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Managing supplier innovations – A systematic literature review

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Abstract

As organizations become increasingly specialized, the ability to engage suppliers in innovation efforts has become critical for success. An increasing number of researchers have emphasized the importance of leveraging supplier capabilities for innovation performance. In this paper we present intermediate results of a systematic literature review in supplier innovation. Our purpose is to map existing knowledge through systematic coding and make a synthesis of means and mechanisms that stimulate supplier innovations and of capabilities that are needed to integrate supplier innovations to business processes.

Keywords: Supplier Innovation, Supplier relationship management, literature review

Introduction

As products, processes, and services continue to grow in complexity, much potentially useful knowledge will necessarily reside outside the boundaries of the firm (Bercovitz and Feldman, 2007). The importance of accessing external sources of knowledge has been recognized in academic literature, and the ability to access and utilize these sources has been regarded as “a critical component of innovative performance” (Schiele, 2006, p. 925). These sources may comprise customers, suppliers, competitors, and research organizations or, in essence, any potential source of knowledge that a company can connect with in order to augment the company’s own knowledge base (Enkel, Gassmann and Chesbrough, 2009; Un, Cuervo-Cazurra and Asakawa, 2011). In the extant literature, the important role of suppliers in the context of innovations has been largely recognized (Pulles, Veldman and Schiele, 2014) and suppliers have been found to have the most positive impact on product innovation outcomes compared to collaboration with universities, customers, and competitors (Un et al., 2011).

Recently, collaborative innovation has gained lots of attention under the conceptual framework of open innovation (Chesbrough, 2003). One of the key processes in terms of open innovation is the outside-in process, which refers to enhancing focal company innovativeness by collaborating with external resources (Enkel et al., 2009). However, the specific role of suppliers in the innovation process has been less intensively researched in this line of research (Gassman, Enkel and Chesbrough, 2010). Furthermore, it has been claimed that extant studies, which focus on collaboration with suppliers, have taken a one-sided view. Wagner and Bode (2014) suggest that findings so far have mostly contributed to the model of supplier innovation where the buying firm is the active party, pulling innovations from the

supplier. Mechanisms that enable innovation push on the supplier's part in terms of voluntary sharing and offering of innovations to customers have thus received less attention.

In our study we aim to provide an overview of the current state of knowledge on supplier innovations. By summarising extant studies, we are able to identify means, mechanisms and research gaps regarding to innovations in buyer-supplier context. Our key research question is: *what is the current knowledge on how to enhance supplier-driven innovation in the context of buyer-supplier relationships?* Furthermore we question, *which aspects of supplier innovation deserve more attention in academic research?* Specific focus is given to focal firm activities in terms of 1) finding innovative suppliers 2) stimulating supplier innovation 3) co-creation and 4) integrating innovation to focal firm business. Based on the systematic literature review, findings are presented and considerations for further research directions discussed.

We focus on literature dealing with supplier innovation. We define innovations as new value-adding products and services, methods of production, markets, or ways to organize business (Fagerberg, 2005). Supplier innovations are defined as innovations created by or with suppliers. Both incremental and radical innovations are in our scope, as it has been proposed that buyer-seller interaction in supply chain relationships may lead to both (see Roy, Sivakumar and Wilkinson, 2004). We also consider both knowledge exploration i.e. the co-creation of new knowledge and knowledge exploitation i.e. transactions involving existing knowledge in our study (Paasi, Luoma and Valkokari, 2010).

Conducting the literature review

In order to ensure a replicable and transparent approach, the systematic literature review process outlined by Denyer and Tranfield (2009) was adopted. Systematic review locates existing studies, selects and evaluates contributions, analyses and synthesizes data, and reports the evidence as conclusions about what is and is not known (Denyer and Tranfield, 2009). Systematic literature reviews are likely to produce unbiased and comprehensive accounts of the literature.

Prior to starting the literature study, we conducted two interview rounds in five organizations regarding their collaboration practices with suppliers in innovation context. Four of the organizations are large industrial companies and one is a public organization; there were 1-3 informants (CPOs, and persons from product development) from each organization. The purpose was to get initial insight into the used practices and means, and ways to manage supplier innovation, as well as the areas where companies felt a need for additional knowledge and support. In addition a workshop with participants from each of the five organizations and two research institutions was organized to discuss the identified research interests and needs. Based on the interviews and the workshop, we identified four managerial viewpoints relevant for the study: 1) how to identify and find innovative suppliers, 2) how to stimulate suppliers to create novel ideas and innovations, 3) how to manage co-creation of innovations with suppliers, and 4) how to integrate supplier innovations into the buyer firm's business.

