, and Solomon Islands rank higher

level of bribery, 86.17%, 76.24%, 70.13%, respectively than Malaysia, 37.01% and Philippine, 47.55%. Indonesian firms are more transparent with only 11.82%.

An aggregate variable has been constructed to examine whether firm was asked to make gifts or informal payments, this includes a variety of survey questions in term of whether firm was asked to pay informal payments or make gifts to obtain electrical connection, water connection, construction-related permit, exemptions from inspections or meetings with tax officials, import license, operating license, or cleaning customs of exporting goods directly. According to sample analysis 22.45% of respondent firms were asked to make gifts or informal payments, this ratio appears to be higher in both Timor leste and Solomon Islands, while other countries states lower rates, for instance, Indonesia’s proportion is only 13.27%. Table (8) explains the percentages of firms in term of their responses about governance aspects.

Table (8): the percentages of firms in term of their responses about governance aspects

Panel A							
Country	Court fair	Expected informal payments/gifts	Bribed firms	Foreign ownership		State ownership	
				10%	50%	10%	50%
Vietnam	67.43	24.11	76.24	8.23	6.53	3.51	1.51
Indonesia	62.42	13.27	11.82	10.38	3.33	0.91	0.45
Philippine	49.72	19.04	47.55	21.95	15.96	0.07	0
Papua New Guinea	41.54	20.41	92.31	69.23	61.54	0	0
Timor leste	86.51	53.91	86.17	2.38	0.79	2.38	0
Malaysia	65.84	22.70	37.01	18.10	2.60	4.20	0.4
Solomon Islands	33.33	45.65	70.13	46.36	39.07	0	0
Average	59.96	22.45	38.29	16.24	8.97	1.86	0.5

The table also illustrates the firm governance and ownership structure of firms in the sample. The paper set two level of ownership in regard of foreign and state ownership of these firms, firms are 10% or more owned as an indicator of slight holding and firms more than 50% owned by these two owners. It can be clearly seen that 16.24% of firms are owned by private foreigners at 10% level and 8.97% owned at 50% level, however, in term of government ownership, 1.86% of firms are owned by a state at 10% level and 0.5% of these firms are owned by a state at 50% level.

Based on the ES questions, this study classifies firms into innovator and non-innovator and that is reflected in core innovation index variable. In addition, ES asked firms about their trust in court system and whether they paid or were asked to pay informal payments. Based on core innovation index that is constructed in this paper, I found that 49.68% of firms (2,476 out of 4,984 firms) introduced new products or new processes. But, only 56.31% of innovative firms which responded to the court fairness question demonstrated their trust and 43.69% did not. However, 63.52% of non-innovative firms which answered the same question showed their trust and 36.48% did not.

In regard of corruption, across the seven countries, firms were asked several questions in the context of making informal payments or gifts in many governmental deals, this paper found that 16.81% of firms were asked to make such action to obtain electrical connection, 21.46% for water connection, 23.64% for import license, 14.24% for operating license, 17.87% for cleaning exports customs, 13.24% for tax exemption, 22.04% for construction-related permit. Additionally, 29.09% of firms are innovators and they were asked to make informal payments or gifts for government officials and 70.91% innovators were not asked, however, only 12.29% of firms are non-innovator and they were asked, and 87.71% were not. Furthermore, only 2,964

firms – innovator and non-innovator – gave their feedback about making informal payments or gifts, 53.09% of those are innovators made such informal actions and 46.91% innovators did not, while 25.06% are non-innovators did the same behavior and 74.94% did not.

Selecting finance channel is more crucial for firms and could affect their performance and innovation activities. In the study’s sample, determining the percentage of firms’ working capital financed from certain resources were requested to be identified. The survey recognizes financing working capital by two main categories, the internal funds / retained earnings, and the external finance such as borrowing from banks, borrowing from non-bank financial institutions, purchases on credit from suppliers and advances from customers, and funding by moneylenders, friends, relatives, etc. only for purpose of data summary, this paper divides finance level into three groups, small (from 1% to 20%), medium (from 21% to 50%) , and large (>50%) contribution. This study presents that only 2,549 firms employed external finance, 17.30 % of these have small external finance, 46.84% medium, and 35.86% large external finance⁴. Table (9) includes percentage of firms in each country employed three ways of finance and distribution of firm size across percentage of working capital finance. It is obviously shown that the majority of firms across countries and across size categories prefer to mix between external and internal finance.

Table (9): % of firms in term of external finance levels across countries and firm size.

Panel A			
Country	External finance (1% -20%)	External finance (21%-50%)	External finance (51% 100 %)
Vietnam	21.09	38.42	40.49
Indonesia	18.80	48.69	32.50

⁴ In each level of firms’ finance, the complementary percentage is internal fund.

Philippine	16.67	42.67	40.67
Papua New Guinea	13.04	21.74	65.22
Timor leste	6.90	50.00	43.10
Malaysia	11.53	53.46	35.01
Solomon Islands	37.11	44.33	18.56
Average	17.30	46.84	35.86
Small firm	18.98	49.94	31.08
Medium firm	18.31	45.08	36.61
Large firm	14.15	45.22	40.63
Average	17.30	46.84	35.86

A comparison between 2,307 innovative firms have access / have no access to loans, 48.03% of those firms have access to bank finance or line of credit and 51.97% have no. moreover, the second external finance strategy (21%-50%) is the most favorable for innovative firms, hence 45.71% of innovators prefer this range, 37.14% prefer external finance more than 50%, and 17.14% desire to be less than 20%.

Chapter four

4. Empirical Results and Discussion

All regressions are projected using firm-level data across 7 countries from East Asia and Pacific. This paper uses a logit probability model to estimate these regressions because the 11 individual indicators of firm innovation are dummy variables with 0–1. However, Since the aggregate innovation indicators are cumulative and cross-country estimation with more than 100 observations for almost countries, the study uses ordered logit model to estimate regression models for the three aggregate indicators.

In the empirical results part, this paper goes to test a set of hypotheses were broadly discussed in the literature and linked to the study questions, these hypotheses are discussed in the following sections:

4.1 Governance environment and firm innovation

In this section, this study examines the statistical association between governance environment in which firm operates and the extent to which firm innovates. I defined the governance environment as, first, the external environment which is related to trust in and strength of legal system as well as corruption and bribes. Second, the internal environment which includes ownership structure of firms, role of external audit, and the percentage of the largest owner has in the firm. Therefore, three main hypotheses are investigated in this section:

H1a: firms that pay bribes are more likely to engage in innovation than firms don't pay.

