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Firm-Level Innovations in an Emerging Economy: Do Perceived Policy Instability and Legal Institutional Conditions Matter?

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Abstract: Innovation has become a key factor of production, driving and sustaining firms' productivity and competitiveness. Despite the growing importance attached to innovations, existing studies have produced different results on the factors driving firm-level innovations. This study investigates the factors driving innovations in the service and manufacturing sector firms in Thailand. The study tests proposed hypotheses using cross-sectional data on a sample of 613 firms from the World Bank enterprise survey of 2016. Our empirical results show that specific aspects of the business environment, such as policy instability, legal institutions, corruption, and informal competition, negatively influence non-technological innovations. Contrarily, we find that formal training, foreign technology licenses, research and development have marginal and additionality effects that positively enhance both technological and non-technological innovations. We provide practical implications for firm managers and policymakers in Thailand on adaptive measures to improve the business environment to make it conducive for firm-level innovations.

Keywords: technological innovations; non-technological innovations; business environment; corruption; legal institutions; foreign technology licenses; Thailand

JEL Classification: L62; 030; 031; 036; P37; P48

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1. Introduction

Innovation is proven to play an imperative role at the macro level as it promotes and sustains economic growth and development of countries. At the micro level, the adoption of innovations drives improvements in firms' productivity, profitability, and competitiveness. The acceptance of innovation gives businesses a competitive advantage over market competitors [1]. Innovations are driven and sustained by numerous factors, which can be classified as technological and non-technological. The contribution of firms to innovation is vital, and a vibrant business sector is a strategic source and conduit of technological and non-technological innovation. Innovation is therefore seen as a significant strategic determinant for firms' productivity and competitiveness in both emerging and developed economies [2,3]. Nevertheless, innovation activities and processes vary considerably at the firm level and across sectors and are influenced by firms' characteristics, degrees of technological knowledge production, corporate behavior, and strategies [4]. Innovation is seemingly perceived not only through new products and process development but also through technological and non-technological factors. Technological innovations comprise new products and process development, whereas non-technological innovations broadly entail marketing and organizational innovations [5]. The breakdown of innovations into technological and non-technological components is based on the criticism of the conventional viewpoint that new products and processes do not provide an adequate description of firms' innovations [6].

Firms face considerable "innovation gaps" stemming from a variety of strap constraints. Several factors influence and constrain firms in their search for innovations. Some of these factors are internal and within the firms' control. The internal factors constraining innovative firms include inadequate capital to invest in research and development, inadequate skilled personnel, and unhealthy competitive pressure from informal sector firms, among others [7]. In contrast, some obstacles to firms' innovations are also external to the firm. External factors are embedded in the business environment where the firm operates. Some of these external factors relate to the political environment, economic institutions, customs regulations, corruption, the judicial system, etc. [8,9]. An unfavorable business environment can serve as an obstacle to firms' innovations as it can inflate the cost of innovations. Corruption, for instance, can increase the total cost of innovation investment as firms will syphon money meant for innovations into paying bribes. Conversely, weaker institutions, such as weak rule of law and a poor regulatory environment, will also undermine innovation investments. According to Rodríguez-Pose and Zhang [10], weak institutional quality acts as a serious obstacle to firm-level innovation, while improved institutions cut back the total time firms spend dealing with demanding government regulations that could influence innovations. Competitive pressure from informal sector firms can also pose a serious threat to the operations of innovative firms. In emerging economies, there is the coexistence of formal and informal sector firms contesting for scarce resources [11]. The competition from these informal sector firms influences the innovation strategies of formal businesses, as it could discourage them from investing in innovations that could help them introduce new products or processes [12].

The existing studies on innovation in Thailand exhibit some limitations that do not provide a clear understanding of the innovation landscape. First, these studies have overly focused on the manufacturing sector at the expense of the service and other sectors (see [13]). Others have also measured innovations from just the technological perspective (see [14,15]). We argue that the neglect of other sectors and the narrow measure of innovation does not provide an in-depth understanding of firm-level innovations. This calls for research that builds upon these identified caveats to extend the existing understanding of innovations. This study, therefore, fills these gaps by analyzing innovations specifically by focusing on firms from all sectors, regions, and sizes. This paper aims to investigate the various factors capable of driving and sustaining innovations within firms. We use determinants spanning the business environment, such as policy instability, corruption, legal institutions, and informal competition, to determine their potential impacts on innovations. We also analyze whether firm characteristics, innovation activities, and foreign technologies influence technological and non-technological innovations.

The empirical specifications involved 613 innovative firms from both the manufacturing and service sectors spanning all of Thailand's regions. We analyzed these firms to determine whether policy instability, legal institutions, competitive pressure from the informal sector, and other internal factors drive innovations within these firms. This study is novel as it differs from previous studies in Thailand, which have not focused on analyzing the impacts of the business environment on firm-level innovations. Our results have shown that specific aspects of the business environment or institutional conditions, such as policy instability, legal institutions, and informal sector competition, negatively affect technological and non-technological innovations. The negative influence that these institutional conditions can have on firm-level innovations is consistent with institutional theory. These results, therefore, contribute to and extend the literature on institutional theory from the emerging economy perspective. Another novelty of the paper is its focus on measuring innovations from the international technological linkage perspective. Our results have demonstrated that international technological linkages could generate positive externalities on innovations in Thailand which corroborates the findings of other studies (see [16]). For instance, while there are many studies on innovations in Thailand, none of these studies have specifically focused on exploring the nexus between international technological linkages and innovations (see, for instance, [17,18]). Our study, therefore, helps to better understand innovation from this perspective and provides a better understanding of the factors driving and sustaining firm-level innovations. We have shown that foreign technology licenses have both marginal and additionality influences on both technological and non-technological innovations. Our results have proven that foreign technology licenses could significantly help induce firm-level innovations.

Our results make significant contributions to both practice and theory. In terms of policy instability and legal institutions, our results have shown that they exert negative impacts on non-technological innovations. These results indicate that firms perceive the political environment and legal institutions to be substantial obstacles to their innovation search and performance. This, therefore, calls for Thailand's policymakers to improve the political landscape and institutions as well as legal institutions to make them conducive for firms' operations. These results contribute to institutional theory, which affirms that firms vigorously respond to formal and informal institutional conditions, and these institutions critically influence their access to vital resources needed to survive [19]. Our results have also shown that foreign technologies matter for both technological and non-technological innovations [20]. Firms that have technology licenses from abroad can improve their innovations marginally. This research finding, therefore, contributes to the burgeoning literature on firm-level innovations from the technology acquisition point of view, as studies exploring this relationship are scarcely undertaken in Thailand and other ASEAN countries. The main limitations of this study relate to the data used and the specific focus on Thailand. The data used for the empirical estimation is from 2016 and the current release by the World Bank. This means that our results might not mirror the current situation of firm-level innovations in Thailand. Moreover, the measures of innovations adopted in this paper were solely from technological and non-technological perspectives. We admit that our deliberate exclusion of other measures such as degrees of novelty and patents, among others, can be the focus of further studies. This can help provide a detailed understanding of Thailand's innovation ecosystem.

The rest of this article is arranged in the following order: Section 2 reviews and discusses existing literature on technological and non-technological innovations and the different factors enhancing them. Section 3 is devoted to the methodology, source of data, and measures. Section 4 is dedicated to the detailed discussion of the results with reference to the existing studies. Section 5 completes the research with suggestions for further research, policy and practical recommendations and research limitations.

