Innovation is seen as a major drive of economic growth and firms’ performance (Chudnovsky, López, & Pupato, 2006; Stock, Greis, & Fischer, 2002). Although the importance of innovation is figured as a vital factor in firms’ performances, studies examining the determinants of innovation are still far from complete. A large number of studies focus on the importance of size (Laforet, 2008; Lee & Xia, 2006; Pla-Barber & Alegre, 2007), ownership (Love, Roper, & Du, 2009; Molas-Gallart & Tang, 2006) and the firms’ internal resources such as human resource practices and other dynamic capabilities (Chen & Huang, 2009; Leskovar-Spacapan & Bastic, 2007), lacking analysis on the role of institutions (government support), organizational innovation or change and export market expansions or internalization. For instance, Sanidas (2004) contends that the issue of organizational innovation is less explored. More importantly, its effects on technical product and process innovation are not fully documented. In addition, evidence at firm level on the determinants of innovation by distinguishing product and process innovation is still lacking (Mol & Birkinshaw, 2009; Raymond & St-Pierre, 2010), and more so for developing countries like Malaysia. It is important to address this gap in research to provide insights to help policy makers to assess the importance of government incentives as well as internal firm capabilities e.g., organization innovation/change and export capability. This paper is designed to address a number of interesting questions relevant for developing countries. First, the paper assesses the effectiveness of government supports especially the tax and non-tax incentives (e.g., technical supports) in promoting innovation at firm level. Second, the paper examines the role of a firm’s organizational innovation or changes, namely, knowledge management practices and integrated structures and export capability in improving innovative capabilities of firms. This is done by framing the determinants of process and product innovation capability using the firm theory controlling for other firm-specific variables like size and ownership in the context of the Malaysian manufacturing sector.

The selected case study of the Malaysian manufacturing sector is interesting in a number of ways. Malaysia has recorded an impressive performance in the manufacturing sector. The sector contributed 81.6% to gross exports and 31.6% to Malaysia’s GDP in 2005. This dramatic economic growth is often attributed to Foreign Direct Investment (FDI). The Plaza Accord in 1985 and the withdrawal of the generalized system of preferential treatment in 1988 boosted FDI inflows to Malaysia. The Investment Act of 1986 further stimulated FDI. This policy provided many incentives, including pioneer status tax holidays, larger...
investment tax allowances for expansion projects, tax deductions for export promotions, the establishment of Free Trade Zones and other types of incentives to attract FDI. Malaysia further relaxed restrictions on capital ownership by foreign companies, thus improving FDI in Malaysia in the late 1980s. Malaysia’s initial attraction to foreign investors came from its basic infrastructure, political stability, liberal policies and low-wage labor market. However, rapid globalization and other emerging markets such as China and India make these factors less appealing in attracting FDI. Conversely, the sustainability of FDI-led growth may begin to erode due to the new challenges. It is crucial for the Malaysian manufacturing sector to focus on building technological capabilities and innovation to maintain competitiveness. For this reason, the Malaysian government has been emphasizing innovative developments at the firm level as the drive to economic performance (Malaysia, 2010a, 2010b).

Due to the evolution of industrial development in Malaysia (from import substitution to export promotion strategies and from low tech to high tech industries) and the industry’s lagging performance at the innovation frontier, the government’s role in stimulating technological advancement is critical. Moreover, the high level of uncertainty over R&D returns deters firms from investing in R&D. Stimuli in the form of tax and non-tax incentives are needed to accelerate the pace of innovation by firms. Lall (1996) notes the importance of the government not only in providing the right technological development policies but also in providing fiscal and other incentives for technological progress. These incentives have a major impact on a firm’s investment decisions. By creating the necessary economic incentives (tax and non-tax), the Malaysian government plays a pivotal role in spurring innovation by manufacturers. These incentives include tax exemptions for the use of R&D services, construction of industrial buildings for R&D and approved R&D projects (see Li & Imm, 2007 for a detailed summary of R&D incentives). Although, the government has pursued strategies to encourage innovation, studies empirically modeling the role of government are limited. For this reason, we examine the significance of government support for innovation in this paper.

This paper is organized as follows: The analytical framework and hypothesis section illustrates the analytical and theoretical relevance of each of the explanatory variables in the econometric model. The methodology section discusses the sample, data and variable measurements while the model specification section illustrates the linear model and sensitivity analyses. The results are reported in empirical results section. Discussion and conclusion section provides the policy implications and the conclusion of the study.

