Factors Affecting Open Innovation: Evidence from Malaysia

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Abstract: This paper uses Partial Least Square (PLS) as an analysis tool to test the hypothesized relationships of Managerial Ties and Organizational Citizenship Behaviours (OCBs) with Open Innovation and tests the moderating effect of appropriability regimes on these relations. 60 managers from 60 firms Malaysian firms participated in this study. The results reveal that managerial ties relate to open innovation, while non-significant findings are found with the other two hypotheses. Social Exchange and Actor-Network theories are used to explain the framework of this study. Limitations, practical and academic implications are discussed.

Key words: Open Innovation, organizational citizenship behaviours, managerial ties, Malaysia.

INTRODUCTION

Since Chesbrough’s introductory work on open innovation, the open innovation paradigm has emerged as an alternative model of innovation wherein firms commercialize both external and internal ideas and technologies. Open innovation is a result of the rapid changes taking place in today’s business world with high mobility of knowledge workers and the rise in venture capital. In many industries today, the approach of research and development (R&D) as an internally oriented and closed concept is fading. The speed at which products change following the ever-changing preferences of customers makes it a challenge for any firm to have all the R&D resources to conjure up ideas that will produce what the consumers want.

In his book, "Open Innovation - The new imperative for Creating and Profiting from Technology" (Chesbrough, 2003), explains how in the 20th century firms profited from innovations that were outcomes of heavy investments in internal research and development of firms. However, with the changing times towards the end of the 20th century, a number of factors combined together to cause the closed innovation process to break up in the United States. The two main such factors were: 1) Rise in the number and mobility of knowledge workers and 2) Growing availability of private venture capital. While the increase in the number and mobility of knowledge workers made it difficult for companies to control their proprietary ideas and expertise, the increased availability of private venture capital helped finance new firms and commercialize new ideas that would otherwise be found useless or less useful in corporate research labs. This paved the way for more open innovation (Chesbrough, 2003a).

Chesbrough (2003a) summarized six principles behind firms operating in the open innovation paradigm: a) not all smart people work in-house and thus there is a need to tap into external knowledge, b) external R&D can generate significant value, c) research does not need to originate from internal work to be profitable, d) a strong business model is more important than bringing products to the market first, e) internal and external ideas are essential to win and f) we can capitalize on our own IP and we should buy others' IP when needed.

The advances in information technology and the forces of globalization have increased the demand for pooling complementary assets of external organizations (Archabal et al., 2005). Globalization has also in many ways further necessitated the need to collaborate with external players in the open innovation process. The effects of globalization in terms of increased competition, increased mobility of skilled workers, shorter product life cycles, higher risks and lower profit margins have forced firms to spread risk and develop new products and services quickly and efficiently (Chesbrough, 2003). In addition, complex environments that are a result of increased collaborations between different players have in many ways necessitated the shift from closed to open systems that facilitate informal behaviour to match situational and contextual factors (Brodbeck, 2002).

Some reasons for the shift to open innovation include: profitable growth, improvement in product margins, perceived inability to meet corporate growth objectives absent recourse to external technologies, increased speed to market, cost reduction and monitoring of potentially disruptive technologies (Chesbrough & Crowther, 2006). The transition from closed to open innovation is evident in many industries – from copiers, computers, disk drives to biotechnology and even military weapons and communications systems. This is a result of a number of very vital innovations emerging not from the central R&D labs of large companies but from unlikely external sources such as startups, universities, research centres and other outside firms. Other industries are also now leaning towards open innovation, such as automotive, health care, banking (Chesbrough, 2003a) and asset-intensive industries like cement manufacturing (Chiaroni, Chiesa, & Frattini, 2011). However, adopting the open innovation model does not seem to be easy as several challenges come in the way of the open innovation...
Open Innovation:

Open innovation is defined as “the use of purposive inflows and outflows of knowledge to accelerate internal innovation and to expand the markets for external use of innovation, respectively (Chesbrough, 2006, p.1).” Open innovation has come to be due to the extraordinary results experienced by firms in attaining growth through new discoveries within a short period of time. These discoveries were a result of leveraging the
technical resources and capabilities of others in what is now known as inbound open innovation, which stipulates that firms need not and should not rely exclusively on their own R&D. The other concept of open innovation, termed outbound open innovation outlines the options of firms to look for others who can commercialize a given technology and that it does not have to rely entirely on internal paths to market. As such, the industry that has benefited tremendously from open innovation is the software development community (Chesbrough, 2010).

Open innovation incorporates explicitly the business model as the source of value creation and value capture, helping a firm sustain its position in the industry while at the same time sharing the task of value creation across industry value chain (Chesbrough, et al., 2006). In an open innovation paradigm, external ideas and external paths to market are placed on the same level of importance as that reserved for internal ideas and paths to market during the closed innovation era (Chesbrough, 2003).