2. Theoretical Background and Hypotheses Development

The main theoretical underpinning of this research is based on institutional theory, which posits that firms need to actively act in response to formal and informal institutional conditions [21–23]. These institutional conditions critically influence firms' abilities to acquire vital resources needed to survive and accomplish competitiveness [21]. The institutional environment, therefore, informs firms' prospective strategy choices, which comprise both market and non-market strategies [24]. Similar country-level institutional conditions could influence the frequency of political connections [25,26]. Firms, therefore, endeavor to establish close relationships with governments that control the essential resources they need to survive and develop so as to stay competitive. This dependent relationship between industries and governments is very strong in developing and transition countries. Transition markets are distinguished by weak regulatory quality, with regular tumultuous changes as well as superior levels of informality. These situations allow government officials to have more discretion over law enforcement and scarce resource allocation [27]. This discretionary power of government officials grants them extra opportunities to obtain bribes from firms. This situation could escalate firms' transaction expenses on significant resources regulated by the government. Firms' dependent relationship with the state encourages them to embrace deviating strategies to engage in corruption to decrease uncertainties [28]. Furthermore, the constant institutional changes and swift economic growth in transition countries can also swell the probability of policy unpredictability, which could encourage corruption and unscrupulous behavior [29]. Policy instability could also reinforce firms' dependence on the government, allowing firms to resort to using non-market strategies such as corruption to diminish the cycle of dependency to circumvent the government's transaction processes.

The OECD Oslo Manual describes innovation as "scientific, technological, organizational, financial, and commercial activities which lead or are intended to lead to the implementation of technologically new or improved products or services" [30]. The foundations of these scientific and technological inventions could be traced to the firms' environment as well as the greater business environment, higher education institutions such as universities and other public research centers. Innovations can be categorized as technological or non-technological based on the source criteria. Technological innovations generally comprise product and process innovations, whereas non-technological innovations consist of organizational and marketing innovations [31,32]. Technological innovations can be explained as any set of activities undertaken by firms or in partnership with other partners that substantially leads to enhancements in technological changes that offer economic incentives to firms [33]. Technological innovations basically relate to the growth and usage of modern technologies. In contrast, non-technological innovations involve the launch of improved organizational techniques or the introduction of innovative marketing methods [34]. This involves incorporating new practices in the design of industrial processes such as supply chain and quality controls.

Several factors influence and sustain firms' probabilities to innovate successfully. Some of these determinants are internal within firms' environs, while others are external factors that firms do not have absolute control of. Some of the internal factors relate to research and development, internal funding, human capital, and other embedded firm characteristics such as size, ownership structure, age, etc. Conversely, the external factors comprise but are not limited to R&D collaborations with partners such as academic institutions and governments, which can also go beyond national boundaries. The main driving factor for innovation is new knowledge, which is proven to be a catalyst for enhancing and sustaining it [35,36]. Both internal and external activities result in new knowledge production, which can be appropriated by firms for further use in the innovation process. Research and development activities are central to new knowledge production that can translate into innovative products and process development. R&D allows and enables firms to increase their productivity, competitiveness, and ultimately economic success. R&D can be undertaken internally within firms through in-house activities or externally through the open innovation search [37]. Universities and other public and private research facilities are key sources of new knowledge and ideas through their R&D activities. Research by Anzola-Román et al. [38] found that internal R&D practices improve the likelihood of producing technological innovations. Research by Akinwale [39] found that there is an indirect positive influence of R&D on the success of both technological and non-technological innovations, albeit the effect was higher for technological in comparison to non-technological innovation.

The correlation between innovation and policy instability has been well proven in the innovation literature (see [40]). Governments play crucial roles in resource allocations, especially in developing and transition countries where institutions are not well developed [27]. Entrenched policy instability encourages mistrust and insecurities, acting as a strong hindrance to sustainable innovation [41]. Political instability is usually concomitant with ineffectual institutional capabilities, weak innovation and economic growth rates, and reduced investment influxes [42]. The excellence of political institutions shapes territorial behavioral responses to embarking on innovative activities; its absence dampens innovation investment. Another aspect where policy instability can affect the innovation process is its tendency to encourage the emigration of skilled labor, such as researchers, scientists, and engineers. Mass emigration leads to an innovation drain, with the loss of highly skilled human capital and tacit scientific knowledge needed to undertake and sustain the innovation process [43]. The mass emigration of highly skilled human capital weakens the national and regional knowledge networks, thereby rendering them ineffective for innovations [44]. A recent study by Krammer and Kafouros [42] in sub-Saharan Africa concluded that policy instability has a robust and negative influence on firms' product innovation. The study by Shumetie and Watabaji [45] in Ethiopia also found that political instability has a statistically significant negative influence on firms' innovativeness. Related research in Pakistan conducted by Nadeem et al. [40] concluded that political instability has a detrimental influence on firm-level innovation. Based on the conclusions of these studies, we anticipate that perceived policy instability will negatively affect firms' innovations which could be technological and non-technological. We, therefore, provide our first hypothesis as:

Hypothesis 1. *Policy instability is expected to have a negative influence on technological and non-technological innovations.*

Acquiring foreign technologies through inward licensing agreements is ubiquitous in modern innovative firms' operations. Foreign technology licensing agreements enable firms to have the complete rights to use technologies developed and owned by foreign firms [46]. Inward technology licensing represents an indispensable means for firms to obtain new technologies required to enhance innovation and related activities. These technology licenses can be patents, trademarks, marketing knowledge, or technical knowledge. Foreign technology licenses have become an important part of the innovation process because they allow the licensee firms to conserve and pool resources together to undertake their own internal R&D for new products, processes, and services offered by the license. Firms have ready access to new technologies without having to invest in their outright purchase or development [47]. This enables licensees to gain access to existing recognized intellectual property which helps to save the licensee firm time, product, or investment in such technologies. This translates into licensees being able to rapidly produce new products and processes that can be new to the firms or to the market. Johnson [48] posits that technology licensing speeds firm-level learning. Firms can learn and develop their own technological abilities through the licensing of new technologies from foreign firms. This development has led to the "learning-by-licensing" concept. A technology license is a means for technology and external knowledge transfer to lagging countries. Learning by licensing helps firms to improve their knowledge accumulation, which is a catalyst for new product and process development [49]. Firms can expand their own internal technological capabilities by licensing technology. However, this should be supplemented by other investments such as internal R&D. Research by Nguyen-Van and Chang [20] concluded that foreign technology licenses are significantly and positively associated with innovation. In line with the above-mentioned study, we summarize the understanding that firms that obtain foreign technology licenses can access and integrate foreign knowledge and technologies into their new products, process marketing, and organizational activities. This foreign knowledge and technology can help to increase the knowledge and technological stock, resulting in improved innovations. Based on this understanding, we hypothesize that:

Hypothesis 2. *Foreign technology licensing is expected to positively influence technological and non-technological innovations.*

The national and regional innovation systems place much emphasis on innovation capacity, which is significantly shaped by economic and legal institutions [50,51]. However, the nexus between legal institutions' role and adopting innovation has received less scholarly attention. Well-organized legal institutions stimulate innovation at both the macro and micro levels. In a democratic dispensation, the rule of law guarantees rapid dispute resolution between parties by offering legal rights related to innovation replication [52]. Similarly, lawmakers are forced to provide private businesses with incentives to invest in research, which has been shown to be a proven catalyst for the growth of innovation. Lawmakers also protect the public from the potential externalities emerging from innovations and new technologies. Public interventions could potentially impact the anticipated profitability arising from innovation. This can impede the incentives to undertake research and other innovation activities. Conversely, competition laws serve as the legal basis for the indictment of anti-competitive behavior, guiding against cartel activities and the abuse of dominant positions. Competitive laws help to reduce the anti-competitive effects that arise from mergers. The evaluation of innovative firms' behavior demands well-designed competition laws alongside competent competition agencies. The proper enforcement of competition laws can play a vital role in supporting innovations by permitting actions that stimulate innovation and those that hinder it. Well-organized competition policies enforced by a well-organized legal system can promote innovations. Research by Usman et al. [51] conducted with a sample of 24,166 firms from 41 developing nations concluded that well-organized legal establishments stimulate firm-level innovations. Similarly, Ghabri [53] also found that firms in countries with common law system tend to show a positive valuation influence and higher performance when compared to firms in countries with the same corporate governance civil law. Based on these aforementioned studies, we summarize the idea that managerial perceptions about good legal institutions can provide firms with a better environment to innovate because the legal system is expected to protect firms from illegitimate actions. Therefore, we provide our third hypothesis based on firm managerial perceptions as:

Hypothesis 3. *Firms with the perception of operating in a well-organized legal environment are likely to improve their technological and non-technological innovations*.

