

University of Malaya

From the Selected Works of Nader Ale Ebrahim

Winter December 9, 2010

The Effectiveness of Virtual R&D Teams in SMEs: Experiences of Malaysian SMEs

Nader Ale Ebrahim
Shamsuddin Ahmed
Salwa Hanim Abdul Rashid
Zahari Taha



Available at: <https://works.bepress.com/alebrahim/36/>

The Effectiveness of Virtual R&D Teams in SMEs: Experiences of Malaysian SMEs

Nader Ale Ebrahim [†], Shamsuddin Ahmed, Salwa Hanim Abdul Rashid

Department of Engineering Design and Manufacture,
Faculty of Engineering, University of Malaya
Kuala Lumpur, Malaysia

Zahari Taha

Faculty of Manufacturing Engineering and Management Technology,
University Malaysia Pahang,
26300 Gambang,
Pahang, Malaysia

Abstract - The number of small and medium enterprises (SMEs), especially those involved with research and development (R&D) programs and employed virtual teams to create the greatest competitive advantage from limited labor are increasing. Global and localized virtual R&D teams are believed to have a high potential for SMEs growth. Due to the fast growing complexity of the new product, coupled with new emerging opportunities of virtual teams, a collaborative approach is believed to be the future trend. This research explores the effectiveness of virtuality in SMEs virtual R&D teams. An online questionnaire emailed to Malaysian manufacturing SMEs and 74 usable questionnaires were received, representing a 20.8 percent return rate. To avoid the bias that may result from pre-suggested answer, a series of open-ended questions asked from expertise. This study based on analyzing an open-ended question; extract four main themes among expertise recommendations on the effectiveness of virtual teams for SMEs growth and performance. These are suitable for SMEs new product design manager to realize the key advantage and importance of virtual R&D teams in the process of NPD, which lead to increase the effectiveness of the new product's procedure.

Keywords: Virtual teams, New product development, Survey finding, Small and medium Enterprises.

1. INTRODUCTION

small and medium-sized enterprises (SMEs) are a major part of the industrial economies (Eikebrokk and Olsen, 2007). The importance of SMEs in economic growth has made them a central element in much recent policymaking (Hoffman et al., 1998). SMEs seem to be appropriate units to behave like network nodes because of their lean structure, adaptability to market evolution, active involvement of versatile human resources, ability to establish subcontracting relations and good technological level of their products (Mezgar et al., 2000). SMEs have advantages about flexibility, reaction time, and innovation capacity that make them central actors in the new economy (Raymond and Croteau, 2006). Gassmann and Keupp (2007) found that managers of SMEs should invest less in tangible assets, but more in those areas that will directly create their future competitive advantage (e.g., in R&D to

generate knowledge, and in their employees' creativity to stimulate incremental innovations in existing technologies). One very important trend to enable new knowledge creation and transfer in and to SME's is developing virtual collaborative environments and networks to increase their innovation abilities as a single unit but also the capabilities of the network as a whole (Flores, 2006). Virtuality has been presented as one solution for SMEs aiming to increase their competitiveness (Pihkala et al., 1999). Virtual teams reduce time-to-market (May and Carter, 2001). Lead Time or Time to market has been generally admitted to being one of the most important keys for success in manufacturing companies (Sorli et al., 2006). In moving to virtual R&D teaming, an understanding of existing practices is important. Therefore, this paper based on the research of recent literature of virtual R&D teams, at the first step provides a

[†] : Corresponding Author email: aleebrahim@perdana.um.edu.my

primary definition of virtual R&D teams and its relationship with SMEs; next, the research method and data analyzing, described and lastly a guideline for future study devised.

2. VIRTUAL R&D TEAMS AND SMES

Gassmann and Von Zedtwitz (Gassmann and Von Zedtwitz, 2003) 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.” Another definition suggests that virtual teams are distributed work teams whose members are geographically dispersed and coordinate their work, mainly with electronic information and communication technologies (e-mail, video-conferencing, telephone, etc.) (Hertel et al., 2005). Among the different definitions of virtual teams the following concept is one of the most widely accepted definitions (Ale Ebrahim et al., 2009b): “virtual teams are 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” (Ale Ebrahim et al., 2009a). Virtual R&D team is a type of virtual teams, which includes all the features of virtual teams and concentrates on the R&D activities. The members of the virtual R&D team use different degrees of communication technology to complete a research with no space, time and organizational boundaries limits.