AN ANALYTICAL FRAMEWORK AND HYPOTHESIS

Government support

North’s (1990) pioneering work on institution has attracted a lot of attention among economists in explaining the growth phenomena. Most studies, referring to institutions as organizations as well as informal rules and norms, examine how these institutional elements shape the behaviors and expectation of firms (Luiz, 2009). Indeed, existing studies emphasize the role of institutions, especially the role of local government in selectively intervening in the market to stimulate local industrial capabilities in very broad perspectives (Lall, 1996; Mathews, 1996; Mathews & Cho, 2000; Moon & Bretschneider, 1997). In a similar vein, the national innovation systems (NIS) literature which takes the systems approach by identifying innovation as a result of an interactive process, also supports the role of government in correcting market failures. Within the NIS framework (Nelson & Winter, 1982a, 1982b), the role of various institutions is highlighted and in particular, with regards to providing basic infrastructure and supports in terms of training, technology acquisition and development and
intellectual protection rights. Developing countries are more likely to favor subsidies, incentives, and state-owned enterprises as ways to solve market failures and improve social welfare. However, studies show that the government plays a role not only in technological catch-up countries such as Taiwan (Rasiah & Lin, 2005) and South Korea (Kim, 1993) but also in developed countries. For instance, government support at the early stage of development in R&D is evident in the United States, Japan, Germany and France. With respect to innovation, Santikarn (1981) and Madu (1989), for instance, highlight the positive role of government in cultivating indigenous technological capabilities via various policy instruments and programs. Important policy directions that foster innovation capabilities among firms include increasing R&D expenditures, upgrading institutions, creating linkages, and setting up incentives programs. In the case of Taiwan, Amsden and Chu (2003) and Rasiah and Lin (2005) articulate the importance of government intervention in developing the country’s industrial capabilities. In a newly industrialized economy (except Hong Kong) as a whole, the success of the semiconductor industry is due to strong support from the government, especially at the early stages of development. A recent study by Lin, Shen, and Chou (2010) explicitly shows how the active role of the Taiwanese and the Irish government, through innovation policies, was instrumental in driving the industrial technology innovation. Rasiah (1999) highlights the importance of government policy in the machine tool industries in Malaysia. Through an in-depth study, Rasiah finds that the intermediary role of the state government is significant in explaining the transformation of Eng Hardware into a high-precision engineering firm. Narayanan and Lai (2000) discuss the necessity of government involvement in nurturing innovation directly or indirectly (using incentive systems) because of the pressure of heavy R&D investments and high levels of uncertainty and risk. The Malaysian government has designed various policy measures as a form of incentive for R&D to enhance the firms’ innovative activities and reduce the likelihood of market failure. These incentives, it is hoped, will help firms reduce some of their R&D costs and encourage them to pursue innovative activities. Based on the above arguments, we posit that firms receiving government support have significantly higher innovative capabilities. The following hypothesis is formed:

H1: Government support positively influences innovation
H1a: Government support positively influences product innovation
H1b: Government support positively influences process innovation

Organizational innovation
The literature on organizational innovation or change has been diverse and takes many different forms with different interpretations. Organizational innovation is not only crucial for economic performance but also for technical innovation (Sanidas, 2004). Although the literature on organizational innovation is diverse in nature, however, most of these literatures reach consensus on the need for organizational innovation as a necessary condition to introduce technical innovation namely the product and technical process innovation (Armbruster, Bikfalvi, Kinkel, & Lay, 2008). Examining the literatures, three important different theories stand out in describing organizational innovation (Lam, 2005) namely: organizational design theory; theories of organizational learning; and organizational change. The organizational design theory focuses on the organization structure including the new organizational forms and governance structure. According to the organizational design theory proponents (Burns & Stalker, 1994; Lawrence & Lorsch, 1967; Mintzberg, 1979; Teece & Pisano, 1998), organizational structural forms play an important role in influencing the ability to innovate. Likewise, theories on organizational learning focus on knowledge creation and assimilation as important factors in promoting the capability to innovate. Nonaka and Takeuchi (1995) and Chen and Huang (2009) emphasize the importance of learning for innovation especially the process of knowledge creation. In addition,