H1b: The difference between innovation for bribed firms in strong and weak court system is not different than the difference between non-bribed firms in strong and weak court system

H1c: An increasing foreign ownership in local firms contributes significantly to their innovation activities.

In purpose of investigating this relationship, in the first step, I examine the impact of a variety of external governance variables on firm innovation and controlled them by firm size, firm age, legal statues, capital city, number of establishments in the firm, and country - industry fixed effect. The regression model for firm i in country k in industry j is estimated in the following form:

$$(1) \text{ firm innovation}_{i,k,j} = \alpha + \beta_1 \text{ external governance}_{i,k,j} + \beta_2 \text{ large firm dummy}_{i,k,j} + \beta_3 \text{ medium firm dummy}_{i,k,j} + \beta_4 \text{ Firm age}_{i,k,j} + \beta_5 \text{ Corporation dummy}_{i,k,j} + \beta_6 \text{ Partnership dummy}_{i,k,j} + \beta_7 \text{ capital city}_{i,k,j} + \beta_8 \text{ Number of establishments}_{i,k,j} + C_k + I_j + \varepsilon_{i,k,j}$$

$$k = 1, \dots, 7 \quad j = 1, \dots, 41$$

Where Firm innovation $_{i,k,j}$ represents one of the three aggregate indicators (core Innovation Index, activities innovation index, or Innovation effectiveness index), or one of the eleven main indicators of innovation based on firms' responses to survey questions. External governance $_{i,k,j}$ is trust in courts, court obstacle, bribed firms, expected informal payments or gifts. C_k is vector of country fixed effects, I_j is vector of industry fixed effects.

In the second step, I examine the impact of ownership structure on firm innovation by employing related variables of foreign and state ownership at two levels of ownership (>10% and <=50%) and (>50%), the largest owner proportion of firm ownership, and whether financial statements of the firm are subjected to check by external auditor, and controlled them by firm size, firm age, legal statues, capital city, number of establishments in the firm, country-industry fixed effect. The following regression model I estimate is in the following form:

$$(4) \text{ firm innovation}_{i,k,j} = \alpha + \beta 1 \text{ Internal governanc}_{i,k,j} + \beta 2 \text{ large firm dummy}_{i,k,j} + \beta 3 \text{ medium firm dummy}_{i,k,j} + \beta 4 \text{ Firm age}_{i,k,j} + \beta 5 \text{ Corporation dummy}_{i,k,j} + \beta 6 \text{ Partnership dummy}_{i,k,j} + \beta 7 \text{ capital city}_{i,k,j} + \beta 8 \text{ Number of establishments}_{i,k,j} + C_k + I_j + \varepsilon_{i,k}$$

Internal governance_{i,k,j} is foreign ownership dummy at >10% & <=50% level, >50% level, state ownership dummy at level >10%, external auditors dummy, and the proportion of the largest owner in the firm. C_k is vector of country fixed effects, I_j is vector of industry fixed effects.

Table (10) illustrates the coefficients of regression models in term of the correlation between governance environment and firm innovation. The firms' managers were asked two questions regarding their trust in legal system, whether they believe that courts are fair and uncorrupted as well as the degree of the extent to which courts are obstacle to the current operations of firms. I found negative association among the strength of court system and firm innovation, firm that trusts courts system is less likely to engage in innovation activities and firm that consider courts are obstacle is more likely to innovate. That means firms can innovate even they face some obstacles in the legal system. The nature of legal system, whether it is flexible or

rigid, in the country plays a role in firm performance, (Anderlini, Felli, Immordino, & Riboni, 2013) concluded that rigid legal regimes are favorable in terms of welfare and technological innovation outputs in the early stages of development. however, flexible systems are proper in development intermediate stages, but both systems are equivalent when technology is mature. So, the innovation outputs in the rigid system may be, in some cases, either low or high.

The main finding from Table (10) below is the positive correlation between paying informal payments and aggregate indexes of both core and activities of firm innovation, firms that pay bribes to public officials are more likely to innovate processes, but not products, than those don't. additionally, they are more motivated to engage in almost innovation activities except foreign technology license, which indicates that innovative firms are public rent-seeking, hence they are somehow in need of government-provided services than non-innovative firms.

The same trend has been shown when I used the variable of whether firms were asked to make informal payments or gifts, it is clear from the coefficients in the table that all regression estimations between this variable and innovation outputs and activities are significant, which means that innovative firms are mostly targeted by corrupt public officials in purpose of avoiding bureaucratic regulations. But, there is no evidence that paying bribes leads to generate new functions and better quality of the new introduced or developed products as well as it doesn't automate manual processes, partially or fully, and doesn't introduce a new technology or method of the innovative processes. These results are robust in case of using other two contentious variables, percentage of total annual sales paid as informal payments and total annual informal payments, where both of them positively related to firm innovation. therefor, the results accept H1a that implies, firms that pay bribes are more likely to engage in innovation than firms don't pay.

While I couldn't definitely rely on these results due to potential endogeneity concerns, I employed 2SLS-instrumental variable to find the causal relationship. A new variable has been generated for this purpose which is the percentage of total senior management's time was spent on dealing with requirements imposed by government regulations, but, I dropped the firms that were inspected or visited at least one time by tax officials. Therefore, the spent time is expected to be related to bribes or any other cases linked to legal system. This variable is uncorrelated to dependent variables (firm innovation) and correlated to explanatory variables, trust in court, paid bribes, and whether firms were asked to pay bribes.

The 2SLS results show no association at 5% level is reported between the extent to which firms trust court system with either the two core innovation variables nor the five innovation activities. However, similar results with logit regressions in term of the relation among paying bribes and innovation have been confirmed, where the significant correlation between firm innovation and firms pay bribes is hold when I instrumented the bribe variable with the instrumental variable of interaction time with government officials. thus, this study agrees with H1a that implies firms that pay bribes are more likely to engage in innovation than firms don't pay. It is noteworthy that the study of (Ayyagari et al., 2010) concluded that despite the negative correlation between firm performance and bribe payments, innovative firms having to make higher informal payments.

