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Role of Technology Transfer through Research and Development to Increase Competitiveness. Do SME's in Malaysia Take Advantages on It?

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Abstract: *Technology transfer is very crucial in sharing and improving knowledge among SMEs. It's importance in assisting them to growth in more proactive manner. Most of the process is done through research and development (R&D). Therefore, this study proposes to demonstrate the role of technology transfer through R&D expenses can increase Small and Medium Enterprises (SMEs) competitiveness. Other than that, this study will also bring the result on whether the SMEs are really benefit from this process. This study considered 148 SMEs in Malaysia as sample of data and its covered 10 years period of study, which is from year 2004 until 2013. Three sectors are studied namely manufacturing, service and agriculture. The competitiveness of SMEs through technology transfer is represented by return on asset (ROA), return on equity (ROE), net income and sales turnover. The results suggest that R&D expenses affect positively to the firm performance. Among these three sectors, this study found that R&D expenses have more significant on services sector compare to other sectors. Along the process of conducting this study, researcher discovered that, most of the SMEs are not recorded their R&D expenses in their financial statements which can limit the number of samples. The future research related for this study are the financing strategies by Malaysian agencies to encourage SMEs involve in technology transfer through the R&D investment to increase the firm competitiveness.*

Keywords: *Technology transfer; R&D expenses; Firm competitiveness; SMEs*

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I. INTRODUCTION

Malaysia is one of the developing country in South East Asia. The major economic contribution come from manufacturing and services sector. According to Malaysian Economy Report 2014 by Ministry Of Finance, it stated that the Malaysian economy expanded strongly in 2014 where the growth was 6% supported by domestic demand, in particular private consumption and investment. Exports continue their climb out driven by regional and increasingly global demand. Not forgotten, the Small and Medium Enterprise (SME) also played a major role to contribute for the national gross domestic product (GDP). Malaysia focus on SME and entrepreneurship development through productivity and innovation led growth. According to the SME Corporation, SMEs account for close to 99% of all the establishments in the manufacturing, services and agricultural sector, provide around 65% of total employment and it is expected that the value added production of SMEs to be around RM120 billion or 50% of total production in the manufacturing sector by 2020.

The growth of SMEs is crucial to ensure survival and subsequent consolidation in their operating markets (Lotti et al., 2009). In addition, SMEs are considered to be the main driving force behind economic and employment growth in many countries and therefore should be given a special status in major government policies. Innovation is the cornerstone of sustained growth and prosperity. Many countries including Malaysia aspire to innovate more and they need to boost the innovation capabilities quickly. Empirical studies suggest that the benefits of innovation are large. R&D related innovations for example, which represent a small subset of the range of innovations, are found to contribute no less than 1.4 percentage points of annual GDP growth in the United States..

This researchanalyzed the role of technology transfer through research and development (R&D) to increase SMEs competitiveness, focusing in Malaysia. SMEs should consistently invest in market research, R&D and innovation in order to increase their competitiveness. Such understanding should assist in delivering superior value to customers, compared to what their competitors are able to do. This in turn will increase customer retention rate. SMEs should leverage the advantages of being small by deploying relationship marketing strategies. The relatively small customer base of SMEs makes them more suitable for long-term customer relationships.

Firm level competitiveness indicated a firm's ability to design, produce and market products superior to those offered by competitors, where superiority can be evaluated from several factors, like price, quality and technological advancement. Firm level competitiveness focuses on behaviors and performance of firms. Besides financial or market-based indicators, one of the variables that can be used to measure the competitiveness is innovations.

Technology transfer can be defined as a flow between technology holder and technology user. It can be done through buying, renting, lending or licensing. Technology transfer can consist of several entities. The most important are innovators (technology creators), commercialization (companies) and central government institutions (economic policy). There is a high correlation between the intensity of technology transfer and country's innovation capabilities.

According to Romer (1986), technological innovation is created in the R&D sectors using human capital and the existing knowledge stock. It is then used in the production of final goods and leads to permanent increases in the growth rate of output. Innovation enables sustainable economic growth, given that there are constant returns to innovation in terms of human capital employed in the R&D sectors. The positive relationship between countries own R&D and productivity growth has been also confirmed by studies using international panel data, such as Frantzen (2000) and Griffith (2001).

