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Impact of Government Incentive on MSME Innovation

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Abstract

MSMEs find it challenging to undertake innovation activities given their limited resources and capabilities. Studies on innovation in MSMEs have identified internal and external factors that affect innovation capabilities and activities, one of which is government support. Incentives such as tax deductions/credits, grants, subsidies and other similar instruments have been used by governments to promote innovation especially in MSMEs. Using the 2015 Survey of Innovation Activities of Establishments, this paper presents a profiling of innovation activities and characteristics of surveyed MSMEs in the Philippines, and attempts to estimate the impact of government incentives on their innovation behavior and outcomes. Findings indicate that more MSMEs undertake knowledge management, organizational and marketing innovation than product or process innovation. Receipt of government financial support for innovation activities was found to have a positive impact on organizational and marketing innovation.

Keywords: MSMEs, SMEs, innovation, government incentives, government support, innovation factors

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Impact of government incentive on MSME innovation

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1. Introduction

Micro, small and medium establishments (MSMEs) dominate the business sector in the Philippines, composing 99.6 percent of establishments[1], generating 62.9 percent of total jobs. It is estimated that 60 percent of exporters are MSMEs, accounting for 25 percent of the country's total exports revenue.[2] The magnitude of MSMEs and their contribution to the economy make them critical drivers of growth, job creation, trade and investment, including technological innovation.[3]

Relatedly, productivity and competitiveness are critical elements for MSMEs to prosper and grow, and ultimately contribute to the economy. It is widely known that innovation drives improvements in productivity and competitiveness. To be able to compete in the domestic and/or international market, and participate in the global value chains, undertaking upgrading or innovative activities will benefit firms. MSMEs, however, are known to have relatively limited resources (compared to larger firms) which can deter upgrading or innovative activities.

There are a number of studies that have analyzed what drives and hinders innovation among firms. For the case of the Philippines, Quimba et al (2017) examined the innovation activity of establishments based on firm surveys in 2009 and 2015. Results of the study indicated that the larger the firm, the more likely to innovate; and other characteristics such as practice of knowledge management, industry classification, and being located in an export processing zone suggested more likelihood of undertaking innovation activities. Meanwhile, studies have found that factors such as limited access to finance and inadequate technological and technical capabilities can hinder upgrading and innovation-related activities in firms (e.g. Aldaba 2012; Del Prado and Rosellon 2017b). In view of the contribution of innovation in stimulating economic growth and wealth but with impediments faced by firms, the role of government support has been examined in previous studies (e.g. Derregia and Chittenden 2007; Bergner et al 2017[4]). These studies examined the hypothesis that government incentives should be offered to promote innovation in firms; for instance, incentives that will increase investment in R&D and in efficient capital assets, and motivate innovation behavior and activities among firms.

While previous studies have looked at establishments overall, this paper aims to contribute inputs to MSME development by focusing the analysis on the innovation activities of the MSME sector. In particular, the study profiles innovation activities and characteristics of MSMEs, and attempts to estimate the impact of government incentives on innovation activities using the PIDS Survey of Innovation Activities of Establishments (SIAE). Policy implications and recommendations are presented based on findings of the study.

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[1] Based on the 2017 list of Establishments of the Philippine Statistics Authority (PSA) [source: DTI].

[2] https://www.dti.gov.ph/dti/index.php/2014-04-02-03-40-26/news-room/179-workshop-on-market-access-for-MSMe-set.

[3] MSME Development Plan 2011-2016

[4] More in the review of literature.

2. Significance of the Study

This study aims to provide evidence to the effect of government incentives in inducing innovation among MSMEs as it is a critical instrument to achieve the vision for the Philippines by 2040, to wit, inclusive growth, high-trust society and a globally competitive and resilient economy. This is because innovation of MSMEs expands business opportunities and employment which could eventually lead to a reduction in poverty and inequality (Albert et al. 2011; Llanto and Del Prado 2016; Pachouri and Sharma 2016). In addition, this research may be used to support the implementation of legislation particularly the Philippine Innovation Act of 2019 (Republic Act 11293), ["An act adopting innovation as vital component of the country's development policies to drive inclusive development, promote the growth and national competitiveness of MSMEs, appropriating funds therefor, and for other purposes"]

Understanding the efficacy of the current policy environment in promoting innovation among MSMEs enables the government to adapt current strategies so that its targets are achieved at minimal cost. One of the government strategies for expanding economic opportunities is removing restrictions to businesses, modernizing incentives and promoting investments that could create more jobs (Philippine development plan 2016-2022). This paper informs the discussion on how to modernize the incentive system by assessing its impact on innovation activity of firms, particularly that of MSMEs. An example of such information would be a differentiated impact of incentives on innovation activity of firms as earlier studies on innovation activity of firms in the Philippines (Albert et al. 2011; Albert et al. 2015; Llanto and del Prado 2016; Quimba and Calizo 2017) have shown that innovation activities undertaken by firms vary with the size of the firm.

Finally, this study also contributes to the understanding of how the Philippines can effectively promote innovation activities of MSMEs in order to achieve the SDGs. Because MSMEs make up more than 90% of the businesses in the country, they are critical instruments for achieving a number of SDGs particularly goal 8 (Promoting inclusive and sustainable economic growth, employment and decent work for all), goal 9 (Sustainable industrialization and fostering innovation) and Goal 10 (reducing income inequality). In addition, Social enterprises, which are commonly MSMEs, also work towards the achievement of other SDGs by providing public goods and services like healthcare, education or waste management.

3. Review of Related Literature

3.1. Overview of factors that affect innovation capability and activities by MSMEs

Innovation capabilities and activities of MSMEs have been the subject of research to understand how innovation can be promoted in MSMEs. Several research studies have put together factors that affect the innovation capability and activities by MSMEs based on a review of written conceptual and empirical works (e.g. McLaughlin 2011; Bayarçelik et al 2014; Love and Roper 2015; Pierre and Fernandez 2018). These innovation factors can be classified into internal factors or those pertaining to characteristics and capabilities of the MSMEs, and external factors which pertain to sources outside the establishments.

Internal factors for MSMEs include those related to the characteristics and skills of the entrepreneur/business owner; the innovation planning and strategy; the organizational and innovation culture; the learning process and capability, as well as process revaluation; market

orientation; and financial resource. On the other hand, external factors include network integration and university/research institution linkages; customer/supplier integration; and public institutional support (Description of factors are in Table 1).

Studies done for the Philippine case, such as by Llanto and Del Prado (2016), Quimba et al (2017), Albert et al (2017), Quimba and Calizo (2017), identified factors that drive innovation in business establishments. Results of these studies indicated that the larger the firm is, the more likely it is to innovate; and other characteristics such as practice of knowledge management, industry classification (food manufacturing, ICT/electronics, BPO establishments), suggested more likelihood of undertaking innovation activities. Moreover, having foreign equity and foreign linkages were found by Llanto and Del Prado (2015) and Quimba and Calizo (2017), respectively, to be positively and significantly associated with innovation activities in establishments.

While most research, such as those mentioned above, looked at innovation activities of establishments in the Philippines in general (i.e. covered all sizes), there are studies that discussed and analyzed innovation factors and activities of MSMEs using survey results or case studies. The innovation factors that have been identified in these studies are consistent with the internal and external factors listed in Table 1. The financial factor is suggested in the work done by Daño-Luna et al (2018) on drivers of Philippine SME Competitiveness, which found that SMEs that applied for a loan or attempted to borrow were more likely to innovate than those that did not apply or attempt to apply for a loan. A series of innovation case studies by Del Prado and Rosellon (2018; 2017a; 2017b) which covered different industry sectors (food manufacturing, garments, ICT) found that hiring the appropriate personnel (even without a formal R&D unit/department), implementing human resource development practices, and acquiring the needed machinery/technology are important factors for MSMEs to undertake upgrading activities. The business strategy or decisions of the owner/manager of the MSME also plays an important role in the decision to innovate. Other studies also discussed the importance of external sources (Quimba and Rosellon 2012; Rosellon and Yasay 2012; Del Prado et al 2014; Del Prado and Rosellon 2018). These studies found that customers, suppliers, and the internet are important sources of information on new technology. External sources of financing for machinery acquisition or promotional activities (e.g. trade exhibit/mission), and sources of technical assistance also affect the decision to innovate.

