Perceptions of Open Innovation among SMIIs in Malaysia

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Open Innovation concept is beneficial to SMIIs as it substitutes or complements the dependency on internal R and D which is not cost effective. Success and failures in Open Innovation adoption depends on various factors that has been researched to certain extent but not much is known on behavioural and cost factors. Therefore this study undertakes to analyse behavioural and cost factors that impacts open innovation adoption. Significant factors that influences behavioural are Organizational Citizenship Behaviours, Organizational Culture, Managerial Ties and in terms of costs is Transactional Costs. Appropriability Regimes is analysed as moderating role to analyse behavioural and cost relationships. Social Exchange Theory (SET) and Actor Network theory (ANT) theories applied in this study. This study also undertakes quantitative approach where cross sectional data from survey mode from 150 managers in manufacturing firms will be analysed. Purposive sampling technique used and hierarchical multiple regressions employed to test the related hypothesis variables. Theoretical and managerial contributions with the limitations and future research directions also highlighted.

**Keywords:** Open Innovation, Small Medium Industries (SMIIs), Manufacturing, Adoption, Malaysia, Behavioural, Cost.

**INTRODUCTION**

The critical elements in sustaining competitiveness for SMIIs are the capability to innovate and firms with innovation concept able to achieve growth earlier compared to its low innovative competitors (Bullinger and Engel, 2006). Many SMIIs neglect innovation because they lack skilled workforces and this is the main reason that SMIIs lacks in capacity. In addition, lack of innovation strategy reduces the capacity to transform ideas into products. Therefore, capabilities and readiness is crucial in ensuring innovation activities are developed. As such, support mechanism of innovative capability is required to improve innovation perception. Achieving cost effectiveness is very crucial as SMIIs need to be innovative to gain and maintain technological advantages.

Czarnitzki and Delanote, (2012) which also contributes to new processes and products (Cirici et al., 2013).

Open Innovation model has been accepted by some large companies and various governments also recognises the importance of open innovation as source of knowledge and technology (Chesbrough, 2003a, Chesbrough, 2003b, Chesbrough, 2004, Chesbrough, 2007a, Chesbrough, 2007b and Chesbrough and Crowther, 2006). The open model includes internal and external R and D to advance innovation and technologies in the firm’s portfolio. At present closed model is an outdated model in performing R and D, Chesbrough et al. (2006) where innovation ideas occurs anywhere and not necessary occurs only in firms research lab. Chesbrough (2003a) outlined open innovation as use of external innovation ideas to accelerate innovation and to expand productions. Open innovation studies have been mainly focused on large firms and studies in the context of small and medium-sized companies are still in infant stages.
The attention received for open innovation is tremendous but many researchers are still focusing in large and high technology companies through qualitative and case studies Chesbrough, (2003b) and Kirschbaum, (2005); limits research to specific industries (Henkel, 2006; Leocq and Demil, 2006) and also limits research to specific issues (Chesbrough, 2003a; Laursen and Salter, 2006). Small and medium enterprises receive less attentions from all the above issues and therefore this study attempts to empirically study the rate of adoption undertaken by SMIs. The focus on SMIs is important as manufacturing is a very important component of productions and technology enhances new innovative processes and products. This study examines the extent of application of open innovation practices and how it can be improved if the rate of adoption is low. In the implementation of open innovation, there is a need to explore the motives for SMIs to engage in open innovation. Therefore this study investigates the relevancy of open innovation to SMIs productivity and performances.