Human capital development has become an important prerequisite for successful and sustainable innovations [54,55]. Innovating firms' investments in regular employees' R&D training could enhance internal absorptive capacity and innovative activities. Internally, firms can generate new knowledge primarily through continuous in-house R&D training activities to upgrade employees' skills and knowledge. Employees' skills development denotes a vital source of new knowledge. This is achieved through internal education and training programs. The new knowledge that employees gain from this innovative training can help balance any internal knowledge shortfalls, leading to an expansion in the existing internal knowledge stock. This internal innovation training generates positive human capital externalities that can increase the propensity to develop significantly improved products and processes which could be new to the firm or the market where the firm operates. Formal training improves firm-level human capital, which can have long-run effects on improved innovation performance [56]. Innovation training activities can be undertaken internally, but when this cannot be achieved internally, it can be contracted out to knowledge establishments such as universities and other research centers. Regular formal training equips employees with the necessary requisite knowledge and expertise that can help to transform their capacities to produce and offer improved goods or services to the market ahead of their competitors. Odei et al. [1] concluded that formal innovation training activities implemented by firms help to propel technological and non-technological innovation performance. We summarize the idea that regular formal training for their employees will equip them with new knowledge, technical expertise, and the skills needed to embark on undertaking technological and non-technological innovations. We therefore formulate our fourth hypothesis as:

Hypothesis 4. *Formal training undertaken by firms is likely to contribute to improving technological and non-technological innovations*.

The effects and correlation between corruption and innovation have gradually gained increasing scholarly interest in the field of innovation and strategy management [18]. Corruption is seen as a non-market strategy that can adversely impact on firm-level innovation outcomes. There are mainly two schools of thought related to analyzing the impacts of corruption on innovations. The positive school of thought is of the view that corruption "greases" innovations [57,58]. According to believers of the "grease" perspective, resorting to corruption allows firms to reduce their operational and transaction costs as they can maneuver payments such as taxes and licenses. The avoidance of such payments means that firms could have enough money to spend on vital investments such as innovation activities. In a study on the correlation between corruption and innovations in developing and emerging economies, Riaz and Cantner [59] found that usually the monetary aspect of corruption expedites innovation pertaining to firms' dealings with public officials. However, scholars on the "sand" perspective see corruption as an impediment to firms' innovation performance and overall growth [60]. According to believers of the "sand" viewpoint, corrupt practices such as bribery drain firms' innovation investments and are usually channeled to payments that help to receive favors from government officials and individuals who can influence the policy making process. Goel and Saunoris [60] found bidirectional causality results, proving that corruption has a sanding effect on patents, implying that it negatively impacts design patents. Lee et al.'s [61] study in emerging and developing countries with similar country-level institutional conditions concluded that in countries with the worst governance, corruption has a significant negative effect on firm-level innovation.

Innovative firms are substantially affected by certain elements of the business environment where firms operate. Unhealthy competitive practices by informal sector firms can constrain the innovation activities of innovative firms. Informal competitive pressures and habits could hinder and derail innovative firms' growth and innovation search. Informal sector firms can circumvent the costs connected with tax payments and regulatory compliance, allowing them to enjoy comparative cost advantages [12]. Informal firms can compete with formal enterprises over prices where competitive relations manifest in the product markets. There are two opposing views on the relationship between informal competition and firms' innovations. The first school of thought is the "Schumpeterian effect," where proponents view competition as having a negative effect on innovation [62]. The other school of thought believes in the "escape-competition effect," where exponents view competition as having positive effects on innovation (see [63]). The Schumpeterian viewpoint of the literature basically sees vertical innovations as the "creative destruction" of the product market, which is considered the basis of long-run growth. Competitors are therefore considered a hindrance to firms' innovations because they obliterate the fundamental incentives to engage in innovation activities [64]. In a study of sub-Saharan countries, Avenyo et al. [62] found that informal competition at the local level has a strong negative influence on the intensity of formal firms' product innovation, but in the same industry, informal competition boosts innovative turnover. Miocevic et al. [63] study on new EU candidate countries also found that informal competition enhances product innovation when there is weaker intellectual property right (IPR) protection and higher regulatory quality. In agreement with the study of Avenyo et al. [62], we believe that informal competition will discourage firms' investments in innovations and channel them into bribe payments. Hence, this will mean that informal competition will have a negative influence on new product development.

Decisions, readiness, and the ability to innovate depend on numerous characteristics integral to firms. Numerous strands of the literature suggest that the size of firms can influence their capability to innovate successfully (see [65]). Small businesses are generally viewed as being disadvantaged when it comes to their ability to innovate. Small businesses are known to be resource constrained, this means that they will be less expected to undertake innovation and its related activities such as investing in R&D. Conversely, large firms abound in the resources needed to innovate and sustain themselves. They have the human capital and financial resources to undertake R&D. This means that, from the resource endowment perspective, larger firms will be well positioned to invest more in innovation and its related activities compared to small businesses [66].

3. Research Methodology

3.1. Sample and Data

We used the World Bank Enterprises Survey (henceforth WBES) 2016 data for Thailand to test our hypotheses. The 2016 data is the latest released by the World Bank as of the time of this research. The WBES is conjointly conducted by the European Bank for Reconstruction and Development (EBRD), the World Bank Group (WBG), and the European Investment Bank (EIB). The WBES is presently conducted in about 152 countries, involving more than 200,000 innovative as well as non-innovative firms. This attribute of the data allows for better cross-country analysis and comparison across time. The choice of 2016 firm-level data is solely due to data availability. The WBES 2016 Thai data provides critical information on the business environment, investment, and measures of firm performance. WBES received 1000 responses from legally registered firms in Thailand. The respondents are top managers or owners of the firms. Regional stratification is done across five regions: Bangkok, Central, North, Northeast, and South. We omitted all missing values and responses such as "don't know". This, consequently, decreased the final sample to 613 firms.

Thailand was chosen for this study because, notwithstanding the 1997 financial crisis, its average economic growth by the end of the last century was comparatively closer to that of the advanced economies. However, the slowdown in economic activity over the past decade means that Thailand is caught in the middle-income trap. According to Gill and Kharas [67], this term denotes a situation characterized by a sharp slowing of economic growth following a period of continuous increase in per capita income. Similarly, Agénor [68] observed that "the inability of middle-income countries like Thailand and Malaysia to induce a change in their industrial and export structure looks to imitate the inability to develop enough capability to meet the demand of a rapidly-evolving international product market where the attention is on innovation as well as product differentiation." This paper examines the innovation challenges of Thailand by exploring how economic and legal factors shape the innovative output of domestic firms. The model specification follows strictly from the existing innovation literature.

3.2. Dependent Variables

3.2.1. Technological Innovation

We considered two measures of firm-level innovation: technological innovation and non-technological innovation. Technologically innovative output relates to a new product or improved manufacturing process. More specifically, WBES asks firm owners or managers whether they have introduced any new or significantly improved products or services in the past three years. As a proxy for technological innovation, we followed the literature and used a dichotomous variable that takes the value of 1 if a firm introduced a new or significantly improved product or service, and 0 if otherwise.