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2 See Lam (2005) for an interesting review on organizational innovation.
Exports
With the assumption of the technology push model, economic theory tends to support the concept of supply side determinants enhancing innovative activities. Conversely, favoring the demand pull hypothesis, scholars also tend to support the role of demand in technological progress at the macro (Kaldor, 1957; Shleifer, 1986) and micro levels (Schmookler, 1966; Gilpin, 1975; Gerosky & Walters, 1995). Export expansion may provide the required demand to encourage firms to build capacity and ultimately make innovation more profitable. This conforms to classical arguments (Smith's arguments) that the division of labor is determined by the size of markets. Firms can take advantage of the scale effect offered by export markets (Krueger, 1981) to drive competitiveness and to upgrade technological and innovation capability. In Malaysia, many local firms resulted from the spillover of multinational company (MNC) activities (Rasiah, 1999). They are part of the integrated supply chain of the MNCs, supplying components and modules as well as other services. As such, local firms with links to foreign firms are likely to participate in export markets. Over the years, many of these firms have developed their export capabilities (Ariffin & Figueiredo, 2004). Stringent quality, reliability, and delivery standards demanded by the export markets or clients pressured the exporting firms to upgrade production and technological capabilities (Rasiah, 1994). Using firm level data, Rasiah (2003, 2004) illustrates the significant correlation among exports, process technology and R&D capabilities. Xie and Wu (2003), using a case study, show that the large domestic market in China encourages firms to invest in technological learning. However, in Malaysia, due to the small domestic market, firms have greater incentives to invest in innovation processes when the market expands through export activities. Export expansion also means that existing investments must expand, attaining a higher level of efficiency in operations and progressive upgrading of the exported products. For this reason, it can be posited that higher-export-intensity firms have higher innovative capabilities.
system, younger firms are able to compete with older firms in technology innovation. Hence, we postulate that the age of firms could have a positive or a negative effect. Similarly, capital-intensive firms may be involved in more innovative activities but yet in the case of other developing countries (e.g., China), capital intensity is found to be negative and insignificant (Wang & Kafourous, 2009). Therefore, the signs and significance of capital intensity will be empirically tested.

**Methodology**

**Sample and data**

Data used in this study come from the NIS 2002–2004 conducted by the Ministry of Science, Technology and Innovation, Malaysia. The methodology for this survey follows the approach adopted in the Community Innovation Survey (CIS). Due to the nature of this study, only firms that have engaged in either product or process innovation were included. Indeed, only firms that are involved in innovation activities are eligible for government support. However, not all innovative firms apply or receive government support. It is also possible that innovating and non-innovating firms differ in terms of R&D investment\(^3\) (Czarnitzki & Hottenrott, 2011). And, for robustness of the estimated results, it is appropriate to only use innovating firms as the sample. A number of studies have examined the differences between innovators and non-innovators (considering it as binary response variable) but yet insights on what promote innovation activities among the innovators are less explored\(^4\). This is important since in developing countries, policy makers are also concerned with encouraging innovative firms to become global players.

\(^3\) Our estimates also suggest that R&D is only important when the analysis takes into consideration innovators and non-innovators as the dependent variable. This is consistent with Lee (2008). However, when we examine the determinants of intensities of innovation activities among the innovators, R&D becomes insignificant in the case of Malaysia.

\(^4\) Except studies that examine the determinants of the degree of novelty of innovation among innovators (see Amara Landry, Becheikhb, & Ouimet, 2008 for a complete review).
In pursuing this agenda, the challenges are more on how to increase the innovation intensity among the innovating firms rather than understanding whether or not a firm is innovating or not innovating. Therefore, to recommend any innovation policy prescription, understanding why some firms have impressive innovative performance is important. Policy makers and innovation scholars should pay attention to the determinants of innovation performance differences.