R and D is regarded as an “open system” in which ideas can come from both inside and outside of the organization and can go to the market through similar channels (Chesbrough et al., 2006). This is often a result of an alliance or collaboration or any such agreement between firms and since the knowledge is distributed, the innovation process is also distributed among the players involved in this process (Acha & Cusmano, 2005). As the boundaries become porous, there is more interaction between partner firms that results in greater technology acquisition and exploitation (Chesbrough, 2006). As a result there is a greater amount of resources and expertise at hand than expected in a closed innovation model. This has many benefits, one of which is faster innovations. Further, to adapt to global change, organizations focus on their core competency by looking outside and relying on other companies to provide complementary capabilities (Hagel & Brown, 2003). This is also one of the reasons why strategic alliances between organizations are becoming increasingly important for capturing and internalizing knowledge (Parise & Henderson, 2001; Paswan, 2003).

Open innovation offers many advantages to firms adopting this model. Firms create value externally by acquiring skills and knowledge from partners to complement the internal capabilities of their organizations (Love et al., 2002). Some of the reasons for firms to enter into collaborative relationships are to improve innovation, increase speed to market, and reduce the costs of internal vertical integration. When the partner firms share information, it improves their efficiency and helps them focus on joint opportunity recognition (Moffat & Archer, 2004). If the partner firms have compatible goals and they pool their resources, it creates increased value for the partner organizations as well as the customers (Kesler, 2002). This joining of hands finally provides for the potential for improved designs, shorter lead times, and greater customer value (Ragatz, Handfield, & Petersen, 2002). As a result of collaboration efforts of the partnering firms, a heady mix of talent and expertise from people working together in new ways often stimulates innovation. This has further been made easier by the advent of information technology that has enabled better coordination of alliance partner value chains and greater integration as demanded by the new global market forces (Shaw, 2000). Research has shown that effective collaboration with external partners, like buyers, suppliers and other organizations is one of the important factors for innovation (Faems, Van Looy, & Debackere, 2005; Ritter & Gemünden, 2004).

Given the urgencies of the global markets, it becomes imperative on the organizations and new entrants to regenerate their core strategies and reinvent their industries by developing sustainable core competencies (Prahalad & Hamel, 1994). Organizations that sense the changing environment create focus on the right metrics, align and mobilize the entire organization, implement quickly, and create a generative learning environment to stay competitive (Pietersen, 2001). Hence to lead in the global markets, organizations must think outside their own business units and leverages resources of a coalitions of companies (Prahalad & Hamel, 1994). The open innovation paradigm provides exactly that.

However, despite such successful examples of open innovation adoption and all other benefits discussed above, operating in the open innovation paradigm can pose many challenges. Those challenges include: establishing overall organizational fit between collaborative partners that enhances tangible value and responsiveness to the changing needs of the customers (Ulrich & Smallwood, 2004); sustaining internal commitment (Chesbrough & Crowther, 2006); maintaining mutually beneficial strategic alliances; minimizing transactional costs in searching and evaluating external partners (Chesbrough, 2003b; Omta & Van Rossum, 1999); minimizing risk of resource exploitation (Dahlander & Gann, 2010) and overcoming implementation predicaments. Attempting to establish these challenges is too huge for this paper, instead we explore OCB and its effect on open innovation, as discussed in the following section.

Organizational Citizenship Behaviours (Ocb):

The pioneering researchers of OCBs emphasized that OCBs should be viewed as extra-role and organizationally functional and separate from in-role job performance (Bateman & Organ, 1983; Smith, Organ, & Near, 1983) and that it can be conceptualized as a global concept that includes all positive organizationally relevant behaviours of employees (Graham, 1994). This conceptualization of organizational citizenship thus encompasses the traditional in-role job performance behaviours, organizationally functional extra-role behaviours, and political behaviours, such as full and responsible organizational participation.
While the link between OCBs and business performance has been discussed both conceptually and supported by empirical evidence as shown above, some studies have also shown relationship between innovative performance of a firm and OCBs (Ishak, 2005). However, most of the research about open innovation has either been exploratory and qualitative in nature or very anecdotal. Of late, in the European context, quantitative studies based on surveys have started coming up. But even then, there seems to be no study to the best of our knowledge that answers how OCBs impact open innovation. According to Jex (2002), employee innovations in organizations in the form of new products and services have always been quite visible.

In the organizational innovation literature, some researchers have focused on the process by which employees generate innovative ideas, while others have devoted their time to identifying characteristics of highly innovative employees. In either case the focus has been employees (Jex, 2002). There seems to be no study that investigates the relationship between OCBs and business performance as measured in terms of open innovation – a paradigm that assumes using both internal R&D and external collaborations to fuel innovation. Given the recency of open innovation, we find it difficult to find any specific literature on the relation between open innovation and OCBs. However, a positive relation is expected between these two variables and this statement is made based on the following two grounds: first, shifting from a closed innovation paradigm to an open innovation paradigm may entail scarcity or unpreparedness of resources or teething problems.

Managers cannot foresee all contingencies or fully anticipate the activities that they may desire or need employees to perform (Katz & Kahn, 1978; Organ, 1988). Hence the employees who go the extra mile by performing spontaneous behaviours that go beyond their role prescriptions are especially valued by the management (Ishak, 2005). Therefore, OCBs shown by the employees may go a long way in ensuring success of the open innovation projects as they may help their firms overcome infancy-stage related issues solving which could be crucial in determining ultimate outcome of open innovation efforts (Naqshbandi & Kaur, 2011a).