The SME is not a scaled-down version of a large company. It has different characteristics that distinguish them from large corporations and that can of course change across different countries and cultures; they are independent, multi-tasking, cash-limited and based on personal relationships and informality, as well as actively managed by the owners, highly personalized, largely local in their area of operation and largely dependent on internal sources to finance growth (Perrini et al., 2007). To survive in the global economy SMEs have to improve their products and processes exploiting their intellectual capital in a dynamic network of knowledge-intensive relations inside and outside their borders (Corso et al., 2003). So if small firms want to make a step change in their technological and innovation base, they may have to rethink their approach to cooperation (Hanna and Walsh, 2002). SMEs need to cooperate with external partners to compensate for other competences and resources. This is especially the case in R&D, where SMEs face specific problems in comparison to large firms (Pullen et al., 2008). Levy et al. (2003) state that SMEs are knowledge creators but are poor in knowledge retention. They need to be

proactive in knowledge sharing arrangements to recognize that knowledge has value and the value added is derived from knowledge exchange (Egbu et al., 2005). Such a knowledge sharing can be provided by virtual R&D teams. There is a general movement toward virtual R&D teams (Kratzer et al., 2005). Virtual R&D can help to spread the risk and share costs among a network of companies (Gassmann and Von Zedtwitz, 1999). Therefore, Virtual teams are important mechanisms for organizations such as SMEs seeking to leverage scarce resources across geographic and other boundaries (Munkvold and Zigurs, 2007).

3. METHOD

Data for this research is gathered from the desk study and a survey. A web based questionnaires is designed and delivered to Malaysian manufacturing SMEs. The questionnaire was included the close-ended and open-ended questions. This study clustered two open-ended questions. Clustering involves searching the data for related categories with similar meaning. This analysis is known as Thematic Analysis as the main purpose during the beginning of the analysis is to look for themes. When a set of themes is formed, more advance analysis can be employed to look for clusters and patterns among them (Abdul Rashid, 2009). In this analysis, any sentences that give significant meaning are extracted and then organized under categories.

4. DATA COLLECTION AND ANALYSIS

An on line questionnaire was distributed through e-mail to Malaysian manufacturing SMEs. Participants were directed to a website, and the survey was completed on-line. The rapid expansion of Internet users has given web-based surveys the potential to become a powerful tool in survey research (Sills and Song, 2002). Denscombe (2006) 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. Another authors stressed the data provided by Internet methods are of at least as good quality as those provided by traditional paper-and-pencil methods (Gosling et al., 2004, Deutskens et al., 2006). However minor differences occur between the two survey methods; online respondents provide more improvement suggestions (Deutskens et al., 2006) and tended to be slightly longer than those from the paper version, the differences are not statistically significant (Denscombe, 2008).

The survey was first tested with 12 expert people, then adjusted and distributed. Finally, a questionnaire consisting of open and close-ended questions was distributed to 356 Malaysian manufacturing SMEs. The main target group

regards the organization's size and field of industry was, managing director, R&D manager, new product development manager, project and design manager and right people who were most familiar with the R&D issue in the organizations. 74 usable questionnaires were received, representing a 20.8 percent return rate. The response rate was satisfactory since accessing the managers is usually difficult. Table 1 summarized online survey data collection. 42 SMEs were met the criteria of this research so the rest of responded took away from analysis. Descriptive statistics were used to analyze the responses. Table 2 shows the frequency of using virtual teams among the sample Malaysian SMEs. The result shows that 33.3% SMEs employed virtual teams. So, virtual team application in manufacturing SMEs is still in infancy.

