Enhancing Organizational Performance Through Strategic Technology Alliances: A Study on Malaysian Manufacturers

Juhaini Jabar, Norfaridatul Akmaliah Othman, and Mohd Asmadi Idris

Abstract—Organizations are constantly searching for strategic methods in order to stay competitive. This paper examines the relationship between organizations' resource availability and absorptive capacity as well as type of alliances with organizational performance. A total of 2,500 Malaysian manufacturers were surveyed resulting in 335 of usable responses were then analyzed using Structural Equation Modeling (SEM). The result establishes that Malaysian manufacturers need to increase their efforts in increasing internal resources that are the source of competitive advantage in order to achieve superior manufacturing performance.

Index Terms—Strategic technology alliance, Resources, Absorptive capacity, Manufacturing, Malaysia.

I. INTRODUCTION

Globalization and rapid technology change are some of the main challenges faced by organizations today [1]. This challenge is especially felt by manufacturing organizations that are constantly in need of up-to-date technologies. Organizations are then constantly examining their strategies to enhance their innovative capabilities as a means to stay current in their field [1], [2]. Organisations using high technologies are especially feeling the pressure to continuously upgrade their technological capabilities to avoid the risk of their technologies becoming obsolete [3]. The transformation of technology and innovation affect global industry greatly [4]. Therefore, organisations need to strategically manage their technology by deciding whether to innovate internally or acquire external knowledge and technological capabilities that are available in other local or foreign firms [5]-[7].

There are various benefits organisations can gain from undertaking internal innovation, such as radically changing their business ideas, technologies, products and processes [8]. However, when conducting such internal innovation, organisations need to be prepared for the disadvantages related to this process. Internal innovation requires internal knowledge and technical expertise; it can be time-consuming and expensive and poses a high risk of failure [4]. This development may take years, and companies may not possess adequate resources.

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Alliances are becoming popular strategies that enable firms to decrease the amount of time, costs and risks involved to acquire external technologies [9], [10]; hence increasing the number of strategic technology alliances (STAs) formed [11]-[13]. In this study STAs include all types of alliances such as joint ventures, equity alliances and non-equity alliances between organizations seeking resources, knowledge and technologies to enhance their overall business performance while maintaining their competitive advantage [14]-[16]. There has been a growing stream of literature on STAs in developing nations [17], [18], where organizations form STAs to access resources that they are lacking and to acquire external knowledge through learning. Additionally, organizations from developing countries also form STAs to adopt and access foreign technologies as they lack indigenous capabilities to create their own technologies [19], [20].

Usually, studies on alliances in high-technology organisations have been limited to developed countries—for example, studies on STAs have been conducted mainly in the US [21]-[25]. Studies on STAs have also been conducted in Finland [26], Italy [27], Greece [28] and in transition economies such as Russia [17]. Currently, research on STAs is increasing in developing countries such as Taiwan [18], [29] and China [30]. Apparently, it is felt that there is still limited research conducted on STAs in developing countries [31]. Therefore this research intends to contribute towards the literature on STAs in developing countries by focusing on organizations' resource availability and absorptive capacity as well as type of alliances as factors affecting the inclination of firms forming STAs and the relationship with organizational performance.

II. LITERATURE REVIEW

A. Resource Availability

The resource-based view (RbV) regards firms as collections of resources that include tangible assets and capabilities (or intangible assets—usually semi-permanently attached to the firm) [32]-[35]. This collection of resources must be simultaneously *valuable, rare, imperfectly imitable, and non-substitutable* (sometimes referred to as VRIN) [33]; and are also the firm's source of sustainable competitive advantage [36]. Firms will engage in STAs when there is a need for additional resources (specifically involving technology) that are expensive and difficult to replicate in a certain time frame [37]; and can enhance the value of their existing resources [36]. From this perspective, firms adopt alliances as a means to extend their collection of value-creating resources, which are otherwise unattainable

independently. Hence this study defined resource availability as organization's tangible assets as well as intangible assets that include technology and knowledge embedded in product material, physical assets, processes and production, and management capabilities.