Second, research has shown a positive relation between OCBs and organizational performance as measured in the (closed) innovation paradigm (Jomo et al., 1999). A positive relation is thus likely also in the case of open innovation as by and large the objectives of open innovation and closed innovation remain the same in that both paradigms aim at product and process innovations - only difference being that the methods of coming up with such innovations vary. Hence based this discussion, the following hypothesis is developed:

**H1: OCB Relates To Open Innovation:**

### Managerial Ties:

Managerial ties are "executives' boundary-spanning activities and their associated interactions with external entities" (Geletkanycz & Hambrick, 1997), which form a part of social capital or social exchange. Social capital, according to Adler and Kwon (2002) is “roughly understood as the goodwill that is engendered by the fabric of social relations and that can be mobilized to facilitate action”. Social capital acts as a powerful factor to explain actors' relative success in a number of organizational arenas. Adler and Kwon (2002) cite a number of studies showing the effect of social capital many outcomes – from career success, facilitating product innovation, to creating intellectual capital. To succeed, particularly in a transition economy developing ties with business leaders and government officials is critical, as who you know can often be more important than what you know (Tsang, 1998; Xin & Pearce, 1996).

Networking at the firm level can enhance a firm's competitive advantage by providing access to resources of other network members which can help in entering markets that involve a firm's core technologies and competencies (Thorelli, 1986). However, if the aim of networking is creation of innovation, such a process entails several challenges. This is because the participating firms may require entering into relationships with universities and research institutions (Perkmann & Walsh, 2007), suppliers (Emden, Calantone, & Droge, 2006) and users (von Hippel, 2001; von Hippel & Katz, 2002). The view that embeddedness of firms in networks has important implications in their functioning has assumed added importance in that networks are important particularly for learning and innovation between firms (Gilsing & Nooteboom, 2005). In case of open innovation, firms rely on an extensive use of inter-organizational relationships to internalize external ideas from a variety of external innovation sources and to market the ideas that are developed within the firm but fall outside the firm's current business model (Chesbrough, 2006; Chesbrough, et al., 2006). Such firms search for new ideas and technologies by increasing the search breadth (the number of external sources they rely upon in their innovative activities) and the search depth (the extent to which firms draw deeply from the different external sources) of their innovation networks (Laursen & Salter, 2006). The purpose of this could either be to use the inter-organizational relationship for explorative or exploitative purpose (March, 1991). However, in the open innovation paradigm, given the diversity of partners, the activities of acquisition, assimilation, transformation and exploitation (Zahra & George, 2002) become all the more complex. During exploration, there are good reasons for a dense structure of ties that are strong in most dimensions. During the exploitation process, there are good reasons for structures that are non-dense, with ties that are strong in other dimensions than in networks for exploration (Gilsing & Nooteboom, 2005). This is where the role of well-connected managers and managerial ties becomes paramount. The processes of in-bound and out-bound open innovation,
involve a high degree of uncertainty both in terms of exploration for better partners and outcomes of such
partnerships. It is here that managerial ties can play a crucial role in making right decision about identifying right
partners, forging proper partnerships and ensuring their outcomes (Naqshbandi & Kaur, 2011b). Therefore, on
the basis of discussion in the above sections, the following hypothesis is developed:

**H2: Managerial Ties Relates To Open Innovation:**

**Appropriability Regimes:**

Teece (1988) showed that the benefits of an innovation by a firm are potentially shared by four groups: the
innovating firm, the customers of the firm, suppliers of the firm, and the imitators or followers who even
without investing much in the initial R&D accrue benefits of the innovations. As Teece (1986) noted, the ability
of firms to monetize their innovations depends on appropriability. In the absence of appropriability, imitators
will commercialize the idea, depriving the innovating firm of any incentives to invest in innovation activities
again. The appropriation of results of innovative activity is vital for innovative companies because it enables
them to enjoy the profits their innovations generate (González-Alvarez & Nieto-Antolin, 2007). In the absence
of favourable regimes of appropriability, firms may not be able to appropriate even the cost of investment in
their innovation activities while the “second mover” firms may benefit more than the original innovator firm.

Appropriability is the ability of the owner of a resource to receive a return equal to the value created by that
resource (Levin et al., 1987; Teece, 1987). Atkins (1998) defines appropriability as “the ability of different
stakeholders to retain for themselves the financial benefits that arise through the exploitation of an innovation”. 
West et al. (2006a) state that in the context of public policy, “appropriability is what allows the innovator to
capture a return from the value created by an innovation”. Regimes of appropriability thus are the institutional
or industry dynamics that allow a firm to safeguard its innovations and benefits thereof.

Strong regimes of appropriability are generally characterized by tacit knowledge and strong legal
protection. On the contrary, codified knowledge and weak legal protection are the features of weak regimes of
appropriability (Hurmelinna, Kyläheiko, & Jauhiainen, 2007). On the other hand, under weak appropriability
regimes as may be expected in transition economies, since knowledge spillovers are high (Kafouros & Buckley,
2008), investors would be skeptical about the returns and thus investments in projects related to innovation are
likely to be low.