A review of the available literature indicated that internal characteristics and external factors referring to innovation partners and collaborators appear to be widely investigated. On the policy side, government support such as technical assistance and financial grants/loans have been mentioned by MSMEs in case studies, but have not been probed and analyzed further. This study focuses on this policy variable, particularly government incentives, and attempts at a quantitative analysis to determine the impact on innovation activities of MSMEs.

Table 1. MSME Innovation Factors

Internal Factors
•***Ownership/entrepreneur, management characteristics/skills*** The owner/entrepreneur and management can be the initiator of innovation activities in SMEs. Their work experience, professional capacities, attitude towards risks and capacity for taking risks can influence innovation decisions and strategies. This also include skills and capacities to detect, analyze, and use internal as well as external resources. •***Innovation strategy and planning/Innovation process management*** Strategy and planning designed by the firm, which fits with the overall business strategy and considers its competitive environment, and competencies, resources and how to manage them. •***Innovation/organization culture*** This refers to how the firm embraces creativity, supports collaboration and risk-taking. The organizational culture or climate that encourages the employees' innovation capacity and supports personal growth and development is said to be vital factors to foster innovativeness. •***Learning process/capability*** Learning for a firm refers to experiential and cognitive processes and involves knowledge acquisition, knowledge sharing, and knowledge utilization. Learning how to detect and integrate internal and external knowledge increases the knowledge capital of the firm. Absorptive capacity also fosters knowledge-based competitive advantage. •***Innovation-dedicated resources; technical capability*** Innovative firms that possess capabilities and resources that are specialized in the innovation area that the firm is pursuing. Training of personnel should also be a continuous process. Specialized human resources can provide necessary external knowledge. In addition, investing in high quality and specific equipment promotes/maintains competitive innovations. SMEs are recommended to be efficient in their recruitment and investment process due to lack of resources. •***Market orientation*** Market orientation refers to integration of market information related to existing and potential customers, dissemination of market information inside the firm, and the firm's response to such information. New product development activity in firms is found to be significantly associated with the extent and nature of its market orientation. •***Process revaluation (to update capacities, strategies, processes, organization)*** Successful SMEs tend to assess their innovation capabilities, allowing them to remain innovative and competitive. Revaluation is an important tool to improving and updating their innovation capacities, innovation strategy, process and organization. •***Financial factor*** Financial resources are considered key 'levers' of innovation, being the resource needed to start, operate and grow. Adequate level of finance is an essential condition for innovation. Small firms are also found to put greater importance on financial factors, compared to medium and large-sized enterprises.
External Factors
•***Network integration/linkages*** Network integration is important for innovation by SMEs given the limitation in resources. SMEs would need to detect potential networks, create and maintain collaborative relationships, and exploit the advantages provided by network relationships. •***User/customer, supplier*** *integration* Customers and suppliers are most often identified by SMEs as the most important partners in innovation. They provide direct information on market needs, which firms integrate into their innovation process. •***Institutional support*** Public institutional support on SME competitiveness and innovation through financial or technical support have been commonly used. Financial aid comes in the form of tax incentives and direct financing, and technical/non-financial aid through coaching, networking and facilities support. Governments, for instance in Europe, provide tax incentives for R&D activities (e.g. tax credit for R&D spending, capital allowances for R&D related capital expenditure).

Source: Authors' compilation based on the literature, such as McLaughlin (2011), Bayarçelik et al (2014), Quimba et al (2017), Pierre & Fernandez (2018).

3.2. The role of government incentives in promoting innovation

Government innovation policy can be categorized into supply-side, demand-side and environment or systemic measures (Sheng et al 2014; Intarakumnerd and Goto 2016). Supply-side support refers to capital, technology and human (e.g. training) support, and may include R&D tax incentives, grants and subsidies, loans and direct equity participation.[5] Demand-side policy instruments include those that can stimulate the markets for products made by MSMEs. For instance, government procurement can create market demand for innovative products, which can encourage innovation behavior in MSMEs. Advisory programs on expanding new market segments is also one form of support. Environment and systemic support refers to infrastructure, e.g. those related to information and communication, high-tech infrastructure and platforms that promote coordination among stakeholders in innovation. Policies providing interest subsidies, tax shields and patent protection law also provide a good environment for innovation. Government can also provide an environment or platform facilitating collaboration among firms (especially large and innovative firms) and with universities and research institutions.

Conventional views would state that government incentives such as tax incentives can be an effective tool for promoting investment in R&D and capital assets as they lower the cost of capital for businesses (Derregia and Chittenden 2007). Incentives such as tax allowance or credits can help raise the amount of expenditure on technology and innovation related acquisitions which can help firms improve productivity. Other views would argue that such association is not as straightforward. Investment in R&D is one of those business decisions that is uncertain and irreversible. The payoff from spending on R&D and innovation activities is an important business consideration.

A study on SMEs in the UK found that uncertainty can also come from whether government upon assessment will grant the incentive (Derregia and Chittenden 2007). Moreover, tax credits for instance can be ignored and may have limited impact when making innovation decisions because innovation expenditures ensue before the tax credit. Given the risks to investing in innovation, government intervention through incentives can be effective if it will be able to address negative impact of uncertainties or irreversibility.

Meanwhile, a 2007 study on UK's R&D tax policy indicated that SMEs with small R&D programs found it costly,[6] complicated and time consuming to make tax claims, thereby neutralizing much of the potential benefits resulting from the incentives (Derregia and Chittenden 2007). On the other hand, SMEs with substantial R&D expenditure do not find this problematic. More so, while the tax policy improved their cash flow and motivated them to allot more funds for R&D, some of the SMEs did not consider the tax incentive a major deciding factor for investing in R&D. In these situations, R&D incentives will have minimal impact on starting new or expanding R&D and innovation programs by SMEs.

In a review of tax incentives targeted at SMEs in EU member states, Bergner et al (2017) deduced that tax incentive programs for small businesses receive support because of their prospective effect on innovation and, further, on driving growth in the economy. The rationale behind this is the presence of positive spillover effects coming from the originator of innovation

[5] Direct government investment, or support through government-owned or linked venture capital (Intarakumnerd and Goto 2016).

[6] Expenses on preparation, documentation, application, as well as keeping of proper records can be prohibitive for SMEs with small R&D programs and resource constraints (Derregia and Chittenden 2007).

spreading to its own industry and others (e.g. downstream)[7] and ultimately the economy. That is to say, the social rates of return exceed private rates of return. This has been supported empirically, mostly using US data on manufacturing industries (based on review of literature by Derregia and Chittenden 2007).

On the other hand, there is argument on the occurrence of market failure, i.e. when the originator of innovation invests for its own personal benefits, which can lead to investment in innovation at 'suboptimal level', and in the end, social welfare losses (Bergner et al 2017). In either case, the effect of tax incentives on innovation would depend on how the intervention will spur innovation-related activities and thereby create positive spillover effects. A review of the literature by Petrin (2018) suggested that grants and subsidies (direct support) appeared to stimulate more R&D than tax incentives (indirect support), though the former generate lower spillovers. A careful examination and consideration of possible positive and negative implication and effects of these incentives would then be crucial in policymaking.

Notwithstanding the arguments towards unlikely influence of government incentives in promoting innovation, previous studies have found positive impact. Dechezleprêtre et al (2016) saw a significant increase in R&D and patenting among small firms during a change in threshold eligibility for R&D tax subsidies in the UK. They found large R&D tax price elasticities, particularly among smaller firms which are hypothesized to experience financial constraints. The authors also estimated that without the R&D tax policy, aggregated business R&D expenditure would be lower by around 10 percent. They also found that the R&D generated by the tax incentive scheme appeared to have produced positive spillovers on the innovation activities of technologically related firms.

A literature review by Trong et al (2017) presented empirical studies that suggested a positive relationship between government support on innovation and innovation performance. The review cited the study by Doh and Kim in 2014 which found a positive relationship between technological development assistance from the government and innovation performance in the regional strategic industries in South Korea. Another study cited was by Mingzhi Li, Wei, and Liu in 2015, which classified government support into vertical and horizontal support, and found that vertical support represented by direct R&D subsidies and horizontal support represented by regional innovation policy both have a positive impact on innovation performance of Chinese firms.