In total, the sample size is 272 firms. Although the exact population frame for innovating firms is not available, the annual manufacturing survey conducted by Department of Statistics (DOS) provides a valuable guide. Therefore, we use the yearly annual manufacturing survey conducted by DOS\(^5\) as a reference point to assess the sample representation. The survey indicates that only around 5.5% of establishments out of the total establishments (around 31,000) are actively involved in R&D activities in 2004. The most active sectors include electrical and electronics, manufacturer of motor vehicles, chemical, food and beverages, rubber, plastic, wood and furniture (DOS, 2005). The average percentage of R&D spending out of the total R&D over the year 2000–2004 by the active sectors are 50.45% (electrical and electronics with electronics alone accounting for 43.73%), 30.87% (manufacturer of motor vehicles), 2.19% (chemical), 2.51% (food and beverages), 1.98% (rubber and plastic), 1.26% (wood and furniture), 0.49% (textile), and 0.26% (paper products), respectively\(^6\). It terms of industry classification, our sample represents the active sectors involved in R&D and it includes the eight major industrial sectors\(^7\) (see Table 1). The representation of the sample for this study can also be evaluated based on firm size. (see Table 1). Manufacturing surveys indicate that, on average, SMEs (those with less than 150 workers) represent nearly 90% of the total establishments (DOS, 2005, 2006). In our sample, SMEs represent 78% of the total sample. In terms of years of operation, the majority of the firms (167 firms or 61%) have been operating for at least 9–14 years. Table 1 shows the profile of the firms and the descriptive statistics of the untransformed values of the variables under study. The average number of total, process and product innovation over the 3-years period (2002–2004) are 10, 5 and 6, respectively. Over the 3 years, in average, firms spend around 0.5 million Malaysian ringgit on R&D activities.

To understand more about why certain relationships exist between the dependent and independent variables, the field survey of the first author is utilized. The field survey was conducted between October 2007–January 2008. It involved interviewing 11 top management personnel from electronic companies in Penang as well as eight personnel from other related government agencies such as the Penang Development Corporation, Federation of Malaysian Manufacturers, InvestPenang and non-government agencies\(^8\).

**Variable measurements**

**Firm level innovation**
Most often, R&D investment is used as the indicators of innovation, however, this indicator is less relevant in many ways (Raymond & St-Pierre, 2010). R&D should be treated as the input for innovation activities and the outcome of these activities, namely, the number of process and product innovation reflects the true innovative capacity of the firms. Developing nations often define innovation differently from developed economies.

\(^5\) DOS follows a standard sampling methodology (stratified) that is deemed to represent the manufacturing industry.

\(^6\) Author’s calculation is based on the unpublished sectorial data obtained from DOS, Malaysia.

\(^7\) Although the exact population of innovating firms are unlikely to be known, the sample representation follows the annual manufacturing survey sampling framework. In this sense, the proportion of sample representation in this study follows the major industrial classification.

\(^8\) Please note that these interviews were only used to deduce some insights on the issue of the role of government, organizational innovation and export performance. Since the interviews only cover the electronics industry, it may not reflect the scenario of the entire manufacturing industry. However, interviews with the government agencies provide some insights on the issues that affect the innovation capability in different sectors.
path dependency of innovation analyzed by Rosenberg (1982) and David (1975) warrants some attention. Consequently, unlike the Schumpeterian notion of innovators, incremental innovations are important due to the cumulative nature of innovation (Nelson & Rosenberg, 1993). Changes in existing designs and processes or even modifications of machines are seen as important sources of innovation. Rasiah (1994) maintains that adaptation of machinery is an important source of innovation.

Therefore, a broad definition of innovation is vital for latecomers like Malaysia. In fact, countries like Japan, South Korea and Taiwan depend on incremental innovation to compete with countries at the technological frontiers. Even with the absence of R&D departments, firms can still engage in process innovation, improving product design and production processes through experience (learning by doing). For example, innovative production and organizational techniques such as material resource planning, quality control, and statistics process control have been an important source of innovation for Japanese companies, which are highly efficient and competitive. Technological innovations by latecomers are not R&D-centered but rather incremental improvements to existing products and processes (Hobday, 2003). In examining electrical and electronics (E&E) firms using firm level data, Hobday (1999) confirms the importance of process innovation in the Malaysian E&E subsector. This is true in the case of other Malaysian manufacturing sectors, which still lack R&D and new product development capabilities (Ariffin & Bell, 1999; Rasiah, 1994; Hobday, 2003).

In light of the research described above, we use the term innovation in this study in the

<table>
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<th>Variables</th>
<th>Sample</th>
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<tr>
<td>Age</td>
<td>1–8 years (8.2%) 9–14 years (61%) 15–35 years (30.8%)</td>
</tr>
<tr>
<td>Size</td>
<td>Small and medium (78%) Large (22%)</td>
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Because the former is not always at the innovation frontier (Hobday, 2005). In general, innovation refers to the successful introduction of a new or improved product or process to the marketplace. Hobday (2005) argues, however, that this definition may not suit developing countries, given the differences in technological advancement between developed and developing countries. He further argues against limiting the definition of innovation to something new to the marketplace since that definition does not capture incremental innovation or the application of new knowledge and skills or minor innovation. In addition, the
broader sense (see Hobday, 2005) to include product and process innovation that are new to the firm as well as the market or the world. The survey, following CIS, defines product innovation as a new and significantly improved goods and services. Process innovation is defined as a new and significantly improved method of production or logistic or other supporting activities namely maintenance and operations for purchasing, accounting or computing. These two types of innovation measure the overall innovation of the firm. The natural log of overall innovation (INNO) is measured as:

\[ \text{INNO} = \ln(\text{PROCI} + \text{PRODI}) \]