With respect of interaction between governance variables, I tested the interaction between bribed firm and fair court variables to discover the difference between innovation for bribed firms in strong and weak court system, whether it is different than the difference between non-bribed firms in strong and weak court system by using this model:

*firm innovation*_{*i,k,j*}

$$= \alpha + \beta_1 \text{Fair court dummy}_{i,k,j} + \beta_2 \text{bribed firm dummy}_{i,k,j} \\ + \beta_3 (\text{Fair court dummy}_{i,k,j} * \text{bribed firm dummy}_{i,k,j}) + C_k + I_j + \varepsilon_{i,k}$$

The interaction regression coefficient is positive and significant in some of innovation aspects implying that there is different relationship between paying bribes and firm innovation for strong compared to weak court system. That difference is related to processes innovation rather than product innovation, and is existed in patents, quality certificate, and formal training and aggregate innovation activities indicators rather than others. So, H1b which says, “the difference between innovation for bribed firms in strong and weak court system is not different than the difference between non-bribed firms in strong and weak court system” is rejected in this test.

Table (10): logit regression results between governance environment and innovation

variables	Product Innovator	Process Innovator	Core Innovation index	Patents	R&D Spend	Quality certif	Foreign Tech License	Formal Training	Innov Activiti index	New function	Quality	Automation	Process tech	Innovation effectiv index
Fair court	-0.3259 (0.00)	-0.1939 (0.005)	-0.2375 (0.001)	-0.1548 (0.152)	-0.2763 (0.002)	0.1904 (0.833)	-0.4213 (0.00)	-0.1045 (0.174)	-0.1536 (0.029)	-0.0858 (0.538)	0.3694 (0.304)	-0.0245 (0.855)	-0.0844 (0.454)	-0.3121 (0.434)
Court obstacle	0.3700 (0.00)	0.4839 (0.00)	0.4753 (0.00)	0.4587 (0.00)	0.5222 (0.00)	0.2843 (0.004)	0.1676 (0.116)	0.4688 (0.00)	0.3599 (0.00)	-0.1092 (0.477)	-0.0580 (0.870)	0.2574 (0.079)	0.0426 (0.730)	-0.1301 (0.778)
Bribed firm	0.7466 (0.508)	0.6249 (0.00)	0.5839 (0.00)	0.7211 (0.00)	0.6656 (0.00)	0.4340 (0.001)	0.3385 (0.019)	0.4340 (0.00)	0.5563 (0.00)	0.6138 (0.003)	-0.4226 (0.378)	-0.0046 (0.981)	-0.3136 (0.046)	-1.0113 (0.140)
Expected informal	0.5599 (0.00)	1.0044 (0.00)	1.0385 (0.00)	0.9359 (0.00)	0.8652 (0.00)	0.5803 (0.00)	0.5454 (0.00)	0.8666 (0.00)	1.0603 (0.00)	0.2433 (0.186)	-0.2920 (0.488)	0.1492 (0.398)	0.1103 (0.435)	0.0980 (0.438)
Fair court* Bribed firm	-0.3128 (0.059)	0.3999 (0.005)	0.2799 (0.050)	0.5807 (0.009)	0.2685 (0.142)	0.4593 (0.012)	-0.1687 (0.409)	0.4369 (0.006)	0.4317 (0.003)	0.6921 (0.022)	0.7989 (0.385)	0.2711 (0.318)	-0.4319 (0.065)	1.1712 (0.388)
Foreign ownership> 50%	-0.1637 (0.203)	-0.1876 (0.122)	-0.1712 (0.136)	0.1548 (0.383)	0.2671 (0.054)	1.1461 (0.00)	0.6182 (0.00)	0.1776 (0.149)	0.4075 (0.001)	0.3334 (0.155)	0.2916 (0.607)	-0.3000 (0.180)	-0.1332 (0.476)	0.3257 (0.639)
Foreign ownership> 10%&<=50%	0.3179 (0.031)	0.3445 (0.009)	0.3469 (0.009)	0.8632 (0.00)	0.3250 (0.026)	1.0812 (0.00)	0.9956 (0.00)	0.4516 (0.001)	0.7972 (0.00)	0.2599 (0.348)	0.6931 (0.295)	0.0391 (0.860)	0.0397 (0.839)	1.2081 (0.255)
State ownership >10%	0.5578 (0.042)	-0.2966 (0.248)	-0.3435 (0.181)	-0.5310 (0.143)	-0.1231 (0.667)	0.6018 (0.030)	0.3032 (0.334)	0.1844 (0.475)	0.8497 (0.009)	0.6168 (0.188)	0.2734 (0.810)	0.2070 (0.690)	0.4252 (0.304)	-1.0639 (0.337)
External auditor	0.4874 (0.00)	0.6422 (0.00)	0.6069 (0.00)	0.6968 (0.00)	0.6707 (0.00)	1.0444 (0.00)	1.0695 (0.00)	0.8119 (0.00)	0.9024 (0.00)	0.1481 (0.368)	0.1908 (0.594)	0.1230 (0.376)	0.4345 (0.00)	0.3129 (0.456)
Largest owner %	0.0004 (0.847)	-0.0020 (0.360)	-0.0012 (0.592)	0.0079 (0.013)	-0.0005 (0.814)	0.0078 (0.002)	-0.0071 (0.017)	0.0029 (0.205)	0.0045 (0.043)	0.0013 (0.734)	-0.0003 (0.971)	0.0011 (0.781)	-0.0070 (0.032)	0.0038 (0.747)

In regard of internal governance, this paper compares between two levels of foreign ownership in local firms, foreign ownership >50% and foreign ownership between 10% and 50%. I didn't find evidence that firms with more than 50% foreign ownership innovate products or processes more than those foreign owned by less than 50%. But, there is evidence that these firms engage significantly in some innovation activities such as having international quality certificates, foreign technology licenses, and partially R&D investments. From the other side, firms with > 10% and <=50% are more likely to innovate products and processes more than those >50% foreign owned. I found also, even though the aggregate innovation activities index for >50% foreign owned firms is significant, the aggregate indicator of those with <50% has higher coefficient, they invest more in R&D, inventions, and foreign technology licenses. Thus, I suggest that innovation is correlated significantly with FDI at a certain level but not at level of control the local firms. therefore, I reject H1c because an increasing foreign ownership in local firms over 50% has a negative impact on their innovation activities.

This paper also examined the state ownership in local firms and whether there is any association with firm innovation. I concluded that there is a positive correlation between the increasing state ownership and product innovation and conducting international quality certificate only and not correlation with other innovation aspects. The results from the table also shows positive and considerable relations in the term of external audit and innovation linkage, regular check of firm's financial statement by external auditor surge firm innovation activities as well as firms that subject to external audit are more likely to indulge in core innovation outputs. I also investigate whether the ownership percentage of firm the largest owner has is correlated with innovation, my results refer to substantial correlation between this ratio and some

innovation activities such as patents, international quality certificate, and foreign technology license. But it doesn't make sense in core innovation.