Open innovation is defined as inflow and outflow of technological knowledge, Chesbrough (2003a) to increase the usage of external innovation (Chesbrough et al., 2006). Studies on open innovation in the context of small and medium companies are still in early stages Rahman and Ramos (2010), and it is important to analyse these type of companies as they lack strategies in developing technology to produce effectively (Colombo et al., 2014). Open innovation is considered as beneficial to SMIs as they are able to respond to current environment (Parida et al., 2012). As such, this study undertakes to analyse the behaviour of SMIs in order to change the mind set in adopting external innovation facilities. In addition, this study also looks into the opportunity costs in adopting open innovation and if not viable SMI need to focus on closed innovation (Colombo et al. 2014). Selection of external partners is crucial in determining the success of adoption Theyel, (2013) and it will not be an easy task to search for external partners with innovative ideas and knowledge as it involves costs (Abouzeedan et al., 2013; Lee et al., 2010 and Spithoven et al., 2013). Open innovation enables SMIs to achieve more benefits Parida et al. (2012) and therefore collaborations with external partners is important to gain technological knowledge which is not achievable for the closed innovation model (Colombo et al. 2014).

The main factor that influences the level of open innovation adoption in an organisation depends on how the management value employees’ skill, Comacchio et al. (2012) and without such skill would dampen the innovative actions (Idriassia et al., 2012). As such, selections of employees (Theyel, 2013) are important for SMIs to enhance appropriate technologies (Abouzeedan et al., 2013). In addition, SMIs need to communicate, associate and cooperate with external parties to kick-start innovation practices (Vrgovic et al., 2012). Therefore capacity of managers and competencies are crucial in determining open innovation practices among SMIs (Wynarczyk, 2013). In order to enhance cooperation and collaboration with internal and external players, open policy need to be incorporated (Kim et al., 2014) by formulating policies and network support programs (McAdam et al., 2014). This also can be initiated through informal organisational approaches (Bocken et al., 2014). The capability of managers in communicating with external parties benefits the organisation as it will boost the company’s adoption level (Brunswicker and Ehrenmann, 2013). Capability of managers is needed in incorporating open innovation with closed innovation by identifying, assimilating, transforming and applying the valuable external knowledge (Grimaldi et al., 2013; Teirlinck and Spithoven 2013). The implementation of open innovation in SMIs still need in depth study as various theories has been utilised, Clausen et al. (2013), however there are various factors that need to be taken into consideration such as limited internal innovation capabilities. SMIs require major changes in the manufacturing as many researchers have given limited attention to innovation especially in Malaysian context (Brunswicker and Vanhaverbeke, 2014; Hin et al., 2013 and SME, Corp, 2015).

Studies has focussed on external players issues in the adoption of open innovation but internal issues within the organisation such as employees issues rarely has been discussed (Wendelken et al., 2014). Employee participation is crucial in any firms that want to adopt open innovation but this issue is highly under-researched (Wendelken et al., 2014). Therefore, overcoming employees barriers and encouraging them to be involved would definitely help SMIs in been implemented successfully. Open innovation benefits SMIs through collaborations with external partners to gain technological knowledge which are not achievable from closed innovation concept (Colombo et al., 2014 and Parida et al., (2012)). Many researches focused on drivers that impacts open innovation among various organisations but none of them focused on behavioural factors, Bigliardi and Bertolini, (2012); Burchart, Knudsen and Søndergaard, 2014; Chesbrough and Crowther, 2006; Chiaroni et al. 2011; Gassmann et al., 2010; Huizingh, 2011; Petroni et al., 2012; Savitskaya and Ihlirg, 2012; van de Vrande et al. 2009; Verbano and Ventrilini, 2013; Chesbrough et al. 2006). Researchers are also interested in smaller organizations (Gassmann et al., 2010; Henkel, 2006; Lee et al., 2010; Parida et al., 2012; Rahman and Ramos, 2013 and Rahman and Ramos, 2014), but mainly focussed on specific industries and specific issues through qualitative and case studies (Chesbrough, 2003a; Laursen and Salter, 2006).