Where,

INNO is the overall innovation (includes the product and process)

PROCI is the number of process innovations introduced by the firm from 2002–2004

PRODI is the number of product innovations introduced by the firm from 2002–2004.

**Government support**

The government plays a crucial role in stimulating innovation. The tax and non-tax incentives the government gives to firms are used to proxy the government support (GOV). The non-tax incentives include technical consultancy services (e.g., assistance related to new technologies through technology transfer), technical support services (e.g., evaluation of equipment, implementation of productivity improvements, and registration of patents) and commercialization of R&D funds for innovation. The measured government support reflects only the above-mentioned incentives. Due to limited information, other types of direct financial supports were not included. GOV is measured as a dummy variable:

\[ \text{GOV} = 1 \text{ if firms receive any of the tax and non-tax incentives} \]

\[ \text{GOV} = 0 \text{ when no support is received.} \]

**Organizational innovation**

In the NIS, organizational innovation is defined as the implementation of new or significant changes in firm structure or management methods that are intended to improve a firm’s use of knowledge, the quality of goods and services, or the efficiency of work flows. Organizational innovation measures include three management practices deemed to be the key for innovative activities. First is the practice of sharing information, knowledge and skills within the company. Second are changes in management structure and the integration of different departments and activities. Third, if there are significant changes in relationships with other firms or public institutions i.e., alliances, partnerships, outsourcing or sub-contracting. The three measures of organizational innovation, typically, measure what is known as the structural change or structural innovation. The intra-organizational structural change includes significant changes in the way knowledge is shared within the organization while the inter-organizational structural change involves the changes in the cooperation practices with external organization that requires changes in the internal structure subsequently (Armbruste et al., 2008). The survey instrument provides a clear distinction between organizational innovation and product and process innovation following the definition adopted by the CIS 2004 and 2006 questionnaire. Since there is a clear definition of the terms used in the survey, it is expected that ambiguity of overlapping and misconception of the innovation variables involved is minimized. However, to avoid the problems of endogeneity between organizational and product and process innovation, we have also undertaken a series of tests which are explained in the next section. Using this information, organizational innovations are measured as a dummy variable as follows:

\[ \text{OI} = 1 \text{ if a firm has undertaken any one of the organization innovations} \]

\[ \text{OI} = 0 \text{ if otherwise} \]

A nominal value of 1 is given when any of the following OI exists in the firms.

**Export incidence**

Two measures are considered at the initial stage: the export intensity (measured as the ratio of exports to total output) and export incident, a
dummy variable distinguishing exporters from non-exporters. However, due to the high skewness of the export intensity measure, we use the export incident. Export incidents were measured as:

\[ X = 1 \text{ if the firm exports} \]
\[ X = 0 \text{ otherwise.} \]

**Control variables**

Firm size is used to control economics and diseconomies of scale. Three different measurements are available to control for firm size, including total number of employees, sales and total assets. In this study, firm size is measured by the natural logarithm of the total number of employees. The ownership structure of the firm is indicated as either foreign or local. If a firm has more than 50% foreign equity ownership, we consider it foreign owned. Foreign ownership (FO) is measured by introducing a dummy variable:

\[ FO = 1 \text{ if foreign equity ownership of the firm is 50% or more} \]
\[ FO = 0 \text{ otherwise.} \]

A firm’s years in operation are associated with its experience. A firm’s age is calculated based on years in operation. The value is in natural logarithm. The natural logarithm variable of capital intensive (CI) is added to the equation to complement the specification of the technology of various firms. This proxy will capture the effect of factor intensity as measured by the capital–labor ratio (CI). The CI is calculated as:

\[ CI = \frac{\text{Fixed assets}}{\text{total number of employees}}. \]