4.2 Firm characteristics and firm innovation

By using logit regression and ordered logit model, I investigated the association between firm innovation and firm characteristics and estimated the regression models into two equations: the first one uses firm age, size, number of establishments, and legal status as predictors for firm innovation. Then the first equation is considered as a baseline equation and build on it to examine the second equation to estimate the relation between firm innovation and its trade and market characteristics and that by fixing firm size, age, legal status and number of establishments in the firm as control variables alongside country and industry fixed effect. For this purpose, a set of hypotheses have been constructed and tested based on literature findings:

H2a: younger firms are more likely to innovate than older ones.

H2b: larger firms are more innovative than medium-sized and small businesses.

H2c: Corporations are more likely to engage in innovation activities than partnerships, proprietorships, and other legal status of firms.

H2d: Number of establishments positively correlated to firm's probability to innovate.

H2e: Exporter firms are more innovative than un-exporter ones.

H2f: highly experienced top managers in the firms hamper firm innovation.

H2g: Number of competitors affects negatively on firm innovation.

H2h: Competition against informal firms increases the probability of firm innovation.

H2i: Firms compete in international markets are more likely to innovate than those compete in domestic and national markets.

The estimation of the first model is as follows:

$$(1) \quad \text{firm innovation}_{i,k} = \alpha + \beta 1 \text{ Firm Age}_{i,k,j} + \beta 2 \text{ Medium Firm dummy}_{i,k,j} + \\ \beta 3 \text{ Large Firm dummy}_{i,k,j} + \beta 4 \text{ Corporation dummy}_{i,k,j} + \beta 5 \text{ Capital city dummy}_{i,k,j} + \\ \beta 6 \text{ Number of establishments}_{i,k,j} + C_k + I_j + \varepsilon_{i,k,j}$$

$$k = 1, \dots, 7; j = 1, \dots, 41,$$

where C_k is vector of country fixed effects, I_j is vector of industry fixed effects, and Firm innovation $_{i,k,j}$ represents 1 of the three aggregate indicators (core Innovation Index, activities innovation index, or Innovation effectiveness index), or 1 of the 11 main indicators of innovation based on firms' responses to survey questions.

The estimation of the second model is as follows:

$$(2) \text{firm innovation}_{i,k} = \alpha + \beta 1 \text{ Firm Age}_{i,k,j} + \beta 2 \text{ Medium Firm dummy}_{i,k,j} + \\ \beta 3 \text{ Large Firm dummy}_{i,k,j} + \\ \beta 4 \text{ Corporation dummy}_{i,k,j} + \beta 5 \text{ Capital city dummy}_{i,k,j} + \\ \beta 6 \text{ Number of establishments}_{i,k,j} + C_k + I_j + X_{i,k,j} + \varepsilon_{i,k,j}$$

$$k = 1, \dots, 7; j = 1, \dots, 41,$$

where $X_{i,k,j}$ is a vector of variables describing different aspects of the firm's trade and market characteristics, competition against informal sector, number of competitors for the main product, exporter firm, manager's years of experience working in the sector, and whether the main market in which firm sell its main product is an international market.

Table (11) explains the estimated coefficients of both baseline and second regression models. The table demonstrates that most of individual firm characteristics are significantly associated with firm innovation outputs and activities but not with the quality of innovation, that

can be clearly seen from the estimated results in the table where most of the significance levels are less than 0.05.

Firm age is closely correlated with core innovation outputs either in aggregate indicator or in individual indicators such as introducing or developing new products and processes. Also, it is linked with firm innovation activities such as purchasing/licensing patented or non-patented inventions, spending on R&D, acquiring international quality certificate, using foreign technology license, and providing formal training to employees in purpose of developing or/and introducing new products or/and processes⁵. So, there is no evidence that younger firms in East Asia and Pacific countries are more likely to innovate than older ones. Thus, H2a is rejected.

Regarding firm size, the paper found that large firms and medium-sized firms are more likely to introduce or develop new products and processes than small ones. In addition, they are more likely to undertake innovation activities than small firms⁶. However, the estimated coefficients in the regression models imply that probability to innovate in larger firms exceeds that in medium-sized ones either in the context of core innovation outputs or in undertaking innovation activities. This is clear in the table, compared to medium-sized firms, large firms are more likely to innovate new products and processes, spend on R&D, undertake patents activities, obtain international quality certificate, use technology licensed from foreign-owned companies, and runs formal training programs. Thus, this paper supports the H2b hypothesis of that larger firms in East Asia and Pacific countries are more innovative than medium-sized and small businesses.

⁵ Ayyagari et al, 2011 found that younger firms are more innovative. But, their innovation measurements are different from this paper.

⁶ In unreported statistics, a negative correlation between small firms and most of innovation activities and core innovation outputs has been states.

Legal status of firms has no substantial impact on firm innovation compared to firm size, this study's statistics show different result to (Ayyagari et al, 2011) where they found that corporations are more innovative than partnerships and sole proprietorships. However, my reported estimations found similar results, corporations are more likely to innovate than partnerships and sole-proprietorships, but this is in case of non-controlling by firm size, while this correlation is not persisted in case of controlling by firm size. Regarding innovation activities engagement, corporations are more likely to undertake innovation activities like patents, R&D investments and others than other legal statuses even in case of size control. So, H2c is not accepted here in the context of core innovation only.

This paper rejects H2d. Controlling for size, age, and legal status, there is no evidence that the number of establishments in the firm rises the probability that a firm will introduce or develop new process or/and new product. While, it is positively correlated to firm's efforts to obtain foreign technology license. Firms located in official capital city are more innovative than those outside the capital.