Under strong appropriability regimes, firms will choose to patent their innovations in order to deter
imitation by rivals and protect their revenue streams (Anton & Yao, 2004). Under weak appropriability regimes,
as obtaining patents, copyrights, etc requires some disclosure of enabling knowledge to the parties concerned
(Anton & Yao, 2004) and since patents and copyright laws frequently fail to ensure the degree of protection
they were intended to afford (Atkins, 1998), firms may use isolating mechanisms like adopting secrecy in
routines and operations to obstruct imitation and derive benefits from innovations (Zahra & George, 2002).
Hence, in a fully protected innovation environment (strong appropriability conditions), full disclosure poses no
risk of unauthorized imitation, but with limited protection (weak appropriability conditions), disclosure risks
imitation (Anton & Yao, 2004). In line with conventional view that strong appropriability regimes encourage
open innovation (H. Chesbrough, 2003b; Cohen & Walsh, 2001; West, et al., 2006a), Laursen and Salter (2005)
empirically showed that open innovation is strongest in industries with strong regimes of appropriability (e.g.
pharmaceutical, electrical) and weakest in industries with low regimes of appropriability (e.g. textile). Nevertheless, Teece et al. (1997) concluded that absent strong appropriability regimes, firms can create advantage through superior ‘dynamic capabilities’ such as rapid learning, although such advantages would be
rare and less sustainable than those provided by formal appropriability (as read in: West et al., 2006a, pg 115).

In general, recieving the appropriability conditions of an industry can help determine its favorableness for
innovation. Although, according to Harabi (1995), measuring appropriability is difficult because of the lack of a
“theoretically sound” and an “empirically precise” method of measuring the private and social returns of
innovation. Nonetheless, some means of judging appropriability conditions, brought forth due to the efforts of
many researchers, are: patents, secrecy, lead time, moving quickly down the learning curve, superior sales or
service efforts, making imitation more difficult for competitors, economies of scale, national advertisement
and national distribution (López & Roberts, 2002). These have been broadly divided into three groups: a) patents, b)
secrecy, and c) lead time and related advantages (Scherer & Ross, 1992).

Our study uses these three industry-level measures of appropriability to study appropriability. There is
hardly a study about how appropriability conditions affect the relationship between OCBs and managerial ties,
and open innovation. Can appropriability conditions skittle the creation of open innovation even in presence of
OCBs and good managerial ties? How effective are appropriability conditions in creating successful open
innovation? A few studies report on the relation between appropriability regimes and open innovation, but the
results are contradictory. According to the conventional view, strong appropriability regimes create increased
williness among innovators to offer internal innovations for others to use thereby enhancing open innovation
outcomes (H. W. Chesbrough, 2003). However, Laursen and Salter (2005) found through a large-scale survey
that open innovation provides better results in moderate appropriability regimes. Adding to difference in results,
Fabrizio (2005) reported negative relationship between high appropriability and aspects of open innovation. Dosi et al. (2006) broadly conclude that appropriability conditions in general have only limited effects on the pattern of (closed) innovation. Given this dichotomy between the results of several different studies on innovation, this research aims to address the moderating role of appropriability regimes between OCBs and managerial ties and the creation of successful open innovation. Therefore, based on the discussion in the above sections, the following hypothesis is developed:

**H3: Appropriability Regimes Moderate the Relationship Between OCBs and Open Innovation:**

### Theoretical Underpinnings:

Building on the existing knowledge of organizational behaviour, networks and innovation management, our study is conducted based on the Social Exchange Theory and Actor-network Theory (ANT).

Social Exchange Theory states that individuals or groups interact with each other for a reward or in its expectation (Emerson, 1976). Pioneering scholars laid the foundation of this theory which later became popular in many disciplines including management research. Social exchange relationships also implicitly assume that extra-role efforts over time are recognized, appreciated and rewarded (Ishak, 2005). Extending the Social Exchange Theory to the setting of our study, employees can expect benefits from their employers if they practice OCBs and help the organization overcome challenges that it may face while embracing the open innovation model. These benefits can come in the form of recognition. In this hope, while the firm is embracing the open innovation paradigm and is in need of addition commitment and support from the employees, employees can be expected to perform the extra-role behaviours and involve themselves in innovative behaviour in order to benefit their organizations (Åmo, 2005). Similarly, the *raison d'être* for ties that managers establish with different people is a rational expectation of a reward or reciprocation. Managerial ties form a part of social capital or social exchange. Social capital is known to affect among others career success, executive compensation, improving inter-firm learning etc. (Adler & Kwon, 2002). The ties of managers thus are not only expected to benefits the managers as individuals but help the firm meet its objectives as well. To conclude, the Social Exchange Theory provides a cogent reason to believe that employees practicing OCBs and establishing managerial ties as processes of social exchange will finally benefit the open innovation outcomes of the firms they work for besides accruing to them individual recognition in different forms.