In the first part of the paper will briefly explain about the overview SME in Malaysia. The second part of this paper is about some academic literature review related with this study. Then in the third part of this paper will give some hypothesis. The remainder of this paper is organized as follows, in part fourth is about data and empirical methodology, part five is about statistics and evidence for this analysis, and final part is conclusion.

1.1 Overview of SME in Malaysia

Small and medium enterprises (SMEs) played an important role in fostering growth, employment and income. Malaysia has been a success story, enjoying significant economic and social progress for several decades, thus facilitating a transition from a low-income to middle-income nation. The role of SMEs will become increasingly critical, not only as enabler of growth by providing the support to large firms, but also a driver of economic growth. Figure 1 indicates the GDP level in Malaysia. It shows that the GDP level in Malaysia are increasing trend. In year 2000, the total GDP is only RM 356,401 ('million) and in year 2012 the total GDP boost up to RM 941,237 (' million) almost triple increasing.

The development of a competitive and resilient small and medium enterprise sector is a key component of the Malaysian Government's economic growth strategy. Malaysian Government embarked on promoting entrepreneurship and SMEs as an important thrust to achieve balanced economic development and higher living standards at all strata of society. The SME sector contributed 32% of the real gross domestic product (GDP) and 19% of the total export value of the nation. Besides large enterprises, SME also plays an important role for national GDP. In 2013, the growth of SMEs GDP strengthened to 6.3 per cent as compared to the growth of overall GDP at 4.7 per cent

II. LITERATURE REVIEW

2.1. The Literature on Technology Transfer and SMEs

Technology from a very broad perspective, is defined as the capability of human society to transform natural resources into useful products for human consumption (Storper and Walker, 1989). The word "technology" originates from the Greek words "techne" and "logos", "techne" meaning the skill of hand or technique, and "logos" meaning a knowledge or science (Willoughby, 1990). Technology transfer is the process by which technology or knowledge developed in one place or for one purpose is applied and exploited in another place for some other purpose. Technology transfer is the process by which existing knowledge, facilities, or capabilities developed under research and development funding are utilized to fulfil public and private needs. Brooks (1966) provided the first definition of technology transfer as a process by which science and technology are diffused through human activity. This definition explains technology transfer as any activity by which systematic, rational knowledge developed by one group or institution is embodied as a way of doing things by other institutions or groups. Meanwhile, according to Autio and Laamanen (1995), technology transfer is intentional, goal oriented interaction and an active process between two or more social entities.

Besides that, the term technology transfer can be defined as the process of movement of technology from one entity to another (Sounder et al. 1990; Ramanathan 1994). The transfer may be said to be successful if the receiving entity, the transferee, can effectively utilize the technology transferred and eventually assimilate it (Ramanathan, 1994). Mansfield (1975) classified technology transfer into vertical and horizontal technology transfer. Vertical transfer refers to transfer of technology from basic research to applied research to development and then to production respectively and horizontal technology transfer refers to the movement and use of technology used in one place, organization, or context to another place, organization, or context.

Technology transfer can benefit the firm. Mansfield (1975) pointed out that, one of the fundamental processes that influence the economic performance of nations and firms is technology transfer. The preferred mode of technology transfer depends on the characteristics of the technology itself. For examples its age and complexity, the level of education of the workforce, labor skills, and technology transfer requirements, and competition. In the other view, Zhao and Reisman (1992) (.14), tend to link technology transfer to innovation and to view technology, including social technology, as a design for instrumental action that reduces the uncertainty of cause-effect relationships involved in achieving a desired outcome. Innovation enables sustainable economic growth, given that there are constant returns to innovation in terms of human capital employed in the R&D sectors. Innovation is seen as a key facilitator of the adaptation process to both endogenous and exogenous changes affecting the social, economic, and technological order in countries (Gopalakrishnan and Damanpour, 1997). Innovation aims at increasing the economic growth and welfare trough strengthening and sustaining the competitive advantage of firms, industries, and sectors, and improving living standards and quality of life (Gopalakrishnan and Damanpour, 1997).

