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Nader Ale Ebrahim
Shamsuddin Ahmed
Salwa Hanim Abdul Rashid
Zahari Taha



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Virtual R&D Teams: A potential growth of education-industry collaboration

Nader Ale Ebrahim¹, Shamsuddin Ahmed and
Salwa Hanim Abdul Rashid
Department of Engineering Design and Manufacture
Faculty of Engineering, University of Malaya
Kuala Lumpur, Malaysia
¹alebrahim@perdana.um.edu.my

Zahari Taha
Faculty of Manufacturing Engineering
University Malaysia Pahang
Gambang, Malaysia

Abstract—In this paper, we present our more than two years research experiences on virtual R&D teams in small and medium-sized enterprises (SMEs) and draws conclusions, giving special attention to the structure of virtual teams required to support education-industry collaboration. We report the relevant results of an online survey study. The online questionnaire was emailed by using a simple random sampling method to 947 manufacturing SMEs. The findings of this study show that SMEs in Malaysia and Iran are willing to use virtual teams for collaboration and the platform for industry-education collaboration is ready and distance between team members or differences in time zones, are not barriers to industry-education collaborations.

Keywords—Collaboration, virtual teams, SMEs, Education

I. INTRODUCTION

With the advent of the global economy and high-speed Internet, online collaboration is fast becoming the norm in education and industry [1]. Information technology (IT) creates many new inter-relationships among businesses, expands the scope of industries in which a company must compete to achieve the competitive advantage. Information systems and technology allow companies to coordinate their activities in distant geographic locations [2]. IT is providing the infrastructure necessary to support the development of new collaboration forms among industry and education. Virtual research and development (R&D) teams represent one such relational form, one that could revolutionize the workplace and provide organizations with unprecedented levels of flexibility and responsiveness [3-4]. Virtual teams give many advantages to organizations, including increased knowledge sharing [5] and improve organizational performance [6]. Virtual teams have altered the expectations and boundaries of knowledge worker's interactions. Many R&D organizations and teams currently use a specialized knowledge portal for research collaboration and knowledge management [7]. Hence, the move towards a virtual world is becoming ever more relevant to industry and education as organizations outsource activities across national geographic boundaries [8].

The purpose of this study is to extend the research finding of virtual R&D teams in small and medium-sized enterprises to industry-education collaboration. The further outline of this paper is as first, discuss the different aspects of virtual teams and its relationships with SMEs, and then briefly explore the research methodology.

Following, elaborate on the empirical findings and finally, analysis the data and conclude the paper.

II. ASPECTS OF VIRTUAL TEAMS

A. Definition of Virtual Team

Gassmann and Zedtwitz [9] defined “virtual team as a group of people and sub-teams, which interact through interdependent tasks guided by common purpose and work across links strengthened by information, communication, and transport technologies”. Different authors have identified diverse definition [10]. Reference [11] developed one of the most comprehensive and widely accepted definitions of virtual teams: “virtual team is the small temporary groups of geographically, organizationally and/or time dispersed knowledge workers who coordinate their work, predominantly with electronic information and communication technologies in order to accomplish one or more organization tasks”.

B. Benefits and pitfalls of virtual teams

The availability of a flexible and configurable base infrastructure is one of the main advantages of agile virtual teams [11]. Virtual team may allow people to collaborate with more productivity at a distance [12]. Virtual teams reduce time-to-market [13]. Lead time or time to market has been generally admitted to being one of the most important keys for success in manufacturing companies [14]. A potential advantage of virtual teams is their ability to digitally or electronically unite experts in highly specialized fields working at great distances from each other [15]. Virtual teams are enlightening and managing creativity [16] and useful for projects that require cross-functional or cross boundary skilled inputs [17].

As a drawback, virtual teams are particularly weak at mistrust, communication and power struggles [15]. Cultural and functional diversity in virtual teams leads to differences in the members thought processes [18]. Virtual teams will not totally replace conventional teams. Although virtual teams are and will continue to be an important and necessary type of work arrangement, they are not appropriate for all circumstances [19]. Hence, the complexity of management and coordination to choose the best collaboration tools will increases.

III. SMEs AND VIRTUAL TEAMS

SMEs need to focus on core competences for efficiency matters; they need to cooperate with external partners

such as an educational institute to compensate for other competences and resources. Reference [20] found that managers of SMEs should invest less in tangible assets, but more in those areas that will directly generate their future competitive advantage (e.g., in R&D to generate knowledge, and in their employees' creativity to stimulate incremental innovations in already existing technologies). The combination of explosive knowledge growth and inexpensive information transfer creates a fertile soil for unlimited virtually invention [21]. While, it is widely known that many big corporations have already invested in the information technology (IT) as they have come to realize the advantages and the competitive edge they will gain from IT. It is believed that SMEs, without investing heavily in total solution systems, can still benefit from the available information technology [22]. Virtuality has been presented as one solution for SMEs aiming to increase their competitiveness [23]. The SMEs are one of the sectors that have a strong potential to benefit from advances of virtual teams and the adaptation of new collaboration modes [24].