**Model specification**

**The model**

Our model specification is grounded based on the innovation literature which is common to most analyses (Jaffe, 1986; Mansfield, 1981; Scherer, 1984; Rasiah, 2004; Wignaraja, 2002). The full linear model is specified as:

\[
\ln \text{INNO} = \beta_0 + \beta_1 X + \beta_2 \ln \text{SIZE} + \beta_3 FO + \beta_4 \ln \text{GOV} + \beta_5 OI + \beta_6 \ln \text{AGE} + \beta_7 \ln \text{CI} + \epsilon
\]

As in equation 1, we estimate a separate model for product and process innovation. Model 1 represents the full model i.e., for overall innovation (INNO), while models 2 (PRODI) and 3 (PROCI) are estimates for product and process innovation, respectively. Our empirical model uses logarithmic (ln) transformation of INNO, SIZE, AGE and CI. The transformation enforces model linearity (Wang, Buckley, Clegg, & Kafouros, 2007) and also reduces the problem pertaining to serial correlation, heteroskedasticity and outliers.

**Sensitivity analyses and endogeneity**

A number of sensitivity analyses are performed to avoid bias estimates as well as to check the robustness of the results. In a cross-sectional study, the problem of heterogeneity may pose a problem. We check for heterogeneity using the White test. In some of the models, the heteroskedasticity is accepted at 5% significance level. In the presence of heteroskedasticity, we estimate the models using white heteroskedasticity consistent errors and covariance (White, 1980).

The estimation will also be biased in the presence of multicollinearity. It is expected that organizational innovation is influenced by other independent variables, namely, size, R&D, ownership as well as capital intensity. Few tests are conducted to detect the presence of multicollinearity. Informal check on the correlation matrix does not seem to suggest any multicollinearity problem within the independent variables. In addition, we compute the variance inflation factor (VIF) scores and they do not seem to exceed more than 1.5 for the variables included in the model, thus indicating no problem of multicollinearity. Furthermore, to test the expected influence of control and other variables on organizational innovation, we estimate logit model using organizational innovation as the dependent variable and size, ownership, export incidence and capital intensity as independent variables. However, we find that none of these variables are significant in explaining innovation.
organizational innovation. Besides, to be extra cautious on the robustness and validity of the estimation, we also perform step wise regression analysis to examine the sensitivity of the significance of variables of interest e.g., government support, organizational support and exports. However, we find that regardless of dropping certain independent variables (their inclusion and exclusion) from the estimation, it does not affect the estimated coefficients, signs of the coefficients and their significant level significantly. In fact, the effects of government support, organizational innovation and exports remain robust in the absence of other right hand side variables.12

Although R&D expenditure is suggested as one of the determinants of innovation (Raymond & St-Pierre, 2010), we find that including R&D on the right hand side of equation 1 poses two major problems. First, the Hausman (1976) test confirms R&D as an endogenous variable. In other words, there is simultaneity between R&D and innovation.13 Firms engaging significantly in product and process innovation may require more R&D spending. Second, R&D itself is affected by a number of control variables such as size, age, ownership, government support and capital intensity contributing to the problem of multicollinearity. Study shows that R&D is influenced by size, ownership and age (Lee, 2008). One possible solution to account for the possible biasness is to use the fitted values of R&D in equation 1. This involves adopting a two stage least square approach (see Johnston & DiNardo, 1997). However, the fitted R&D is found to be insignificant in all the models. The result is inconsistent with Lee (2008). However, when we estimate the same equation using innovators and non-innovators as the binary response variable as the dependent variables as in Lee (2008), R&D is significant supporting Lee’s work. It might obviously suggest that R&D contributes only when one distinguishes innovators and non-innovators or when firms decide to engage in innovation activities.

However, it is a surprise to learn that R&D does not contribute to the intensity of innovation activities among innovating firms, be it product or process. One possible explanation is that R&D is too low to significantly promote any product innovation. Indeed, the average ratio of R&D spending to sales is only 0.2% which is way less than 1%.14 In addition, scholars have shown that only in medium to high tech industries, the R&D intensity is significant for product innovation. Industries in Malaysia, being at the crossroad in learning to innovate especially among SMEs lack sufficient R&D intensity to promote product innovation. These industries are involved in incremental rather than radical innovation. And for process innovation, it does not necessarily require high R&D investments. In fact, evidence shows that even in the absence of R&D investment, process innovation is still possible (Narayan & Lai, 2000). In addition, R&D itself is affected by a number of control variables such as size, ownership, government support and capital intensity contributing to the problem of multicollinearity. Study shows that R&D is influenced by size, ownership and age (Lee, 2008). One possible solution to account for the possible biasness is to use the fitted values of R&D in equation 1. This involves adopting a two stage least square approach (see Johnston & DiNardo, 1997). However, the fitted R&D is found to be insignificant in all the models. The result is inconsistent with Lee (2008). However, when we estimate the same equation using innovators and non-innovators as the binary response variable as the dependent variables as in Lee (2008),