Moreover, studies found that innovation policies tend to be more effective with complementation among measures such as R&D tax credits, grants and technical/business assistance (BIS 2014). In a survey of Turkish SMEs, it was found that both financial and advisory services were the most effective government policy to increase innovation efforts, with the need depending on the existing technological capability of the firm (Bascavusoglu-Moreau and Colakoglu 2011). Both financial support and consultancy/technical assistance impact on innovation performance of SMEs that are in the early stages of innovation/innovative capacity building or less innovative. On the other hand, financial support appeared to have a higher positive impact for SMEs that are persistent innovators.

In East Asian industrializing economies such as Malaysia, Thailand, Chinese Taipei, and Singapore, different government incentives have been implemented to stimulate innovation in SMEs (Intarakumnerd and Goto 2016). These policy measures include R&D tax incentives,

[7] For instance, through product imitation, or knowledge transfer via movement of labor (Bergner et al 2017).

grants or direct subsidies, loans, and equity participation[8]; and the impact on spurring innovation is found to be associated with flexibility, policy coordination, continuity and a mix of complementing instruments. Policies appeared to more effective when they were compatible with the level of technological and innovative capabilities and needs of firms. Some of the measures have been firm-specific or prepackaged (Intarakumnerd and Goto 2016); or modifiable to suit the demand. An example in Singapore is its R&D tax incentives for startups which can be converted to grants for firms that may not have earned substantially in their initial operations. Moreover, the economies mentioned also effectively used systemic measures, along with supply- and demand- side policies.[9] For instance, Singapore established and advanced the linkages between transnational firms and local firms especially SMEs; and in Chinese Taipei, public research institutes highly contributed to propagating new and foreign knowledge to local SMEs.

Most of the literature look at effect of incentives on R&D expenditure, such as discussed in this section. Some studies refer to R&D expenditure and other related indicators as input additionality. On the other hand, other indicators such as innovation outputs/outcomes and innovation behavior have also been examined and have been referred to as output and behavioral additionality, respectively. Examples of innovation outputs/outcomes are production and sales of better, more innovative products, and improved production processes; while innovation behavior include decision on the composition of R&D expenditure, changes in management and organization to support the firm's innovation strategy.

Petrin (2018) reviewed available literatures on government incentives that examined effect on innovation outcomes and innovation behavior of firms. The author's review suggested that government support such as grants, subsidies and loans for R&D had a positive but modest impact on innovation outcomes, in terms of increase in number of patents and sales of new product and introduction of new processes. Meanwhile, studies on innovation behavior of firms are scarce, as there are challenges in estimation and on how this outcome is measured. Nonetheless, the review by Petrin (2018) of a few econometric studies indicated a positive impact of R&D tax incentives on innovative behavior of firms especially SMEs, financially constrained firms, and young innovative firms.

Petrin (2018) assessed that research using innovation outcomes and behavior are conducted to a lesser extent compared to R&D or innovation expenditure. This paper attempts to contribute to empirical evidence on the impact of government incentives on (indicators of) innovation outcomes and behavior.

4. Overview of Philippine policies to promote innovation

4.1. Science, Technology and Innovation (STI) programs

Historically, science, technology and innovation (STI) has always been viewed as a supporting actor in the quest for economic and social development. Science and Technology (S&T) programs have been crafted in support of priority sectors in the Philippine development plans. For instance, the S&T Agenda for National Development Plan of 1993 was crafted to support the industries identified by the Department of Trade and Industry (DTI) as export winners while

[8] Direct government investment, or support through government-owned or linked venture capital (Intarakumnerd and Goto 2016).

[9] Supply-side measures were predominant; while demand-side measures were not used extensively (Intarakumnerd and Goto 2016).

the S&T plan of the Estrada administration supported the government's program of poverty alleviation (Quimba, Albert and Llanto 2017).

The current administration, on the other hand, perceives STI as a means of achieving the vision of a high-trust and resilient society, and a globally competitive knowledge economy. To realize this, NEDA identified a two-pronged strategy: to promote and accelerate the use of technology and innovation in all production sectors, and to increase innovation by enhancing the capacity to generate knowledge and strengthen collaboration across the STI ecosystem (NEDA, 2017).

The Department of Science and Technology (DOST) under the Duterte Administration (2016-2022) has launched the Science for Change: Accelerated R&D Program for Capacity Building of Research and Development Institutions and Industrial Competitiveness. Under this program are four projects aimed at strengthening the STI ecosystem of the country. These four projects are Collaborative Research and Development to Leverage Philippine Economy (CRADLE), Niche Centers in the Regions for R&D (NICER), R&D Leadership Program (RDLead) and Business Innovation through S&T for Industry Program (BIST).[10]

The Collaborative Research and Development to Leverage Philippine Economy (CRADLE) Program aims to create a synergistic relationship between academe, R&D institutions, and industry through collaboration on R&D projects targeting problems identified by the private sector industry. The strategy is expected to promote knowledge exchange and innovation through the production and utilization of new technologies. The program is particularly targeting areas and industries jointly identified by the DTI and DOST particularly:

1) Agri-processing
2) Agriculture, fisheries and forestry
3) IC Design
4) Semi-conductor and electronics
5) Creative industries/knowledge-based industries
6) Renewable energy
7) Industrial waste treatment
8) Information and communication technology (including artificial intelligence)
9) Food and Nutrition
10) Infrastructure and logistics
11) Environment and climate change
12) Manufacturing

The Niche Centers in the Regions for R&D (NICER) Program provides institutional grants for R&D capacity building and improvement of S&T infrastructure in the region. It intends to make significant improvement in the capacity of Higher Education Institutions (HEIs) in regions of the Philippines to conduct quality research by integrating development needs with existing R&D research capabilities and resources. Examples of centers identified for funding under the 2018 DOST-GIA include: Eastern Visayas Center for Crustacean Research and Development; Freshwater Fisheries Center (FFC) for Cagayan Valley ; Astronomical Near-Earth Observation Light Pollution (ANEO-LiPo) in Rizal Technological University.[11]

[10] https://ncr.dost.gov.ph/index.php/s4cp.

[11] CY 2018 DOST-GIA Projects (http://www.dost.gov.ph/knowledge-resources/downloads/file/782-cy-2018-dost-gia-approved-projects-as-of-october-3-2018.html).

The R&D Leadership Program (RDLead) aims to strengthen the research capabilities of the HEIs/RDIs in the regions by securing the services of Filipino experts in the Philippines and abroad. The Filipino experts shall lead in upgrading of existing R&D Centers under the NICER Program. They are also expected to:

(1) train and capacitate local researchers, faculty, students, laboratory heads/staff;
(2) develop and/or update: a) Environment, Health and Safety Manual and Protocols b) Risk Management Services; c) Sustainability and Maintenance Programs; d) Protocols and Training Modules and e) existing facility guidelines, e.g. Good Laboratory Practices (GLP) Guidelines – Standard Operating Procedures (GLP Manual and Training Module)
(3) provide policy recommendations for to the continuous development, maintenance and sustainability of R&D Centers in the country keeping up with latest technologies and world-class standards.

Together with the NICER Program, RDLead aims to help HEIs improve and hasten the use of research results that will help address critical challenges in several areas such as agriculture, industry, emerging technologies, health, climate change and disaster risk reduction. Aside from research publications, the program aims to produce patents, products/process innovation, facilities, scientific and technological workforce, approved policy/program/project proposals, R&D roadmaps and programs.

With the goal of supporting the technology development value chain, the Business Innovation through S&T for Industry Program (BIST) aims to facilitate Filipino companies' acquisition of advanced and strategic technologies by providing funding resources for acquiring high-tech equipment and machinery, technology licenses, and/or patent rights. It is one platform of the government to encourage firms to invest in R&D. The program is targeting the same areas identified in CRADLE.

In addition to these policies and programs, one notable program specifically targeting MSMEs, is the Small Enterprise Technology Upgrading Program (SETUP). The program was initiated during the Arroyo administration and still persists to this day. Quimba, Albert and Llanto (2017) highlights the success of this program in ensuring that technological upgrading results in economic development and produces jobs. Because the program is also implemented regionally, it ensures that regions outside Metro Manila receive much of the benefit. Recognizing the potential of SETUP and equipping it further to address the challenges brought about by the Fourth Industrial Revolution, NEDA and DOST planned for an expanded version of the program dubbed SETUP2.0[12]. The SETUP 2.0 is planned to receive an initial fund of PHP800 million nationwide of which PHP50 million will be allocated to Davao region[13]. Under the program, MSMEs are given one year to implement their project with zero interest payable in three to five years.

