

The Implication of Entrepreneurial Behavior and Network Collaboration on Firm Innovativeness in Knowledge Intensive Business Services

¹Md Noh Ab. Majid and ²Mohd Ghani Awang

¹Faculty of Business Management, Universiti Teknologi MARA, 23000 Dungun, Terengganu,

²Faculty of Industrial Management, Universiti Malaysia Pahang, 26300 Kuantan, Pahang, Malaysia

Abstract: This study explored the role of entrepreneurial behavior and network collaboration on firm innovativeness among 'Knowledge-Intensive Business Services' (KIBS) in Malaysia. Applying the resource-based view approaches, a field study was carried out and data were randomly obtained from 200 firms in this service sub-sector by using a self-administered questionnaire via a key-informant from each firm. The questionnaires used were pre-tested before the actual survey. Data were analyzed by using Partial-Least Square (PLS) as it involved structural modeling of latent constructs, the use of hierarchical models and formative items construct which aimed at estimating complex model while maximizing the variances in the dependent variable. Results showed that both predictor variables significantly influence firm innovativeness. It distinctly revealed that professional employees' innovative behavior and collaboration with commercial lab or private Research and Development (R&D) institutes as two vital resources of firm innovativeness in KIBS. This research has made a significant contribution on theoretical conceptualization as well as empirical validation in firm innovativeness studies. Conceptually, it extends theory by reframing entrepreneurial orientation into entrepreneurial behavior as a hierarchical model that incorporates corporate entrepreneurship and innovative behavior. Empirically, it confirms that PLS path modeling is applicable to estimate the parameters of a higher-order model developed in this study. This research has offered firms in the service sector vital strategies to enhance innovativeness for organizational competitiveness.

Key words: Firm innovativeness, corporate entrepreneurship, service innovation, innovative behavior, network collaboration, partial-least squares

INTRODUCTION

Researches in organizational innovation have been established in the west since the 1960s where most studies focused on New Product Development (NPD) in the manufacturing sectors. As a result, innovation theories were generally biased towards manufacturing. Today, the world economies have shifted its attention to the service sectors, where the service industry is viewed as one integral driver for economic development (Bitner and Brown, 2008). In tandem research in organizational innovation has shifted towards services and New Service Development (NSD) among service firms. This has prompted contemporary organizational researchers to examine NSD particularly how innovations evolve in service firms.

Background of the study: Various strategies have been launched to achieve Malaysian aspiration to become a

modern country by the year 2020 and among these strategies were the special focus on the competitiveness of Small and Medium Enterprises (SMEs). In Malaysia, more than 99% of businesses are SMEs while only 0.8% are large businesses. However, the innovativeness of many Asian SMEs including Malaysia are far below international standards and were too dependent on innovation produced by other parties (Ibrahim *et al.*, 2009).

Since, the year 2000, the share of the service sector in many countries has grown and has recorded 70% of employment and Gross Domestic Product (GDP) (Gallouj, 2002). In one study, Aris reported that 86.5% of SMEs are service businesses that have provided the highest employment opportunities totaling to 2.2 million jobs in Malaysia.

The service sector was formerly believed to be laggards in innovation as opposed to manufacturing. Service industries were also perceived to be passive

adopters of technologies and as a result innovation in the service sector was considered as 'supplier dominated' (Pavitt, 1984). Lately, innovation in service has acquired a significant amount of attention in many countries, especially among the specialized business service sector (Tamura *et al.*, 2005) such as the engineering consultancy, law, architectural and accounting.

Knowledge-intensive business services: The specialized service business is also known as the 'Knowledge-intensive Business Service' (KIBS). These firms function through the professional knowledge of scientists, engineers and experts in multiple specialized areas. Many KIBS operate in major metropolitan areas such as capital cities close to their client firms (Koch and Strotmann, 2006; Wood, 2002). KIBS is believed to have a vital role as enablers, intermediaries and innovators themselves by channeling and transforming knowledge, innovation and technology acquired from one firm to another firm (Doloreux and Shearmur, 2010) in the economy. Thus, the innovativeness of KIBS directly affects the innovativeness of other firms particularly SMEs and firms that employ their expert services. KIBS have been lauded "as creative innovators themselves rather than as mere adopters and users of new technologies" (Freel, 2006a). Thus, KIBS is conceived to take a pivotal role in the new knowledge-based economies.

Besides their ability to transform client firms into learning organizations KIBS themselves are learning organizations where to provide services KIBS need to master new technology and knowledge model that is compatible with the client's technology and business processes (Yang and Yan, 2010). Through a process called 'co-production' KIBS bands together with client firms to formulate customized services required by their respective client firms (Moeller, 2008). This process not only stimulates client firm's knowledge that is important for innovation (Tuckova and Strouhal, 2010) but also KIBS own innovativeness.