Table (11): logit regression between Firm characteristics and innovation

variables	Product Innovator	Process Innovator	Core Innovation index	Patents	R&D spend	Qualit y certif	Foreign Tech License	Formal Training	Innov Activiti index	New function	Quality	Auto- mation	Process tech	Innov effectiv index
Age firm	0.0119 (0.00)	0.0062 (0.024)	0.0075 (0.008)	0.0145 (0.00)	0.0118 (0.00)	0.0159 (0.00)	0.0108 (0.002)	0.0081 (0.005)	0.0099 (0.001)	0.0016 (0.728)	-0.0006 (0.961)	-0.0015 (0.762)	0.0042 (0.315)	-0.0064 (0.626)
Large firm	0.6919 (0.00)	0.7599 (0.00)	0.7681 (0.00)	1.0863 (0.00)	0.7685 (0.00)	1.9627 (0.00)	1.2417 (0.00)	1.2802 (0.00)	1.6194 (0.00)	-0.1051 (0.543)	-0.1357 (0.732)	0.1607 (0.327)	0.3101 (0.024)	-0.4162 (0.389)
Medium firm	0.4100 (0.00)	0.2793 (0.044)	0.3386 (0.00)	0.2236 (0.09)	0.4515 (0.00)	0.7974 (0.00)	0.4453 (0.001)	0.5098 (0.00)	0.5961 (0.00)	-0.0725 (0.649)	-0.0372 (0.920)	0.1031 (0.487)	0.1381 (0.264)	-0.4488 (0.311)
Corporations	0.0606 (0.515)	0.2451 (0.091)	0.1344 (0.112)	0.4939 (0.00)	0.5262 (0.00)	0.8687 (0.00)	0.1798 (0.187)	0.2017 (0.02)	0.3431 (0.00)	0.2053 (0.174)	-0.1500 (0.675)	0.3906 (0.009)	-0.1583 (0.187)	0.6248 (0.144)
Capital city	0.5481 (0.00)	0.7508 (0.00)	0.7613 (0.00)	0.4042 (0.007)	0.5070 (0.00)	0.2255 (0.060)	0.7588 (0.00)	0.4105 (0.00)	0.6589 (0.00)	-0.2321 (0.154)	-1.0920 (0.002)	0.3109 (0.077)	0.3650 (0.01)	-0.4923 (0.250)
Number of establishments	0.0005 (0.539)	0.0015 (0.330)	0.0021 (0.229)	0.0016 (0.229)	0.0004 (0.632)	0.0009 (0.414)	0.0219 (0.002)	0.0009 (0.382)	0.0087 (0.006)	-0.0040 (0.202)	0.0345 (0.276)	0.0020 (0.581)	-0.0012 (0.241)	0.1181 (0.487)
exporter	0.5527 (0.00)	0.4834 (0.00)	0.5452 (0.00)	0.8998 (0.00)	0.6755 (0.000)	1.2089 (0.000)	0.7706 (0.000)	0.5204 (0.000)	0.9630 (0.000)	0.3488 (0.034)	-0.1865 (0.819)	0.1474 (0.368)	0.0935 (0.498)	0.1186 (0.335)
competitors	-0.4927 (0.00)	-0.4800 (0.00)	-0.5095 (0.00)	0.0432 (0.811)	-0.1501 (0.254)	-0.0781 (0.541)	-0.0579 (0.646)	-0.3957 (0.000)	0.0622 (0.535)	-0.0445 (0.671)	-0.5089 (0.087)	0.0256 (0.812)	-0.1598 (0.068)	-0.0846 (0.269)
Competition informal	0.6362 (0.00)	0.7624 (0.00)	0.7476 (0.00)	0.4235 (0.00)	0.5934 (0.00)	-0.0259 (0.776)	0.4411 (0.000)	0.4462 (0.000)	0.4504 (0.000)	-0.1572 (0.306)	-0.1018 (0.774)	0.1079 (0.447)	0.0890 (0.456)	-0.0775 (0.475)
Manager experience	0.0084 (0.033)	0.0025 (0.505)	0.0044 (0.239)	-0.0218 (0.00)	-0.0068 (0.128)	-0.0165 (0.001)	-0.0124 (0.019)	-0.0093 (0.019)	-0.0168 (0.00)	-0.0077 (0.289)	0.0100 (0.564)	0.0028 (0.709)	0.0019 (0.770)	-0.0013 (0.808)
International business	0.2944 (0.015)	0.2704 (0.017)	0.3474 (0.002)	0.7469 (0.00)	0.2431 (0.069)	1.2590 (0.000)	0.7483 (0.000)	0.6002 (0.000)	0.6324 (0.000)	0.2096 (0.381)	0.1552 (0.771)	0.0291 (0.901)	0.2630 (0.169)	0.2661 (0.118)

This study also examined the impact of trade orientation on firm innovation. The estimations regarding the linkage among being exporter or un-exporter firm and its innovation progresses are constant with findings in the literatures, see (Richardson & Rindal,1995; Ayyagari et al, 2011), hence the statistics provide evidence that exporter firms are more likely to innovate new products and processes than un-exporter firms. In addition, the probability of exporters to invest in innovation activities such as inventions, R&D, quality certificates, training, and foreign technology licenses outweigh the probability of un-exporters. Due to previous analysis, H2e is accepted, exporter firms are more innovative than un-exporter ones.

Furthermore, even though, there is a significant positive association between the year of top manager experience and innovating a new product, there is no evidence that firms with more experienced top managers in the sector tend to innovate new processes more than those with less experienced top managers. However, I found a negative correlation between manager experience years and aggregate innovation activities index. thus, the persistence of such kind of managers diminishes the probability of firms to undertake innovation activities such as purchasing patented or non-patented inventions, obtaining international quality certificate, and arranging formal training for innovation. See also (Daellenbach et al, 1999)⁷. therefore, I prop H2f, highly experienced top managers in the firms hamper firm innovation.

The influence of marketing and competition standings on innovation have been tested as well. In the context of competition, this paper investigated whether firm innovation correlated to the number of competitors and competition against informal sector or not. Results suggest that greater number of competitors, the lower probability that the firm will innovate new products and processes. Additionally, the ability of firms that compete more than 10 competitors are not

⁷ They found no evidence that average experience years of top management team within the company's industry are positively linked with the firm's adherence to innovation.

linked to their engagement in innovation activities except formal training which is negatively linked with number of competitors. So, H2g, Number of competitors affects negatively on firm innovation, is confirmed.

From the other side, the managers in the survey were asked whether their firm compete against unregistered or informal firms, the study's estimations imply that competition against informal sector increases the probability of firms to undertake core innovation outputs like new products and processes as well as innovation activities, particularly investing in R&D. therefore, these results support H2h that suggests competition against informal firms increases the probability of firm innovation.

With respect of firm's marketing strategy of its main product, the coefficients in the table show that the higher opportunity of selling the firm's main product in international markets, the more likely that the firm will engage in aggregate core innovation as well as conduct in international quality certificate and other innovation activities. Consequently, *H2i* is not rejected, firms compete in international markets are more likely to innovate than those compete in domestic and national markets.

4.3 Finance and firm innovation

In this section, this study investigates the association among finance channels of which firms in East Asia and Pacific countries employ to finance their working capital. In the survey, firms' managers were asked to determine the proportion of working capital financed and fixed assets by a variety of channels as well as firms were asked whether they have access to banks loan or not. This paper defines the external finance to be the percentage of working capital that are financed by external resources such as borrowing from bank or non-bank institutions and

informal channels like families and friends, however, retained earnings is considered to be the internal resource⁸. The solo hypothesis in this section is:

H3: firms access to external finance are more likely to innovate than those dependent mostly on internal finance. In addition, the nature of channels by which external finance plays a significant role in shaping the level of firm innovation.