Results have shown that organisations are constantly seeking complementary resources when forming alliances [27], [38]. Forming alliances with firms possessing different yet complementary resources will enable greater performance compared with alliances formed with firms that have similar resources [39]. However, firms may also form alliances to broaden their range of unique resources through learning and knowledge acquisition [40]-[42]. Learning and knowledge acquisition through alliances enable firms to internalise their partner's knowledge and combine it with their own in developing their own technological competencies [27]. Therefore, it is concluded that firms lacking complementary resources have a higher inclination to form STAs in order to access the resources they desire. Therefore it is proposed that:

H1: The organization's resource availability has a negative relationship to the formation of strategic technology alliance

B. Absorptive Capacity

Absorptive capacity is largely related to the firm's level of prior knowledge [43]. It is further reconceptualized that absorptive capacity is a set of organizational practices and procedures, by which firms acquire, assimilate, transform and exploit external knowledge [44]. For effective learning to take place, partnering firms should have 'medium knowledge overlap' [45, p. 260] because knowledge overlap that is too high or too low may hinder successful learning in collaborations. This is in line with other studies on the level of absorptive capacity of partners to ensure successful organisational learning, the ability to embrace new technologies or new business practices [43], [46]. This can be seen as a potential source of competitive advantage for firms through the improvement of operational performance and in seizing market opportunities, engaging in alliances and being able to respond rapidly.

Organisations need to be aggressive to stay competitive in the global business environment. A great deal of information needs to be absorbed quickly when organisations choose to form alliances. Information and knowledge that will be transferred through alliances are usually tacit and socially complex. Therefore, it is vital for the firm to be able to absorb, internalise and exploit the knowledge, as it could influence the achievement of higher revenue and profit. In summary, organisations that have managed to successfully acquire the ability to absorb knowledge from their previous alliances will have a greater inclination to form more alliances in the future. This is because they have obtained the capability to benefit from all internal and external sources of know-how. Hence it is important for organizations to embrace suitable levels of absorptive capacity prior to forming technology alliances to enable successful STAs. Therefore it is hypothesized:

H2: The organization's absorptive capacity has a positive relationship to formation of strategic technology alliance

C. Type of Alliance

Alliances create a unique learning opportunity for firms

with different skills, knowledge bases and organizational cultures. Learning outcomes in alliances depend on the type of alliances formed [47]. Learning outcomes in alliances depend on the nature and type of alliances and the resulting opportunities [47]. For example, non-equity alliances such as licensing require small or no resource commitment. Commitment required in this type of collaboration is usually non-monetary, e.g. the organisation's effort [48]. However, equity alliances and joint ventures require the organisation to invest a certain amount of resources as a sign of commitment towards the collaboration. Various authors acknowledged greater learning opportunities in joint ventures and equity alliances, as compared to non-equity alliances [49]-[51]. There is however, a challenge for firms to maintain a balance when sharing knowledge with partners, and controlling knowledge flows to avoid unintended divulgence of confidential information [52]. Hence:

H3: The nature of strategic technology alliance has a positive relationship to the formation of strategic technology alliance

D. Organizational Performance

There is evidence suggesting organizations forming alliances will experience enhanced organizational performance [53]-[55]. There are also various measures for alliance success; for example partner satisfaction [56], product, market and financial performance [15], profitability [16], and innovation [57]. Due to the demanding and complex production processes, including distribution, marketing, and R&D efforts in Malaysian manufacturing organizations, there are various initiatives and schemes to encourage alliances with world-class corporations and research establishments in order to amplify the performance of these organizations [58]. Hence it is posited that:

H4: Strategic technology alliance formed by organizations will lead to positive organizational performance
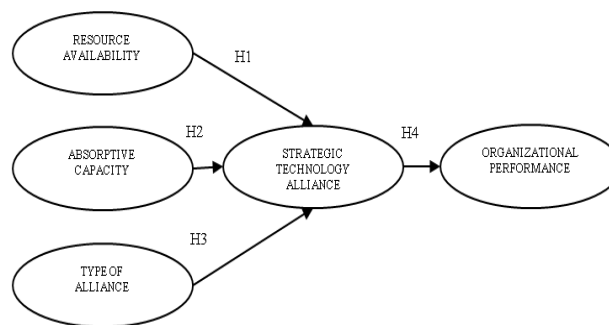

Fig. 1. Theoretical framework.