Problem statement: As noted above, the competitiveness of the Malaysian business sector, specifically SMEs are lagging behind their counterparts due to the low propensity of firms to innovatively introduce something new. In the face of globalization, local business can easily lose out to international competitors if they are not innovative enough to develop novel product and services. As a result, local businesses will continue to

become imitators or passive adopters of innovation developed by Foreign innovators where this will definitely restrict firm's development.

Overdependence to Foreign expertise in professional consultancy services can also pose another problem. For instance, Foreign consulting firms may not fully understand local nuances especially cultural barriers such as language, belief and tradition of local operators and clients that influence creativity and innovativeness. Engaging Foreign expertise in business consulting service is costly and in parallel hinders the development of local KIBS which can subsequently inhibit employment of local university graduates. Drawbacks like these can hamper the modernization process to achieve vision 2020.

Research objectives: Since, the innovativeness of SMEs is related to the efforts and innovativeness of KIBS, the objective of this study is to determine if local KIBS's entrepreneurial behavior and network collaboration with their respective external parties can improve innovativeness just like KIBS in the western world. This study also needs to understand specifically which behavioral aspects of entrepreneurship along with collaboration partners significantly shape KIBS innovativeness in Malaysia. Additionally, this research needs to answer if entrepreneurial behavior and network collaboration partners hypothesized in this study affect firm innovativeness differently.

The study is important in the sense that it provides a clearer picture to managers and KIBS operators which organizational resources to strategize and which aspect of entrepreneurial behavior and network collaboration most effective to achieve higher firm innovativeness. As a result, KIBS can perform its role as producer, carrier and agent of innovations in the country more effectively.

Literature review: Defining the dependent variable firm innovativeness: Numerous efforts have been made to re-conceptualize the meaning of innovation aimed to find the best definition. However, all these attempts boil down to a single connotation of 'newness' (Jong and Vermeulen, 2003). Innovation is defined as the successful introduction of a new product into the market, new process or new organizational model (Schumpeter, 1934). Likewise, innovativeness is defined as "the generation of a new idea and its implementation into a new product, process or service which lead to the dynamic growth of the national economy and the increase of employment as well as to a creation of pure profit for the innovative business enterprise". These two definitions seemed quite similar in general understanding but do differ on certain aspects. Innovativeness imparts an impression of

innovation on a wider scale that spans from idea generation to commercialization of these creative ideas into product/service in the market and resolves as an achievement of the innovating firm. Innovation is a much simpler term that observed one's ability and success in introducing something new into a product or system that change a status quo. In this study, firm innovativeness is defined as the propensity of firm to introduce a new idea, service-solution, methods and strategy that is mobilized by firm's entrepreneurial mindset to initiate novelties (Moos *et al.*, 2010).

Among the important antecedents to organizational innovation and firm innovativeness previously studied were 'entrepreneurial orientation' and 'network cooperation' but many of these studies were performed in the manufacturing sector and much lesser in the service sector. Research in the service sector, especially among Malaysian KIBS sub-sector is relatively scarce. Therefore, further studies will clarify the importance of this sector and its impact in Malaysian scenario.

Entrepreneurial behavior and firm innovativeness: In KIBS, the professional workers are their greatest asset that allows firms to function as an expert service provider. Thus, the innovative behaviors of these professional workers will define the innovativeness of KIBS. This study focused on the behavioral aspect of entrepreneurial orientation and therefore is referred to as behavior instead of orientation

Entrepreneurship is part of the behavioral aspect of worker and organizational culture in a firm (Birley, 1986; Drucker and Noel, 1986) that promotes proactiveness and risk taking conducts during the search for organizational renewals. Jong and Wenekers posited that the "key behavioral aspects of intrapreneurship are personal initiative, active information search, out of the box thinking, voicing, championing, taking charge, finding a way and some degree of risk taking".

Intrapreneurship is akin to innovative behavior in firm. Intrapreneurship is entrepreneurship processes that take place within existing organizations (Antoncic and Hisrich, 2003). Likewise, innovative behavior is defined as the "intentional creation, introduction and application of new ideas within a work role, group or organization, in order to benefit role performance, the group or the organization" (Janssen, 2004).