By controlling for firm characteristics and country-industry fixed effect, the following model is estimated:

$$\begin{aligned} \text{firm innovation}_{i,k,j} = & \\ & \alpha + \beta_1 \text{External Finance}_{i,k,j} + \beta_2 \text{Firm Age}_{i,k,j} + \beta_3 \text{Medium Firm dummy}_{i,k,j} + \\ & \beta_4 \text{Large Firm dummy}_{i,k,j} + \beta_5 \text{Corporation dummy}_{i,k,j} + \beta_6 \text{Capital city dummy}_{i,k,j} + \\ & \beta_7 \text{Number of establishments}_{i,k,j} + C_k + I_j + \varepsilon_{i,k,j} \end{aligned}$$

$$k = 1, \dots, 7; j = 1, \dots, 41,$$

where external finance represents the proportion of working capital that are financed by the four finance channels, bank borrowing, non-bank borrowing, purchase on credit or in advance from customers, and informal finance such as friends and relatives, or bank loan dummy, whether the firm has a line of credit or a loan from a financial institution.

Table (12) shows that in general, access to external finance boosts the probability to extend innovation outputs and activities more than internal finance. As it is explained in the estimated coefficients, firms with easy access to external finance are more likely to introduce new products and processes as well as engage in R&D, patents, and other activities. These findings are constant with testing the correlation but using the dummy variable of access to

⁸ In the survey, the sum of all mentioned external finance channels represents the complementary ratio (100%) of internal finance variable.

bank loans where the coefficient of this dummy is positively associated with most of individual and aggregate indexes of innovation outputs and activities. however, access to loans doesn't guarantee firms accessibility to international quality certificates. Moreover, from the coefficients of external finance and loan access in term of individual and aggregate innovation effectiveness, there is no evidence that access to external finance ensure the effectiveness of innovation.

In comparison between bank borrowing and non-bank borrowing, I found that access to finance from non-bank financial institutions such as microfinance institutions, credit cooperatives, credit unions, or finance companies contributes more than bank finance in extending products/process innovation and R&D investment. While, the opposite is true regarding foreign technology license and formal training.

Further finance channels have been presented in this analysis, firms that don't have access to loans from financial institutions use another finance methods such as purchasing on credit or borrow from relatives or friends. In this table, we can see that using on credit purchases or in advances from costumers significantly associated with the probability of firms to innovate core outputs and conduct innovation activities. by contrast, even though, the coefficient of informal finance variable is positive and considerably correlated to both introducing new product, new processes, and R&D investing, the aggregate indexes of innovation activities are not significant.

Therefore, we can support the third hypothesis which suggests that external finance is more influential than internal resources like retained earnings in fostering firm innovation. Also, the study confirms that the nature of channels by which external finance play a significant role in shaping the level of firm innovation.

The previous results in the second section, small firms are negatively correlated with innovation aspects compared to large and medium firms. additionally, the results in this section showed that access to loans is positively associated with firm innovation. but, in case of interaction between both variables the results constitute non-correlation on innovation aspects except the positive relationship with patents. Furthermore, I did interaction model in term of firms that have access to loans and pay bribes, I found no difference for the previous results for each except in some innovation activities.

variables	Product Innovator	Process Innovator	Core Innovation index	Patents	R&D spend	Quality certif	Foreign Tech License	Formal Training	Innov Activiti index	New function	Quality	Autom- ation	Process tech	Innovation effectiv index
External finance	0.0082 (0.00)	0.0128 (0.00)	0.0134 (0.00)	0.0057 (0.001)	0.0072 (0.00)	0.0061 (0.00)	0.0079 (0.00)	0.0069 (0.00)	0.0099 (0.00)	-0.0036 (0.151)	-0.0153 (0.007)	-0.0020 (0.411)	-0.0001 (0.994)	-0.0012 (0.497)
Loan Access	0.4724 (0.00)	0.8833 (0.00)	0.8228 (0.00)	0.3806 (0.00)	0.6447 (0.00)	0.1587 (0.071)	0.5157 (0.00)	0.6655 (0.00)	0.7730 (0.00)	0.2231 (0.163)	0.4879 (0.213)	0.2027 (0.170)	-0.0313 (0.802)	-0.0320 (0.774)
banks Borrowing	0.0029 (0.077)	0.0080 (0.00)	0.0073 (0.00)	0.0028 (0.215)	0.0022 (0.220)	0.0035 (0.061)	0.0059 (0.007)	0.0058 (0.00)	0.0072 (0.00)	0.0037 (0.255)	-0.0065 (0.335)	-0.0014 (0.661)	0.0062 (0.023)	0.0055 (0.02)
Non-bank Borrowing	0.0131 (0.005)	0.0126 (0.002)	0.0153 (0.001)	0.0076 (0.151)	0.0169 (0.00)	0.0170 (0.00)	0.0044 (0.465)	0.0074 (0.083)	0.0137 (0.001)	0.0045 (0.660)	-0.0375 (0.010)	0.0079 (0.370)	-0.0095 (0.162)	-0.0048 (0.433)
Credit /advance	0.0139 (0.00)	0.0233 (0.00)	0.0256 (0.00)	0.0106 (0.00)	0.0105 (0.00)	0.0083 (0.00)	0.0109 (0.00)	0.0098 (0.00)	0.0155 (0.00)	-0.0079 (0.037)	-0.0131 (0.073)	-0.0005 (0.884)	-0.0031 (0.320)	0.0055 (0.046)
Informal finance	0.0093 (0.006)	0.0070 (0.036)	0.0066 (0.007)	-0.0017 (0.730)	0.0106 (0.003)	0.0020 (0.636)	0.0052 (0.276)	0.0020 (0.559)	0.0026 (0.427)	-0.0115 (0.091)	-0.0091 (0.536)	-0.0029 (0.669)	-0.0110 (0.047)	-0.0153 (0.006)
Loan access*small firms	0.1239 (0.453)	0.0521 (0.718)	0.0531 (0.713)	0.7822 (0.001)	-0.1239 (0.511)	0.3288 (0.133)	0.1347 (0.567)	0.0093 (0.990)	-0.0626 (0.664)	-0.1087 (0.711)	0.3288 (0.133)	0.1003 (0.702)	0.2359 (0.282)	0.3861 (0.637)
Loan Access* bribed firms	0.6116 (0.004)	0.4384 (0.027)	0.4520 (0.023)	0.2154 (0.434)	0.1995 (0.397)	0.8435 (0.00)	-0.6687 (0.009)	0.1626 (0.429)	-0.1007 (0.596)	0.9361 (0.013)	0.0404 (0.961)	-0.0078 (0.982)	-0.2162 (0.447)	0.7561 (0.563)