R&D and technology transfer have independent and similar effects on a firm's knowledge base and productivity, we should expect to find the two types of innovative activity relating as substitutes. That is, technology transfer would substitute for the firm's internal R&D effort. This belief in the crowding-out effect of foreign technology on indigenous R&D effort motivated earlier efforts by the Indian government to restrict the purchase of foreign technology (Deolalikar and Evenson, 1989). A by-product of R&D is therefore to enhance a firm's absorptive capacity, which in turn boosts the efficacy of technology transfer. Drawing on the recent experience of East Asian economies, Kim and Nelson (2000) suggested that imitation through the adoption of existing technologies serves as an effective learning experience that paves the way for indigenous technological innovation. As suggested by

Joseph Schumpeter, innovation involves the creation of market value and thus, it is deeply related to the entrepreneurial activity (Schumpeter, 1934). This theory stated that innovation is at the heart of economic growth, driven by the entrepreneurial spirit of individuals and linked to the constant "creative destruction" shaping capitalist economies. Innovation is a key for achieving a competitive edge. Innovation, as a strategy and a process, deals with how to develop successfully new products or processes. Having valuable knowledge at the right moment plays a key role. Knowledge is considered a key intangible resource which properly managed leads to wisdom and to business success. Innovation represents a way to create more value in a firm. It enables firms to achieve sustainable competitive advantages, and is thus a key factor for growth (Cheng and Tao, 1999).

Throughout the world the role of small and medium sized enterprises (SMEs) is becoming increasingly prominent (Veskaisri et al., 2007). SMEs can be established in any locality for any kind of business activity in urban or rural area (Khalique et al., 2011). The two main primary reasons for the existence of small firms are: (1) to provide goods and services to satisfy customers' needs in a manner that they will continue to use and recommend the firms' goods and services, i.e. "customer service business" and (2) to create desired goods and services so that the investment in the firm is converted to cash as quickly as possible, i.e. "cash conversion business" (Armstrong &Drnevich, 2009). Mayer and Blaas (2002) point out that, in recent decades, SMEs have begun to utilize technology transfer as a strategic means of meeting challenges posed by the globalization of business. However, the history of technology transfer has not been one of unqualified success. Many failures have occurred for reasons that have not always been clear (Cohen, 2004). This is mostly due to the complexity, sophistication, and dynamism of the processes, the high requirement of financial, human, physical, and technological resources, a lack of or low technology absorptive capacity in the recipients, as well as differences in culture and languages, business practices, rules and regulations, economic situations, competitors and technological infrastructure (Nahar, 2001). Besides that, assessing technology transfer effectiveness is complicated by the fact that it is difficult to determine when and under what circumstances technology (or applied science, or know-how, or technological processes) has been transferred, much less transferred successfully.

2.2. R&D Investment, Patents, Economic Growth and Firm Performance.

The influence of R&D intensity on SME growth is an issue of great interest and complexity, especially with respect to the need for structural transformation in the economies of developed countries. Many studies have found that R&D intensity has a positive effect on SME growth. R&D expenditure contributes to increased diversification of activities, making SMEs more competitive (Deloof, 2003; Baptista and Karaoz, 2011). R&D expenditure allows for increased export capacity, which may contribute decisively to reducing the level of risk associated with SME activities (Beise-Zee and Rammer, 2006). R&D investment increases absorptive capacity, for examples the capacity to absorb knowledge created from the relationships formed with agents outside the firm, as well as the capacity to use that knowledge to increase firm performance (Cohen and Levinthal, 1989 and Gilsing et al., 2008). R&D activity is a well-organized process of knowledge creation, production, diffusion, and application. Griliches, 1986 and Griliches 1990, Mansfield (1988), Goto and Suzuki (1989), Meliciani

(2000), Timmer (2003), and Gonzalez and Gascon (2004) have provided theoretical argument as well as empirical evidence from various industries in many countries regarding the R&D could result in better production technology, raise the productivity and the rates of return on investment at both firm and industry level.