In line with these behaviors KIBS professionals having expertise at their disposal assume the role as corporate entrepreneur or 'intrapreneur' to innovatively deliver innovative services to their clients. These professionals basically bear part of the risk by autonomously experimenting with new processes, new

product and services for the interest of the organization. From the above arguments entrepreneurial behavior in KIBS can be observed in two dimensions, namely, corporate entrepreneurship and employee innovative behavior (or intrapreneurship). Corporate entrepreneurship is a top down managerial strategic entrepreneurship (Amo, 2006) while intrapreneurship is a bottom up proactive employee work-related initiatives. These two complementary dimensions were conceptualized to make up KIBS professional workers' entrepreneurial behavior that influences firm innovativeness. Based on this premise, this research proposes that entrepreneurial behavior among professionals in KIBS relate positively with the firm's level of innovativeness:

- H₁: entrepreneurial behavior of KIBS professionals has a positive relationship with firm's innovativeness

Network collaboration and firm innovativeness: Network collaborations with external parties were claimed to provide firms with important sources of competitive advantage (Achrol and Kotler, 1999; Kogut, 2000). Smaller firms including SMEs find that collaboration with external partners is more important than large firms where it allow them to obtain pertinent inputs for innovation (Rogers, 2004). To create new or better products, firms must deploy resources, combine new or existing resources both inside and outside firms in new ways (Tsai and Ghoshal, 1998). Previous researches in KIBS observed that the common types of collaborative arrangement that these firms engage in innovation consist of internal, market, research and information networks (Amara *et al.*, 2010; Freel, 2006b; Koch and Strotmann, 2008).

These researchers categorized 'internal networks' as cooperative efforts with other firms within the same enterprise group. 'Market networks' are collaborative efforts with customers or client; suppliers of equipments, machinery and materials which also include competitors or other firms in the sector. 'Research networks' are teamwork with research labs, higher education institution, universities or R&D firms. Finally, 'information networks' are cooperation with governmental/public institutions or its agencies.

Because of the diversified nature of KIBS businesses different KIBS may have different sets of networking partners and different collaborative strategies. For example to increase market share or market penetration, collaboration with customer/client will be more advisable. But if the target is to achieve, efficiency and cost saving cooperation with competitors will be better (Bigliardi and Dormio, 2009). To generate scientific knowledge for

radical innovation collaboration is best with universities and research lab/institution (Koch and Strotmann, 2008) whereas if firm favor knowledge for incremental innovation collaboration with business partners will be sufficient (Todtling *et al.*, 2009).

Given the above collaborative strategies, the question now is which collaboration partner(s) is most effective that can strongly promote KIBS innovativeness. Previous researches have never investigated this but merely establishing the empirical relationship between various cooperation partners and innovative capacities in KIBS (Amarat *et al.*, 2010; Koch and Strotmann, 2008). With these arguments, this research conceptualizes that network collaboration with external partners will stimulate a higher degree of KIBS innovativeness.

- H₂: the network collaboration with external partners is positively related to KIBS innovativeness

MATERIALS AND METHODS

Methods and conceptual model: This study employed the positivist ontology, the empirical epistemology and research approach by using quantitative methodology which is a research process generally applied in scientific investigation. Similar to most organizational innovation research (Hult *et al.*, 2004; Rhee *et al.*, 2010), this study employed the cross-sectional field study. The unit of analysis was organizations classified as KIBS sub-sectors. A key-informant was identified from each organization for data collection by using a self-administered questionnaire mailed directly to them. They were the top managers such as Chief Executive Officer (CEO) or the General Manager (GM).

This research applied to the Resource-Based View (RBV) (Barney, 1986; Wernerfelt, 1984) of firm competitiveness to understand how organizational resources can be formulated to drive innovation performance. This theory stipulates that competitive advantage lies basically on how firm utilize its collection of valuable resources (Dai and Song, 2009). These strategic resources are not only valuable but also rare, difficult to imitate and non-substitutable (Wernerfelt, 1984). Based on this theory, a conceptual model was developed.

The proposed conceptual research model incorporated two predictor variables. The first predictor is a second order exogenous (independent) latent construct namely entrepreneurial behavior that is comprised of two first-order variables as shown in Fig. 1. The sec predictor is a formative item construct representing network collaboration in KIBS. Firm innovativeness is the endogenous (dependent) latent construct in this study. Firm age, size, knowledge intensity and variety of knowledge resources were set as control variables.

Construct operationalizations: All measurements of the research instrument were adapted from previous studies and were slightly modified to accommodate the sample of this research. Following contemporary studies in firm innovativeness (Kmieciak *et al.*, 2012), the seven-point Likert scale was applied to measure all reflective items in the constructs, ranging from (1) strongly disagree to (7) strongly agree.