In this literature study we follow a five-step process that includes question formulation, locating studies, study selection, analysis and synthesis, and reporting and using the results.

As the first step, research questions are formulated as follows:

1. What is the current knowledge on how to enhance supplier-driven innovation in the context of buyer-supplier relationships?
2. Which aspects of supplier innovation deserve more attention in academic research?

Locating studies, the second step, aims to select and appraise research that is relevant to the research questions (Denyer and Tranfield, 2009). Literature search was conducted using specific keywords in three databases: Ebsco, Emerald, and ScienceDirect Elsevier. The keywords ‘supplier’ AND ‘innovation’ or ‘alliance’ AND ‘innovation’ were searched from article title, abstract, or keywords. The search was not limited to a certain time frame.

Study selection, the third step, requires transparency and a set of explicit selection criteria to assess the relevancy of each study (Denyer and Tranfield, 2009). The following inclusion and exclusion criteria were applied when reading the article titles, abstracts, and full papers: the papers should be full papers and written in English, should have a description of methodology, should be published in peer-reviewed journals, and should discuss buyer-supplier relationships and innovation as one of their main topics. Furthermore, the papers should have practical relevance and contribute to at least one of the four key managerial viewpoints introduced above. The papers with the following criteria will be excluded: not full papers, duplicate papers, and papers that are not addressing supplier management from the viewpoint of innovations. The selection process is described in Figure 1.

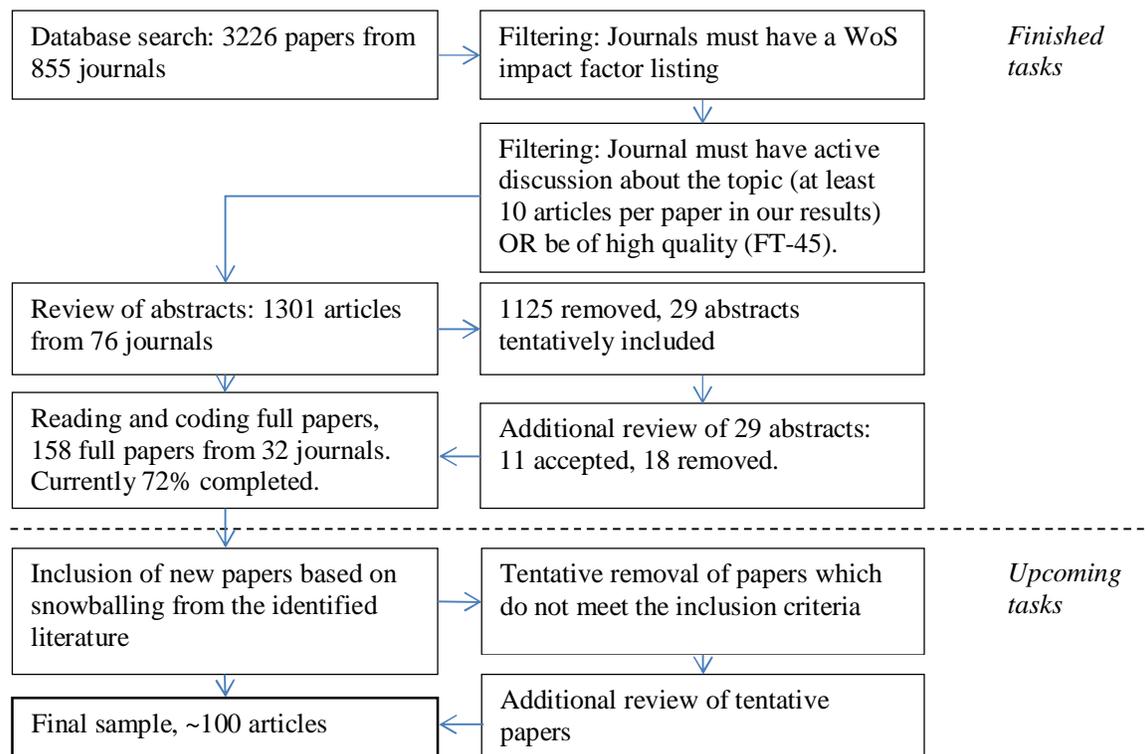


Figure 1. Selection process of the articles included in the data sample.