Moreover, another specific MSME program under the MSME Development strategy is the Shared Service Facilities (SSF) program. Launched in 2013, it aims to improve the competitiveness of MSMEs by providing them with machinery, equipment, tools, systems, skills and knowledge under a shared system.[14] The SSF projects aim to increase the productivity and competitiveness of MSMEs, and thus, encourage them to participate in the

[12]http://www.neda.gov.ph/wp-content/uploads/2018/03/SER-Chap-14_as-of-April-2.pdf; http://www.dost.gov.ph/knowledge-resources/news/49-2018/1429-dost-gears-up-for-industry-4-0-launches-setup-2-0-at-s-t-week.html

[13] http://www.pna.gov.ph/articles/1040559

[14] https://www.dti.gov.ph/programs-projects/shared-service-facilities.

global value chains and reach better and wider markets. Beneficiaries of the SSF projects are MSMEs, individual entrepreneurs, cooperatives, associations or groups of MSMEs. A key purpose for projects is to address processing and manufacturing gaps of the industry cluster, which include among others: absence of a needed facility (to conform to standards, to improve quality of products); lack of capacity of an existing facility; non-affordability of services of an existing facility; inadequate technical and administrative services that will promote and facilitate growth of MSMEs within the industry cluster.

The STI programs have supported businesses, especially MSMEs, and have contributed to job generation and productivity. According to DOST Secretary Fortunato de la Peña, companies supported by the SETUP reported in 2018 that they have created over 40,000 jobs. The DOST funded technology interventions and projects in these companies, which in 2018 achieved cumulative gross sales amounting to PhP8.344 billion and reached productivity of 41 percent (Tumampos 2019). Moreover, CRADLE program has provided PhP 85 million in grants to help develop solutions to decrease losses and increase productivity of local companies (Flora 2019).

4.2. Recent Developments

Inclusive Innovation Industrial Strategy (i^3S)

The *i3S*, currently the country's industrial strategy, is aimed at 'growing innovative and globally competitive manufacturing, agriculture, and services while strengthening their linkages into domestic and global value chains' (DTI 2017). The strategy identified different channels towards industry growth namely, competition, innovation and entrepreneurship, and productivity. It prioritizes the growth and development of 12 major industries including automotive; electronics and electrical; aerospace parts; chemicals; iron and steel and tool and die; garments/textiles, furniture, and creative; shipbuilding; tourism; IT-business process management (knowledge process outsourcing and E-commerce); agribusiness; construction; and transport and logistics. The industrial strategy and actions involve collaborative and cooperative efforts among government agencies, the industry and academe.

This strategy is composed of five major pillars whose strategic actions become the basis for the formulation and implementation of specific policies and programs. The five pillars are: building new industries, clusters, and agglomeration; capacity-building and human resource development; MSME growth and development; innovation and entrepreneurship; and ease of doing business and investment environment.

In particular, the strategy to support MSME growth and productivity is motivated by the 7Ms namely, mindset, mastery, mentoring, money, machine, market, and models. Strategic actions also include programs on establishment of common service facilities, improving access to finance, technology, and skilled workers; linking MSMEs with large domestic enterprises and multinationals; promoting inter-firm and academe collaboration; efficient storage and logistics, e.g. handling, cold storage (DTI 2017).

Under the innovation and entrepreneurship pillar, strategic actions include establishing an inclusive innovation and entrepreneurship ecosystem composed of the academe, industry, and government; strengthening industry-academe collaboration focusing on market-oriented research; revising engineering curricula particularly manufacturing engineering and work related to industries; and equipping universities to carry out research relevant to industries (DTI

2017). Strategic actions also include intellectual property protection, R&D incentives (tax credit, accelerated depreciation), and shared facilities for rapid prototyping and demonstration.

Ease of Doing Business and Efficient Government Service Delivery Act of 2018

In 2018, the Philippine government has passed the Republic Act 11032 or the Ease of Doing Business and Efficient Government Service Delivery Act of 2018. The law aims to reduce processing time and cut bureaucratic red tape that affects a number of business transactions. RA 11032 provides processing time of three days for simple transactions with government agencies and government-owned and controlled corporations while complex transactions are given seven days for completion while twenty working days are provided for highly technical transactions. Apart from these, the law mandates all local government units to set-up one-stop-shops and utilize a unified business application form for issuance of business permits.

Building on the establishment of the one-stop-shops, the I^3S of the DTI aims to utilize these one-stop-shops to support innovation in MSMEs by providing additional services such as certification, licensing, capability training, production and marketing of products/services. These services can be expanded to provide business mentorship for startups as well as creative and design services that can aid in the transformation of ideas and prototypes into commercially viable products and services.

The Philippine Innovation Act

The Philippine Innovation Act (Republic Act 11293) is a key legislation signed in April 2019 aimed at strengthening the role of MSMEs in economic development by supporting their innovation activities. Predicated by the fact that 99.6 percent of Philippine businesses are MSMEs which are typically faced by bottlenecks to innovation, the law puts Science, technology and innovation at the center of the country's national development policies, and it recognizes innovation as major driver of inclusive, economic development through the participation of MSMEs in local and global value chains.

Aiming to improve innovation governance in the country by ensuring effective coordination and eliminating fragmented innovation policies and programs, the Act established the National Innovation Council (NIC), chaired by the president, with its 24 members[15] coming from line agencies and the private sector. The law mandates the NIC to define the country's strategic vision for innovation and ensure a coherent strategic direction for the government. As the NIC is headed by the president, it ensures that innovation programs and projects shall be undertaken following a whole-of-government approach. Furthermore, to support the whole-of-government approach, the government agencies are tasked to establish a joint web portal that bears pertinent information to innovation policies, programs and services such as grants and financial assistance and trainings.

Specifically targeting MSMEs, this law mandates the NIC to develop strategies towards promoting MSME internationalization through the participation in local and global value chains. The law provides for the development and implementation of a comprehensive support program for MSMEs covering all aspects of the business cycle. The support program would

[15] Secretaries of the following agencies are members of the NIC: NEDA, DOST, DTI, DA, DENR, DOH, DOE, DND, DICT, CHED, DBM, DepEd, DILG, DFA, DOLE, IPOPhil. The president appoints 7 additional members from the ranks of business, academe and the scientific community.

include coaching and mentoring in the areas of design; technology extension services; standard business practices in contracting, accounting and management; patents and others.

To achieve its objectives, the Act provides for a secretariat and a revolving fund of PhP 1 Billion pesos for the initial year of implementation. To augment these resources, the Act also urges the NIC to access bilateral and multilateral funds to support innovation activities in the country. The law also encourages pursuing partnerships with the private sector in the implementation of innovation initiatives in research, development and extension (RD&E), education, product development and others.

TRABAHO Bill

The government is also pushing for the Package 2 of the comprehensive Tax Reform Program commonly known as the Tax Reform for Attracting Better and High-Quality Opportunities (TRABAHO Bill or House Bill 8083) which aims to reduce corporate income tax rates from 30 percent in 2019 to 20 percent by 2029 and streamline the incentives provided by the government ensuring that these are targeted, transparent, performance-based, and time-bound. Data from the DTI find that the current incentive structure is inequitable as around 90,000 SMEs pay the incentive-free rate of 30 percent of net taxable income. In contrast, those that enjoy incentives only pay between 6 to 13 percent.

The TRABAHO Bill proposes providing incentives of income tax holiday for at most 3 years and a reduced income tax rate of 18 percent (2019) to 13 percent in 2029[16]. In addition, these other income tax based incentives may be granted to sectors determined in the Strategic Investment Priority Plan (SIPP). The Board of Investments (BOI) shall prescribe the level of additional deductions for selected industries. These incentives would include:

1. Depreciation allowance of assets (10% for buildings and 20% for machineries and equipment),
2. 50 percent tax deductions on labor expense from increase of direct local employment
3. 100% additional deductions on the increment of R&D
4. 100% additional deductions on trainings incurred
5. Up to 100 percent deduction on infrastructure development
6. Allowable deduction to a maximum of 50 percent on its reinvestment within 5 years from such reinvestment
7. Enhanced Net Operating Loss Carry Over – loss during the first 3 years carried over within the next 5 consecutive years
8. Up to 50 percent additional deduction on the increment of domestic input expense incurred in the taxable year.