Entrepreneurial behavior: Entrepreneurial behavior was hypothesized as a sec-order reflective model that is theoretically explained by two first-orders reflective

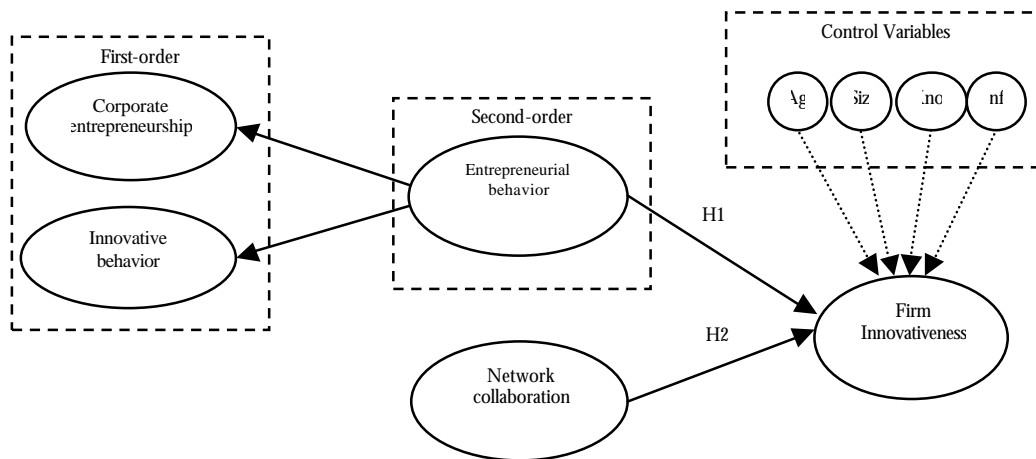


Fig. 1: Conceptual model

measurement constructs, i.e. corporate entrepreneurship among managers as well as supervisors and innovative behaviors among employees. Both dimensions reflect KIBS employees' behavior and renewal efforts via innovation initiatives in a company (Floyd and Wooldridge, 1999).

These two dimensions are not mutually exclusive because professional workers at times can be assigned take a leading or supervisory role in handling projects and tasks for the firm's client (Igo and Skitmore, 2006). Therefore, entrepreneurial behavior in KIBS can be reflected by any employees' innovative behavior regardless of their position in the firm whether they are just another professional staffs or as a project manager/head of the organization.

Corporate entrepreneurship among managers was operationalized by adapting five out of 11 items using measures developed by Pearce *et al.* (1997). In his research the original 11 item scales has established high content validity, unidimensionality and a high internal consistency (Cronbach's alpha = 0.94), thus affirming the reliability of the scale measuring entrepreneurial behavior among managers.

Employees innovative behavior was operationalized by adapting five out of the original ten items 'Innovative Work Behavior' (IWB) originally developed by Scott and Bruce (1994) and subsequently improved by De Jong . In De Jong's empirical study these 10 item scales have established a high convergent and discriminant validity and a satisfactory internal consistency (Cronbach's alpha = 0.75), thus affirming the reliability of the scale measuring innovative behavior among employees.

Network collaboration: Network collaboration was measured by eight items adapted from previous studies (Freel, 2006a, b; Freel and Harrison, 2006; Koch and Strotmann, 2008). Each of these items have been formerly measured by using a dichotomous scale (i.e. Yes = 1 and No = 0) to indicate respondent's selection. In this study a seven-point Likert-type formative items rating scale (1 = never to 7 = very high) was applied on each of the eight items to assess the collaboration intensity with partners solicited for innovation. The use of formative measurement items for this construct allows assessment of the significance and relative importance of the eight network collaboration indicators presented below. A formative item is when a change in the direction of one or more of the items measuring a construct will not necessarily elicit similar or opposite changes in other items used in measuring the construct (Chin, 1998). This means that items in formative construct do not necessarily correlate with each other.

Firm innovativeness: Measured using reflective items firm innovativeness was measured by seven items input-oriented perceptual scales as recommended by Moos *et al.* (2010). This scale was originally developed by Hurley and Hult (1998) to probe into firm's innovativeness construct. This scale is preferable because previous authors have applied and confirmed their reliability and validity in organizational innovation studies (Cepeda-Carrion, 2012).

Control variables: Control variables were included in this research to partial out any possible confounding effect of certain KIBS characteristics on firm innovativeness. Firm size, age, knowledge intensity and variety of knowledge resources were included as control variables, as previous research found that these variables can influence firm innovativeness in KIBS (Amara *et al.*, 2009; Rhee *et al.*, 2010).