### Actor-Network Theory (ANT):

Actor-network theory (ANT) is described here to explain how it is used in open innovation. Developed by science and technology studies (STS) scholars Michel Callon and Bruno Latour, sociologist John Law and others, ANT maps relations between things and between concepts (Actor-network theory). For example, the interactions in a school involve children, teachers, their ideas, and technologies (such as tables, chairs, computers and stationery) and together these form a single network. ANT was created initially to understand processes of innovation and knowledge-creation in science and technology. However, in the 1990s ANT became a popular tool in different fields - from organizational analysis and informatics to sociology, anthropology and economics.

The concept of translation is central to ANT which is a network in that all the actors agree that the network is worth building and defending (Law & Hassard, 1999). There are four moments of translation, as defined by Callon. We attempt to relate the process of open innovation to these four moments, which is outside the scope of our paper but within the aim of our bigger research project. The first moment addresses the question - what is the problem that needs to be solved? Who are the relevant actors? In open innovation, firms identify inbound and outbound innovation as areas of interests. Firms also select managers that will represent groups of actors, in terms of identifying innovation within the firm and external partners that collaboration can take place. The second moment of translation is getting the actors (internal employees or external partners) interested and negotiating the terms of their involvement. The primary actor works to convince the other actors that the roles it has defined for them are acceptable. The third moment of translation sees the actors accepting the roles that have been defined for them during the second moment of translation, in which case actors have the potential to display OCBs. The third moment of translation become active support in the final moment when the actors in the network adequately represent the masses in which case benefits start to accrue (Latour, 2005).

### MATERIALS AND METHODS

Data for this study was collected through a survey of questionnaire forms and the unit of analysis is companies. The questionnaire was designed to elicit responses from the respondents with respect to the variables of interest. Administration of the questionnaires was carried out by the researchers via self-administered and emails.

**Measurements:**
The scale used to measure OCBs has five dimensions and was adopted from Podsakoff and Philip (1990) and Bell and Menguc (2002) (Coefficient alpha .98). The responses are assessed on a 7-point Likert scale ranging from “strongly disagree” to “strongly agree”. Twenty items in all and these items allow the respondents to evaluate their contact employees. Managerial ties has three dimensions and were adapted from Peng and Luo (2000) and Ramos-Vielba et al. (2010) with a total of nine items. All the responses are assessed on a 7-point Likert scale ranging from “very little” to “very extensive” (Coefficient alpha .84).

Open innovation is measured using instruments developed by Sisodiya (2008), De Jong et al. (2007) and Lichtenthaler (2009) with two dimensions: inbound and outbound innovation. All the responses are assessed on a 7-point Likert scale ranging from “very little” to “very extensive”. A total of 10 items measured open innovation in this study (Coefficient alpha .79). The development of the appropriability regimes measure was pioneered by Levin et al. (1983). Levin et al. (Levin et al., 1987) identified six alternative mechanism that firms use to appropriate the returns of innovative activities: patents to prevent duplication; patents to secure royalty income; secrecy; lead time; moving quickly down the learning curve and sales or service efforts. Almost all the empirical studies on appropriability regimes revolve around these six alternative mechanisms. Therefore many past studies were consulted to develop measures of this variable. This variable is thus measured after consulting many empirical studies and by building on many scales (Cohen & Walsh, 2001; Harabi, 1992; Harabi, 1995; Hurmelinna et al., 2007; Levin et al., 1987; Levin, 1988). A total of six items are used to measure this variable on a 7-point Likert scale ranging from “least effective” to “most effective” (Coefficient alpha .88).

In order to reduce common method bias, “marker variables” (OCB3, OCB8, OCB17, and OCB21) were used and no self-report was required (Conway & Lance, 2010). The OCB scale required respondents to response about their direct reports’ (subordinates’) OCB, while managerial ties, appropriability regimes and open innovation respectively asked for respondents to answer statements concerning their firms.

Results:

The sample for this study consisted of 60 managers from 60 firms in the Klang Valley, Malaysia. A background of the respondents in this study is shown Table 1.

Table 1: Background summary of respondents (N = 60).

<table>
<thead>
<tr>
<th>Respondent background</th>
<th>Number</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>1) Industry</td>
<td></td>
<td></td>
</tr>
<tr>
<td>• Biotech</td>
<td>5</td>
<td>8.33</td>
</tr>
<tr>
<td>• Electronics</td>
<td>1</td>
<td>1.67</td>
</tr>
<tr>
<td>• Others</td>
<td>54</td>
<td>90.00</td>
</tr>
<tr>
<td>2) Years working in the current firm</td>
<td></td>
<td></td>
</tr>
<tr>
<td>• 0 – 3 years</td>
<td>36</td>
<td>60.00</td>
</tr>
<tr>
<td>• 4 – 7 years</td>
<td>17</td>
<td>28.33</td>
</tr>
<tr>
<td>• 8 – 11 years</td>
<td>4</td>
<td>6.67</td>
</tr>
<tr>
<td>• 12 – 15 years</td>
<td>2</td>
<td>3.33</td>
</tr>
<tr>
<td>• 16 – 20 years</td>
<td>1</td>
<td>1.67</td>
</tr>
<tr>
<td>3) Age of firm</td>
<td></td>
<td></td>
</tr>
<tr>
<td>• 0 – 10 years</td>
<td>17</td>
<td>28.33</td>
</tr>
<tr>
<td>• 11 – 20 years</td>
<td>19</td>
<td>31.67</td>
</tr>
<tr>
<td>• 21 – 30 years</td>
<td>10</td>
<td>16.67</td>
</tr>
<tr>
<td>• 31 – 40 years</td>
<td>7</td>
<td>11.67</td>
</tr>
<tr>
<td>• Above 40 years</td>
<td>7</td>
<td>11.67</td>
</tr>
<tr>
<td>4) Firm’s market</td>
<td></td>
<td></td>
</tr>
<tr>
<td>• Local/national</td>
<td>30</td>
<td>50.00</td>
</tr>
<tr>
<td>• Regional</td>
<td>5</td>
<td>8.33</td>
</tr>
<tr>
<td>• Global</td>
<td>25</td>
<td>41.67</td>
</tr>
</tbody>
</table>