The positive relationship between countries own R&D and productivity growth has been also confirmed by studies using international panel data, such as Frantzen (2000) and Griffith, Redding and Reenen (2002). R&D expenditure is an important part of the competitive strategy of the firm. Decisions on R&D projects have to go to the same decision process as other investment decisions. However, it seems to be more difficult to forecast the market profitability of R&D projects when compared to other investment decisions. New knowledge and new technology generated from R&D activities increase productivity, not only at the firm level but also at the industry and nations levels. An increase in productivity eventually leads to higher returns to investment, higher income levels and to greater economic growth. It is expected that countries that engage in more R&D activities will tend to achieve higher income levels.

However, R&D intensity can also reduce growth in SMEs. R&D investment is associated with a high level of risk, added to which is its contribution to the creation of intangible assets in a firm, which in turn may make the level of risk faced by SMEs even higher. This may add to SME's difficulties in obtaining external finance, hampering efforts to grow and diversify (Yasuda, 2005; Muller and Zimmermann, 2009). Efficient use of R&D investment requires management may even contribute to decreased growth (Santarelli and Sterlacchini, 1990; Muller and Zimmermann, 2009).

Technology transfer and R&D can share a complementary relationship. Cohen and Levinthal (1989) discuss that R&D not only involves innovation but also learning. A result of R&D is therefore to enhance a firm's absorptive capacity, which in turn enhancements the efficiency of technology transfer. Kim and Nelson (2000) suggested that imitation through the adoption of existing technologies serves as an effective learning experience that paves the way for indigenous technological innovation.

The patent is the most important indicator of research outcome. Patent statistics will provide a potentially useful sources of information on R&D activities. According to Goto and Suzuki (1989) they stated that the time lag between input and output would be two years in conducting measurement of production efficiency on R&D performance. Porter and Stern (2000) is one of the first studies that utilized aggregate level patent data to examine the determinants and the effects of innovation. They found that innovation is positively related to human capital in the R&D sectors and national knowledge stock. Lerner (2002a, 2002b) analyses changes in patenting activity of foreign and domestic issuers following patent reforms in sixty countries over a 15 years period. He finds an increase in patenting activity among foreigners, which is suggestive of increased technology transfer, but he does not directly examine technology transfer, nor does he study the heterogeneity of responses across firms. According to Ernst (1995), he used sales based performance indicators to assess the impact of patenting behavior on performance. The indicators used to test the impact are relative sales growth, relative sales per employee, and relative development of sales per employee. Based on these three performance measures Ernst concludes that patent-active firms show better performance.

2.3. Firm competitiveness

According Lall (2001), a complete competitiveness analysis must define what competitiveness means and how it is to be measured and identify the most important factors influencing it, the interactions between these factors and how they affect the competitiveness of the subject of investigation. Previous studies have shown that the indicators and drivers of competitiveness have multidimensional construct and complex relationships. Competitiveness can be considered as "multi-faceted" in nature as a number of variables should be jointly adopted to measure it. Economic literature examines competitiveness along two different levels: competitiveness of national economies (macroeconomic level) and competitiveness of firms/ industries (microeconomic level). Competitiveness of a firm can be taken as its ability to do better than comparable firms in sales, market shares, or profitability (Lall, 2001). Competitiveness is synonymous with a firm's long-run profit performance and its ability to compensate its employees and provide superior returns to its owners (Buckley et al. 1988, p.176).

Besides that, competitive can be defined as comparison and rivalry. It can be interpreted as "the asymmetry or differential among firms along any comparable dimension that allows one firm to compete better than its rivals" (Ma, 2000: 53). Firm level competitiveness indicated a firm's ability to design, produce and market products superior to those offered by competitors, where superiority can be evaluated from several factors, like price, quality, technological advancement, etc. Various financial performance measures are often used for measuring the competitiveness of firms. For example return on assets determines an organization's ability to make use of its assets and return on equity reveals what return investors take for their investments. The advantages of financial performance measures are the easiness of calculation and that definitions are agreed worldwide. Traditionally, the success of a manufacturing system or company has been evaluated by the use of

financial measures (Tangen, 2003). At the firm level, profitability, costs, productivity and market share are all indicators of competitiveness.