Firm age was operationalized by the number of years the firm has been in operation since inception in Malaysia. Firm size was measured by the natural logarithm of the number of employees the firm employs. The variety of knowledge sources were measured by the sum of 12 affirmative response items adapted from Amara *et al.* (2009). Knowledge intensity was measured by using a percentage index of university graduates the firm employs.

Survey instrument: The questionnaire underwent two levels of refinement namely the pre-field and field testing. The Jobe and Mingay (1990)'s 'Cognitive Laboratory Interviews' (CLI) was employed for the pre-field testing procedure. In the pre-field testing phase draft copies of the questionnaire were personally administered to a group of ten potential respondents in various KIBS sub-sectors aimed to verify the content validity of the instrument. Consequently, a field testing was conducted by using purposive sampling where questionnaires were mailed to 50 KIBS firms aimed to assess non-response errors (Sekaran and Bougie, 2009). A total of 30 questionnaires were returned and non-response item was found to be not a problem.

Data collection: By using Miles and coauthors definition of KIBS subjects was extracted from the 'Malaysian Service Directory' hosted by 'Malaysia External Trade Development Corporation' (MATRADE) website. The MATRADE database was already segregated by 17 categories of service firms of various sizes. It provides the researcher ease and access to firm's profile such as business address, contact, fax number and type of business, etc.

The number of KIBS acquired from this directory was 725 firms and was set as the population frame. Considering the potential low return rate when using mail survey, questionnaires were mailed to all 725 top level officers in each firm, together with a returned addressed envelope. Sampling was done throughout the Malaysian peninsula. A total of 230 questionnaires were returned equivalent to 31.7% return rate. From this total, about 29 questionnaires were excluded as they were found to have more than 25% unanswered items and one respondent was found to be non-KIBS. Finally, only 200 units (27.6%) of the questionnaires were usable for data analysis.

RESULTS AND DISCUSSION

Descriptive analysis: As presented in Table 1, most KIBS (81%) in this sample are located in Klang Valley around the capital city of Kuala Lumpur, Malaysia. The majority (41.5%) of firms earns an annual sale of one to five million Ringgit. Most KIBS in the sample were considered to be small firms (66%) and most (64%) KIBS in the sample were newer firms established <20 years ago. Sixty seven percent of KIBS in the sample indicated that their client firms include SMEs.

Data analysis using partial least square: Data analysis was conducted by using the Partial Least Square (PLS) path modeling with 500 bootstrap re-sampling procedures. PLS allows the concurrent use of reflective and formative measurement within a structural model and able to handle complex models by using relatively small sample sizes and non-normal data (Chin, 1998). Like other ‘Structural Equation Modeling’ (SEM) techniques, PLS has the ability to account for measurement error of latent

construct and test the significance of the structural model simultaneously by applying the two stage analysis; measurement model and structural model (Anderson and Gerbing, 1988). Prior to this Harman’s, single-factor test was employed to check for common method bias and found that common method error is not a threat to the data collected.

Measurement model assessment: The measurement model for all reflective item constructs in the model was assessed by using Confirmatory Factor Analysis (CFA) i.e. by evaluating the convergent and discriminant validity of corporate entrepreneurship, innovative behavior and firm innovativeness constructs. Convergent validity was analyzed by examining Composite Reliability (CR) and Average Variance Extracted (AVE) from the measures (Fornell and Larcker, 1981). In this analysis (Table 2), the CR of all constructs exceeds the threshold of 0.70 which indicated that these measures are reliable (Nunnally and Bernstein, 1994). The AVE values range from 0.553-0.709 which exceeded the recommended limit of 0.50 (Hair *et al.*, 2011). The path loading of most items constructs is above 0.70 which showed that there is convergent validity of measures.

The measurement model for formative item construct of network collaboration was assessed by inspecting the relative weights for each item contributing to the overall factor (Chin, 1998). The weight represents the relationship between each indicator to its corresponding latent construct and this is achieved by bootstrap procedures. The data were processed by using Smart PLS 2.0 M3 software by running 500 sub-samples on 200 cases in the sample.

The results (Table 3) showed that five out of eight indicators were found to be significant elements shaping

Table 1: Descriptive analysis

Items	Category	Frequency (N = 200)	Percentage
Firm Location	Klang Valley	162	81.0
	Northern Malaysia	22	11.0
	Southern Malaysia	12	6.0
	Eastern Malaysia	4	2.0
Firm annual sales	< RM200,000	19	9.5
	RM200,000 and < RM1 million	65	32.5
	RM1 million-RM5 million	83	41.5
	> RM5 million	33	16.5
Firm size (Mean: 39, SD: 98)	Micro (below 5 employees)	18	9.0
	Small (5 to below 30 employees)	132	66.0
	Medium (30-75 employees)	33	16.5
	Large (above 75 employees)	17	8.5
Firm Age (Mean: 19.02, SD: 11.94)	20 years and below	128	64.0
	21-40 years	61	30.5
	41 and above	11	5.5
KIBS Clients	Large manufacturing	81	40.5
	Large service	119	59.5
	Small and medium enterprise	134	67.0
	Governmental	132	66.0
	Personal customers	46	23.0