After reviewing of abstracts, all identified articles were read and coded according to an agreed protocol. From all articles, purpose of the article (or research questions), type of the inter-organizational tie the article deals with, theoretical base and research method applied,

and main findings were recorded. To address the research questions of this study, each article was coded based on the key activity that the paper focuses on. In addition, innovation type (product process, service) and studied mechanisms were coded.

During coding, re-checks were performed to ensure that the articles did in fact meet the inclusion criteria. If a coder identified that an article did not fulfill the inclusion criteria, another researcher evaluated the paper independently and if the same conclusion was made, the article was removed. If needed, the article was discussed in a meeting by all researchers.

Additional searches will be conducted in the form of snowballing from the identified literature.

The content analysis will be based on the coded data and aims at forming synthesis of the literature. The analysis provides answers to research questions 1 and 2, and requires identification of the main concepts in each selected article, and combining them to classes.

Preliminary results

At the time of the submission we have read 113 of the 158 full papers (72%). Of these papers we have included 62 and marked 51 for re-check and potential removal. Here we present preliminary results based on our partial sample of 62 papers.

In our database searches we used the keywords ‘supplier’ AND innovation’ or ‘alliance’ AND ‘innovation’. Both searches resulted in a significant number of articles, the keyword ‘supplier’ dominating slightly (55% vs 45%). However, during the review of abstracts, many of the alliance papers were removed because they did not specifically discuss buyer-supplier relationships. Of the 62 included papers, only 11 originated from the ‘alliance’ AND ‘innovation’ search.

The current sample consists of articles published in 30 academic journals. Looking at the distribution of journals according to the number of articles, two journals stand out. Ten of the papers have been published in the Journal of Product Innovation Management, whereas Industrial Marketing Management comes second with six articles. The rest of the journals had one to three articles each.

Our sample covers articles published between years 1981 and 2015. Graph in Figure 2 illustrates the increasing growth of interest in supplier innovation in the recent years.

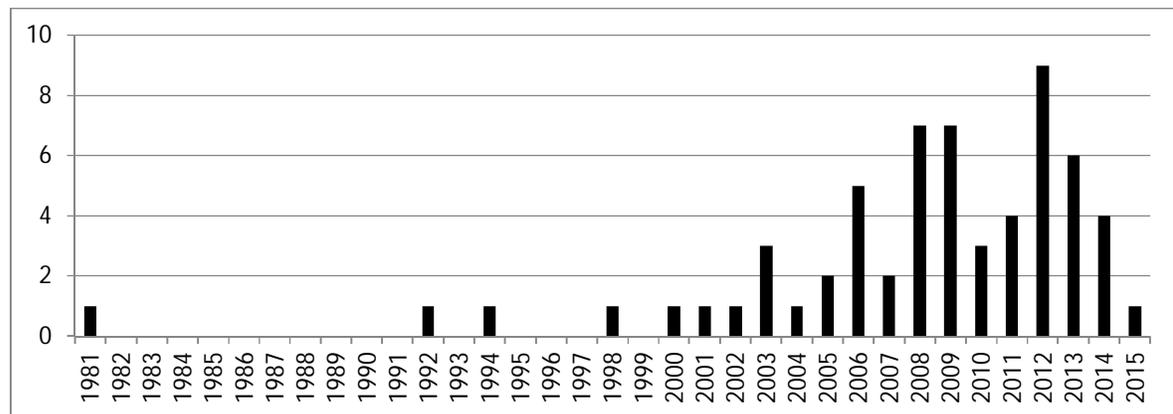


Figure 2. Number of articles per year

When looking at the type of inter-organizational ties, we observed that a clear majority (74%) of the articles examines dyadic relationships between a buyer firm and a supplier firm. Single occurrences were identified where the focus was on triadic relationships, supply chains, or technological platforms with the suppliers. Several articles discussed alliances with suppliers without defining the number of parties in the alliances.

The examined articles did not suggest any dominant theoretical paradigms in the studies of supplier innovation management (see Table 1). We classified the articles according to nine key theories in the management literature. Only 24 per cent of the articles fit into this classification. Some of the remaining studies mentioned additional theories, such as knowledge-based view, knowledge management, and network theory. However, majority of the studies did not clearly define any theoretical basis.