Apart from these, additional incentives like duty exemption and value-added tax exemption and zero-rating of domestic purchases may also be provided.

Critical to the provision of incentives would be the SIPP which takes into account the following: amount of investment, generation of employment, MSE adoption of inclusive business activities and value-added production; use of modern or new technology; adoption of adequate environmental protection systems; addressing supply chain gaps and promotion of

[16] Ecozones and Freeports Direct Remittance will enjoy gradually lower National Government tax rates of 15% in 2019-2020; 14% in 2021 to 222; 13% in 2023-2024; 12% in 2025-2026; 11% in 2027-2028 and 10% in 2029. Local business tax will be 1.5% for Municipalities, Component cities and Provinces while Highly Urbanized Cities will have local business tax of 3%.

market competitiveness. The activities preferred by the BOI for incentive support are presented in Table 2. MSMEs have to fall within these industries to enjoy these incentives.

Table 2. Preferred Activities under the Strategic Investment Priority Plan (SIPP)

1. All Qualified Manufacturing Activities including Agro-Processing 2. Agriculture, Fishery, and Forestry 3. Strategic Services (a) IC Design (b) Creative Industries/Knowledge-Based Services (c) Maintenance, Repair, and Overhaul (MRO) of Aircraft (d) Charging/Refueling Stations for Alternative Energy Vehicles (e) Industrial Waste Treatment (f) Telecommunications (g) State-of-the-art Engineering, Procurement, and Construction 4. Healthcare Services including Drug Rehabilitation Centers 5. Mass Housing (a) Economic and Low Cost Housing (b) In-City Low Cost Housing for Lease	6. Infrastructure and Logistics including LGU-PPPs (a) Airports and seaports (includes RO-RO ports) for cargo and passenger (b) Air, land and water transport i. Air Transport ii. Land Mass Transport iii. Water Transport iv. Mass Rail (c) LNG Storage and Regasification Facility (d) Pipeline for Oil and Gas (e) Bulk Water Treatment and Supply (f) Training/Learning Facilities (g) Testing Laboratories (h) Domestic Industrial Zones (i) PPP Projects (j) Tollways
7. Innovation Drivers (a) Research and Development (b) Centers of Excellence (COE) (c) Innovation Centers, Business Incubation Hubs, Fabrication Laboratories (FabLabs)/ Co-working Spaces (d) Commercialization of New and Emerging Technologies Agricultural biotechnology tools. Disaster mitigation/prevention hardware or software. Hardware or software for increasing agricultural productivity Mechanized means for natural resources conservation	Portable technologies Hardware or software for the prevention of disease outbreaks Remote monitoring devices or systems Professional services for remote sensing Hardware or software for the upgrading of local industries Photonics Nanotechnology. Natural health products 8. Inclusive Business Models 9. Environment or Climate Change-Related Projects 10. Energy

Source: Board of Investments.

5. Innovation activities of MSMEs

Profiling of MSMEs and their innovation activities used the 2015 Survey of Innovation Activities of Establishments (SIAE). The 2015 SIAE is a survey of 891 establishments in the Philippines, covering different industries (food and other manufacturing; information and communication technology (ICT); business process outsourcing (BPO)). Micro, small and medium enterprises compose 73.3 percent of respondents. The survey aimed to generate information on the types of innovations engaged in by firms, the environment wherein innovation activities are conducted, and the factors that drive as well as hamper innovation

performance.[17] The 2015 SIAE was used in this study as it is the latest available survey which contains information required in the analysis.

About a third of MSMEs in the 2015 SIAE are product or process innovators,[18] and most of the innovations are mainly done in the establishment (more than 60%) (Table 3). Across different firm sizes, small enterprises appear to develop most of its innovation activities within the establishment (over 70%) compared to micro and medium enterprises, based on proportions. As for other innovation activities, about 42 percent of MSMEs in the survey practice organizational and marketing innovation, and over 50 percent practice knowledge management. A greater proportion of microenterprises are seen to practice marketing innovation more than other innovation activities. Survey results also indicate that around 7 percent of MSMEs had abandoned product/process innovation activities in the period of January 2015 to March 2016.

Across industries, enterprises in the food manufacturing, machinery & transport equipment, and other manufacturing industries appear to innovate on processes more than on products; while a higher proportion of ICT and BPO enterprises undertake product innovation (Table 4). But consistently, a high proportion of enterprises (more than 50%) in all industries practice knowledge management. The survey results also indicate that across industries, food manufacturing showed the smallest proportion of MSMEs that practice knowledge management and organizational innovation; while, machinery & transport equipment enterprises had the highest proportion of abandoned innovation activities (January 2015 to March 2016) at 9.2 percent, which is higher than the MSME overall average of 7.2 percent.

Geographically, Mindanao has the lowest proportion of innovators and enterprises undertaking organizational and marketing innovation, and knowledge management (Table 5). Meanwhile, Luzon has the relatively highest share of innovators but also the highest share of enterprises that abandoned innovation activities in the reference period.

Table 3. Innovation activities by establishment size (% of establishments)

	Micro	Small	Medium	All
Product Innovator	26.4	32.1	32.6	30.6
Unit that developed product innovation				
Mainly the establishment	54.2	71.9	53.6	62.5
The establishment together with its main office and/or establishment within the enterprise	37.5	19.8	42.9	30.5
Other establishments or institutions	8.3	8.3	3.6	7.0
Process Innovator	23.6	35.5	37.8	32.8
Unit that developed process innovation				
Mainly the establishment	51.2	77.4	61.5	67.3

[17] More details on the survey objectives and survey plan in Albert et al (2017).

[18] Product innovator – the establishment introduced new or significantly improved goods and/or services that are new to the establishment or to its market.

Process innovator – the establishment introduced new or significantly improved methods of manufacturing or producing goods and/or services; new improved logistics, delivery or distribution methods for its inputs, goods and/or services; new or significantly improved supporting activities for its processes, e.g. maintenance systems or operations for purchasing, accounting or computing.

(Source: 2015 Survey of Innovation Activities of Establishments questionnaire)

The establishment together with its main office and/or establishment within the enterprise	41.9	17.9	35.4	28.0
Other establishments or institutions	7.0	4.7	3.1	4.7
Organizational Innovation	35.6	44.1	43.9	41.7
Marketing Innovation	43.1	42.4	39.2	41.7
Knowledge Management	40.6	52.0	60.4	51.0
Abandoned product/process innovation activities (January 2015 to March 2016)	7.7	7.7	5.8	7.2

Source: Authors' calculations using 2015 SIAE

Table 4. Innovation activities by industry group (% of establishments)

	Food Manufacturing	Machinery & Transport Equipment	Other Manufacturing	ICT	BPO	All
Product Innovator	25.2	33.3	31.5	33.7	18.8	30.6
Unit that developed product innovation						
Mainly the establishment	51.4	64.0	71.6	55.4	66.7	62.5
The establishment together with its main office and/or establishment within the enterprise	40.0	28.0	22.2	37.5	33.3	30.5
Other establishments or institutions	8.6	8.0	6.2	7.1	0.0	7.0
Process Innovator	30.9	36.0	34.2	32.5	12.5	32.8
Unit that developed process innovation						
Mainly the establishment	60.5	81.5	75.0	53.7	50.0	67.3
The establishment together with its main office and/or establishment within the enterprise	37.2	18.5	20.5	37.0	50.0	28.0
Other establishments or institutions	2.3	0.0	4.6	9.3	0.0	4.7
Organizational Innovation	37.0	55.4	40.0	41.8	43.8	41.7
Marketing Innovation	38.7	50.7	36.9	48.8	31.3	41.7
Knowledge Management	47.8	64.0	47.5	52.4	60.0	51.0
Abandoned product/process innovation activities (January 2015 to March 2016)	5.8	9.3	7.8	6.6	6.3	7.2

Source: Authors' calculations using 2015 SIAE

Table 5. Innovation activities by location of establishment (% of establishments)

	NCR	Luzon	Visayas	Mindanao	All
Product Innovator	29.5	31.5	25.0	14.0	100.0
Unit that developed product innovation					
Mainly the establishment	71.2	60.3	58.0	57.1	62.5
The establishment together with its main office and/or establishment within the enterprise	25.4	28.6	34.0	39.3	30.5
Other establishments or institutions	3.4	11.1	8.0	3.6	7.0
Process Innovator	24.3	31.3	27.6	16.8	100.0
Unit that developed process innovation					
Mainly the establishment	67.3	67.2	71.2	61.1	67.3
The establishment together with its main office and/or establishment within the enterprise	30.8	26.9	25.4	30.6	28.0

Other establishments or institutions	1.9	6.0	3.4	8.3	4.7
Organizational Innovation	22.2	32.2	27.4	18.2	100.0
Marketing Innovation	23.7	27.8	29.6	18.9	100.0
Knowledge Management	25.8	28.9	27.7	17.6	100.0
Abandoned product/process innovation activities (January 2015 to March 2016)	21.3	36.2	23.4	19.2	100.0

Source: Authors' calculations using 2015 SIAE

Another indicator for innovation activities is the application for intellectual property instruments. The survey indicates that most MSMEs have applied for a brand name, and for a trademark (Table 6). There are also applications for other instruments, such as patent, copyright, utility model registration, by MSMEs that introduced innovations in the reference period but they mostly applied for brand name and trademark.