IV. METHODOLOGY

Data for this research is gathered from the desk study and survey in Malaysian and Iranian small and medium-sized enterprises (SMEs). A web based questionnaires is designed and distributed between manufacturing SMEs. The rapid expansion of Internet users has given web-based surveys the potential to become a powerful tool in survey research [25]. Reference [26] findings encourage social researchers to use web-based questionnaires with confidence and the data produced by web-based questionnaires is equivalent to that produced by paper-based questionnaires.

The main sampling target was managing director, R&D manager, new product development manager, project and design manager and appropriate people who were most familiar with the R&D concern in the firm. A Likert scale from 1 to 5 was used. This set up gave respondents a series of attitude dimensions. For each dimension, the respondent was asked whether, and how strongly, they agree or disagree to each dimension using a point rating scale. Based on collected data some interpretations of the current situation of SMEs to employ virtual R&D teams are developed. Statistical methods and analysis are carried out to examine the SMEs readiness for education-industry collaboration.

V. DATA COLLECTION AND ANALYSIS

The empirical data has been collected through on-line questionnaires with manufacturing SMEs in Malaysia and Iran. Out of the 3625 companies targeted, 947 responded, 210 completed the questionnaire and the rest were partially-completed. The response rate was satisfactory

Table 1 Summarized on-line survey data collection

Total of emails sent to companies	3625
Total responses	947
Total responses / sent (%)	26.1
Total completed	210
Total completed / sent (%)	5.8
Response rate (%)	22.2

Table 2 Cross-tabulation between country and virtual teams

		With Virtual Teams		Total
		Yes	NO	
Iran	Count	35	14	49
	% within sample	71.4%	28.6%	100.0%
Malaysia	Count	14	28	42
	% within sample	33.3%	66.7%	100.0%
Total	Count	49	42	91
	% of Total	53.8%	46.2%	100.0%

since accessing the managers is usually difficult. Table 1 summarized online survey data collection. Although the on-line questionnaire sent to the targeted SMEs in the both countries, only 91 firms were met the criteria of SMEs definition 'number of employees up to 15 and maximum turnover RM 25 million [11]' in this research so the rest of responded deducted from analysis.

A cross-tabulation descriptive statistics employed to find the frequency and relationship between the country and virtual team as illustrate in Table 2. The result shows that in the sample 53.8% of targeted SMEs employed virtual teams in R&D and Iranian SMEs employed virtual teams more than two times of Malaysian SMEs 71.4 and 33.3 percent respectively.

The mean scores for frequency of use to exchange business shows that E-mail is the most frequently used tool for all teams in Malaysia and Iran. Personal telephone call is second most frequently used tool in selected countries. Malaysian firms used more face to face interaction than Iranian ones. On the other hand, team base communication technologies such as shared database, group telephone conference, electronic whiteboard and video conference were not often used.

The last sections of the questionnaire developed to identify the requirements of the SMEs in determining the appropriate collaborative tools. The Likert scale ranged from "1" for not important to "5" for extremely important, with "4" as the neutral point. The Likert mean was 3.31 (Figure 1) on the 5-point scale for demand of "online training and e-learning". The score is clearly in the direction that, SMEs needs to the education-industry collaboration. Hence, sample SMEs in Malaysia and Iran

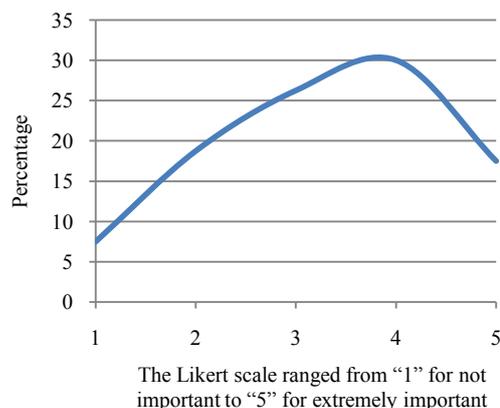


Figure 1 The 5-point scale for demand of "online training and e-learning"

are enthusiastic over use virtual teams for industry-education collaboration. This empirical study across countries shows a substantial and increasing return to virtual teams in SMEs. New technologies open up opportunities for small firms to expand their collaboration beyond firms' borders.

VI. CONCLUSION

Nowadays, distance between team members or differences in time zones, are not barriers to industry and education collaborations. Using a virtual R&D team's context as a collaborating environment provides industry management with opportunities to acquire some of the technical skills required for the professional workplace. The paper concludes that virtual R&D teams and industry-education collaboration have much more benefits than disadvantages. In fact, selecting the appropriate sets of communication tools are challenging for the virtual team's managers.

Above 46% of SMEs in selected countries are still avoiding to use virtual teams. Today's combative environments dictate a new model of communication as a basic requirement. The SMEs in Iran and Malaysia have to restructure their approach to employ virtual teams. Many SMEs have limited recourses, and it is well-known for their dynamic behavior in contrast the difficulty of diverting skilled personnel from day-by-day activities, to undertake process re-engineering and R&D. Therefore, applying virtual R&D teams in SMEs is a foundation of high growth industry-education collaboration.

Future research would now seem to be essential for developing a comprehensive study, combining survey with case studies in various sizes of companies and types of activities (e.g. research and development and new product development). Such a study needs to investigate a larger sample of virtual teams from different sectors. In a bigger group, it is possible to compare the results between countries more precisely.

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