III. RESEARCH METHODOLOGY

The data from this research were gathered from manufacturing firms in Malaysia. The procedures employed comprise:

A. Pilot Study

This was conducted to generate measurement items, as exploratory research may utilize several techniques, 'including literature searches, experience surveys, and insight stimulating examples' [59, p. 67]. A survey was designed following an extensive literature review to generate items to be tested. Consequently a pilot study was conducted

to test the reliability of the instrument and to assess the length as well as the readability of the questionnaire. Two consecutive rounds of pre-testing were conducted in order to ensure that respondents understood the questions. First, the questionnaire was reviewed by three academic researchers experienced in questionnaire design and then piloted with four managers from manufacturing organizations. This was followed up with face to face interviews. The conclusion drawn from the interviews was that the questionnaire was too long, and the terms used were 'too academic'. The final questionnaire was shortened and reworded while retaining its original meaning.

B. Large Scale Survey

A random sample of 2,500 organizations was selected from a list of 3,717 in the 2008 Federation of Malaysian Manufacturers (FMM) directory. The Chief Executive Officers/Managing Directors (CEO/MD) or managers were contacted through emails, telephone calls and written letters. The target respondent of the survey was the CEO, MD or managers, whose organization has had some form of strategic technology alliance.

The process yielded 569 executives agreeing to participate in the study and emails were subsequently sent to complete an online survey with assigned password and restricted access, based on their best performing technology alliance. A major concern in survey research is the degree to which the validity of results may be compromised due to non-response by the subjects when the information is not obtained from some elements of the population that were selected for inclusion in the sample [60]. In the present study, non-response is defined as failure to fill in a complete and usable survey.

There were 343 completed surveys during the four-month data collection period yielding a 13.72% response rate. Out of these, 335 (13.40%) were found usable for this study. This accounted for 137 small organizations (less than 50 employees), 51 medium-sized organizations (between 50 to 149 employees) and 147 large organizations (more than 150 employees). Respondents were from various manufacturing sectors in Malaysia as illustrated in Table 1. This table also indicates that there are relative similarities in the distribution of the respondents with the sample population.

TABLE I: FREQUENCY OF RESPONDENTS BY MANUFACTURING SECTOR

Manufacturing	Respondents		Population	
	Frequency	%	Frequency	%
Basic metal product	24	7.2	175	7.0
Electrical and electronics	109	32.5	850	34.0
Engineering supporting	176	52.5	1380	55.2
Others	26	7.8	95	3.8
Total	**335**	**100**	**2500**	**100**

IV. HYPOTHESES TESTING AND RESULT

Before testing the model fit, the satisfactory level of reliability and validity of the measures and constructs were analyzed. Firstly, the items of each construct were assessed using the Cronbach's α coefficient and the items-to-total correlation. All constructs have values of more than 0.7 of the cut-off level set for basic research [61].

Secondly, exploratory factor analysis using Principal Axis

Factoring as the extraction method and Direct Oblimin rotation were used to assess the underlying structure for both exogenous and endogenous variables - namely resource availability, absorptive capacity, type of alliance, strategic technology alliance, and organizational performance. This was performed to examine whether the items for a construct share a single underlying factor and if they are uni-dimensional. The Kaiser-Meyer-Olkin (KMO) and Bartlett test of Sphericity were performed to test the suitability of running factor analysis. Both results suggested that the matrix was factorable with Kaiser-Meyer-Olkin test value of 0.91 and Bartlett test of Sphericity $p < .001$. Principal Axis Factoring identified the presence of six factors with eigenvalues above 1, and the extracted factors account for 54.44 percent of the total variance. All factor loadings are generally high, where the lowest loading is equal to 0.50 [62].

Confirmatory factor analyses were then conducted to test whether items of a construct were uni-dimensional. Several fit statistics were utilized to evaluate the acceptability of each of the factor models. The overall goal in establishing uni-dimensional measurement models is for each set of indicators to have a unique relationship to the latent variable it represents so that unambiguous meaning can be assigned to each of the constructs [63]. A standardized root mean square (SRMR) of 0.05 or less and normed fit index (NFI) of 0.95 and above indicate that the data fit the model well. As recommended by Bentler and Bonnet [64], the goodness-of-fit index (GFI) was utilized and deemed acceptable if above the recommended value of 0.95.

Additionally, the comparative fit index (CFI) and Tucker Lewis Index (TLI) were also used and acceptable model fit are demonstrated with CFI and TLI above 0.95 [65]. Root mean square error of approximation (RMSEA) indicated values of ≤ 0.05 (a close model fit) and ≤ 0.08 (a reasonable model fit) [66].

