

Standard Review

Virtual R & D teams in small and medium enterprises: A literature review

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Small and medium enterprises (SMEs) are the driving engine behind economic growth. While SMEs play a critical role in generating employment and supporting trade, they face numerous challenges, the prominent among them are the need to respond to fast time-to-market, low-cost and rapid solutions to complex organizational problems. Towards that end, research and development (R & D) aspect deserves particular attention to promote and facilitate the operations of SMEs. Virtual R & D team could be a viable option. However, literature shows that virtual R & D teaming in SMEs is still at its infancy. This article provides a comprehensive literature review on different aspects of virtual R & D teams collected from the reputed publications. The purpose of the state-of-the-art literature review is to provide an overview on the structure and dynamics of R & D collaboration in SMEs. Specifying the foundation and importance of virtual teams, the relationship between virtual R & D team and SMEs has been examined. It concludes with the identification of the gaps in the existing literatures and calls for future research. It is argued that setting-up an infrastructure for virtual R & D team in SMEs still requires a large amount of engineering efforts and deserves consideration at top level management.

Key words: Virtual teams, small and medium enterprises, literature review.

INTRODUCTION

SMEs are a major part of the industrial economies (Eikebrokk and Olsen, 2007; Robles-Estrada and Gomez-Suarez, 2007). Their survival and growth have therefore been a prominent issue. Beck et al. (2005) found that a strong and positive association between the growth of SMEs and GDP per capita growth. Their survival depended on their capability to market response, meeting performance and producing goods that could meet international standards (Gomez and Simpson, 2007). Organizations are currently facing unprecedented challenges in an ever dynamic, constantly changing and complex environment (Rezgui, 2007). It is urgent for SMEs to construct a network service platform to speed up the research and development process (Lan et al., 2004).

ICTs are indispensable for SMEs to innovate (Redoli et al., 2008). Web resource services can help the enterprises to get external service resources and implement collaborative design and manufacturing (Dong and Liu, 2006).

Responding to the increasing de-centralization and globalization of work processes, many organizations have responded to their dynamic environments by introducing virtual teams. Virtual teams are growing in popularity (Wayne F. Cascio, 2000). Additionally, the rapid development of new communication technologies such as the Internet has accelerated this trend so that today, most of the large organizations employ virtual teams to some degree (Hertel, Geister and Konradt, 2005). Research on virtual teams is still in its nascent stages (Badrinarayanan and Arnett, 2008; Prasad and Akhilesh, 2002) and because of the relative newness of virtual teams, many areas of research have not been examined (Badrinarayanan and Arnett, 2008). Camarinha-Matos and Afsarmanesh (2003) conclude that, setting-up an infrastructure for virtual team still requires a large engineering effort, which represents a

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Abbreviations: SMEs, Small and medium enterprises; R & D, research and development; ICTs, information and computer technologies.