Table 1 Summarized online survey data collection

Numbers of emails sent to Malaysian Firms	2068
Total Responses (Click the online web page)	356
Total Responses / Received questionnaire (%)	17.2
Total Completed	74
Total Completed / Received questionnaire (%)	20.8

Table 2 Cross-tabulation between country and virtual team

	Using Virtual Team		Total
	Yes	NO	
Count	14	28	42
%	33.3%	66.7%	100.0%

Table 3 Comments on the effectiveness of virtual teams for the company's growth and performance (Compare before and after implementation)

Case No.	Respondent comments
1	Cost saving, Time saving, and Great Convenience. These will enhance the flow of the projects of a company and speed up the progress of our work.
2	Reduce time consumption
3	Time and cost are saved.
4	Since we have different manufacturing location around the world, our marketing department is located away from R&D, the virtual tools are the one that brings us closer and helps in decision making, faster product release and meeting customer satisfaction.
5	Virtual team system/tool is merely ASSISTANCE to the current workload.
6	Save time, money and energy
7	In my opinion, virtual team can make a good connection between the entire assets of organization.
8	With start virtual team system we improved in my performance
9	The virtual team system/tool is effective and can be helpful
10	In both it is seriously important.
11	1) The company could growth faster, due to overcoming to distance and time by using virtual system 2) If system will be managed in an effective manner, the performance is increased due to power of the tools

Open-ended questions have a few disadvantages. They can be difficult to code, tabulate, and analyze, and they ask for some creative thought among the respondent, which the respondent may not be willing to give. However, they are an excellent means of collecting information when the range of possible responses is broad. Because open-ended questions provide a few prompting and impose the fewest limits, they may evoke the most authentic possible response from the respondent (Bobrow, 1997). These are good to use when asking for attitude or feelings, likes and dislikes, memory recall, opinions, or extra comments. In addition open-ended questions are time-consuming and difficult to answer. By considering all advantages and disadvantages, we used very few open ended questions in the online questionnaires. In this study, we only consider one open-ended question, which is:

1. Please explain the total effectiveness of virtual team system/tool on the company's growth and performance, before and after implementation?

5. RESPONDENT COMMENTS

A great majority of the respondents included comments on open-ended questions. Summarizing the results of open-ended questions is not simple due to different levels of management and the individual, subjective wording and phrasing of the responses. However, some comments are quoted direct from the responders and illustrated in Table 3. By applying Thematic Analysis and look for clusters and patterns, the common grounds were identified and shown in Table 4.

12	We did some activities in our company to reduce costs as follows : 1- We arranged virtual network suppliers 2- They arranged R&D teams for our orders 3- our R&D department manage overall activities then we can reduced employees from 50 to less than 20
13	- Capable for attracting experts and knowledge workers - declining ineffectual face to face meetings - improving work environment - Reducing time of trips
14	After correct implementation and good training of users, the growth of company is about 6 from 10 (10 is excellent and 0 is bad)
15	In my opinion it is impossible to work without such systems in the extremely mobile world we face these days.
16	Reduce unnecessary time waste and expedite product outcome
17	We demonstrate a positive annual trend in all factors important to us.
18	There is some effect but might be more effective while internal works are considered. In the case of international cooperation it depends strongly on consortiums formed for project executions

Table 4 Theme and cluster extracted from Table 4
(virtual team effectiveness)

No.	Theme	Cluster
1	Reduce R&D cost and time	Cost saving, Time saving Reduce time consumption Faster product release Reduced employees Reducing time of trips Reduce unnecessary time wastage
2	More effective R&D	Speed up the progress of work. Great Convenience Helps in decision making Assistance to the current workload Improved in performance Virtual team system/tool is effective Capable for attracting experts and knowledge worker
3	Better output	Enhance the flow of the projects of a company Meeting customer satisfaction Performance is increased Improving work environment Expedite product outcome Demonstrate a positive annual trend
4	Increase coordination	Brings us closer Good connection between the entire assets of organization

6. CONCLUSION

Despite the enormous benefaction of employ virtual R&D teams in manufacturing SMEs, applying the virtual teams by most enterprises, is still at its infancy. The study showed on third of Malaysian manufacturing SMEs has employed virtual R&D teams. Competitive advantage is now becoming available to SMEs through geographically open boundaries created by the virtual teams. Existing practices prove fourfold benefiting from the cross

functional virtual R&D teams, which are: 1- Reduce R&D cost and time, 2- More effective R&D, 3- Better output, 4- Increase coordination. Virtual R&D teams bring about better teams output, reduce time-to-market, reduced travel costs, ability to tap selectively into center of excellence, using the best talent regardless of location, greater degree of freedom to individuals, shorter development times, respond quickly to changing business environments, and finally higher team effectiveness and coordination. Therefore, the decision on setting up virtual R&D teams in the SMEs is not a choice but a necessity.