The study examines the relationship between
Organizational Citizenship Behaviour (OCB) with employees’ commitment towards open innovation adoption. Employees are considered as one of the most valuable assets in the knowledge-based economy and important for organisational effectiveness. OCB was proposed by Chester Barnard, Katz and Kahn, Bateman and Organ (1983) is a voluntarily behaviour based on desire and determination Korkmaz and Arpaci, (2009) that enhances organisation’s efficiencies (Bolino and Turnley, 2003). The concept of OCB is used to explain various forms of behaviour in the working environment. Employees’ shows positive behaviour when they are supported and being treated fairly by their management (Lavelle 2010). OCB has been widely used as a key construct representing employees’ behaviour and attitudes in the workplace (Chun et al., 2013). OCB utilised to add value to the employees experience by exchanging information (Sabiote et al., 2012) and enhancing proactive behaviour that would act favourably to open innovation adoption. In addition, companies prefer employees with greater quality of services and create value for any organisations (Gallan et al., 2013; Jaakkola and Alexander, 2014). Researchers have supported the argument that OCB enhances organisation effectiveness Payne (2013) through improved organizational functioning and performance (Omari et al., 2012). Mukhtar et al. (2012) study shows that employees’ behaviours are important for organisation effectiveness and successful and therefore management should use the concept of OCB to empower employees. Babaee et al. (2012) revealed that employees’ performance evaluation and rewards are positively related to citizenship behaviour among employees and continuous appraisal and evaluation is crucial to achieve employee efficiencies (Obisi, 2011). Determinants of OCB are more focused on employee attitudes, characters, and management support and therefore appropriate variables have been examined on individual OCB levels and how management of the organisation able to create satisfaction and work commitment among employees. This study identifies the relationship between the determinants of OCB and the association towards open innovation adoption.

Ties with external parties might lead to effectiveness of open innovation adoption among SMIs Lee et al., (2010) as SMIs tend to benefit more through various opportunities, Heger and Boman (2014) and SMIs are motivated to have ties with concerned external parties (Hemert et al., 2013). McAdam et al. (2014) study indicated that open innovation supports the concept of collaboration among networks. Therefore formal and informal ties are crucial among all stakeholders (Padilla-Meléndez et al., 2013). A study by Török and Tóth (2013) revealed that ties are more effective for SMIs since they can choose whom to work with (Theyel 2013) without any forms of instruction from higher authorities. This study focuses on the relationship between types of managerial ties and open innovation as in innovation management (Huizingh, 2011). The relationship is important in Malaysian context as it is considered to be a potential open innovation hub in Asia (Lindegaard, 2012). Developing a strong networking strategy through managers is crucial for SMIs to pursue open innovation adoption. Managers need to find the right partners Brunswicker and Vanhaverbeke (2014) which includes other firms, universities or research organisations and government officials. The ability of the SMIs to gain government financial assistance dampens when they lack ties with government officials for technological developments (Wynarczyk, 2013 and Brown and Mason, 2014). SMIs collaboration with external partners enables SMIs to attain strategic moves which are not possible in closed innovation model (Colombo et al. 2014). Weak ties with other firms and officials, Dodourova and Bevis (2014) will increase the barriers to adopt open innovation concept (Pullen et al. 2012). Therefore selections of partner need to be carefully refined (Theyel, 2013) for SMIs to gain new knowledge and innovative ideas from the selected partners.

Organisational culture

Culture is typically identified as the way things are done in an organisation Patel and Conklin, (2012) whereby it is the structure and the control system that enhances employees’ behaviours as organisational culture are positively related to performances (Gregory et al., 2009 and Hartnell et al., 2011). Increasing support from innovative technology benefits SMIs but the effects of organisational culture would influence the technology adoption as well as employees’ practices and productivity (Hatch and Cunliffe, 2006). Cooperation and allowing internal motivation as well as socialization to initiative performance by emphasizing communication Ghosh et al. (2004) will push employees to adopt different working culture that is suitable for technology adoption (McKinlay 2005). Ability of SMIs to implement and apply knowledge successfully is important to develop innovative products or technologies. Wonglimpiyarat, (2010) to achieve higher performance as well as organization’s success. Technological and the human factor such as culture are crucial for organisations to advance their innovation capability and performances (Kraśnicka et al., 2014a and Prajogo and Ahmed 2006). Innovation capacity also includes the culture of understanding the environment and the capability of internal processes (Neely et al., 2001). Innovation culture in an organization is vital to promote the activities internally to respond to the external environment (Akman and Yilmaz, 2008). Framework that analyses business performance has been conducted by Neely et al. (2001) by applying innovation culture in an
organisation that enhances productivity. Fostering an innovative culture is crucial to SMIs (Ledwith, 2000; Laforet and Tann, 2006; Pullen et al., 2009) and how these cultures would best bring about innovation (Litz and Kleyesen, 2001). Few researches have been conducted to examine the influence of organisational culture on open innovation and contributing factor to SMIs innovativeness (Naranjo-Valencia et al., 2011; Kraus et al., 2012). Management of an organisation play an important role in encouraging employees to inculcate the innovative culture (Saunila, 2014). Organisational culture is critical for organisation’s functioning, such as innovation, productivity and performance (Pichlak, 2012; Uzkurt et al., 2013). One of the important factors that encourage innovation in a firm is through employee motivation culture (Kraśnicka et al., 2014b).