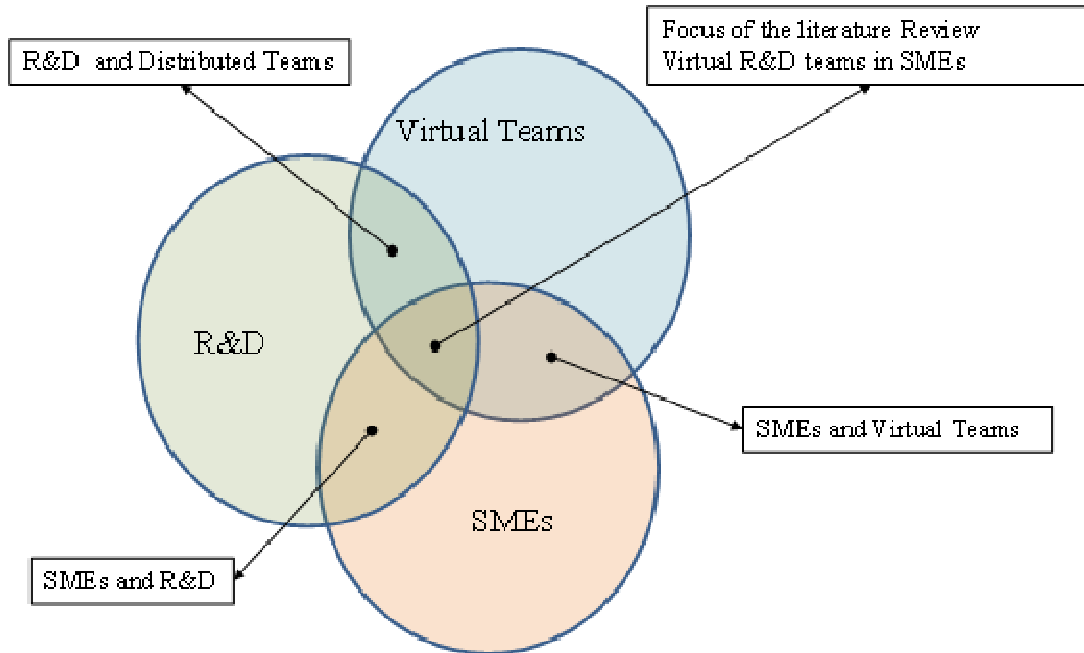


Figure 1. Literature fields included in the review - A general model.

major obstacle for the implantation of this new paradigm. Effective and efficient cooperation across disciplines and distributed teams becomes essential for the success of engineering projects (Zhang et al., 2008). Therefore, the experiments suggest that more research is needed to explore the ways to enhance the performance of virtual teams (El-Tayeh et al., 2008).

A small number of studies exclusively focused on the virtual R & D teams, for example (Gassmann and von Zedtwitz, 1999, 2003b; Kratzer et al., 2005; Tribe and Allen, 2003) and few of them concentrated on the virtual R & D teams in SMEs. This paper summarizes the key finding of precedent works on different aspects of virtual R & D teams in SMEs. It highlights the gaps and weaknesses in the existing literature on virtual R & D teams in SMEs. Finally, it identifies the future research directions in the area of concern.

LITERATURE SEARCH METHODOLOGY

Virtual R & D activities involving SMEs has not wide coverage. This review article is based on reliable and reputed publications that tried to accomplish the gaps. It mainly covers aspects like SMEs characteristics, scope of virtual R & D teams and their relationship with SMEs. The articles are collected from the following two sources:

1. Reputed journals, books and practitioners' literatures related to the topic published since 1997.
2. Research papers presented in a variety of conferences focusing on R & D and SMEs activities and technology management issues.

As there is no single definition of virtual R & D team in SMEs, there is a lack of specific research on the subject. A few studies have been done on virtual R & D teams in multinational companies. Hence, in order to find out structures, dynamics and management intervention in the field, a broader spectrum of literature has been considered. This review covered literatures in the areas of virtual R & D in general and its relevance with SMEs. The current understanding and thinking about SMEs and virtual R & D teams is found at the intersection of these separate fields, as illustrated in Figure 1.

The list of references contains approximately 194 items out of 537 selected items which were extracted from 1,425 pre-investigated items. To find relevant academic publications, some multidisciplinary databases were used. In order to find the relevancy a set of key words from a general model which is shown in Figure 1 were used. The general model for SMEs and virtual R & D teams enables a systematic integration of the fragmented literature on the topic. There is no consensus in the literature whether virtual teams are superior for SMEs or not. We argue that lack of SMEs will be sheltered by virtual teams.

The trend of publication shows that virtual R & D team in SMEs is an interesting topic in recent years. As an example, the distribution of published/cited articles per year extracted from Web of Science® data base is illustrated in Figure 2 to Figure 7.

VIRTUAL TEAMS: ORIGIN, TRENDS AND DEFINITION

While work teams were used in the U.S. as early as the