Table 2: Measurement properties of reflective item constructs

Constructs	Item	Loading	t-value	CR	AVE
Corporate Entrepreneurship	ENT1	0.636	8.378	0.898	0.64
	ENT2	0.852	21.667		
	ENT3	0.836	16.956		
	ENT4	0.786	22.374		
	ENT5	0.867	38.178		
Innovative Behavior	IBV1	0.634	8.965	0.923	0.709
	IBV2	0.891	53.666		
	IBV3	0.907	60.884		
	IBV4	0.850	25.616		
	IBV5	0.897	44.816		
Firm Innovativeness	INNO1	0.814	23.392	0.894	0.553
	INNO2	0.881	28.240		
	INNO3	0.853	32.664		
	INNO4	0.634	8.705		
	INNO5	0.654	11.947		
	INNO6	0.752	18.964		
	INNO7	0.556	9.428		

CR: Composite Reliability; AVE: Average Variance Extracted

Table 3: Measurement properties of formative item constructs

Construct	Item	Mean	Weights	T-value ^a	VIF	t-value ^b
Network collaboration	COLL1	3.44	0.379	2.407	1.535	4.997
	COLL2	3.96	0.024	0.136	1.411	3.312
	COLL3	4.94	0.24	1.415	1.291	3.948
	COLL4	3.05	-0.224	1.147	1.782	2.451
	COLL5	4.37	0.294	1.453	1.458	4.158
	COLL6	2.6	0.73	4.667	1.743	6.505
	COLL7	3.02	-0.418	1.87	2.143	2.341
	COLL8	3.11	0.248	1.125	1.85	3.791

A relative contribution; b Absolute contribution (Bivariate correlations)

Table 4: Discriminant analysis of latent constructs using correlation matrix

Latent constructs	1	2	3	4
Corporate entrepreneurship	0.8			
Innovative behavior	0.555	0.842		
Network collaboration	0.346	0.339	NA	
Firm innovativeness	0.563	0.559	0.418	0.744

Diagonal elements are the square roots of the AVE values

the network collaboration construct. Seven item weights were found to be greater than the minimum threshold of 0.10 with two item weights (COLL4 and 7) showing a negative sign. Three items (COLL2, 4 and 8) were not significant. The analysis showed that the most important element shaping KIBS network collaboration is firm’s partnering activities with commercial lab or private R&D institutes (COLL6) (0.730).

The next step in assessing formative item was the test for multicollinearity (Diamantopoulos and Winklhofer, 2001). A multiple regression analysis was conducted by using Statistical Package for the Social Sciences (SPSS) version 21 with all formative items in the construct as independent variables and the mean score from all of these items in the model as the dependent variable. Multicollinearity was found to be not a problem as all Variance Inflation Factors (VIF) (Fornell and Larker, 1981) values were within 1.291 and 2.143 range which is less than 3.3 (Diamantopoulos and Siguaw, 2006).

Measured on a seven-point Likert scale (1 = never to 7 = very high), the highest mean score (4.94) was observed from client and customer (COLL3) which indicated that KIBS collaborated most frequently with this partner. Whereas, collaboration with commercial lab or private R&D institutes (COLL6) has the lowest mean score (2.60) which implied that network collaboration intensity with this construct is uncommon and relatively low.

Although COLL2, COLL4 and COLL8 were not significant at 0.10 levels, these items were retained in the measurement model because their absolute contributions were significant at 0.001 levels (Cenfetelli and Bassellier, 2009; Hair *et al.*, 2011).

Discriminant validity was assessed by comparing the square roots of AVE value of each construct to the correlation of the respective construct to other constructs. As shown in Table 4, the square roots of the AVE scores are higher than the correlations among the constructs which indicate the presence of discriminant validity.