12 Greene (1993) suggests the following as the symptoms of multicollinearity: significant differences in the parameter estimate when there is a small change in the data; coefficients with wrong signs or an implausible magnitude and coefficient with very high standard errors and low significant levels.
13 We also thank the referees for highlighting this in the earlier version of the paper.
14 Only transport equipment and radio, television & communication equipment subsectors show R&D expenditure more than 1%.
Table 3 reports the results of the estimation with and without the inclusion of control variables, as well as XI, respectively. As expected, the results provide empirical evidence supporting the positive relationship between government support for overall innovation and process innovation at a 5% significant level. This indicates that government support does matter in driving a firm to perform innovative activities, especially with regard to process innovation. However, government support does not seem to show any influence over product innovation. This might suggest that the incentives provided are insufficient for product innovation, which usually requires high levels of investment and know-how. Indeed, the result does not surprise us, given that the non-tax and tax incentives are only sufficient for promoting process innovation, a less expensive undertaking than product innovation. Industries indicate the lack of direct financial support by government limits product innovation (Lee & Chew-Ging, 2006; MOSTI, 2006). The NIS survey data also indicates that the main sources of direct financial support in most cases come from internal sources. Li and Imm (2007) further suggest that the lack of direct policy and incentive schemes directed to firms as the major cause of the lackluster results in R&D activities among firms. Similarly, Ritchie (2005) argues that although Malaysian policies contribute to rapid economic growth, policies that encourage unproductive agents through the redistributive policy have retarded technological development in manufacturing. He further attributes the lack of technological development to the discontinuity of the institutional engagements and ignorance on issues of information exchange, investment appropriation, monitoring and enforcement.

Organizational innovation is found to have a significant influence on overall innovation as well as product and process innovative activities at a 1% level. The results indicate that innovation activities demand significant improvements in existing organizational structure and knowledge sharing practices. For managers, encouraging innovation should involve directing the available resources for organizational transformation.

15 This can be easily formed by including the residuals of endogenous variables in the original model. The residual is from the reduced form of the OLS estimates of organizational innovation as a function of all exogenous variables in a regression of the original model. If the residual is statistically different from zero, then there is indeed a problem of endogeneity.

16 Although other remedies are available to control multicollinearity, e.g., estimating using ridge regression (Kutner, Nachtsheim, & Neter, 2004), we settle for the simplest remedy by just dropping the variables for two reasons. First, ridge regression itself is complex especially in determining the biasing constant c. Second, our main motive is to detect the possible influence of organization innovation, government support and exports by estimating parsimonious regression.
especially with regards to internal and external knowledge sharing channels as well as structural changes that suit the innovation agenda of the firm.

Among other factors, export incidence (XI) is found to be highly significant in explaining the innovative activities of these firms. Export has a positive sign in all three models, indicating that export-oriented firms have greater product and process innovation. It confirms earlier predictions based on the argument that export-oriented firms need to continually innovate to maintain their competitive position in the export markets. This is consistent with Lee (2008), that innovative firms are more export oriented than non-innovative firms. Export market expansion acts as a catalyst of innovation activities. This might suggest that the government should establish innovation financing policy targeting export-oriented firms to promote product and process innovation. However, it is less clear whether export market destination matters for product and process innovation. For instance, firms exporting to destinations (such as Japan and other developed nations) that have stringent quality standards and other requirements possibly require the firms to introduce new process innovation.

Among the control variables, size, ownership and capital intensity are significant in explaining innovation activities. Size is found to have significant relationship with innovation. The positive coefficient indicates that large firms are innovating significantly compared to the small firms. Owing to the scale-based production (mass production) in large firms, process innovation is important to produce at marginal efficiencies of scale. This may explain why large firms are significantly involved in process innovation in our sample. With regards to ownership, although it is only significant at the 10% level in some cases, we find that foreign-owned firms undertake significant product and process innovation compared to local firms. This result suggests the need to encourage local firms to become involved in innovation through insertion into the global value chain networks. Closer linkages between foreign subsidiaries and local firms will help promote innovation among local firms. Since the onus to develop indigenous technology rests with local firms, incentives to encourage these initiatives should be formulated by the government.