3.2.2. Non-Technological Innovation

The existing innovation literature focuses excessively on technological innovation (see, for instance, [1,20]). Our study expands the analysis by considering the development of new marketing or logistics methods as non-technological innovations. WBES asks respondents whether the establishment develops new marketing methods. To explore the non-technological aspect of firm-level innovation, our study uses a dichotomous variable, taking a value of 1 if a firm has introduced new or significantly improved marketing methods and 0 if not.

3.3. Independent Variables

Policy instability: The WBES data provides information on whether firms perceive policy instability as an obstacle to their operations. Policy instability refers to the uncertainty that the government may change the rules. Following Athanasouli and Goujard [69], we used a dummy variable, taking a value of 1 if the establishment sees policy instability as an obstacle and 0 otherwise.

Foreign technology licenses: The WBES asks participating establishments whether they acquire technology licenses from foreign firms or not. To examine the effect of a foreign technology license on both types of innovation, this paper uses a dummy variable which takes a value of 1 if firms use technology licenses owned by a foreign company and 0 otherwise [46].

Legal system: Van Waarden [50] and Usman et al. [51] pointed out that firms' innovative output is influenced by economic and legal institutions. The WBES data also contain information on whether firms see the courts as obstacles to their operations. We, consequently, use a dummy variable, taking a value of 1 if the establishment sees the courts as an obstacle and 0 otherwise.

Formal training for employees: Human capital has been proven to influence firms' innovations. We use a dummy variable, taking a value of 1 if the firms provide formal training to permanent employees and 0 otherwise.

3.4. Control Variables

The extant literature reviews have shown that certain factors such as size, product market competitions, R&D and corruption could potentially influence firms' innovations, we therefore controlled for these variables in the models.

Firm size: Following the literature, the study controls for the influence of firm size on technological and non-technological innovations by using WBES categories of firm size, which are small, medium, and large. It is argued that large firms are more likely to be innovative compared to smaller ones, due to economies of scale [69,70]. Informal competition is the unhealthy competitive practices by informal sector firms that can constrain the innovation activities of formal sector firms. Informal competition is a proxy for product market competition. It accounts for product market competition from informal sector firms which could be an impediment to formal firms' innovation [71]. We used a dummy variable that indicates whether firms perceive product market competition as a problem for their operations. Research and Development (R&D): In the WBES, establishments were asked if they engaged in internal R&D during the past three years. To measure R&D, we used a binary variable that takes a value of "1" if the respondents say yes, and "0" if otherwise. We also considered the potential influence of corruption on innovation. We measured corruption by using a dummy variable equal to 1 if firms perceive corruption as an obstacle to their operations and 0 if not.

4. Methodology

We use probit estimation techniques as our dependent variable is a binary variable. In general, binary outcome models estimate the probability that the outcome variable, $y = 1$ as a function of a vector of independent variables x. That is

$$P_r[y = 1Ix] = \phi\left(x^t \beta\right)$$

where ϕ is the cumulative distribution function of the standard normal distribution while β is the estimated parameters. Our estimated model is written as;

$$y = x^t \beta + \varepsilon$$

where y is represented by technological and non-technological innovations. The courts, policy instability, formal training, foreign technology license, and other control variables are represented by x. The error term ε is anticipated to be normally distributed with a mean value of zero and standard deviation 1.

In the first stage of the empirical assessments, the coefficient of the probit regressions is estimated, followed by the average marginal effects. In the second stage, we used the inverse probability weighted regression adjustment treatment effect estimation technique. In agreement with previous studies (see [72–75]). Prior to obtaining the average treatment effect estimates, propensity scores were calculated, and the region of common support generated. Firms within the common support are matched depending on the propensity scores while those firms out of the region of common support were ignored. The propensity score matching addresses the issue of selection bias [75]. The treatment effects technique analyzes the causal effects of a treatment on a given outcome of policy interest. Though we believe the probit model is an efficient and consistent estimator, it can be affected by key econometric problems such as confounding and selection biases. Therefore, using the treatment effect estimator can help correct these principal econometric problems. The inverse probability weighted regression adjustment is a well-known method for estimating more unbiased, consistent average treatment effects [76]. Using the inverse probability weighted regression adjustment technique also helped us eliminate and manage all possible problems pertaining to confounding and selection biases, leading to more robust results [77]. We modelled the outcome variables using technological and non-technological innovations and the treatment dependent variables as the various variables that focus on policy stability, legal institutions, corruption, informal competition, formal training, and foreign technology licenses. The control variables also included firm size, R&D activities, and regional dummies. The inverse probability weighted regression adjustment method also allowed us to determine the additionality effects these treatment variables could have on technological and non-technological innovation outcomes. The study uses the inverse probability of weighting in estimating the average treatment effects. For this approach, each firms' weight is equal to the inverse of the probability of receiving the treatment in question. Regarding the outcome model assessment, we utilized the probit model technique. For each of the four variables of interest (corruption, legal obstacles, informal competition, and policy instability) and the three controls (R&D, formal training, and foreign technology licenses), as well as the two outcome variables (technological and non-technological innovation), two separate propensity scores were estimated and then used to weight the outcomes. The normalized weights for both outcomes are shown in the Appendix A.

5. Results

Table 1 below reports the results of the correlation analysis amongst our variables. The results show that the correlations among our variables are low. Political instability, corruption, and the courts are significantly correlated with technological and non-technological innovations. Control variables such as formal training, foreign technology licenses, firm size, internal research activities, and firm location have the expected statistically significant positive correlation with innovations.

Table 1. Correlation analysis results.

Variables	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)
(1) Non-tech. innovation	1.000										
(2) Technological innovation	0.569 *	1.000									
	(0.000)										
(3) Corruption	0.141 *	0.184 *	1.000								
	(0.000)	(0.000)									
(4) Policy instability	0.307 *	0.227 *	0.425 *	1.000							
	(0.000)	(0.000)	(0.000)								
(5) Courts	0.221 *	0.202 *	0.414 *	0.228 *	1.000						
	(0.000)	(0.000)	(0.000)	(0.000)							
(6) Informal competition	−0.050	0.047	0.028	0.032	0.001	1.000					
	(0.145)	(0.177)	(0.429)	(0.363)	(0.972)						
(7) Formal training	0.362 *	0.406 *	0.126 *	0.117 *	0.129 *	0.123 *	1.000				
	(0.000)	(0.000)	(0.000)	(0.001)	(0.000)	(0.000)					
(8) Technology license	0.287 *	0.310 *	0.172 *	0.145 *	0.204 *	0.155 *	0.432 *	1.000			
	(0.000)	(0.000)	(0.000)	(0.001)	(0.000)	(0.000)	(0.000)				
(9) Firm size	0.082 *	0.072 *	0.000	−0.005	0.037	−0.051	0.225 *	0.269 *	1.000		
	(0.014)	(0.034)	(0.998)	(0.879)	(0.286)	(0.129)	(0.000)	(0.000)			
(10) R&D	0.383 *	0.378 *	0.173 *	0.203 *	0.178 *	−0.043	0.364 *	0.317 *	0.161 *	1.000	
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.211)	(0.000)	(0.000)	(0.000)		
(11) Regions	0.067 *	0.125 *	0.324 *	0.260 *	0.233 *	0.226 *	0.250 *	0.157 *	0.007	0.023	1.000
	(0.044)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.842)	(0.492)	

Source: Own estimations. Note: * Significant at 5% level.

Table 2 provides the results of the descriptive statistics of the variables employed in the empirical examination. The results show that about 20% of the firms reported being non-technological innovators, while 11% reported being technological innovators. These results imply that most firms in the sample introduced non-technological innovations. Regarding corruption, about 34% of firms reported this to be an obstacle to their operations. About 78% of firms perceived policy instability as a significant obstacle in the business environment that affects their operations. The result of policy instability has been confirmed by other studies (see [78,79]). Regarding the role of the judicial system in firms' operations, about 27% of the firms reported that the courts (judicial system) significantly affected their operations. About 23% of the firms consider competition from informal sector firms to be an obstacle to their daily operations.