**Transactional costs**

Firms have to make decisions whether to maintain closed innovation or adopt open innovation or combinations of both Bogers (2010) as the outcome depends on the effectiveness of innovation. Transaction costs exist in any firms that undertake innovative initiatives in their productions Schiebacher, (2012) but it depend on how firms able to manage the innovative activities that would reduce the transaction costs and as such innovation has direct impact on transaction costs. Therefore, the aim of this study is to examine open innovation adoption improving existing products or creation of new products with a low degree of transaction costs (Cirera, 2015). Open innovation is the consequences of the emergence of radical innovation applied to SMIs to enable them to reduce transaction costs (Fink et al., 2015). SMIs that are unable to adopt open innovation will tend to increase the transaction costs and would have adverse effects in their productions and growth (Goedhuys and Srholec, 2015). The transaction costs in SMIs are high as many SMIs are lacking in innovation activities (Goedhuys and Veugelers, 2012). Therefore, the strength of in managing firms in different level would have strong incentives in adopting innovation (Tebaldi and Elmslie 2013). Transaction costs have received substantial consideration among various studies agreeing that lower transaction costs reduces overall production costs (North, 2005). However poor control leads to weak management that would increase the transaction costs causing hindrance to innovation adoption (Chadee and Roxas, 2013). Management plays an important role in managing costs by reducing explicit and implicit cost involved in manufacturing (Zhu et al., 2012). Transaction costs involve resources which are required to facilitate innovative activities and the process includes many stages. Therefore innovations goals are to reduce transaction costs (Suematsu, 2014) and as such, transactions cost determines make or buy decision (Tidd et al., 2001).

**Appropriability mechanisms**

Appropriability mechanisms employed by businesses to avoid unwanted free riders using the technology without any costs and therefore emphasis on appropriability mechanisms is crucial for effectiveness of innovation collaboration with external parties (Laursen and Salter, 2014). As such, appropriability mechanisms provide framework for exclusive knowledge sharing, Audretsch et al. (2012) and Hagedoorn and Zober, (2015) especially for manufacturing firms (Laursen and Salter, 2014). Appropriability mechanisms can be implemented in various forms of instruments such as patents, trade secrets, trademarks, and design rights to protect the innovative initiatives from free riders (Hagedoorn and Zober 2015). Many legal system exists to protect intellectual property (IP) especially patents (Boldrin and Levine, 2013; Moser, 2013) but patents are just one of the instruments. Other formal forms of appropriability include copyrights, trademarks, and design rights and informal methods include confidentiality agreements, lead time, secrecy and complexity. However patents are considered as the most effective appropriability mechanism. A strong appropriability mechanism is needed for SMIs to gain profit in the long term and build confidence to investors (Czarnitzki et al., 2014). Technological innovations can be exploited in many ways and therefore mechanisms placed to avoid any forms of exploitation (Milesi et al., 2013). Innovations are incremental and radical (Hurmelinna-Laukkanen, et al. 2008), therefore appropriability mechanism is crucial to moderate the relationship between innovation abilities and adoption of innovation (Lawson et al., 2012). Few empirical studies addresses the relationship between SMIs appropriability strategies and innovation adoption (Leiponen and Byma 2009; Thomâ and Bizer 2013). Studies also revealed that many innovative small and medium industries have shown a positive development toward patent registration compared to Asian countries, Hollanders and Es-Sadki (2013) and the main purposes of appropriability regime is to increase firms’ profit (Milesi et al., 2013).