This study is probably the first to present an empirical study on virtual R&D teams, which was limited to Malaysian manufacturing SMEs. The future research needs to investigate the fourfold benefit of virtual R&D teams by a larger sample from different sectors. While some studies have been conducted on use of Virtual R&D teams in large companies, applications within SMEs remain undocumented. Future research should concentrate on this gap and find a virtual collaborative system for SMEs that are geographically dispersed. Such the collaborative system should virtually link SMEs, so the engaging members focus on their specialized tasks yet also can share their knowledge and experience (information resources) to create agile manufacturing environments and enterprises.

REFERENCES

- ABDUL RASHID, S. H. (2009) An investigation into the material efficiency practices of UK manufacturers. *Department of Manufacturing, School of Applied Sciences. Cranfield University.*
- ALE EBRAHIM, N., AHMED, S. & TAHA, Z. (2009a) Virtual R & D teams in small and medium enterprises: A literature review. *Scientific Research and Essay*, 4, 1575–1590.
- ALE EBRAHIM, N., AHMED, S. & TAHA, Z. (2009b) Virtual Teams for New Product Development – An Innovative Experience for R&D Engineers. *European Journal of Educational Studies*, 1, 109-123.
- BOBROW, E. E. (1997) *The complete idiot's guide to*

new product development, New York, Alpha Books.

CORSO, M., MARTINI, A., PAOLUCCI, E. & PELLEGRINI, L. (2003) Knowledge management configurations in Italian small-to-medium enterprises. *Integrated Manufacturing Systems*, 14, 46-56.

DENSCOMBE, M. (2006) Web-Based Questionnaires and the Mode Effect: An Evaluation Based on Completion Rates and Data Contents of Near-Identical Questionnaires Delivered in Different Modes. *Social Science Computer Review*, 24, 246-254.

DENSCOMBE, M. (2008) The Length of Responses to Open-Ended Questions: A Comparison of Online and Paper Questionnaires in Terms of a Mode Effect. *Social Science Computer Review*, 26, 359-368.

DEUTSKENS, E., DE RUYTER, K. & WETZELS, M. (2006) An assessment of equivalence between online and mail surveys in service research. *Journal of Service Research*, 8, 346-355.

EGBU, C. O., HARI, S. & RENUKAPPA, S. H. (2005) Knowledge management for sustainable competitiveness in small and medium surveying practices. *Structural Survey*, 23, 7-21.

EIKEBROKK, T. R. & OLSEN, D. H. (2007) An empirical investigation of competency factors affecting e-business success in European SMEs. *Information & Management*, 44, 364-383

FLORES, M. (2006) IFIP International Federation for Information Processing, *Network-Centric Collaboration and Supporting Fireworks*. Boston, Springer.

GASSMANN, O. & KEUPP, M. M. (2007) The competitive advantage of early and rapidly internationalising SMEs in the biotechnology industry: A knowledge-based view. *Journal of World Business*, 42, 350-366.

GASSMANN, O. & VON ZEDTWITZ, M. (1999) Organizing virtual R&D teams: towards a contingency approach. *IEEE Management of Engineering and Technology, Technology and Innovation Management. PICMET '99. Portland International Conference on Management of Engineering and Technology*. Portland, OR, USA.

GASSMANN, O. & VON ZEDTWITZ, M. (2003) Trends and determinants of managing virtual R&D teams. *R&D Management*, 33, 243-262.

GOSLING, S. D., VAZIRE, S., SRIVASTAVA, S. & JOHN, O. P. (2004) Should We Trust Web-Based Studies? A Comparative Analysis of Six Preconceptions About Internet Questionnaires. *American Psychologist*, 59, 93-104.

HANNA, V. & WALSH, K. (2002) Small Firm Networks: A Successful Approach to Innovation? . *R&D Management*, 32, 201-207.

HERTEL, G. T., GEISTER, S. & KONRADT, U. (2005) Managing virtual teams: A review of current empirical research. *Human Resource Management Review*, 15, 69-95.