Although financial indicators are the most widely used indicators of competitiveness, several non-financial performance proxies are also important. Examples of non-financial performance indicators are the market share of a firm, the market share growth and the overall customer satisfaction. Besides that, beyond financial or market-based indicators, measures of competitiveness increasingly include other variables such as innovativeness, quality, and social ones like ethical standing, social responsibility, working conditions of employees, etc.

III. HYPHOTESIS

Technology transfer is an important mechanism for transforming technological capabilities generated through research and development projects, into new or improved features and functions within assistive technology and even mainstream products. The technology transfer process progresses from an idea for a technology application, through the development of a working prototype and then on to a commercial product. This progression raises the importance of distinguishing between a technology and a product. A technology is not a product, although one or more technologies are incorporated to provide a product's features and functions. Technology transfer is really one overall process encompassing multiple elements that collectively transform technologies into products. The elements comprising technology transfer are routinely viewed as discrete activities, but it is more constructive to treat them as a continuous process from technology discovery through product consumption.

To measure the successful of technology transfer is very subjective. We can identify the success of technology transfer by looking at the number of patents or intellectual property being licensed. This can be seen after a few years and several times. For a large firms, the technology transfer can be done by hiring the third party likes private research centre or research university, so that they can develop the product according what they needs. However, for the small firms like SMEs, they cannot afford to hired a third party to do a product research and development for them, so the internal R&D by adapting some technology transfer is good enough for them to come out with some marketable and innovative product. This R&D expenses will then be used to relationship between firm performances in this study.

The relationship between competitive sources and performance were tested using panel regression analysis for the following reasons: First, because panel data suggests that firms are heterogonous and therefore do not run the risk of obtaining biased results. Second, because panel data gives more informative data, more variability, less collinearity among the variables, more degrees of freedom and more efficiency. Finally, panel data are able to identify and measure effects that are simply not detectable in pure cross section or pure time-series data. I chose the fixed effects model as an appropriate specification as we are focusing on a specific set of firms and our inference is restricted to this set of firms.

R&D expenditures are positively correlated with firm performance (Branch, 1974; Erickson and Jacobson, 1992). It is also widely adopted that investments in research and development contribute significantly to sales, productivity and firm's profits (Romer, 1990; Jones, 1995). Several studies have concluded a positive relationship between R&D investment and market value of the firm (Chan et al. 1990; Chauvin and Hirschey, 1993). Hall and Hayashi (1989), concluded that investing in research and development is a very important intangible asset, which can lead to higher profits, in greater duration of time.

This study constructed the following two hypothesis:

Hypothesis 1: R&D expenses affect positively the firm performance

Hypothesis 2: R&D expenses have more significant on manufacturing sector compare to other sector.

The conceptual framework for this study are as follow:

IV. METHODOLOGY

4.1Data

This study employed the financial data of Malaysian SMEs from Bureau van DijkOrbis Database. SME Corp. in Malaysia defined small and medium sized companies as companies who match at least one of the following conditions:

As at year 2013, total number of SMEs established in Malaysia is around 645,136 companies. The total number of SMEs here is based on number of business registration to the Companies Commissions of Malaysia

(SSM). Based on this number, it's difficult to know how many SMEs are still active and still run their business. This is because, due to high level competitiveness, many of SMEs in Malaysia cannot survive in their main business. Besides that, most of the SMEs in Malaysia did not have proper financial statement recording. From Orbis Database, data was searched based on the Malaysian SMEs definition and guidelines, from the searching process, the study found 164,689 companies. Furthermore, the companies are filtered based on research and development expenses and no of patents. Resulted from that, total companies found are 148. This 148 companies from various industries will be the samples for this analysis.