Table 6. Application for intellectual property protection instruments (% of establishments)

	Micro	Small	Medium	All	Product innovator	Process innovator
Patent	3.3	11.1	11.6	9.1	17.5	18.7
Trademark	6.0	11.4	18.6	11.8	22.0	23.4
Copyright	1.7	8.4	10.5	7.1	17.0	16.8
Utility model registration	1.1	6.4	8.1	5.4	13.0	13.6
Design registration	4.4	8.8	9.9	7.8	16.6	16.9
Brand name	11.5	14.8	14.5	13.8	29.0	29.4

Note: Reference period - since January 2015
Source: Authors' calculations using 2015 SIAE

A key innovation factor as identified by the literature is the financial resource. Looking at the expenditure side of the innovation activities, the survey results indicate that MSMEs on average spend close to 10 percent of their sales for innovation expenses (Table 7). Microenterprises registered the highest innovation expense-sales ratio at almost 20 percent; while for small and medium enterprises, the ratio is 9.1 percent and 4.6 percent, respectively.

Looking closely into expenditure items, more than 50 percent of innovative MSMEs allot their innovation-related budget for acquisition of machinery, equipment and software; and training for personnel. MSMEs spend more than half of innovation expenses on the former. Interestingly, about 43 percent of MSMEs spend innovation expenses for in-house R&D and for design of products/services; though they both cover less than 20 percent of total innovation expenditure. Nonetheless, this may be a good indication that the MSMEs are developing or strengthening internal capabilities on research and development, and product design.

Table 7. Innovation expenditure, by establishment size

	Micro	Small	Medium	All
Proportion of innovating establishments				
In-house R&D	42.3	41.8	44.9	42.9
Outsourced R&D	19.2	18.2	9.0	15.5
Acquisition of machinery, equipment and software	48.1	50.8	60.3	53.2
Acquisition of other existing knowledge	25.0	23.0	18.0	21.8
Training for innovative activities	51.9	54.9	56.4	54.8

Market introduction of innovations	34.6	38.5	39.7	38.1
Design	44.2	44.3	41.0	43.3
Others	31.3	27.3	32.9	29.9
Proportion to total innovation expenditure (mean %)				
In-house R&D	21.0	16.2	17.9	17.8
Outsourced R&D	2.2	6.3	2.7	4.2
Acquisition of machinery, equipment and software	47.4	60.3	61.2	57.9
Acquisition of other existing knowledge	8.3	6.6	3.4	5.9
Other innovation activities incl. design, training, marketing and other relevant activities	21.0	10.6	14.8	14.3
Innovation expenditure as % of sales*	19.9	9.1	4.6	9.8

Source: Authors' calculations using 2015 SIAE
*If with outlier, mean value is 100.9 for Micro, and 25.8 for All.

The literature discussed earlier mentions factors, aside from financial resource, that can influence the decision to innovate. The 2015 SIAE also includes information on factors that can hinder innovation activities (Table 8). High innovation cost and the lack of funding are identified as important cost factors that hinder innovation for MSMEs, especially for microenterprises. Around 11 percent of MSMEs also consider the lack of qualified personnel for innovation activities as highly important factor. For about 12 percent of MSMEs, competition with more established enterprises and uncertainty of demand for innovative products are also factors that can significantly affect the decision to innovate.

Table 8. Factors hampering innovation activities (% of establishments)

	Micro	Small	Medium	All
Cost factors				
Lack of funds within the establishment or enterprise	25.4	16.2	17.4	19.1
Lack of finance from sources outside the establishment	20.4	12.5	12.2	14.6
Innovation cost too high	28.2	21.9	20.4	23.2
Knowledge factors				
Lack of qualified personnel	13.8	11.5	8.7	11.4
Lack of information on technology	8.3	7.7	8.1	8.0
Lack of information on markets	7.7	5.7	6.4	6.5
Difficulty in finding cooperation partners for innovation	12.2	9.1	7.0	9.4
Market factors				
Market dominated by established enterprises	14.4	10.4	12.3	12.0
Uncertain demand for innovative goods or services	13.9	8.8	11.7	11.0
Reasons not to innovate				
No need due to prior innovations	6.1	6.4	14.0	8.3
No demand for innovations	8.9	10.8	12.9	10.8

Note: Counted only factors of 'high' importance
Source: Authors' calculations using 2015 SIAE

External partners and collaborators are also important influencers in innovation for MSMEs. Overall, 47.4 percent of surveyed MSMEs responded that they have cooperated with other establishments/non-commercial institutions for their innovation activities (Table 9). As for specific cooperation partner, suppliers of equipment and materials are identified by most MSMEs to be most valuable, followed by clients/customers from the private sector. A look at the specific markets indicate that customers of product and process innovators are largely domestic (national and local); and that less than 9 percent and about 15 percent of establishments have customers in ASEAN and other countries, respectively (Table 10). The proportion of exporting innovative MSMEs is relatively low based on these numbers. But whether it indicates small participation in the global value chains cannot be determined unless there are details on local transactions (which this study was not able to collect). MSMEs can possibly be indirect exporters, or suppliers to exporting local enterprises.

In addition, the survey results indicate that microenterprises consider government/public research institutes as their most valuable cooperation partner in innovation activities, while none of the surveyed MSMEs consider universities or other higher education institutions as the most valuable cooperation partner (Table 9). Universities and research institutions can be valuable sources of information and can be collaboration partners. The results may be an indication of the weak linkage between industry and universities/academe.

Table 9. Partners in innovation activities (% of establishments)

	Micro	Small	Medium	All
Cooperated with other establishments or non-commercial institutions	40.4	50.0	48.1	47.4
Most valuable cooperation partner				
Other establishments within its enterprise	19.1	16.7	31.6	21.9
Suppliers of equipment, materials, components, or software	33.3	38.3	31.6	35.3
Clients or customers from the private sector	19.1	26.7	23.7	24.4
Clients or customers from the public sector	4.8	10.0	7.9	8.4
Competitors or other establishments in its sector	4.8	3.3	2.6	3.4
Consultants, commercial laboratories, or private R&D institutes	4.8	-	2.6	1.7
Universities or other higher education institutions	-	-	-	-
Government or public research institutes	14.3	5.0	-	5.0

Source: Authors' calculations using 2015 SIAE

Table 10. Market of establishments with innovation activities (% of establishments)

	Product Innovator	Process Innovator
Local	54.5	53.7
National	43.5	43.5
ASEAN	7.0	8.4
Other countries	14.5	15.0

Source: Authors' calculations using 2015 SIAE

6. Impact of government incentives on MSMEs' innovation activities

This study aims to offer evidence on the impact of government incentives on innovation activities of MSMEs in the Philippines. To accomplish this, it attempts to estimate the impact using the 2015 SIAE dataset (MSME respondents only), and the propensity score matching (PSM) technique. PSM is a statistical technique that is used to estimate the effect of a treatment, by pairing treated with control groups (e.g. pairing participants with nonparticipants of a program) on the basis of the conditional probability of receiving the treatment, given a vector of observable characteristics (Rosenbaum and Rubin 1983; Essama-Nssah 2006). In this study, the effect of (receipt of) government incentive is estimated by pairing recipients and non-recipients, given covariates of observable firm characteristics that predict receiving the incentive.