Finally, given that the purpose of the study is to test the hypothesized causal relationships in the model, a structural equation-modeling package AMOS 17.0 was utilized. The data did not fit the model well where, $\chi^2 (3) = 8.89$, $p = 0.03$. Therefore a post-hoc procedure was utilized and the data fit the model well with Bollen-Stine $p = 0.31$. Other fit indices include: SRMR = 0.04, GFI = 0.99, CFI = 0.99, NFI = 0.99, TLI = 0.97 and RMSEA = 0.07 indicating model fit. Having assessed the overall fit of the structural model, the theoretical relationships were then examined. The parameter estimates and their significance are shown in Fig. 2.

The findings of this study generally support the conceptual model where three out of four hypotheses were supported.
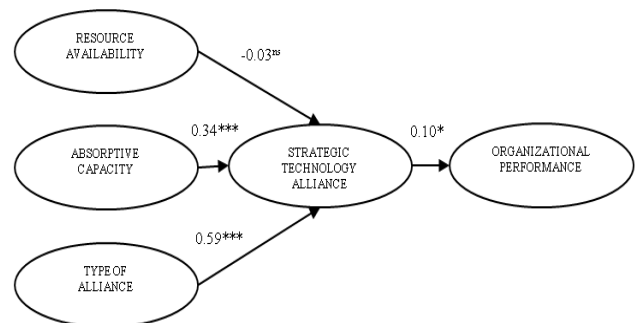
Note: ***p<.001, *p<.05, ns=not significant
Fig. 2. Structural parameters of proposed relationships.

Absorptive capacity positively affects strategic technology alliance therefore supporting Hypothesis 2. Additionally Hypothesis 3 is also supported indicating that type of alliance positively leads to strategic technology alliance formation. However there is no support on the hypothesized negative relationship between resource availability of organizations with strategic technology alliance therefore, Hypothesis 1 is not supported. Hypothesis 4 is supported signifying that strategic technology alliance positively affects organizational performance.

V. RESEARCH LIMITATIONS

The findings presented in this study must be understood in the context of the following limitations: firstly, it was difficult to identify organizations that had some form of technology alliances before distributing the questionnaire; otherwise a more effective sampling technique such as stratified random sampling would have been adopted. Additionally, the sample from this study was attained from the FMM directory hence limiting the population to only organizations registered to this database. Therefore, it is suggested that subsequent research in Malaysia should include other databases for a more robust population sampling.

Secondly, since data were collected only from manufacturers in Malaysia, findings and conclusions may not be generalized to STAs formed by manufacturers from other countries. Therefore, it is believed that future comparative studies on STAs formed by manufacturers from other countries or other industries may be beneficial to further understand the model proposed in this study.

VI. DISCUSSION AND CONCLUSION

Collaborations should be seen as opportunities to create, store and apply knowledge. Consequently, managers have to consider how to manage such partnerships to enhance their capabilities and performance. This form of learning, according to Huber [38] adds to the organization's knowledge base by internalizing knowledge not previously available to it. Furthermore, as managers seek to incorporate new production methods, there must be a willingness to risk vulnerability and confidence of forbearance among partners.

This paper has examined the Malaysian manufacturing relationship between organizations' resource availability and absorptive capacity as well as type of alliances with organizational performance. The result indicated that collaborations and partnerships is factor of consideration to enhance capabilities and performance.

From a theoretical standpoint, the development of studies on STAs has lagged far behind the fast growing acceptance of STA as an organisation strategies to enhance organisational innovative capabilities. The problem is even more acute outside the developed world where knowledge of STA is almost non-existent. The research described in this study has attempted to bridge the gap between the existing theories and knowledge and the approaches required for increased effectiveness of STA in a developing country like Malaysia.

Additionally, this study offers valuable insights to government institutions and policy makers in offering incentives for manufacturing technologies. There are also opportunities for additional public investment and industry support by increasing the number of programs and incentives such as rebates, tax relief and technology grants, for Malaysian firms to enhance their technological competencies. However this research has demonstrated that there may be insufficient capabilities present in Malaysian manufacturing firms for developing new products. Therefore, a more pressing strategy is to better understand the key performance objectives of Malaysian manufacturers and shaping the manufacturing environment as managers could focus on improving their absorptive capacity and learning capabilities in terms of technology acquisition

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