Due to the small number of respondents (N = 60), we resorted to Partial Least Squares (PLS) path modeling algorithm. Although the sample size was small, it does fulfill the minimum sample size, which is ten times the largest number of structural paths directed at a particular construct in the inner path model (Karim, 2009), which in our study is inbound open innovation and appropriability regimes with six structural paths each (although OCB seem the largest construct but it has five dimensions with four items each).

The first analysis using PLS is the individual item reliability which was assessed by examining the loadings of the respective items on their respective latent construct. The items with loadings of 0.60 and above were retained, hence the bold items and its corresponding scores, as shown in Table 2.

Out of the 45 items only 16 had loadings of 0.60 and above. All the 16 items retained had shared variance between their respective constructs and its measures than error variance (Hulland, 1999). The items retained includes: Four out of the nine items of managerial ties (MT1, MT3, MT5 and MT8); only one item was not retained in the appropriability regimes variable (RA1-5 were retained); out of the 20 items of OCB, only three
were retained (OCB13, OCB14 and OCB15); four items in the open innovation measure were retained (OI2, OI5, OI6 and OI7).

In order to assess the reliability of the scales, composite reliability and Cronbach’s alpha were used and the values for all scales were above the minimum threshold of 0.7, as depicted in Table 3, thus indicating reliability of all scales used in this study.

Table 2: Loadings of items (N = 60).

<table>
<thead>
<tr>
<th></th>
<th>MT</th>
<th>RA</th>
<th>OCB</th>
<th>OI</th>
</tr>
</thead>
<tbody>
<tr>
<td>MT1</td>
<td>0.79</td>
<td>0.90</td>
<td>-0.41</td>
<td>0.45</td>
</tr>
<tr>
<td>MT2</td>
<td>-0.66</td>
<td>0.86</td>
<td>-0.55</td>
<td>0.78</td>
</tr>
<tr>
<td>MT3</td>
<td>0.81</td>
<td>0.71</td>
<td>-0.57</td>
<td>0.43</td>
</tr>
<tr>
<td>MT4</td>
<td>-0.12</td>
<td>0.73</td>
<td>-0.02</td>
<td>0.47</td>
</tr>
<tr>
<td>MT5</td>
<td>0.78</td>
<td>0.79</td>
<td>-0.05</td>
<td>0.62</td>
</tr>
<tr>
<td>MT6</td>
<td>-0.27</td>
<td>0.24</td>
<td>-0.10</td>
<td>0.64</td>
</tr>
<tr>
<td>MT7</td>
<td>0.15</td>
<td></td>
<td>OCB9</td>
<td>-0.76</td>
</tr>
<tr>
<td>MT8</td>
<td>0.66</td>
<td></td>
<td>OCB10</td>
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<td></td>
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<td></td>
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<td></td>
<td>OCB13</td>
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</tr>
<tr>
<td></td>
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<td></td>
<td>OCB14</td>
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<td>OCB15</td>
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<td></td>
<td></td>
<td></td>
<td>OCB16</td>
<td>-0.15</td>
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<tr>
<td></td>
<td></td>
<td></td>
<td>OCB18</td>
<td>-0.26</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>OCB19</td>
<td>-0.11</td>
</tr>
<tr>
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<td></td>
<td>OCB20</td>
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</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>OCB22</td>
<td>0.05</td>
</tr>
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<td></td>
<td>OCB23</td>
<td>0.35</td>
</tr>
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<td></td>
<td>OCB25</td>
<td>0.18</td>
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<tr>
<td></td>
<td></td>
<td></td>
<td>OCB26</td>
<td>0.41</td>
</tr>
</tbody>
</table>

Note: OI = Open innovation; OCB = Organizational citizenship behavior; MT = Managerial ties; RA = Appropriability regimes.

Table 3: Reliability, convergent and discriminant validity (N = 60).