Second-order construct analysis: To test the validity for second-order construct, this research adopted a method suggested by Chin (1998) which has been employed in other studies (Akter *et al.*, 2010). By using Smart PLS 2.0 M3 software, the second-order hypothesized factors

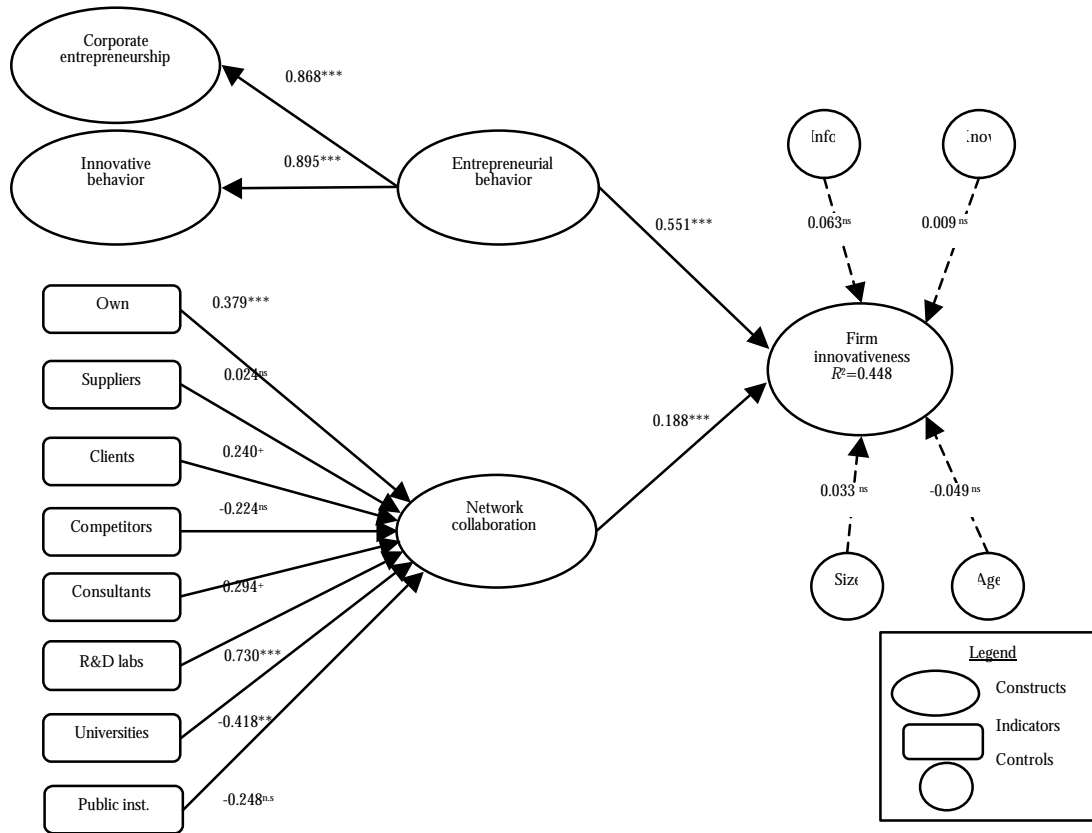


Fig. 2: Results of structural model

underwent a series of factor examination. It begins with testing for unidimensionality, followed by a multi-dimensional test and finally a second-order validation test of the model. In this analysis, the repeated-indicator approach (Lohmoller, 1988) was applied. Here, the coefficients from both first-order factors were modeled on to the second-order factor by using a principal components factor analysis. It then pulled the first-order factors together as reflective measures as theorized in this study.

After completing the factor examination stage, the correlation between the two first-order factors was found to be moderate (0.555). This suggests that a reflective model is more suitable. It can be concluded that a second-order reflective model is better for its accuracy and parsimony in representing distinct complementary dimensions of the entrepreneurial behavior construct.

Structural model assessment: Figure 2 presents the results of the PLS analyses of the conceptual model, the overall explanatory power (R²) and path coefficients between latent constructs in the model. The model explains 44.8% of the variance in firm innovativeness with both paths being significant, thus provides a strong support for the research model.

Overall, entrepreneurial behavior ($\beta = 0.551, p < 0.001$) and network collaboration ($\beta = 0.188, p < 0.001$) have a significant relationship with firm innovativeness, thus providing support for H1 and H2, respectively. This shows that both entrepreneurial behavior and network collaboration have an important role in shaping KIBS innovativeness. Following a method applied by Berghman (2006), all control variables were found to be not significant. These variables therefore have no influence on firm innovativeness when measured simultaneously with the two predictor variables.

Predictive relevance and effect size: To estimate the model's predictive relevance Q² but (Wold, 1982) this study applied Stone (1974)'s and Geisser (1974)'s cross-validated redundancy measure. Predictive relevance Q² was detected by performing blindfolding by using this cross-validated redundancy computation via SmartPLS 2.0 M2 software programs. In this study, firm innovativeness construct was found to be above zero, indicating predictive relevancies on this endogenous construct. The Q² for firm innovativeness is 0.227 and therefore has above medium predictive relevance. Thus, it is concluded

that the path model proposed to assess firm innovativeness in this study has valid predictive relevancies.