4.2Dependent variable

To analyses the firm competitiveness, one of measurement we can used is by using the firm performance. I choose several financial ratios as a dependent variable for this study. Financial ratios, which are calculated by using variables commonly found on financial statements, can provide the following benefits (Ross et al, 1998): Measuring the performance of managers for the purpose of rewards; measuring the performance of departments within multi-level companies; projecting the future by supplying historical information to existing or potential investors; providing information to creditors and suppliers; evaluating competitive positions of rivals; evaluating the financial performance of acquisitions. The dependent variable in this analysis is measured by annual return on assets (ROA), annual net income, and operating revenue.

ROA is an accounting measure for firm performance and it is widely adopted by many studies (e.g., Anderson et al. 2000; Coombs and Gilley 2005; Henderson and Fredrickson 2001; Hogan and Lewis 2005; Kato et al. 2005; Tosi et al. 2000). ROA can be used as indicator of how profitable a company is relative to its total assets. It gives an idea as to how efficient management is at using its assets to generate earnings. It can be calculated as follow:

ROA = NET INCOME / TOTAL ASSETS

ROE is the amount of net income returned as a percentage of shareholders equity. It measures the firm profitability by revealing how much profit a company generates with the money shareholders have invested. It can be calculated as follow:

ROE = NET INCOME / SHAREHOLDERS EQUITY

Net income is a company total earning or profit. It is important measures on how profitable the company is over a period of time. It can be calculated by taking revenues and adjusting for the cost of doing business, depreciation, interest, taxes and other expenses. *Operating revenue (Sales turnover)* is about income derived from sources related to a company daily operations.

4.3 Independent variables

The main independent variables for this study is *research and development expenses.* R&D expenses are measure by R&D intensity where research and development expenses divide by sales. Hall and Hayashi (1989), state that R&D is an important intangible capital that can lead to more long-lasting and supernormal returns; it is embodied in the firm and its employees and includes knowledge, accumulated know-how, technical expertise, trade secrets, patents, etc. R&D investment, the independent variable in our study, is measured by R&D intensity (R&D expenditures as percentage of sales). R&D expenditures and sales were also obtained from Orbis database. Many past studies have tried to investigate the linear relationship between R&D investment and firm performance where R&D intensity is usually adopted (e.g., Erickson and Jacobson 1992; and Henderson and Fredrickson 2001).

The second independent variables are *number of patents*.Pakes and Griliches (1984) found a strong relationship between R&D spending and the number of patents. This data also can be obtained from Orbis database.

4.4. Control Variables

As mentioned, firm performance can be influenced by many other factors besides R&D. Therefore, in order to avoid potential omitted variable problem, I also include controls for firm characteristics such as firm size, firm age, and leverages.

Firm size is measured by the natural logarithm of total assets (Finkelstein and Boyd 1998), which was obtained from Orbis Database. Empirical studies show that large firms mayhave greater resources to develop sustained R&D programs and exploit innovations, so firm size may effect on organizational performance (Im et al. 2001). *Firm age* which is defined as the observation year minus the registered start year. The extensive information of firm age is unique, and should enable us to accurately assess the age effect on growth persistence. *Leverages* is one of several financial measurements that look at how much capital comes in the form of debt (loans), or assesses the ability of a company to meet financial obligations. Ross, Westerfield and Jordan (1998), retreated that the use of debt in a firm's capital structure is called financial leverage. The more

debt a firm has (as a percentage of assets), the greater is its degree of financial leverage. Leverage is measured as long-term debt divided by the summation of long term debt and equity. The same approach was employed by Rajan and Zingales (1995). This method reflects the percentage of long term debt in the companies' capital structure.

Firm types. For this study, I used 4 types of firm. The indicator for each type are number 1 is for manufacturing, number 2 is for services, number 3 is for construction, and number 4 is for agriculture.