HOFFMAN, K., PAREJO, M., BESSANT, J. & PERREN, L. (1998) Small firms, R&D, technology and innovation in the UK: a literature review. *Technovation* 18, 39-55

KRATZER, J., LEENDERS, R. & ENGELEN, J. V. (2005) Keeping Virtual R&D Teams Creative. *Industrial*

Research Institute, Inc., 1, 13-16.

LEVY, M., LOEBBECKE, C. & POWELL, P. (2003) SMEs, co-opetition and knowledge sharing: the role of information systems. *European Journal of Information Systems*, 12, 3-17

MAY, A. & CARTER, C. (2001) A case study of virtual team working in the European automotive industry. *International Journal of Industrial Ergonomics*, 27, 171-186.

MEZGAR, I., KOVACS, G. L. & PAGANELLI, P. (2000) Co-operative production planning for small- and medium-sized enterprises. *International Journal of Production Economics*, 64, 37-48.

MUNKVOLD, B. E. & ZIGURS, I. (2007) Process and technology challenges in swift-starting virtual teams. *Information & Management*, 44, 287-299.

PERRINI, F., RUSSO, A. & TENCATI, A. (2007) CSR Strategies of SMEs and Large Firms. Evidence from Italy. *Journal of Business Ethics*, 74, 285-300.

PIHKALA, T., VARAMAKI, E. & VESALAINEN, J. (1999) Virtual organization and the SMEs: a review and model development. *Entrepreneurship & Regional Development*, 11, 335 - 349.

PULLEN, A., WEERD-NEDERHOF, P. D., GROEN, A. & FISSCHER, O. (2008) Configurations of external SME characteristics to explain differences in innovation performance. *High Technology Small Firms Conference Twente University, Netherlands*.

RAYMOND, L. & CROTEAU, A. M. (2006) Enabling the strategic development of SMEs through advanced manufacturing systems A configurational perspective. *Industrial Management & Data Systems*, 106, 1012-1032.

SILLS, S. J. & SONG, C. (2002) Innovations in Survey Research: An Application of Web-Based Surveys. *Social Science Computer Review*, 20, 22-30.

SORLI, M., STOKIC, D., GOROSTIZA, A. & CAMPOS, A. (2006) Managing product/process knowledge in the concurrent/simultaneous enterprise environment. *Robotics and Computer-Integrated Manufacturing*, 22, 399-408.

AUTHOR BIOGRAPHIES

Nader Ale Ebrahim is Technology Management PhD candidate in the Department of Engineering Design and Manufacture, Faculty of Engineering, University of Malaya. He holds a Master of Science in mechanical engineering from University of Tehran with distinguished honors. His research interests focus on the management of virtual teams for new product development in SMEs R&D centers. His papers have published in the several referees journal.



Shamsuddin Ahmed is currently an Associate Professor in Manufacturing at the University of Malaya (UM), Malaysia. He obtained his first, second, and tertiary degrees from different reputed institutions of higher learning in different countries. He has been in graduate level teaching since 1986. He offered a good number subjects for both undergraduate and postgraduate studies and supervised a large number of students. He published more than 60 papers/articles in different international, regional and national journals, conference proceedings and bulletins. He assessed a good number of papers for a few journals including some Emerald journals.



Salwa Hanim Abdul Rashid is currently a Lecturer in the Department of Engineering Design and Manufacture, University of Malaya, Malaysia. She was awarded Bachelor of Engineering and Master of Science degrees in Manufacturing Management from Salford University and Loughborough University, respectively. She then completed her research and obtained her PhD in Sustainable Manufacturing from Cranfield University, United Kingdom. Other than Sustainable Manufacturing, her research interests focus on the organizational change and development of manufacturing companies.



Zahari Taha is currently a Professor of Faculty of Manufacturing Engineering at the University Malaysia Pahang. He obtained his PhD in Dynamics and Control of Robots from the University of Wales Institute of Science and Technology in 1987. From 1995 to 1998, he completed his postdoctoral at the University of Wales Institute College Cardiff in the area of engineering design and ergonomics. Prof. Zahari has published more than 100 papers in academic books, journals and proceedings. His major research interest includes mobile robots, underwater robots, surgical robots, ergonomics design, ergonomics at work, software development for traffic applications and motion analysis.