To measure the f^2 effect size, the next step is to determine the change in the R^2 value when a specified exogenous construct is removed from the model. According to Chin (1998), f^2 values of 0.02, 0.15 and 0.35 which specify whether latent exogenous variables have a small, medium or large effect size respectively. It was found that the f^2 buteffect size of entrepreneurial behavior (0.4366) has a large effect whereas network collaboration (0.0580) has a small effect in producing the R^2 for firm innovativeness.

To measure the q^2 but effect size the same technique was applied but this time the R^2 but was replaced with Q^2 but predictive relevance values. The aim is to determine the change in Q^2 values when a specified exogenous construct is removed from the model. The result finds that the q^2 effect size of entrepreneurial behavior (0.099) has a medium effect while and network collaboration (0.0065) has no effect in producing the Q^2 for firm innovativeness. This implies that firm innovativeness in KIBS is substantially determined by entrepreneurial behavior in the model. One-tailed significance: *** $p < 0.001$; ** $p < 0.01$; * $p < 0.05$; + $p < 0.10$; ⁿ Not significant.

This research has empirically demonstrated a positive and significant link between KIBS entrepreneurial behavior and firm innovativeness as hypothesized. This is in line with previous researches that consistently finds an indisputable association between 'entrepreneurial orientation' and firm innovativeness (Hult *et al.*, 2004; Peng, 2008; Renko *et al.*, 2009; Yu *et al.*, 2013). However, those studies stop short in advancing the behavioral aspects of entrepreneurial orientation. By using hierarchical model analysis, this study has shown that both dimensions can substantially shape innovativeness in KIBS firms. This means that managers as well as staffs in KIBS either individually or collectively in project teams can determine the degree of innovativeness in their firms.

Similar to previous studies in the service sector this study found that network collaboration also take a significant role in enhancing KIBS firm innovativeness (Amara *et al.*, 2010; Blomqvist *et al.*, 2004; Freel, 2006a; Koch and Strotmann, 2008; Musolesi and Huiban, 2010). But, those studies did not identify which particular partner(s) can substantially boost firm innovativeness. By using a formative item latent construct in operationalizing network collaboration, this study has able to detect that partnering with commercial lab or private R&D institutes as the most important element in shaping KIBS

innovativeness in Malaysia. The path coefficient of this particular item has recorded the highest relative weight indicating significant positive influence on KIBS network collaboration. However, this item too has the lowest mean score implying that KIBS engage the least with commercial lab or private R&D institutes for innovation, perhaps due to the relatively high cost as most KIBS (75%) in the study were micro and small firms that have limited excess of capital or R&D funding.

Interestingly, KIBS collaboration with universities or other Higher Education Institutions (HEI) showed a negative weight sign. It indicates that partnering with this party is relatively reduced or become less important as KIBS engage more with other partners in the collaboration network. This implies that 'research network' becomes less important if KIBS collaborate more with other external partners for innovation. This sends a clear signal to local universities and HEI that their research output needs to be reviewed and realigned to the need of different segments of the industry.

Overall when the two predictor variables were tested simultaneously in a single model, entrepreneurial behavior was found to be more dominant than network collaboration in shaping firm innovativeness. Thus, it is clear now that entrepreneurial behavior has a greater impact in shaping firm innovativeness among KIBS in Malaysia.

CONCLUSION

This research studied the concept of innovativeness in service, aimed to understand which resources are more important in developing firm innovativeness in the service industry. Factors shaping innovativeness in KIBS in the present study were viewed from two major perspectives, namely employees' entrepreneurial behavior and firm external collaborations. This research therefore concludes that employees' entrepreneurial behavior and firm's collaboration with external parties drive KIBS innovativeness in Malaysia.

Conceptually, this research extends theory by reframing entrepreneurial orientation as entrepreneurial behavior using second-order reflective models that incorporate corporate entrepreneurship and innovative behavior among KIBS employees. Empirically, this study corroborates the use of PLS path modeling to estimate the parameters of higher-order models in complex settings and the use of formative latent construct to evaluate the contribution of items used to form network collaboration in firm innovativeness studies.

RECOMMENDATIONS

Future researchers may employ similar path modeling analysis to explore other factors influencing innovativeness with higher precision and simplicity. Perhaps, future research can include moderator variables for instance KIBS business typologies or even adding other variables such as corporate culture and firm structure into the model that will help manager device effective strategies for better firm performance. This will further enhance the theoretical understanding of how other factors behave and firm can compete more effectively in the market.

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