In the estimation,[19] the treatment variable is 'receipt of government financial support in innovation activities'.[20] The covariates include firm size, age (years of operation) ownership/equity status (if fully Filipino-owned or not), registration with an Investment Promotion Agency (IPA), intellectual property protection application, market (if exporting), awareness of policy or programs on innovation, location, industry classification, share of innovation expenditure to sales, and practice of knowledge management and organization and marketing strategies.

The outcome variables used in the study are product and process innovation, and other innovation activities, particularly, organizational innovation and marketing innovation. For additional insights, the study also includes innovation expenditures (in terms of proportions) as outcome variables.

Estimation results indicate that receiving government incentives for innovative activities impacts on the decision to undertake organizational and marketing innovation (Table 11). Receipt of government financial support increases likelihood of undertaking organizational innovation by 18 percent and marketing innovation by 15 percent (at 5% and 10% level of significance, respectively). Moreover, estimation also indicate a positive effect on product innovation and negative effect on process innovation, though results are statistically not significant.

The impact on total innovation expenditure is negative and not statistically significant. This result implies that there is not enough evidence from the data to support the presumption that government financial support on innovation activities will augment firms' resources for innovation. In an attempt to gather more insights regarding impact on expenditures, the study included estimations using specific innovation expenditure items, particularly their share to the total innovation expenditure.

Results of estimation using innovation expenditure shares indicate positive signs for impact on in-house and outsourced R&D, and other innovation expenditures, though results are not statistically significant. Survey data, however, indicate that more than 40 percent of MSMEs spend innovation expenses for in-house R&D and for design of products/services; both covering less than 20 percent of total innovation expenditure. In addition, MSMEs spend more

[19] To estimate the treatment effects, Stata software's '*teffects psmatch*' was used, with 4 matches. Balance plots are in Appendix A.

[20] Government financial support is defined in the survey as tax credits or deductions, grants, subsidized loans, loan guarantees.

than half of innovation expenditure on training for personnel. These numbers from the survey could be an indication that MSMEs are developing or strengthening internal capabilities for innovation activities.

Interestingly, there is a significant negative sign for impact on acquisition of machinery, equipment and software. The negative effect of government financial support on the share of machinery, equipment and software expenditure suggests that the financial support may have allowed enterprises to increase the share of expenditure towards activities related to organization and marketing activities, as results indicate positive impact on them. In addition, the estimation may have also been affected by the reference period. Acquisition of machinery, equipment or software may take some time to plan, procure and eventually purchase; hence even with external financial support, expenditure may be recorded at a later period.

Table 11. Estimation Results

Outcome Variable	Average Treatment Effect: Recipient vs Non-recipient of government incentive [1/]	Std. Err.	P-value	Matched Obs.
Product innovation	0.037	0.147	0.800	472
Process innovation	-0.042	0.152	0.780	472
Organizational innovation	0.182 ***	0.027	0.004	472
Marketing innovation	0.155 *	0.092	0.092	472
Innovation expenditure	-7485600	4750806	0.115	472
Share to total innovation expenditure: [2/]				
In-house R&D	0.049	0.084	0.557	310
Outsourced R&D	0.018	0.057	0.750	310
Acquisition of machinery, equipment, software	-0.233 **	0.095	0.014	310
Acquisition of external knowledge	-0.017	0.033	0.595	310
Other innovation expenditures	0.182	0.151	0.227	310

*,**,*** Significant at 10%, 5% and 1% level of significance, respectively

1/ Government incentive in terms of financial support in innovation activities (e.g. tax credits or deductions, grants, subsidized loans, loan guarantees)

2/ External knowledge refers to purchase of patents, prototypes, designs, consultants; Other innovation expenditures refer to training, design, marketing and other relevant activities

There are some limitations to our estimation of the impact of government incentive on innovation activities of MSMEs. The variable on government incentive is a generalized measure, as the question in the survey only asked whether or not the establishment received government financial support for innovation activities. A more detailed information on the form/type as well as the amount of incentive received and utilized by the enterprise would allow better estimation and provide deeper insights on the effect on innovation activities.

7. Conclusion and Recommendations

The study's findings based on the 2015 SIAE indicate that MSMEs in the Philippines undertake product or process innovation, albeit quite low at around 33 percent of the surveyed firms. On a more positive note, MSMEs apply for intellectual property instruments, mostly for a brand name or for a trademark; and are connected with their suppliers, clients, and public research universities as partners for innovation activities.

While cases of product or process innovation are relatively low, a bigger proportion, about half of the MSMEs, practice knowledge management, and organizational and marketing innovation. Moreover, the estimation of impact of government incentives using treatment effects indicate a positive significant effect on organizational and marketing innovation. There is, however, a significant negative effect on the share of expenditure on machinery, equipment and software to total innovation expenditure. It is possible that while machinery acquisition is a common upgrading expense, the financial support is allowing enterprises to augment funds towards organizational innovation, and in-house R&D and other expenditures such design, marketing and training which more than 40 percent of MSMEs spend for, according to the survey results. The results could be an indication that MSMEs are developing or strengthening internal capabilities for innovation.

Aside from incentives, there are other factors that are complementary to MSMEs' capability to innovate according to the literature, and which the survey results suggest there is need for improvement. Findings include geographical differences in innovation activities, weak linkage between MSMEs and universities or other higher education institutions, lack of funding and other impediments to innovation.

Based on the findings, the following policy recommendations are presented:

- Strengthen the technological capacity of MSMEs as it is an important characteristic to the decisionmaking for and implementation of innovation activities. One approach is to strengthen and deepen industry-academe linkages. This weak relationship had also been documented in previous empirical studies on Philippine firms. Universities and research institutions can be valuable sources of information and technology, and can be collaboration partners for product/process development and laboratory services.

  Training or courses for skills development, such as for design, R&D, can also be offered as there appears to be demand from MSMEs. They can be offered in universities, TESDA, and/or private technical-vocational training centers.

- Study the provision of financial support for innovation activities. While findings indicate that government financial support for innovation activities has a positive impact on innovation outcomes, there is not enough information and evidence from the data and analysis as to which type or form of incentive should be offered to MSMEs. But based on previous studies, there are direct and indirect incentives offered by governments to MSMEs, and these studies suggest that the former stimulate more R&D than the latter. Successful schemes also complemented government incentives with technical assistance and applied flexibility (e.g. depending on need).

  Tax reduction on R&D expense is being proposed in the Philippine Congress. There are exiting programs providing grants and technical assistance to enterprises. Should the government decide to expand the direct support to include other schemes such as subsidies

or loans (low-interest, or interest-free) for R&D and innovation activities, the implementation funds under the Philippine Innovation Act can be explored.

- Continue to provide support and incentive programs for process upgrading, such as SETUP, even if financial R&D incentives are to be formalized. Not all MSMEs could easily conduct R&D programs/strategies, but they most often embark on innovation activities by upgrading their machinery, equipment, software, and production lines to increase productivity and save on costs. Moreover, STI programs can be further promoted in areas with low cases innovation activities such as in Mindanao.

- Conduct further research on impact of incentives on innovation using a bigger dataset on MSMEs and more detailed information on incentives received and utilized by enterprises (e.g. form of incentive and amount). There were also some estimation results that appear counterintuitive but statistically non-significant, that further studies would be useful to gain more insights.