**Literature Review**

Organisational Citizenship Behaviours (OCB), introduced by Dennis W. Organ in 1982 is a study of organisational behaviour, Podsakoff and MacKenzie, (1997) which is an important feature of behaviour at work. The study of behaviour is crucial to support psychological and social component of organisations which is known as (OCB),
OB is important for small organisations because it influences the effectiveness of various stages of employees' productivity that determines rewarding decisions. Firms need to adopt new technologies to enhance processes and productions but many firms unable to exploit or failed to adopt such technologies due to workforce that are unwillingness to adopt (Burton-Jones and Hubona, 2006). One of the main reasons is due to the behaviour of the workforces that are unable to go beyond their normal role in production functions (Organ, 1988; Organ, et al., 2006). Positive behaviours like cooperation, team player, proposing new methods to develop products and encouraging a positive environment is part of activities in the organisation. It also includes assisting workers, meticulous towards work, communication and information as well as participating in discussions and decision processes rather than condemning the management (Yen et al., 2008). OCB affects performances and organisational rewards (Allen and Rush, 1998; Mackenzie et al., 1991 and 1993; Motowidlo and Van Scotter, 1994) and plays important part in decisions making that impact advancement and success (Podsakoff et al., 2000). Aquino and Bommer (2003) discovered that OCB enhances social attractiveness in working places. OCB is associated with positive behaviour and those exhibits OCB can be socially attractive which are likely to be appreciated in working places.

OB is characterized by traits of Altruism, Conscientiousness, Sportsmanship, and Courtesy among the employees. Behaviour impacts organisational operations and effectiveness. Graham proposed OCB approach to be based on global concept involving all positive organisationally relevant behaviours. Markkula and Kune (2013) focussed on planning and in initiating ideas which will then turn into innovations and it require changes in behaviour and commitment by engaging with all the stakeholders. Engagement with various parties is important in scaling up the ideas of innovation (Kärkkäinen et al. 12). This research aims at identifying working behaviour that will lead to organisational effectiveness Dyne et al., (1994) and most important the dimensions of OCB which influences working culture. Discussion on the relationship between OCB and firms innovative implementation that leads to organisational performances is supported by various empirical evidences (Ishak, 2005; Naqshbandi and Kaur, 2011 and Naqshbandi, and Kaur, 2013).

Organisational Culture has been assessed in various scopes and has resulted in creation of models and theories which differs in theory but similar in fundamental (Ying and Ahmad, 2009). Therefore various approaches have been considered in proposing and explaining organisation culture dimensions in a different manner. Organisation culture can also be categorised as visible and invisible that reflects the identity of the organisation over time (Al-Alawi et al., 2007). The noticeable culture dimension is supported by philosophy values and mission but it is highly reflected in actions and sensitivity of organisation members (McDermott and O'Dell, 2001). Goffee and Jones (1998) has categorised Organisational culture in four categories, i.e. Networked, Communal, Fragmented and Mercenary which includes friendliness, sharing goals and objectives of the organisations. Goffee and Jones' (1998) and Rashid, et al. (2004) established types of culture that facilitates organisational changes in Malaysian context. On the contrary, Ingram et al. (2005) introduced four divisions which represent the reverse of general goals such as politics, no common goals, blindly follow one leader, inflexible management. Meanwhile O'Reilly et al. (1991) developed profiles of an Organisational Culture such as respect for individuals, outcome orientated, innovation, team work, stability, aggressiveness and detailed person. The studies showing the relationship between organisational culture and open innovation is scarce and further research is needed to supplement theoretical and empirical research (Lichtenthaler, 2011). Though scarce, current study generally states that organisational culture is major concern on open innovation adoption (Boschma, 2005; Carbone et al., 2010; Lichtenthaler, 2011; van de Vrande et al, 2009). Organisational culture promotes or opposes to incorporate external setting to internal productions depends on the availability of resources, work force, effective collaborations and supports to facilitate open innovation adoption (Boschma, 2005 and De Jong et al., 2007). This suggests that adverse organisational culture cause collaborations problems (van de Vrande et al., 2009). Saunila (2014) study revealed that there is a negative relationship between culture and innovation performance. However, this result contrast with earlier studies that organisational cultures are positively related to innovation performances (Murat and Baki 2011 and Naranjo-Valencia et al., 2011). The question is what nature of organisational culture is needed to support and what type of culture that needs to be avoided to adopt open innovation. Open innovation is still at infancy stage and therefore there is avenue to conduct an empirical and theoretical research (Lichtenthaler, 2011).