Table 1. Theoretical basis of the articles

Theoretical basis	Number of articles
Transaction cost economics	4
Contingency theory	3
Organizational learning	3
Social capital	2
Resource dependence	1
Social exchange theory	1
Agency theory	1
Resource based view	0
Institutional theory	0
Other	12
Not specifically defined	37

Surveys and case studies were the most frequently used methodologies in the examined studies (see Table 2). Remarkable is the large number of theory building case studies and surveys, and, on the other hand, the low number of conceptual studies aiming at forming synthesis or frameworks of the studied phenomenon. This observation suggests that the field has not yet reached maturity. In addition to the methodologies mentioned in Table 2, our sample included a few papers using social network analysis, consortial benchmark study, and action research methods.

Table 2. Methodology of the articles

Methodology	Number of articles
Survey	26
Case study	24
Secondary data	6
Simulation	6
Interview	4
Conceptual	4
Other	4

The magnitude, that is, the ‘newness’ of the innovation was defined only in circa 20% of the papers. Most of these studies discussed both radical and incremental innovations. Three papers examined system innovations. Around half of the papers (34) mentioned the type of innovations discussed. Product innovation was the dominating innovation type with 25 studies. Other mentioned types were process (9), service (3), technology (2), and architectural and component innovation (1).

Finally, we classified the articles according to the four key activities defined earlier (see Table 3). Majority (65%) of the papers discussed co-creation mechanisms between the buyer

firm and its suppliers. Mechanisms for identifying/finding innovative suppliers (13%), stimulating suppliers (21%), and integrating supplier innovations into focal company's business (21%) were featured in significantly fewer papers.

Table 3. Classification according to key activities

Key activity	Number of articles
Identifying / finding innovative suppliers	8
Stimulating suppliers	13
Co-creation	40
Integration to business	13

Content analysis

Next we present some preliminary observations of the content of each of the four activity categories.

Identifying and finding innovative suppliers

Most important criteria for selecting innovative suppliers are related to supplier capabilities and buyer-supplier relations. Supplier capability criteria cover, for example, technological capabilities, financial strength, delivery capability, and R&D capability. Specialized suppliers, who are committed to specialized technologies, are preferred over generic contractors (Schiele, 2006). Desired relational characteristics include good existing relations to the supplier, preferred customer status, geographical proximity, technological compatibilities, cultural fit, and good legal relationships. To maximize exposure to new ideas it is proposed that supplier network should consist of a large number of strategic suppliers, who are engaged in several collaborative ventures at the same time (Fox, Smith, Cronin Jr. and Brusco, 2013; Schiele, 2006). Supplier concept competitions, predevelopment projects, developing specifications, technology roadmaps, and purchasing scouts were mentioned as methods for finding and identifying innovative suppliers.

Stimulating suppliers

Supplier-specific investments such as ensuring compatibility of production and information systems and investments in specialized tools, equipment and training are proposed to stimulate supplier innovations. Similarly, customer-specific investments by the supplier are associated with more ideas for innovations (Wagner and Bode, 2014). Other mechanisms include keeping suppliers close with co-operation, trust, joint learning, information flows, and long-term contracts, and creating an atmosphere for open discussions. Gaining a preferred customer status is suggested to be an important driver of supplier innovation (Ellis, Henke Jr. and Kull, 2012). This can be supported by including suppliers into the focal firm's innovation processes, keeping promises, and refraining from opportunism. Supplier innovations are less likely in the case of low interactions, over-specified tenders, and high-development costs.

Innovation co-creation with suppliers

Most articles (40) of the studied 62 focus on innovation co-creation with suppliers, and several mechanisms to support co-creation of innovations with suppliers are proposed. First,

knowledge transfer mechanisms to access, transfer, and integrate knowledge between buyer and supplier, are proposed to play an important role in co-creation. Rich two-way knowledge sharing can be ensured by frequent face-to-face meetings, emails, and prototyping. Attention should be paid to the transfer of tacit knowledge (Nielsen and Nielsen, 2009). Co-creation activities may benefit from hiring new personnel and providing training for own and supplier's engineers. Furthermore, knowledge of the buyers' and supplier's development teams should also be complemented with outside knowledge sources (Grunwald and Kieser, 2007). Second, companies need to organize for co-creation purposes; for example establishing a separate organizational unit responsible for these activities may be beneficial (Joglekar and Rosenthal, 2003). Several authors emphasize the value of cross-functional interactions within the focal company. Moreover, collaboration can be organized by rotating employees between the buyer's and supplier's R&D teams. Third, some articles discuss managing co-creation in practice, for example by various communication, coordination, and development tasks, such as instituting procedures for daily updates on schedules, scheduled meetings with suppliers, joint problem solving, workshops, setting targets and measures, and quality checks. An important task is designing and negotiating contracts to address risk and reward sharing. One study suggests, that letting service suppliers retain control over their intellectual output leads to more innovation (Leiponen, 2008).