Table 2. Descriptive statistics.

Variable	Mean	Std. Dev.	Min	Max
Non tech. innovation	0.202	0.402	0	1
Technological innovation	0.113	0.317	0	1
Corruption	0.337	0.668	0	1
Policy instability	0.781	1.027	0	1
Courts	0.269	0.534	0	1
Informal competition	0.233	0.423	0	1
Formal training	0.150	0.357	0	1
Foreign tech. license	0.113	0.316	0	1
Firm size medium	0.340	0.470	0	1
Firm size small	0.380	0.490	0	1
Research activities	0.042	0.201	0	1
Central	0.330	0.470	0	1
North	0.090	0.290	0	1
Northeast	0.160	0.360	0	1
South	0.120	0.320	0	1

Source: Own estimations.

Furthermore, the results show that about 15% of the sampled firms reported having formal training for their employees aimed at human capital development. Regarding international technological linkages measured with foreign technology licenses, the mean result shows that about 11% of these firms reported having acquired these licenses from foreign companies. About 11% of the firms reported being direct exporters to other countries. Regarding firm size, most of the firms are micro-enterprises. Research and development activities are known to be catalysts of sustainable innovation. The results show that just 4% of these firms reported engaging in R&D activities. The low level of R&D and its related activities among Thai firms is confirmed by other related studies [80].

To test the various hypotheses outlined above, we used the probit regression model. For the first model, we used non-technological innovation (marketing and organizational innovation) as the dependent variable, while the second model used technological innovation (new product and process innovation). Unlike the existing literature, which focuses mainly on technological innovation, we additionally explore non-technological innovation. The results of both models and their corresponding average marginal effects are shown in Table 3.

Table 3. Average marginal effect estimates.

	dy/dx (St. Err.)	z	dy/dx (St. Err.)	z
Nontechnological Innovation			**Technological Innovation**	
Policy instability	−0.091 *** (0.0267)	−3.40	0.005 (0.023)	0.21
Courts	−0.084 *** (0.029)	−2.90	−0.051 ** (0.024)	−2.14
Corruption	−0.008 (0.029)	−0.28	0.026 (0.023)	1.13
Informal competition	−0.127 *** (0.038)	−3.31	−0.026 (0.026)	−0.96
Formal training	0.098 ** (0.048)	2.02	0.124 *** (0.033)	3.71
Foreign tech. license	0.092 ** (0.037)	2.48	0.066 ** (0.033)	1.99
Research activities	0.106 * (0.057)	1.86	0.231 *** (0.050)	4.63
Firm size—medium	0.106 *** (0.035)	3.02	0.059 * (0.033)	1.76
Firm size—small	0.113 *** (0.039)	3.09	0.082 ** (0.036)	2.28
Central	0.224 *** (0.049)	4.48	0.100 *** (0.037)	2.74
North	0.331 *** (0.059)	5.60	0.152 *** (0.043)	3.53
Northeast	0.019 (0.075)	0.26	0.055 (0.054)	1.02
South	0.113 (0.083)	1.35	0.066 (0.055)	1.20
Industry fixed effect	Yes		Yes	

Source: Own estimations. * Significant at 10%, ** Significant at 5%, *** Significant at 1%.

It can be seen from the average marginal effects results in Table 3 that political instability has a negative but statistically significant influence on non-technological innovation ($\beta = -0.091$, $p < 0.001$), confirming Hypothesis 1. The results further show that international technological linkages measured by foreign technology licenses positively enhance non-technological innovation among firms ($\beta = 0.092$, $p < 0.001$), providing enough support for Hypothesis 2. Regarding Hypothesis 3, we find compelling evidence in the sample that the activities of the courts negatively influence non-technological innovation ($\beta = -0.084$, $p < 0.001$). This result also provides firm compelling support for Hypothesis 4. We also find evidence that formal training for employees has a statistically significant positive influence on non-technological innovation ($\beta = 0.098$, $p < 0.05$). The control variables such as informal competition have a negative influence on non-technological innovation ($\beta = -0.127$, $p < 0.001$). Small and medium-sized firms have a positive relationship with non-technological innovation. The results also show that internal research and development activities have a positive and statistically significant impact on non-technological innovation ($\beta = 0.106$, $p < 0.001$). Finally, the results demonstrate that corruption does not have any statistically significant influence on non-technological innovation.

Turning to technological innovation, we observed from our sample that policy instability and corruption have statistically insignificant influence on technological innovations in the sample period ($\beta = 0.005$, $p > 0.1$; $\beta = 0.026$, $p > 0.1$). The courts or legal institutions have a negative and statistically significant influence on technological innovation ($\beta = -0.051$, $p < 0.05$). This finding failed to support our Hypothesis 3. We have support for our Hypothesis 4 that providing formal training for employees positively influences technological innovation ($\beta = 1.124$, $p < 0.001$). Acquisition of technology licenses from foreign firms has a strong positive influence on technological innovation ($\beta = 0.066$, $p < 0.05$), in line with our Hypothesis 2. Relative to large firms, small and medium size firms have positive effect on technological innovation (β = 0.082, $p < 0.05$, β = 0.059, $p < 0.05$), while internal research activities strongly enhance firm product innovation as shown by the coefficient (β = 0.231, $p < 0.001$). Central and North geographic locations have a positive influence on both technological and non-technological innovation. Firms in the Northwest and Southern regions are not likely to be technological or non-technological innovators.

Before the treatment effect estimation, we used propensity score matching (PSM) to check for common support and covariate balancing between the treated and untreated groups. The matching method used was the nearest neighbour with a single neighbour and common support which passed various quality tests. We found significant commonalities regarding common support, as shown below in Figures 1 and 2. A graphical assessment of the density distributions of the evaluated propensity scores for the treated and untreated groups of firms (those that introduced both technological and non- technological innovations as well as those that did not) indicate that the common support assumption is met for both outcome variables. This connotes that there exists substantial overlap in propensity scores distribution between the treated and untreated groups. The bottommost part of the figures shows the propensity score distribution for the untreated group, whilst the top half illustrates the distribution for the treated groups, with their related density scores on the y-axis.

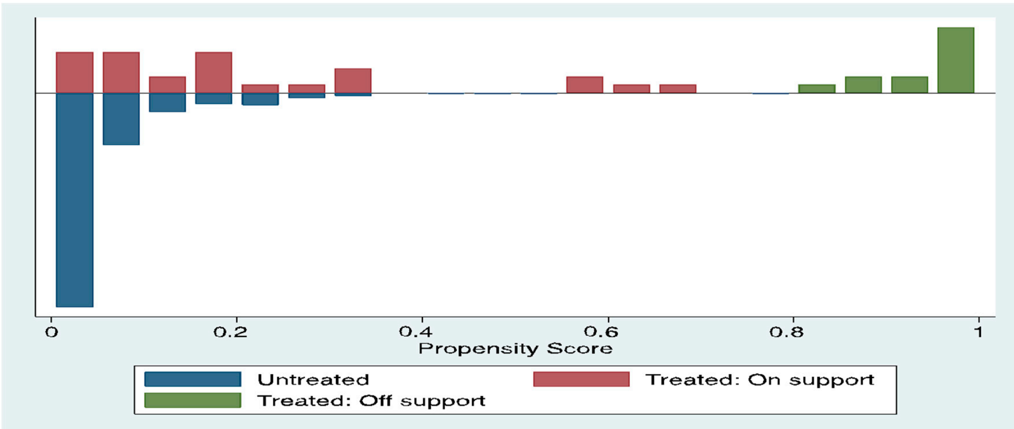

Figure 1. Common support and propensity score distribution for technological innovation. Source: Own estimations.