Managerial Ties is defined as managers or executives who are involved in boundary-spanning activities as they are associated and interact with external parties (Geletkanycz and Hambrick, 1997). Managerial ties are commonly planned to seize opportunities (Peng and Luo, 2000). Managerial ties is a form of social exchange or social capital which enables firms to access scarce resources (Li Poppo and Zhou, 2008), managing uncertainty environments (Li and Zhou, 2010) and improve performance of firms (Adler and Kwon, 2002). Social capital is a form of goodwill that is created through social association framework and can be activated to
empower exploitation (Adler and Kwon 2002). Firms need to provide quality and innovative products and therefore innovation not only needs technological developments but needs a change of mind-set of all relevant actors and for this to happen, networking is very important but it will not be an easy task (Curley and Salmelin 2013). In addition, Keeley et al. (2013) clarified that ecosystem in innovation is crucial for any firms to gain higher returns. Ecosystem includes diverse array of actors and resources which involves researchers, university faculty, other firms etc. who will able to provide professional advice. Searching for the right partner is not an easy task as it involves right decision which is a complex process which may have direct impact on the technology platform that will decide the future innovation direction of any organisation (Holzmann et al. 2014). Open Innovation processes involves high degree of ambiguity in terms of exploration for better partners and outcomes of such partnerships. Therefore managerial ties enable managers to make a right decision in identifying right partners, build cordial relationship to ensure that there is an outcome from those relationships. Managerial ties can play a crucial role in making right decision about recognising right partners, forging proper partnerships and ensuring good outcomes (Naqshbandi and Kaur, 2011). At a time when knowledge is increasing at an increasing rate and shorter product life cycles, challenges of scientific and technological development, cultivating an open and accommodating exchange of ideas with external parties is critical.

Transactions costs include the ex-ante costs such as searching and information that comprises input evaluation such as drafting and negotiating an agreement. This also includes output measurement and costs of safeguarding the agreement such as monitoring and enforcements (Williamson, 1985). Transactions cost is also a process that includes exchanges which encompasses there stages such contact, contract and control (Coase 1937). During contact stage, firms incur costs such as search costs and in contract stages firms incur preparation of transaction agreement and execution costs and finally in control stages, firms incur implementation and tracking costs (Williamson, 1985). In addition, firms need to ensure that transaction partners are reliable contingencies plan need to be placed in the event if the investment becomes sunk. The most significant challenges that manufacturing companies face is limited resources and therefore firms need to reconsider engaging with external parties or internal production. There are tendencies that firms will fail if allocation and managing the resources are not prudently managed in a complexity environment (Brandau, and Hoffjan, 2010). Firms are also exposed to risks if they lack the capability to survive (Gooderham et al., 2004). However transaction cost also includes costs that are related to breaches of contractual promises Rahman and Kumaraswamy (2004) which is very important for today’s businesses. Cooperation among various actors in the industry reduces costs and gains the maximum potential benefit from it (Chotibhongs and Arditi, 2012). The failure to identify the right partner and having cooperation with them are likely to incur high transaction costs (Arditi and Chotibhongs 2009; Chotibhongs and Arditi, 2012). Managers with vision bring various actors together to achieve their goals thereby providing the structure (Dobre, 2013). TCE has had an immense impact on academic theories and also beneficial for practitioners to incorporate the theoretical assumptions of transaction costs into their decision models. In order to assess the validity of the TC arguments in the context of open innovation, there need to be an in-depth research on specific firms in industries to decide the directions of opening up its innovation processes.