Overall, the estimation of this study are as follow:

$$ROA = \beta0 + \beta1\ RND + \beta2\ PTNTS + \beta3(SIZE) + \beta4\ (AGE) + \beta5\ (LEVERAGE) + \beta6\ (FIRMTYPES) + \beta7\ (CONS) + \varepsilon \quad [1]$$

$$ROE = \beta0 + \beta1\ RND + \beta2\ PTNTS + \beta3(SIZE) + \beta4\ (AGE) + \beta5\ (LEVERAGE) + \beta6\ (FIRMTYPES) + \beta7\ (CONS) + \varepsilon \quad [2]$$

$$NET\ INCOME = \beta0 + \beta1\ RND + \beta2\ PTNTS + \beta3(SIZE) + \beta4\ (AGE) + \beta5\ (LEVERAGE) + \beta6\ (FIRMTYPES) + \beta7\ (CONS) + \varepsilon \quad [3]$$

$$REVENUE\ (SALES\ TURNOVER) = \beta0 + \beta1\ RND + \beta2\ PTNTS + \beta3(SIZE) + \beta4\ (AGE) + \beta5(LEVERAGE) + \beta6\ (FIRMTYPES) + \beta7\ (CONS) + \varepsilon \quad [4]$$

Where: β1 RND = research and development intensity
β2 PTNTS = no of patents
β3(SIZE) = total assets
β4 (AGE) = age of firm since registered
β5 (LEVERAGE) = the debt in firm's capital structure
β6 (FIRMTYPES) = types of SMEs

V. DATA ANALYSIS

5.1 Analysis on Hypothesis 1

Table 1, shows a result for the OLS regression analysis while Table 2 shows a results for fixed effect model regression. The dependent variables are ROA, ROE, net income and sales turnover. The P-value for ROA and ROE are 0.8051 and 0.9999, which is above 0.05. In terms of R-sq in Table 1, it shows that the all the independent variable and control variables in this model explain about 71.40% of the variance on net income. Table 1 also show that all the independent and control variables in this model explain about 97.69% of the variance on sales turnover.

Overall, only net income and sales turnover shows a significant and higher relationship between the dependent and independent variables. I believed that since the samples for this study are using the SMEs, which have small asset and equity, the ROA and ROE did not reflect too much to the independent variables compare if we are using very large firms as a sample. For the Hypothesis 1 where research and development expenses can affect positively the firm performance, the answer is R&D expenses can affect positively the firm performance if we look on net income and sales turnovers measurement. When the firm allocate more fund for R&D expenses, it can increase the firm performance and will lead to higher level of competitiveness for the firms.

Table 1: OLS Regression results

Variables	Net income Model 1	Net income Model 2	Sales turnover Model 1	Sales turnover Model 2
R&D intensity	1.756229	1.494065	19.76203	19.12937
No of patents	1717.093	1746.543	-362.8067	-272.7513
Firm Size		0.0045792		0.0128656
Firm age		-323.2029		-298.1558
Leverages		357.4262		1166.27
Firm types		10882.77		-7168.766
Constant	-4138.036	-24335.12	41994.33	6054.742
Fixed effect model	No	No	No	No
N	148	148	148	148
R-sq	69.67%	71.40%	97.61%	97.78%

Table 2: Fixed effect model regression results

Variables	Net income Model 1	Net income Model 2	Sales turnover Model 1	Sales turnover Model 2
R&D intensity	1.752448	1.451063	20	19.76493
No of patents	Omitted	Omitted	Omitted	Omitted
Firm Size		0.0055129		0.0042943
Firm age		24302.72		-726.9248
Leverages		292.2869		254.4968
Firm types		-58316.63		4067.615
Constant	-2036.678	-573788	34675.96	38060.84
Fixed effect model	Yes	Yes	Yes	Yes
N	148	148	148	148
Obs	969	969	969	969
Overall R-sq	68.96%	12.96%	97.61%	97.69%

5.2.Analysis on Hypothesis 2

Table 3 and Table 4 present the summary of regression analysis for all types of firm which is divided to manufacturing, services, construction and agriculture. This study used 148 SMEs as a samples. The distribution of the sample as follow, manufacturing 123 companies, services 15 companies, construction 8 companies and agriculture 2 companies. The number of observable for manufacturing are 799, services 100, construction 58 and agriculture is 11.