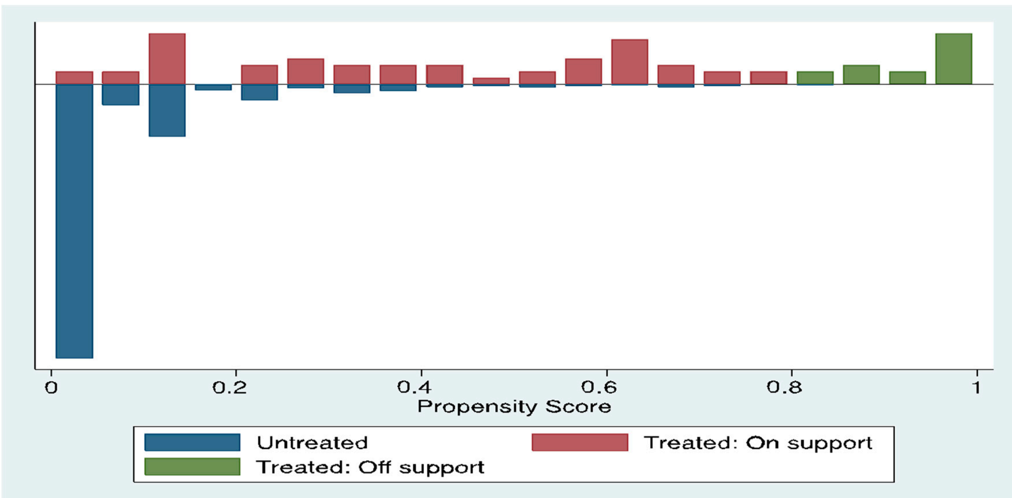

Figure 2. Common support and propensity score distribution for non-technological innovation. Source: Own estimations.

We further performed the covariate balancing test for before and after matching, and the results are shown in Table 4 above. The standardized mean difference for the independent variables used in the propensity score matching for the two outcome variables was between about 48.5–49.9% before matching and this was drastically reduced to 15.2–23.5% after matching. The *p*-values of the likelihood test ratios also show that the joint significance of the explanatory variables was rejected after matching, though they were not rejected before matching. The pseudo R^2 value also dropped considerably, from between about 43 to 47% before matching to about 6–12% after matching for both outcomes. The likelihood ratio tests were all statistically significant before matching for all outcomes but were statistically insignificant after matching. The statistically insignificant *p*-values of the likelihood test ratio, low pseudo R^2, and high bias reduction after matching indicate that the propensity score matching was effective in balancing the covariates distribution between the treated and untreated sub-samples. After the matching quality of the PSM technique was assessed, the influence of the four variables of interest with the three control variables on both outcome variables was examined using the estimated propensity scores to weight the outcomes.

Table 4. Covariate balance indicators before and after matching: Quality test.

Outcome Variables	Pseudo R^2 before Matching	Pseudo R^2 after Matching	LR $\chi 2$ (*p*-Value) before Matching	LR $\chi 2$ (*p*-Value) after Matching	Mean Standardised Bias before Matching	Mean Standardised Bias after Matching
Technological innovation	0.432	0.124	115.58 *** (0.000)	8.77 (0.722)	49.9	23.5
Non-technological innovation	0.466	0.060	173.85 *** (0.000)	8.15 (0.834)	48.5	15.2

Source: Own estimations using WBES for 2016. Note: *** significant at 1% level. The described results are based on the nearest neighbor matching (NNM) method. The results of other matching methods were not reported because they yielded identical results.

6. Discussion

Past research on firm-level innovations in Thailand has been biased toward the manufacturing sector and has ignored vital determinants such as legal institutions, policy instability, and corruption can influence firms' innovativeness. The omission of these important determinants makes our understanding of innovations in Thailand incomplete. It is suggested that the innovative capacity of a country is shaped to a large extent by its economic and legal institutions [50,51]. Despite this revelation, research on the legal system and its impact on firm-level innovation has been limited. This paper has filled in this gap in the literature by including these determinants and analyzing innovations using a sample drawn from both the manufacturing and service sectors. More specifically, we empirically examined the impact of the legal system and other variables such as unstable policies, access to foreign technology, and training of employees that influence both technological and non-technological innovations.

The discussions focus on the average treatment effects (ATE) results in Table 5, as they are robust to potential endogeneity and confounding issues. Our empirical results indicate that the activities of the courts have contractionary effects on both technological and non-technological innovations, as shown in Table 5. A dysfunctional legal system is more likely to reduce technological and non-technological innovation relative to an environment with well-organized legal institutions. More specifically, firms that perceive the court system to be an obstacle are likely to reduce their technological innovations by 15 and non-technological innovations by 21 percentage points in comparison to firms that do not perceive this as an obstacle. These findings failed to support our hypothesis and are not consistent with previous findings in the literature (see [51,53]. These results suggest that the legal environment in Thailand does not favorably enhance innovations at the firm-level. It is probable that there are some weaknesses in the legal system that make it unable to function effectively and efficiently to help firms innovate. Activities that make the judicial system ineffective at enhancing innovations include bribery and corruption, exorbitant transaction costs, and delays in the arbitration process. We argue that the weak institutional frameworks in transitional economies such as Thailand largely account for the inability of the courts or legal institutions to effectively promote firm-level innovations. Our result on the weak judicial system's inability to influence innovations is supported by other previous studies in other emerging economies such as [80–82].

Table 5. Results of average treatment effects (ATE).

	Coef. (Robust St. Err.)	**z**	**Coef. (Robust St. Err.)**	**z**
Non-Technological Innovation			**Technological Innovation**	
Corruption	−0.150 *** (0.031)	−4.88	−0.127 *** (0.026)	−4.86
Policy instability	−0.169 *** (0.026)	−6.43	−0.101 *** (0.021)	−4.74
Courts	−0.206 *** (0.031)	−6.59	−0.152 *** (0.027)	−5.60
Informal competition	−0.046 *** (0.030)	−1.54	0.011 (0.033)	0.35
Formal training	0.407 (0.045)	9.13	0.577 *** (0.065)	8.86
Foreign tech. license	0.342 *** (0.063)	5.42	0.316 *** (0.065)	4.83
R&D	0.721 *** (0.058)	12.54	0.636 *** (0.086)	7.40

Source: Own estimations. *** Significant at 1%.

In line with the existing previous literature, this study finds that policy instability negatively influences non-technological innovation. The robust ATE results (see Table 5) confirm that policy instability has a negative influence on both technological and non-technological innovations. The ATE results show that perceived policy instability is likely to reduce non-technological innovations by 17 percentage points. These results imply that any time there is policy instability, it reduces the likelihood of non-technological innovations. This result is as expected as innovations require stable long-term policies to be sustained. Policy instability is a disincentive to firms' innovations as it encourages uncertainties and insecurities, thereby serving as a strong impediment to sustainable innovation [41]. Policy instabilities manifest themselves when there are ineffectual institutional capabilities, leading to weak innovation [42]. The implication is that frequent and unexpected changes in the rules or policies by the government have the tendency to reduce firms' marketing and organizational innovation outputs. This becomes a hindrance to firms' innovations because policies that kick-start the innovation process are discontinued when there are frequent changes in government, especially in a weak institutional environment. Policy instability is a problem for firm-level innovation and can lead to firms abandoning ongoing innovation projects when there are frequent changes in government. Our result differs from the findings of other related studies in Vietnam by Vo-Thai et al. [83], who found no evidence of the relationship between policy stability and non-technological innovations. Our result is akin to a related study in South Asian countries by [84], who also concluded that policy instability negatively influences non-technological innovations.