According to Teece, (1986), it is the proprietor’s ability to secure the return from any form of value generated through resources. According to Atkins (1998), appropriability is the ability of various stakeholders to maintain their financial benefits arising from the innovation exploitations (Atkins 1998). In addition, West et al. (2006a) defined appropriability in public policy framework whereby innovator will be interested in capturing the return form the efforts put in to create innovative products. Appropriability regime is a system of different mechanisms to protect innovation (Hurmelinna-Laukkanen and Puumalainen, 2007). Therefore, appropriability regime is an instrument that enables firms to safeguard their innovations from various threats especially the imitators and benefits from innovation efforts in the industry. Managers can use appropriability regime strategies to protect their intellectual property rights (Gans and Stern, 2003). There are two types of appropriability regimes: formal (patent, industrial design, trademark, and copyright) and informal (secrecy, lead time, and complexity of design) which can be perceived as substitutes (Kultti et al., 2007; Somaya, 2012) or also as complements (Levin et al., 1987; Cohen et al., 2000; Hall et al., 2014). However, the scope of collaboration in R and D found to be economically significant determinants of innovation for manufacturing and service industries (Leiponen, 2012). Strong appropriability regimes encourage Open Innovation adoption (Chesbrough, 2003a; Cohen and Walsh, 2000; West and Bogers, 2014), especially in pharmaceutical and electrical industries. However a weak appropriability regime discourages Open Innovation adoption such as in textile industries Laursen and Salter (2005). Teece et al. (1997) noted out some points that weak appropriability regimes environment encourages rapid learning on how to overcome imitators which firms in strong appropriability regimes would not have the opportunity to learn (West et al., 2006). Exploring the appropriability conditions can help to determine whether it’s beneficial or
disadvantage in determining the open innovation adoption (West et al., 2006). Measuring appropriability is not going to be an easy task as it lacks theoretical and empirical mode in determining the returns of innovation (Harabi 1995). James et al. (2013) establishes the relationship between appropriability regimes and innovation in manufacturing sector to enable the companies to protect their revenues. In addition James et al. (2013) recommend that gaps in appropriability regimes can be narrowed through surveys to discover the degree of impact towards the revenue.

**Model Selection**

Social exchange theory (SET) is one of theory that examines workplace behaviour Malinowski, (1922) and Mauss, (1925) and also emphasizes on relationships (Blau, 1964). The model emphasizes on social power Molm, et al. (1999), networks Brass et al. (2004), independence Westphal and Zajac, (1997), organizational justice Konovsky, (2000) and psychological contracts (Rousseau, 1995). SET explains the reciprocity in relationship Gouldner, (1960) where parties exchange benefits between one another and such benefits creates mutual obligations and good feelings created between the parties (Coyle-Shapiro and Shore, 2007). ANT attempts to explain the ordering effects of devices Law, (1988) to organisations Law, (1994) and how these relationships can be accomplished. ANT is better understood as an approach to offer analytical tools that can be applied to organisations (Czarniawska, 2009). Analysing organising by ANT is to address the complex system which comprises of humans and nonhumans which is technology and how both work as a network (Bloomfield and Vurdubakis, 1999). Productions are processes that associate between people and materials which is complex and can only be addressed empirically (Cooper and Law 1995). ANT has the capacity to denaturalize organisations to make constructive changes in the organisational processes Spicer et al., (2009) especially in technological perspective (Spicer et. al., 2009). It is essential to recognise how innovation can be influenced through ANT approach (Latour, 2004a and 2004b) to create effects for the organisation.