Table (12): Regression between external finance and innovation

4.4 How much innovation activities engaged by innovative firms can progress innovation effectiveness?

Although, in table (13) this study explains the correlation, at 10% significance level, among innovation activities undertaken by firms and whether the new innovations from products and processes could progress their targets, I couldn't find a significant association between governance, firm characteristics, and external finance with innovation effectiveness despite of employing a variety of instrumental variables like top management interaction time with public officials, average numbers of year of employees education, and the average numbers of employees who completed secondary school. Thus, this paper is incapable to address endogeneity worries and hence leave the identification issues in this area for future work.

Logit reg	New function	Quality	Automation	Process technology	Innovation effectiveness index
Patents	0.1892 (0.251)	0.1353 (0.713)	0.1984 (0.182)	0.5311 (0.00)	0.0910 (0.834)
R&D spending	0.0577 (0.057)	0.4707 (0.159)	0.2999 (0.021)	0.3733 (0.00)	1.6922 (0.006)
International Quality certificate	0.2968 (0.051)	0.0988 (0.782)	0.1904 (0.191)	0.2486 (0.041)	-0.5097 (0.223)
Foreign Technology License	-0.0058 (0.882)	0.5605 (0.178)	0.2096 (0.241)	0.8256 (0.00)	1.2013 (0.081)
Formal Training	0.3814 (0.004)	0.8046 (0.011)	0.2862 (0.019)	0.5132 (0.00)	0.8041 (0.031)
Innov Activity index	0.3043 (0.039)	0.9073 (0.005)	0.2337 (0.075)	0.5281 (0.00)	0.6487 (0.070)

Table (13): regression between innovation activities and innovation effectiveness

The table shows that firm engagement in purchasing or licensing patented or unpatented inventions increase the probability of only generate new technology or method from its new introduced or developed process. While this invention has no any relationship with other

innovation effectiveness indicators and the aggregate index. Spending on R&D has more impact than patents in term of new developed product's having completely a new function comparing to other products as well as automation of manual processes and introducing a new technology or method from new developed process.

Firm's possession of internationally-recognized quality certification increases the probability to obtain a new product with new function and new technology from new developed process. However, using technology licensed from foreign-owned firms is correlated positively with only introducing a new technology or method from new developed process. While, the role of formal training appears to be the most influential activity where firms who provide formal training to any of their employees specifically for the development and/or introduction of new or significantly improved products or services and processes are more likely to progress all the required effectiveness indicators of new products or processes.

4.5 How the performance of innovative firms is affected by governance environment and external finance?

In this section, this paper examines how innovation performance is affected by the interaction between business environment. I generated financial indicators for innovative firms from the survey dataset as well as the previous effectiveness measurements. In the survey firms were asked to determine their total sales for two periods, for the last year and for three years ago. Thus, the first measurement is the log productivity for the last year which is equal to sales per worker as the following formulas:

$\log(\text{productivity}_t = \text{Total Sales}_t / \text{full time employees number}_t)$

The second measurement is log total sales for the last year and the third one is operating income of innovators, it is the difference between log total sales and log cost of production for

last year. Even though firms were asked to state a variety of operating costs, it is not possible to determine the accurate net income for all firms in the sample hence the firms were not asked for all financial statements information.

$$\log \text{ operating income }_t = \log \text{ total Sales }_t - \log \text{ total production cost }_t$$

By using two-sample t-test to compare the means of productivity change between innovative firms and non-innovative firms, the results indicated that there is a statistically significant difference among means ratios ($p=0.0047$). hence, non-innovative firms have statistically significantly higher mean ratios on productivity (0.017) than innovative ones (0.0095) in introducing new process while, there is no a statistically significant difference among means ratios ($p=0.6787$) in term of products innovation hence, both non-innovators and innovators have semi-equal means (0.14, 0.13) respectively. T-test for log operating income showed that innovators have statistically significantly higher mean values of operating income than non-innovators (0.053, 0.46) respectively. While, the opposite is correct in term of change in total sales between the two periods, non- innovators reported greater means percentages than innovators (0.15, 0.11).

Table (14) illustrates OLS results regarding the impact of governance, firm characteristics, and finance on innovative firms' performance. I used a set of independent variables of governance and finance to regress on three dependent variables of innovation performance. Furthermore, the aggregate variables of core innovation and innovation activities are used as explanatories while, all models have been controlled by firm characteristics and external finance in addition to country-industry fixed effect.

$$\text{Innovation performance}_{i,k,j} =$$

$$\alpha + \beta_1 X_{i,k,j} + \beta_2 Z_{i,k,j} + \beta_3 XZ_{i,k,j} + \beta_4 \text{Ferm Age}_{i,k,j} +$$

$$\beta 5 \text{ Medium Firm dummy}_{i,k,j} + \beta 6 \text{ Large Firm dummy}_{i,k,j} + \\ \beta 7 \text{ Corporation dummy}_{i,k,j} + \beta 8 \text{ Capital city dummy}_{i,k,j} + \beta 9 \text{ External finance}_{i,k,j} + \\ C_k + I_j + \varepsilon_{i,k,j}$$

Where $X_{i,k,j}$ and $Z_{i,k,j}$ are vectors of variables describing different aspects of governance, finance, and innovation (new product or process, activities, are used as independent variables). Innovation performance is productivity, sales, and operating income for the last year.

Table (14) shows the extent to which the performance of innovative firms is affected by their efforts to undertake innovation outputs and activities as well as the association among performance indicators and governance-innovation interaction. The results refer to a significant positive correlation between innovation and firm performance, innovative firms, either produced outputs or engaged in innovation activities, are more likely to get better high productivity, sales growth, and operating income than non-innovators. Moreover, as much as firms undertake innovation activities such as patents and R&D spending, they could introduce or develop new products and processes rather than those do not undertake.