Our empirical findings also confirm the positive relationship between formal training of employees on both technological and non-technological innovations as documented in the literature (see, [36,54,56]). This formal training is a source of new knowledge that can help balance any internal knowledge shortfalls, leading to an expansion in the internal knowledge stock. Formal training can enhance innovations as it can equip employees with new knowledge and expertise when conducted by external experts such as consultants. The importance of formal training to both technological and non-technological innovations is confirmed by the results of the ATEs in Table 5. Firms that reported engaging in formal training are likely to improve their non-technological innovations by 41 percentage points in comparison to firms that do not undertake such training. Additionally, firms that engage in formal training are also likely to improve their technological innovations by 58 percentage points. These results mean that formal training has a higher additionality effect on technological than non-technological innovations. Our results, however, need to be interpreted with care. Albeit formal training has been shown by our analysis to be beneficial for firms' innovations, this is highly dependent on employees' having high absorptive capacity to be able to absorb and assimilate this new knowledge from their training effectively in the innovation processes. Our results validate the findings of other existing related studies [36,85].

The positive relationships between foreign technology licenses and technological and non-technological innovations are all expected. Acquiring foreign technology licenses is an international technology linkage that can help spur domestic technology, especially if it is weak. According to Johnson [48], technology licenses speed up firm-level learning. Firms can learn and develop their own technological abilities due to the licensing-in of new technologies owned by foreign firms. The acquisition of foreign technologies allows firms to have access to technologies that they might not have the capability to produce themselves. In this research, we have shown that the acquisition of foreign technologies through licensing agreements drives not only technological innovation but also non-technological innovation. As shown by the ATE results in Table 5, firms that acquire foreign technology licenses can improve their non-technological innovations by 34 percentage points compared to firms that do not acquire them. Firms with foreign technology licenses improve their technological innovations by 32 percentage points. These results mean that foreign technology licenses have a higher additionality effect on non-technological innovations than technological innovations. Our results on the importance of foreign technology licenses on firm-level innovations have been supported by previous studies such as [20,48].

The estimated coefficients of the control variables such as internal R&D activity are positive and statistically significant and in line with the current literature (see [1]). As shown by the ATE results in Table 5, R&D activities have additionality effects on both technological and non-technological innovations. The ATE results show that firms that reported engaging in R&D activities are more likely to enhance their non-technological innovations additionally by 72 percentage points in comparison to firms that do not engage in any form of R&D and its related activities. Firms that engage in R&D and its related activities are also more likely to improve technological innovations by 64 percentage points when compared to firms that do not engage in R&D activities. Informal competition has a negative influence on non-technological innovation, implying that it reduces the likelihood of influencing non-technological innovations. Informal competition reduces non-technological innovations by an additional 5 percentage points. This implies that firms that face informal competition reduce their non-technological innovations. This study finds strong support for the view that small and medium-sized firms are more likely to be both technologically and non-technologically innovative compared to large firms. Small firms are 11 and 8% more likely than large firms to increase their technological and non-technological output, respectively. Similarly, medium-sized firms also have a higher likelihood of increasing their innovative output relative to large ones. Examining the estimated coefficients further shows that small firms, on average, are more likely to be innovative than medium-sized firms.

With respect to geographical location, firms located in the central and northern regions of Thailand are more innovative than those in the northeast and southern regions. As shown by the marginal effects results, the likelihood of non-technological innovations could be marginally higher by 22 percentage points and by 33 percentage points if a firm is in the central and northern region, respectively. The northeast and the southern regions do not have any statistically significant effect on innovations relative to the Bangkok region. Similarly, the empirical results also indicate that firms in the central region are likely to improve their technological innovations by 10 percentage points, while those in the northern region are likely to enhance their technological innovations by 15 percentage points. As shown by the insignificant results in Table 3, firms in both the northeast and southern regions are not likely to be innovators.

7. Robustness Checks

We further evaluated the robustness of the results by using the instrumental variable probit. The essence of the two-stage least square is to check the strength or weakness of the instruments but it also helps to confirm the ivprobit results. This is because in the ivprobit, the reduced form of the endogenous independent variable is considered linear [86]. The robustness checks consisted of checking for the possible existence of endogeneity in the variables that could potentially contaminate our results, leading to unreliable conclusions. Even though the carefully selected explanatory variables measure both technological and non-technological innovations, as shown by the first-stage probit results, we believe that the potential presence of endogeneity could contaminate the results. We presume that our usage of cross-sectional data could mean that there is limited variability of institutional conditions (policy instability and a well-organized legal system) across the sampled firms in Thailand at the specified time. Since Thailand is a unitary government state, we expect that institutional conditions will not vary across regions and cities. We expect that these institutional variables will be country-specific; hence, there will be little variations in these variables to be able to identify any institutional effect. This situation could mean that there are certain features that could instantaneously affect the perceptions of these institutional variables, which could influence firms' abilities to innovate or not. We tested and verified whether the policy instability considered endogenous could be tested for possible exogeneity. In accordance with the literature (see [87]), we utilised the instrumental variable (IV) probit model using Newey's two-step estimation method to check for possible endogeneity in the variables. For the endogenous variable described above, we used policy instability with technological and non-technological innovations as dependent variables while maintaining the remaining covariates. Corruption and the courts (legal system) were instrumented. These variables were used for both models. The Wald test of exogeneity measures whether our data confirms or rejects the null hypothesis of exogeneity. The Durbin–Wu–Hausman chi-square test was further used to check for endogeneity to buttress the Wald test result. We further verified the strength of the chosen instruments for weakness, as weak instruments could create econometric problems that can result in biased estimates of covariates [88]. Furthermore, unchecked, weak instruments can also cause the estimated distribution to deviate significantly from the normal distribution. This was tested using the F statistics and the Cragg–Donald Wald F statistic.

The results of the robustness tests are shown in Table 6. In the model for technological innovations, the Wald test result shows that chi-squared is 0.29; prob > chi-squared = 0.590. Similarly, the Wald test result for non-technological innovations shows that chi-squared (3.44); prob > chi-squared = 0.064. These results are all statistically insignificant at the 95% level, signifying that we accept the null hypothesis that the chosen variable is exogenous and not endogenous. These results were further confirmed by the Durbin–Wu–Hausman chi-square test with p-values greater than the 0.05 significance level (0.192 for non-technological innovations and 0.603 for technological innovations). Based on these results, we conclude that our variables are not affected by potential endogeneity concerns. Furthermore, we tested the strength of the chosen instruments using the F statistics, and the results showed that they were 20.73 and 30.00, respectively, for non-technological and technological innovations. These values exceeded the Stock–Yogo recommended threshold of 10. The Cragg–Donald f-test statistic based on the relevance test of the instruments was 20.288 and 22.507, respectively, for non-technological and technological innovations; these values are more than the recommended cut-off value of 10. Based on these results we reject the null hypothesis that the selected instrument is weak. Since there are no potential endogeneity issues in the variables that could contaminate the results, the estimates of the probit model in the first stage are considered consistent. As a result, instrumental variable models are not preferred, and we do not deliberate on the IV model results.

Table 6. Robustness tests.