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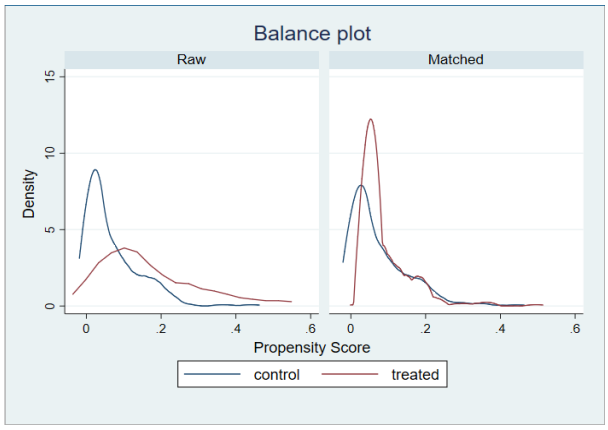
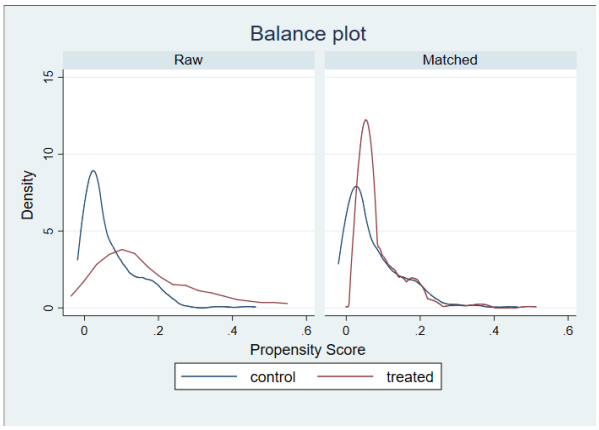
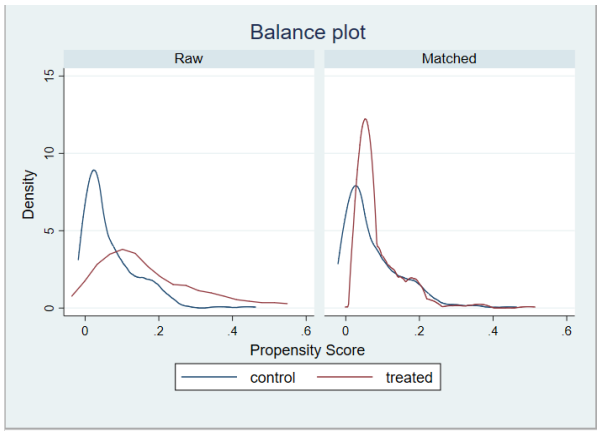
Appendix A. Balance plots for the estimations



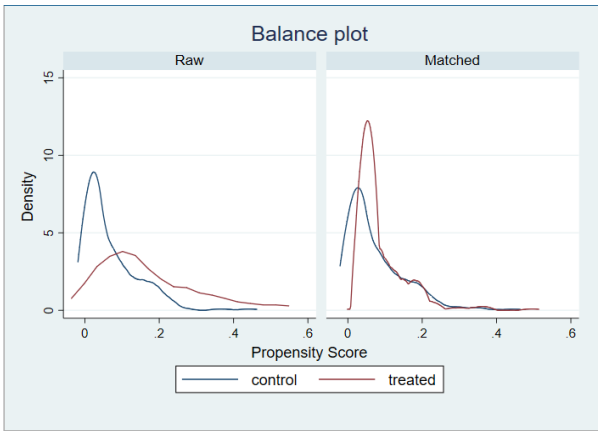
Product innovation



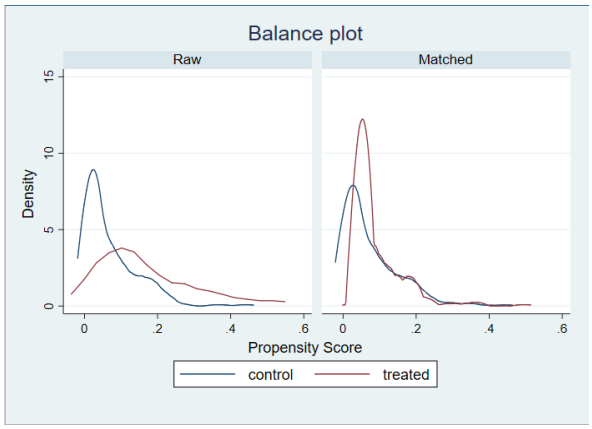
Process innovation



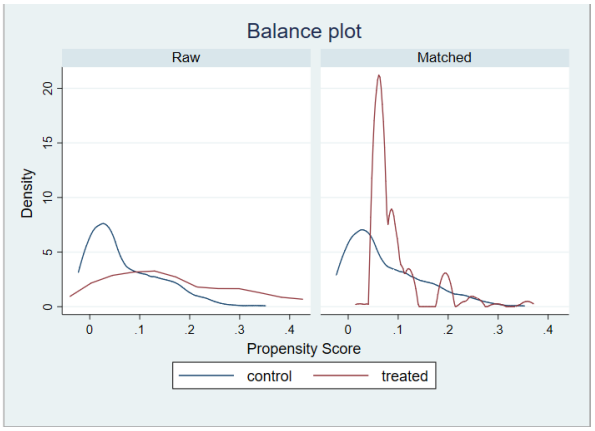
Organizational innovation



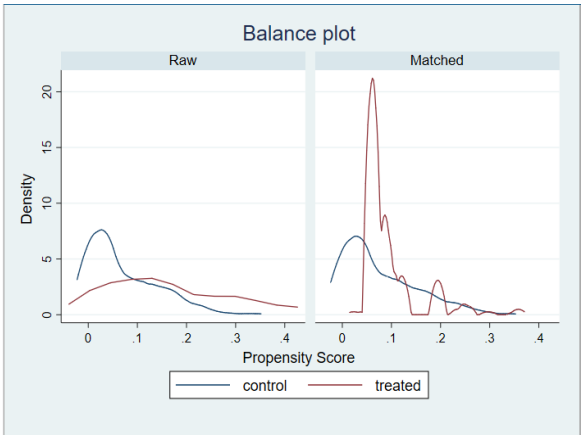
Marketing innovation



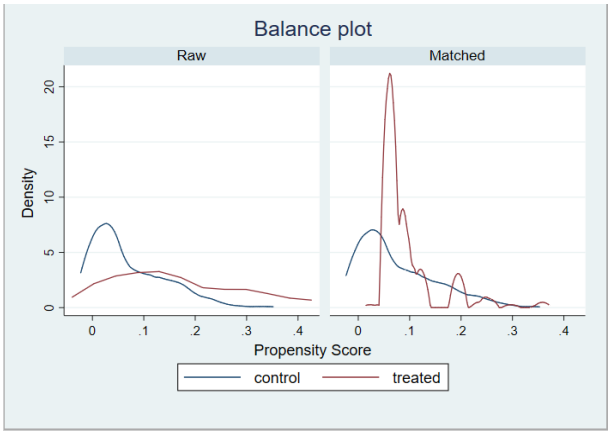
Innovation expenditure



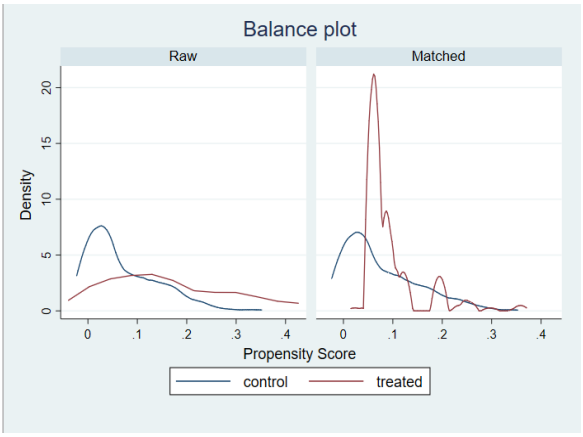
Share of in-house R&D expenditure to total innovation expenditure



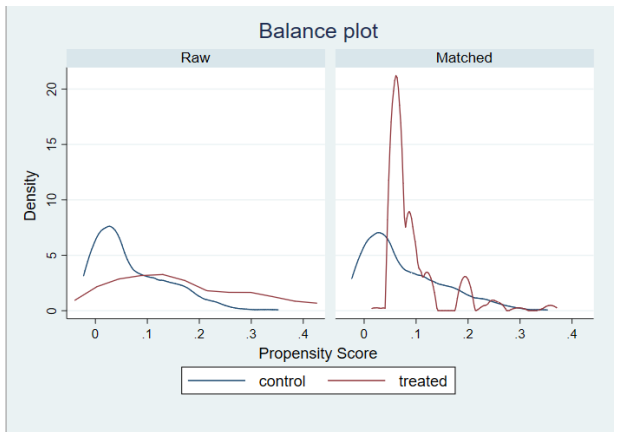
Share of outsourced R&D expenditure to total innovation expenditure



Share of exp. on machinery/equipment/software to total innovation exp.



Share of exp. on external knowledge to total innovation exp.



Share of other expenditures to total innovation expenditure