<table>
<thead>
<tr>
<th></th>
<th></th>
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<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th>CR²</th>
<th>a²</th>
<th>AVE</th>
<th>AVE²</th>
<th>AVE³</th>
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<tr>
<td>1</td>
<td>OI</td>
<td>0.86</td>
<td>0.79</td>
<td>0.61</td>
<td>0.78</td>
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<tr>
<td>2</td>
<td>OCB</td>
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<td>0.99</td>
<td>0.98</td>
<td>0.97</td>
<td>0.98</td>
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<td></td>
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<td></td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>MT</td>
<td>0.64</td>
<td>0.42</td>
<td>0.89</td>
<td>0.84</td>
<td>0.68</td>
<td>0.82</td>
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<td></td>
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</tr>
<tr>
<td>4</td>
<td>RA</td>
<td>0.50</td>
<td>0.09</td>
<td>0.14</td>
<td>0.90</td>
<td>0.88</td>
<td>0.64</td>
<td>0.80</td>
<td></td>
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<td></td>
</tr>
</tbody>
</table>

Note: OI = Open innovation; OCB = Organizational citizenship behavior; MT = Managerial ties; RA = Appropriability regimes. 
*Composite reliability. † = Cronbach Alpha. ‡ Average variance extracted. § square root of AVE.

The factor loadings from the final PLS measurement models are reported in Figure 1.

Fig. 1: Structural Model.

Note: OI = Open innovation; OCB = Organizational citizenship behavior; MT = Managerial ties; RA = Appropriability regimes.
All items loaded significantly (> .50) on their respective factors which was an indication of indicator reliability. Further results from Table 3 revealed that the variance extracted for all factors exceeded the minimum threshold value of .50 which was an indication of convergent validity of all scales. Discriminant validity of measurement model is a result of the square root of the variance extracted estimation, in which case the results from Table 3 revealed relatively high variances extracted for each factor. This shows the discriminant validity of the four constructs (i.e., OI, MT, RA and OCB).

The PLS structural model is evaluated by \( R^2 \) of the endogenous variable, which is open innovation in this study. The \( R^2 \) value of 0.65 describes the endogenous latent variable as substantial, as shown in Table 4. The effect sizes of single predictors following the method introduced by Cohen (Karim, 2009) are obtained by comparing the explained amount of variance when a predictor is either included or not included in the model, that is \( f^2 = (R^2_{\text{incl}} - R^2_{\text{excl}})/(1 - R^2_{\text{incl}}) \). The \( f^2 \) values for this model is 0.49, 0.34 and 0.17 indicating large and medium effects, respectively. The Goodness-of-fit (GoF) of the model revealed a value of 0.69, whereby GoF is normed between 0 and 1, where a higher value represents better path model estimations. The 0.69 value of the GoF index was acceptable.

### Table 4: Path coefficients, communality and redundancy (\( N = 60 \)).

<table>
<thead>
<tr>
<th>Path</th>
<th>( \beta )</th>
<th>( t )</th>
<th>( R^2 )</th>
<th>Communality</th>
<th>GoF*</th>
<th>Redundancy</th>
<th>( f^2 )</th>
</tr>
</thead>
<tbody>
<tr>
<td>MT ( \rightarrow ) OI</td>
<td>0.51</td>
<td></td>
<td>0.65</td>
<td>0.79</td>
<td>0.69</td>
<td></td>
<td>0.23</td>
</tr>
<tr>
<td>OCB ( \rightarrow ) OI</td>
<td>0.06</td>
<td></td>
<td>0.36</td>
<td>0.79</td>
<td>0.69</td>
<td></td>
<td>0.17</td>
</tr>
<tr>
<td>OCB*RA ( \rightarrow ) OI</td>
<td>0.22</td>
<td></td>
<td>1.08</td>
<td>0.79</td>
<td>0.69</td>
<td></td>
<td>0.34</td>
</tr>
<tr>
<td>RA ( \rightarrow ) OI</td>
<td>0.31</td>
<td></td>
<td>2.91*</td>
<td>0.79</td>
<td>0.69</td>
<td></td>
<td>0.49</td>
</tr>
</tbody>
</table>

Note: OI = Open innovation; OCB = Organizational citizenship behavior; MT = Managerial ties; RA = Appropriability regimes. *GoF = square root of average \( R^2 \) multiplied with average communality \( t \) values are calculated through bootstrapping routine with 200 cases and 1000 samples. \( * p < .05 \); \( *** p < .001 \).

Table 4 also revealed the results of testing hypotheses 1 (OCB relates to open innovation) and 2 (managerial ties relate to open innovation). The \( t \) value of 0.36 (\( p > .05 \)) indicated that hypothesis 1 is rejected, hence OCB does not relate to open innovation. On the contrary, the \( t \) value of 11.45 (\( p < .001 \)) revealed that hypothesis 2 is supported. The strong correlation suggests that managerial ties do relate to open innovation.

The result for testing hypothesis 3, as shown in Table 4 revealed the non-significant moderating effect of appropriability regimes on the OCB and open innovation relationship (\( t = 1.08, p > .05 \)). However, the results from Table 4 suggest that appropriability regimes do relate to open innovation (\( t = 2.91, p < .05 \)).

**Discussion:**

**Practical implications:**

Open innovation is a phenomena not to be brushed aside, especially for practitioners in transition economies. However, a deeper understanding of open innovation is much needed. Practitioners would be keen to know when and how to open their innovation. What employee behaviour would enhance open innovation? What kind of partners should we collaborate with and where do we find the right partners with the kind of knowledge and complementary capabilities we seek? And what sort of ties must our managers establish with external partners?