Variables	**Non-Technological Innovations**		**Technological Innovations**	
	ivprobit	**2SLS**	**ivprobit**	**2SLS**
Policy instability	1.125 ** (0.372)	0.189 ** (0.068)	0.312 * (0.366)	0.022 (0.058)
Informal competition	−0.944 ** (0.325)	−0.131 *** (0.041)	−0.315 (0.311)	−0.041 (0.035)
Formal training	0.605 (0.364)	0.077 (0.068)	1.198 *** (0.350)	0.201 ** (0.080)
Foreign tech. license	0.841 * (0.373)	0.160 * (0.071)	0.747 * (0.366)	0.093 (0.068)
Research activities	0.357 (0.671)	0.261 * (0.128)	2.077 ** (0.765)	0.660 *** (0.137)
Firm size—medium	0.658 * (0.325)	0.050 (0.031)	0.642 (0.356)	0.040 (0.024)
Firm size—small	0.666 (0.361)	0.044 (0.042)	0.890 * (0.399)	0.060 * (0.032)
Central	1.643 *** (0.480)	0.162 *** (0.028)	1.160 ** (0.477)	0.062 ** (0.020)
North	2.212 *** (0.560)	0.271 *** (0.086)	1.606 ** (0.565)	0.156 ** (0.066)
Northeast	−1.022 (0.853)	−0.220 * (0.095)	−0.286 (0.814)	−0.012 (0.074)
South	1.098 (0.573)	0.037 (0.063)	0.795 (0.544)	0.013 (0.064)
Constant	−3.837 *** (0.574)	−0.102 *** (0.023)	−3.489 *** (0.582)	−0.038 * (0.020)
Industry fixed effect	Yes	Yes	Yes	Yes
Summary statistics				
Wald test of exogeneity	$chi^2 = 3.44$ Prob = 0.064		$chi^2 = 0.29$ $p = 0.590$	
Prob > chi^2	0.000 ***	0.000 ***	0.000 ***	0.000 ***
Centered R^2		0.314		0.3752
Unlefted R^2		0.408		0.4280
F statistics		20.73		30.00
Kleibergen–Paap rk LM statistic)		20.931 ***		22.509 ***
Cragg–Donald Wald F statistic		20.288		22.507
Hausman test statistic		1.700 (0.192)		0.271 (0.603)

Source: Own estimations. Note: * Significant at 10%, ** Significant at 5%, *** Significant at 1%. The court (legal system) and corruption were instrumented.

8. Conclusions and Policy Implications

The objective of this paper is to investigate the factors driving technological and non-technological innovations in Thailand. Specifically, we assess the influence of policy instability and the legal institutions on both technological and non-technological innovation. We used unique World Bank enterprise survey data for Thailand in our analysis. Our estimation results point to the following key findings: Policy instability has a negative influence on non-technological innovation but has no statistically significant effect on technological innovation. The court (legal) system has significant but negative correlations with both types of innovation. Formal training provided for employees and the acquisition of foreign technology licenses significantly enhances firms' technological and non-technological innovations. We also found that research activities undertaken by firms exert a positive influence on both technological and non-technological innovations. Corruption was found to be an insignificant determinant of both technological and non-technological innovations.

Our results make significant contributions to institutional theory in two ways. First, our results have proven that perceived policy instability, competition from the informal sector, and legal institutions all negatively influence technological and non-technological innovations marginally and additionally. These findings show that perceived unfavorable institutional conditions in Thailand negatively influence technological and non-technological innovation outcomes, which is coherent with institutional theory. Our results on the negative influence of perceived institutional conditions on innovation differ from existing literature on institutional theory [48,53,84]. Secondly, our results have shown that international technological linkages positively influence both technological and non-technological innovations in Thailand. These results show that international technological linkages could have technological spillover effects on Thailand, which is characterised as having weak innovation potential. The interactions between Thai firms and foreign firms through international technological licensing agreements are forms of international institutional collaboration, which is also in line with the neo-institutional theory literature [89]. Our result on the positive contribution of international technological linkages to Thai firms' innovations differs from existing neo-institutional theory literature which found negative significant associations (see [90]).

Our main findings have implications for the growing literature on institutions, international technology linkages, informal competition, and human capital development. These results call for the design of appropriate policies and strategies to bolster firm-level innovation in emerging economies like Thailand. We contribute to the literature on institutions and their ability to enhance innovations in firms. The scholarly attention given to legal institutions and their role in enhancing innovations at the firm level in Thailand is yet insufficient. Our results also contribute to the literature on international technological linkages, as we have shown that firms that acquire foreign technology licenses are likely to improve their technological and non-technological innovations marginally and additionally. These results show that firms positively benefit from international technological cooperation as it can have positive technology spillover effects on emerging countries. Finally, we contribute to the literature on informal competition by showing that it reduces non-technological innovations marginally and additionally. This result calls for Thailand policymakers to take the necessary measures to reduce the harmful effects of informal sector firms that can hinder firms' innovation activities.

Our findings have important implications for policy making. Our results revealed that Thailand's judicial system has a counterintuitive negative influence on both technological and non-technological innovations, implying that firms perceive it to be disadvantageous to their operations. These results, therefore, call for policymakers to reform and restructure the judicial system to get rid of bureaucracies, structural problems, certain actions or behavior and practices that make the judicial system ineffective. For the judicial system to effectively execute its mandate, it must be given the needed resources that will facilitate the successful implementation of its mandate. To make the Thai judicial system more effective and transparent, Information and Communications Technology (ICT) should be used more to make the judicial system more accessible to the public to increase its transparency; this could be instrumental in the fight against perceived corrupt practices in the judicial system. ICT can help reduce human exchanges, which tend to bring about corrupt deals. Our results demonstrated that foreign technologies could positively influence technological and non-technological innovations. The results mean that Thailand, characterized by weak innovation capability, can profit from using foreign technologies through licensing agreements, and this can help to rouse firm-level innovations. This result calls for firm managers in Thailand to take advantage of foreign technologies and acquire technology licenses from overseas. The key implication for firm managers in Thailand and other emerging economies is that openness and access to foreign technologies methodically improves and supplements weak domestic resources, leading to innovations. Acquiring technologies through these foreign licensing agreements can facilitate and accelerate the acquisition of foreign technologies, which can enhance domestic technology spillover effects. Regional variations in innovative outcomes also need policy attention. Relevant regional-specific innovation policies to drive innovation in the northeast and the south are highly recommended to boost innovation in these regions. This necessitates policies that prioritise increased investments in R&D as well as human capital development.

The major limitations of this article need to be admitted. Our empirical analysis included a sample of 613 firms, which we accept is not large enough. Our results could probably be better with a larger sample size. Secondarily, the cross-sectional data does not allow us to know the trend of Thailand's innovations over the years. The characteristics of the data also did not permit us to consider other known measures of innovation, such as patents for new product development, major and minor innovations, etc. The sole focus on technological and non-technological innovations, therefore, means that our results cannot be completely generalized to cover innovations in general. Future research should look beyond our current analysis and explore beyond technological and non-technological innovations. Future research could also examine other aspects of the legal environment to see their effect on both technological and non-technological innovations. Lastly, as data becomes available in the future, panel data could be used to further analyze the causal effects of the economic institutions and legal environment and their abilities to influence firms' innovations.

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Appendix A

Table A1. Standardised difference in means in the weighted sample—technological innovations.

Variables	Mean in Treated	Mean in Untreated	Standardised Difference
Informal competition	0.28	0.20	0.195
Formal training	0.49	0.06	1.065
Foreign technology	0.33	0.06	0.719
R&D activities	0.33	0.00	0.975
Firm size	1.97	1.98	−0.011
Regions	2.67	2.18	0.398
Policy instability	1.33	0.68	0.605
courts	0.54	0.18	0.659
Corruption	0.62	0.25	0.478

Source: Own estimations.

Table A2. Standardised difference in means in the weighted sample—non-technological innovations.

Variables	Mean in Treated	Mean in Untreated	Standardised Difference
Informal competition	0.17	0.20	−0.082
Formal training	0.30	0.07	0.602
Foreign technology	0.27	0.06	0.587
R&D activities	0.23	0.01	0.737
Firm size	2.08	1.97	0.140
Regions	2.42	2.19	0.208
Policy instability	1.56	0.62	0.937
courts	0.50	0.17	0.642
Corruption	0.48	0.25	0.379

Source: Own estimations.

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