Even though, in previous results, there was no correlation between stronger court system and innovation capability of the firms, trust in court system fosters the productivity and sales of innovative firms, that can be seen in case of interaction between innovation and court system trust hence, innovative firms' trust in legal system increases their abilities to innovate. However, the interaction between innovation and corruption variables constitutes a negative impact on performance, innovative firms who pay bribes are less likely to achieve higher levels of productivity, sales growth, and operating income than those do not make informal payments in

spite of that previously concluded in this paper that innovative firms tend to pay informal payments to avoid bureaucracy.

variables	Productivity t		Log Total sales t		Log Operating profit t	
	All sample	Innovators	All sample	Innovators	All sample	Innovators
innovator	0.2800 (0.00)	X	0.6781 (0.00)	X	0.1726 (0.00)	X
Activity innovator	0.5093 (0.00)	0.4882 (0.00)	1.0991 (0.00)	0.9515 (0.00)	0.2640 (0.00)	0.2432 (0.001)
Fair court	-0.0082 (0.881)	0.2191 (0.005)	-0.0139 (0.822)	0.1792 (0.04)	-0.0155 (0.722)	0.0758 (0.261)
Innovator*fair court	0.3407 (0.002)	X	0.5219 (0.00)	X	0.1548 (0.071)	X
Bribed firms	-0.3073 (0.00)	-0.5175 (0.00)	-0.0235 (0.790)	-0.1495 (0.230)	0.2346 (0.00)	0.1393 (0.150)
Innovator*bribed firm	-0.7628 (0.00)	X	-0.6605 (0.00)	X	-0.3240 (0.004)	X
Tax administration obstacle	0.0372 (0.496)	-0.0502 (0.537)	0.2012 (0.001)	0.0541 (0.552)	0.0623 (0.150)	0.0639 (0.352)
Interaction time public official	-0.0130 (0.00)	-0.0076 (0.067)	-0.0165 (0.00)	-0.0044 (0.349)	-0.0030 (0.202)	0.0011 (0.754)
Foreign ownership>10 <=50	0.4707 (0.00)	0.3031 (0.020)	1.0350 (0.020)	0.8898 (0.020)	0.2376 (0.002)	0.1520 (0.141)
Informal finance	-0.0163 (0.00)	-0.0185 (0.00)	-0.0199 (0.00)	-0.0226 (0.00)	0.0010 (0.645)	-0.0063 (0.051)
Loan access	0.2920 (0.00)	0.2416 (0.002)	0.4815 (0.00)	0.3308 (0.00)	0.1694 (0.00)	0.1155 (0.087)

Table (14): Regression of performance indicators and governance-innovation interaction.

The table also presents that tax administration problems in the governance system has no substantial influence on firm innovation and performance except it's negative impact on sales of all firms regardless of their innovation progress. Although, the interaction of firm's managers

with public officials in purpose of facilitating innovation has been taken place, the negative effect on productivity and sales trend is clearly confirmed.

Foreign ownership at level 10% to 50% in the tested firms is positively associated with most performance and innovation indicators, firms, innovators or non-innovators, are more likely to have higher levels of productivity and revenues with this level of foreign ownership than those more than 50% foreign owned. This result has policy implication which is the balance between foreign and local ownership in the firms.

Finally, this paper examined the impact of informal finance (friends or relatives) and access to bank loans on performance of innovative firms, firms who rely on bank loans are more likely to obtain benefits in term of productivity, sales, and income from their innovation activities than those rely heavily on informal finance.

Chapter five: Conclusion and policy recommendation

5.1 Conclusion

Innovation is one of the most important pillars of economic growth in any country. So, policy makers seek to increase the growth rates of innovation activities, either by supporting local firms through finance, regulations, and other incentives, or through cooperation and partnership with foreign companies. In this paper, I studied the relationship between three crucial factors of business environment and diversity aspects of firm innovation for 4,993 firms across seven countries from East Asia and Pacific region. Firms in the sample diversified based on firms age, size, and legal status.

The wide section of the data in this paper provides evidence across a variety of firms and countries. main results constitute that larger firms are more innovative but not necessary for innovator to be younger. firms classified as shareholding are more likely to invest in innovation activities without any preference over other legal statues in term of innovating new products and processes. In addition, firms located in the official capital city are more innovative. Furthermore, the more innovative firms are exporting ones with less than 10 competitors for the main product, they also compete strongly against informal sector and they have worldwide marketing networks with no limited to domestic and national markets.

The correlation between the strength of legal system and innovation has been narrowly examined in the literature particularly in East Asia and Pacific, I found no causal relationship between the degree of trust in court system and firm innovation, hence firms in these countries can practice innovation regardless of degree to which legal system is partial or uncorrupted. However, innovative firms that act in fair court system can progress satisfied levels of productivity and sales growth.

This study finds that firms in East Asia and Pacific are victims of bribes and they are compelled to make informal payments to avoid the bureaucracy and foster their innovation activities, but such interacted corruption doesn't imply that bribed innovative firms have better growth rate of productivity, sales, operating income, and innovation effectiveness.

I find that local firms with 50% foreign ownership or less are more innovative, while no evidence that those with more than 50% are engaged in innovation activities except its role in obtaining international quality certificates and foreign technology licenses for local firms. state ownership in local firms can serve only manufacturing firms in product innovation. moreover, firms that are subjected to external audit services are more innovative than those are not. the largest owner percentage in firm ownership has no any correlation to core innovation practices.

This study provides new evidence to the literature in term of access to external finance and its significant contribution in firm innovation comparing to internal finance such as retained earnings. But, results regarding the channels through which external finance might be the driver of innovation are somewhat different, I find that firms rely on external funds from non-banking system to finance their operation are more innovative than those who are heavily dependent on banks. Furthermore, firms that use informal finance such as friends or families can innovate as well despite the negative impact of such finance channel on their productivity and performance.

5.2 Policy recommendation

The paper's results have some policy implications, firstly, there is an urgent need to develop anti-corruption and bribery policies in the seven countries so as not to be an obstacle to firm innovation. Thus, innovators do not have to pay more informal payments to accelerate their innovation work. Secondly, Governments in these countries should provide adequate support to small businesses in terms of incentives and concessional financing through the introduction of distinctive financing programs that do not pose a barrier to innovation. Thirdly, due to significant association between international trade and innovation, policy makers need to promote the policy of economic globalization, openness and international trade, especially for SMEs through implementing programs to market their products to the international market.

Fourthly, FDI policy makers in these countries might develop appropriate policies for FDI inflows so as not to acquire full ownership of local companies. Fifthly, governments need to develop policies for fostering innovation activities such as patents, obtaining international licenses for quality and technology certificates, and appropriate training programs for local firms' workers particularly those production workers. Finally, influential contribution of governments to reduce innovation costs by determining the cost and benefit of investment in R & D is needed.

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