The rise of China and other emerging economies in innovating and manufacturing innovations of others create stiff competition worldwide. The threat comes in two fold: innovating too slowly and falling in the commodity trap. Business players in transition economies that are slow in innovating lose greatly not only to developed but also to emerging economies. The speed at which innovation takes place is highly important in this day and age when lead time and product life cycle are short and customers demand value. Companies in transition economies that continuously scan the environment, adapt and apply that which is appropriate would seem to be heading in the direction of prosperity. And open innovation provides just the avenue for business players with limited resources to profit from it whereby such players are seen actively seeking industrial knowledge and engaging with stakeholders (i.e. suppliers, users, etc) from all over the world (Chesbrough, 2011a).

The second threat is being a victim of commoditizing. Focusing solely on better products and technologies without differentiating offerings will see firms falling in the commodity trap and running the risk of competing head on against innovative entrants from other emerging economies (Chesbrough, 2011b). One current example that provides useful insight is the success of Taiwan Semiconductor Corporation (TSMC). TSMC manufactures chips of other companies. While the design comes from other companies, TSMC has been able to meet the requirements to manufacture chips according to the requirements of the principal. Open innovation has helped in that TSMC has been able to benefit from the inflows of knowledge to manufacture chips and other small players...
with limited resources concentrated on their core competency in designing the chips instead of than pumping in resources to also build fabrication facilities (Chesbrough, 2011a).

In our sample, open innovation is favorable when managers involved in innovation have ties with key external partners and in the existence of appropriability regimes. These are some insights that could help spur growth in open innovation. At the national level, some legal and research consideration in terms of the kinds of policies that need to be in place to give rise to the right kind of research in universities and research institutions. The establishments of pull factors like tax havens and sound IP rights that would lure technology intensive companies to build networks with key local/national players would provide the platform for open innovation to progress.

**Academic Implications:**
Our research, though small in sample, does indicate to a certain extent that Malaysian firms (limited to the respondents in this study) are already participating in the open innovation process and it could be less salient in their minds. For example, building ties with R&D partners and alliances with governments and other companies are part of the process of opening up innovation. However, the focus is not on such partnerships and alliances as cost saving exercises and transaction cost economizing but to establish the relationship between these inter-organizational ties with open innovation. Our study did not address value creation directly but the findings suggest relationships between managerial ties and appropriability regimes with open innovation respectively. Hence, since these relationships are supported, a probable end result would be value creation. Establishing networks (via social exchange) could suggest that the ties managers build with external partners like universities, government agencies, users, customers, etc as a process of exchange that points to a favourable outcome of open innovation, such as value creation, faster innovation etc.

Identifying strong appropriability regimes can be reflected in the first moment of translation in ANT when effective firms that undertake open innovation, determine risk factors. They try as much to create strong appropriability regimes in view of reducing risks and achieving speedier outcomes. The strength of appropriability regimes determines the potential problems to be faced in the open innovation process. This is similar to the first mode of translation in ANT which addresses the following: what is the problem that needs to be solved? Who are the relevant actors (actors here could mean appropriability regimes)? In ANT, actors (or managers) build managerial ties with external partners that include establishing interest in all parties and negotiating terms of involvement. Success would abound when actors play their roles in the interest of all parties and in which case the relationship constantly evolves to ensure adaptability to external and internal environments. According to ANT, such actor-networks are potentially transient, existing in a constantly evolving environment (Callon, 1986).

**Research Limitations:**
Our research is non-generalizable, as it is cross-sectional and convenience sampling was employed. Limitation of this research also lies with the use of survey method of data collection.

**Conclusions:**
How can firms address the opportunities and risks posed by open innovation? Some structural factors need to be made aware of in terms of having the ability to identify, transfer and absorb external ideas and technologies effectively from outside into the firms. First, firms must already be able to support dedicated resources and talent to build structures to identify useful external knowledge. These structures can be seen in terms of technology outposts in innovation ‘hotbeds’ (such as Hitachi’s office in Dublin or Nokia’s lab in Palo Alto); links with universities through a liaison manager to access emerging university technologies; and seeking out promising technologies through a technology scouting group.

Second, the ability to absorb external ideas and technologies at the initial identification and transfer stages, as these ideas and technologies are rarely fully formed upon transfer. In order to effectively address a commercial need, these external ideas and technologies require substantial modifications. The challenge here is to get the right talent with the required scientific background to understand, absorb and exploit the scientific discoveries and technologies that are developed at universities, research labs or inside companies. Establishing technical advisory boards that help incorporate useful ideas and technologies into their own processes would be extremely useful.

Open innovation should be seen in totality to the extent that its inside out element is equally regarded as an avenue to be explored as a potential business opportunity. Leveraging internal processes, infrastructure, knowledge and ideas and offer these to other firms who want to use it. This becomes another stream of revenue for the firm while offering a value proposition to industry clients. This is the dynamism of open innovation which when overlooked defies the openness concept.
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