Consistent with studies of other emerging markets (Wang & Kafouros, 2009), capital intensity shows a negative effect on innovation. The result suggests that less capital-intensive firms are more involved in innovation activities. One reason is that many of these capital-intensive industries pose technological sophistication but do not have the human capital, knowledge and skills necessary for product and process innovation. Bell and Pavitt (1993) highlight the need for expertise and resources for technological maturity. The limited resources for the capital-intensive firms may have contributed to the

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<th>Mean</th>
<th>SD</th>
<th>lnAGE</th>
<th>lnCI</th>
<th>XI</th>
<th>OI</th>
<th>FO</th>
<th>GOVS</th>
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<td>0.231**</td>
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</table>

***, **Correlation is significant at the 1 and 5% level, respectively.
negative correlation in our analysis. Indeed, it is widely reported by the technology-intensive firms that a workforce with limited education and skills impedes their innovation activities.

Table 3: Regression Results

<table>
<thead>
<tr>
<th>Dependent Variables</th>
<th>Model 1</th>
<th>Model 2</th>
<th>Model 3</th>
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</thead>
<tbody>
<tr>
<td></td>
<td>Overall innovation (lnINNO)</td>
<td>Product innovation (lnPRODI)</td>
<td>Process innovation (lnPROCI)</td>
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<td>Constant</td>
<td>1.150***</td>
<td>0.691***</td>
<td>0.740***</td>
</tr>
<tr>
<td>GOV</td>
<td>0.325***</td>
<td>0.135</td>
<td>0.243**</td>
</tr>
<tr>
<td>OI</td>
<td>0.407***</td>
<td>0.362***</td>
<td>0.348**</td>
</tr>
<tr>
<td>XI</td>
<td>0.677***</td>
<td>0.706***</td>
<td>0.674***</td>
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<td>-0.037</td>
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<tr>
<td>lnSIZE</td>
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<td>0.324***</td>
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<tr>
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<td>0.418*</td>
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<td>17.787***</td>
<td>14.744***</td>
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<tr>
<td>R²</td>
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<td>0.255</td>
<td>0.409</td>
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<tr>
<td>Adj. R²</td>
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<td>0.240</td>
<td>0.396</td>
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</table>

***, ** and * significant at 1, 5 and 10%, respectively.

Overall innovation: Includes product and process innovation. Industry dummies are included but not reported as part of the results.

Discussion and conclusions

This paper examines the relationship of product and process innovation with government support, organizational innovation and export intensity. This paper suggests that government support should also focus on product innovation since the market is not the best allocator of resources for this kind of innovation, especially in developing countries like Malaysia. Policy makers should consider direct financial support in order to encourage product innovation by firms. A significant relationship between organizational innovation and innovation activities suggests that a firm should give priority to improving and reorganizing its organizational elements. Exporting firms are more innovative, especially in the area of process innovation, since they are competing with global market players giving priority to improving and reorganizing its organizational elements. Government policies encouraging significant organizational innovation should be promoted, especially for firms likely to innovate.

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Overall innovation: Includes product and process innovation. Industry dummies are included but not reported as part of the results.
For policy makers, this study carries important implications on how to maximize the returns of R&D investments by knowing where to invest resources efficiently. Knowing what drives innovation including the potential role of the government in facilitating innovation is crucial. Knowing that export capability and organization innovation are important, the policy makers can use this as a guiding principle in allocating appropriate incentives. For instance, targeting firms in the export processing zone could be a good starting point for the government to improve the current state of innovation activities in Malaysia. Likewise, more concentrated efforts by the government to improve product innovation are required in the context of manufacturing industry.

Despite the contribution of this paper, the limitations require some attention. Unlike the longitudinal studies, our cross-sectional study may not have taken into account the lagging effects of government support, organization innovation and exports on process and product innovation. In addition, this paper does not distinguish product and process innovation into different classifications such as whether the product is new to local market, company or the world. There might be different consequences on the determinants of innovation when this classification is considered. Likewise, other drivers of innovation may have been downplayed in this study due to data unavailability, e.g., nature of competition, human capital or even capability of firms. However, this study does offer some insights for policy makers and paves the way for us in understanding the role of government, organizational innovation and exports on innovation especially in developing countries.

Acknowledgements
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References


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