**Research Methodology**

This study undertakes descriptive research which includes surveys and fact-finding enquiries. The justification to use descriptive studies is to seek to measure items such as independent, moderating and dependent variables. The method includes comparative and correlational methods. Causal relationships determine the effects of Actor Network Theory (ANT) and Social exchange Theory (SET) constructs towards open innovation adoption. This study uses quantitative paradigm which adopts a reductionist (positivist) approach (Creswell, 2012). Factor analysis conducted to examine the questionnaire structure emphasizing on Likert 5 point scale. Survey will be conducted through questionnaires, interviews and observations. Data gathered from managers who own or works in SMIs companies to study their behaviour, organisational culture, external ties, awareness of transactional costs, and protection towards open innovation. Purposive sampling method is best suited to determine and locate the population sample on companies that adopts open innovation. The selection of the sample SMIs limited to manufacturing companies. According to Sekaran (2003) this approach involves testing of hypothesized relationships to explain the nature of information, any possible differences among groups, or the link among two or more characteristics of a phenomenon (Sekaran, and Bougie, 2010). Surveys allow outcomes of a study to be appropriately generalized from the sample to a population. In selecting the survey, the planned study deems numerous researchers position on its relevance to the present context. The survey conducted on managers who own or works in SMIs and undertakes projects for big companies. Data gathered from managers who own or work in SMIs companies to study their behaviour, organisational culture, external ties, awareness of transactional costs, and protection towards open innovation. Partial Least Square (PLS) used to analyse the factors which enables to specify, estimate, assess and present models to show hypothesized relationships among variables (Luqman, 2011). Survey questions validated by academicians and industry experts and 150 sample population of SMIs studied which utilised purposive sampling method. The sample consists of managers operating SMIs with at least 5 years experiences and companies undertaking production projects for big companies.

**DATA ANALYSIS STRATEGIES**

The questions from the survey use 5 point likert scale to analyse the data. The responses to each question placed in PLS sheet to analyse further. The selection of PLS in this study is justified as it allows both confirmatory and exploratory modelling. Therefore, PLS suited to confirm or reject theories through testing of hypothesis (Hair et al., 2012 and 2014 and Soo, 2016) especially in testing models with moderating relationships (Hair, 2014). Hierarchical regression used to estimate the relationship and the impact between independent variables and the dependent variable. From the responses, conclusions made on SMIs managers
whether open innovation can be adopted with behaviour concept with cost effectiveness through managers who are innovative in behaviour have potentials toward open innovation adoption.

CONCLUSIONS

The motivation for doing this research is the desire to provide benefits to SMIs in solving the unsolved problems such as innovation adoption, increase in productivity, growth and high revenue. In addition, the desire to gain intellectual delight in providing a creative idea to the industry. The findings of this study provide inferences of the significant factors that affect SMIs adoption level and how SMIs able to retrieve resources by reducing costs through inbound collaborations. This study analyse open innovation adoption by considering the behavioural and cost effect for SMIs to use external sources of innovations. This model is used to review literature of many open innovation-related publications in which majority of these articles addresses elements emphasis on external sources but very less studies has been conducted on internal source. Therefore, this study opens up another point of view in ensuring the success of open innovation especially among SMIs. It also contributes knowledge through quantitative analysis from feedback of SMI managers on how internal sources and external sources can be combined in ensuring the success of open innovation adoption. The study also suggests several points that deemed to be important in SMIs models which may be inconsistent with earlier studies whereby SMIs must be able to access internal and external factors to adopt open innovation.

Recommendations for Future Research

Based on the literature, future research is recommended to be conducted on service industries as service sector dominates the world economies. The study also recommends that future research should investigate SMIs commercialisation of innovation through external parties’ assistance. In addition, transaction cost can be utilised as mediating factor to test whether cost determines as influential factor on productions. Future research should also be conducted to examine open innovation adoption on family related businesses. There is also great potential to undertake studies in terms of human resources, culture and costs in managing the whole process of open innovation.

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