Table 3: Regression results from different firm types (net income)

Variables	Manufacturing	Services	Construction	Agriculture
R&D intensity	1.161206	1.743157	1.19338	0.5814869
No of patents	-356.2278	1876.092	Omitted	Omitted
Firm Size	0.0152872	0.0023043	0.0124723	0.2112185
Firm age	-92.30346	-497.311	-1010.744	36229.96
Leverages	328.561	656.4394	945.1563	-9342.549
Constant	-15804.32	-23378.34	16713.2	-641087.2
N	123	15	8	2
Obs	799	100	58	11
Overall R-sq	60.01%	74.73%	78.05%	94.79%
Significant	0.7304	0.8562	0.8624	-

Table 3 shows the results for net income. Patent are omitted because of collinearity. In terms of R-squared, for the net income, construction sectors show a higher percentage which is 79.59% compare to 74.73% for service sectors and 60.01% for manufacturing sectors. For sales turnover in Table 4, service sector shows a higher percentage which is 100% compare to construction 99.98% and manufacturing 96.19%.

For the significant level, services sector shows a high significant compare to manufacturing and construction. In Malaysia, the service sector contributes very high number to total of SMEs compare to manufacturing sectors. However, the samples for this study are more on manufacturing sectors due to availability of financial data. To answer the hypothesis 2 which is R&D expenses have more significant on manufacturing sector compare to other sector or not, based on the results in Table 4, it can be concluded that R&D expenses have more significant on services sector, thus the hypothesis 2 cannot be accepted.

Table 4: Regression results from different firm types (sales turnover)

Variables	Manufacturing	Services	Construction	Agriculture
R&D intensity	16.35941	19.96791	20.158	20
No of patents	-2403.571	3.173845	Omitted	Omitted
Firm Size	0.1414746	0.0001768	-0.0072694	-0.00137
Firm age	-257.6109	-643.7948	-1458.971	-0.076498
Leverages	962.1508	-213.4409	-96.57702	0.0084103
Constant	621.3779	32502.59	77403.81	1.385459
N	123	15	8	2
Obs	799	100	58	11
Overall R-sq	96.19%	100%	99.98%	100%
Significant	0.9558	1.0	0.998	-

VI. Conclusion

This study conducted the analysis on how technology transfer through R&D expenses can increase firm performance. Two hypotheses were build based on the academic literature review and theoretical framework. The results indicated that R&D expenses affect positively the firm performance and R&D expenses have more significant on services sector compare to other sectors.

From total of 148 SMEs from four types of sectors, the data was collected from orbis database. In order to determine the firm performance four financial tools were used which are ROA, ROE, net income and sales turnover. However, due to the SMEs definition itself is a small and medium firm, the size of the firm plays an important role. The ROA and ROE are less significant in this study because of the small assets.

Besides R&D expenses and number of patents, there are a lot of factors that can contribute to firm performance. Other factors have been advanced in the literature that may be important to boosting firm performance :(i) good internal organization ;(ii) suitable strategies for diversifying activities and (iii) strategic cooperation between firms with respect to R&D projects. Various factors may contribute to R&D investment having greater importance in determining the SMEs performance: (i) the product's shorter life cycle and the high cost of R&D investment at its origin erect entry barriers through sunk costs, which on the one hand, diminish competition faced by high-tech SMEs and, on the other hand, create a need to diversify activities; (ii) continuous, rather than occasional, investment by high-tech SMEs may cultivate more efficient strategies for leading and managing corporate R&D projects; (iii) more highly qualified human resources may be a determinant, in high-tech SMEs, for more efficient management of R&D projects; (iv) greater absorptive capacity, i.e., internal organization may be a determinant for high-tech SMEs to promote more effective use of good management practices in R&D projects; and (v) greater capacity to implement cooperation strategies with similar firms may allow to acquire experience benchmarks in R&D project management.

The limitation of this study is non-recording of R&D expenses in the financial statements of SMEs are very high which can limit the number of samples. This limitation may have affected the results of the study. Furthermore, there is difficulty on modelling such a research because many of the R&D expenditures are calculated in the income statements as production costs and not specifically as an R&D expenses figures. As a conclusion, based on this result, technology transfer through R&D expenses can play an important role to increase SMEs competitiveness. However, involvement of many parties for examples, government agencies, financing sectors are needed to attract and encourage more SMEs involve in the R&D to increase the firm performance.

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