Additional insights suggest that mutual trust and identification facilitate co-creation. Mutual identification increases with cultural alignment, and shared norms and values. Understanding the other party's competencies and practices may help in collaboration. Buyers should therefore work closely with suppliers to learn about their technical competencies, organizational processes, and operations. They can also teach suppliers about their own standards, protocols, ways of doing business and long-term plans.

Last, the studied literature suggests that supplier performance should be evaluated periodically. On one hand, long-term commitment to suppliers may increase innovation performance. On the other hand, close supplier relationships may not be as important in high-velocity environments as in stable environments. Poorly performed suppliers may be switched to new ones. In some cases, it may be worthwhile to help suppliers in large development projects with investments. Managers need to balance alliance portfolios by weighing the benefits from large resource diversity against difficulties in managing many partners (Cui and O'Connor, 2012).

Integrating supplier innovations to business

Integration of supplier innovations into buyer's business can be facilitated by suitable internal organization and interactions with suppliers. Internally, the purchasing unit should be tightly linked with other functions such as R&D, design, and manufacturing. Cross-functional interaction, open company culture, and rotating employees between functions are recommended. Separate teams with purchasing and technological competences, or purchasing and commercial competences can be formed to conduct purchasing at a more strategic level (Schiele, 2010). Studies on interactions with suppliers emphasize frequent contact, fit between learning styles, and two-way information flows.

Conclusions

The purpose of this study is to map current academic knowledge on supplier innovation. The special interest area is the outside-in process of open innovation, which refers to enhancing

focal company innovativeness by collaborating with external resources. By selecting a systematic literature review method, we study the breadth, level and focus areas of extant literature. An important goal is to get guidance for future research efforts.

This article contributes to two areas of supplier relationship management: how to identify and access the best ideas and suppliers in the supply markets, and how to increase and stimulate the innovative performance of key suppliers. Currently the main contribution is in identifying means and mechanisms that stimulate innovations and enhance innovation co-creation. This will be further elaborated and a typology derived in order to understand how to manage the complexities of supplier innovation. Some means, practices and capabilities that connect supplier innovations to business and business performance are identified.

Initial findings suggest that co-creation is the dominating form of supplier innovation in the studied literature. Scant attention (eight articles) has been directed towards identifying and finding the most suitable suppliers. Stimulating suppliers and integration to business are both studied in 13 articles.

Some additional observations were made. First, the sample includes a number of articles claiming, on a quite general level, that supplier innovation leads to improved firm performance without providing further understanding, detailed evidence or patterns to support this claim. Second, definition on supplier innovation was missing or inadequate in most articles. Third, as we were searching for mechanisms on how to promote supplier innovations, the lack of social mechanisms among the most studied ones could be observed. Finally, the four key activities regarding supplier innovation that were identified in the initial stages of our research (i.e. identifying and finding suppliers, stimulating suppliers' innovative performance, innovation co-creation, integrating supplier innovations to business) proved to be a useful and usable basis for classifying of the articles, and is believed to help in the final analyses.

This paper presents work-in-progress study on literature on supplier innovations. The study will be completed by a thorough content analysis during Spring 2015. In further analyses, particular interest will be directed towards identifying focus areas of current research and types of managerial guidance offered. The plan is to compare these findings with the needs of companies that participate in our research project in guiding their efforts in supplier innovation management. This comparison will help to identify research gaps and under-researched areas. The results of this literature review will be used in designing further empirical studies. Potential research questions may include:

- a. Which aspects of supplier innovation deserve more attention in academic research? Which topics are suitable for our empirical studies?
- b. How to enhance supplier-driven innovation in the context of buyer-supplier relationships?
- c. What are the mechanisms in dyadic buyer-supplier setting that enable and facilitate the transfer of knowledge between the buyer and the supplier for innovation purposes?
- d. How useful are the mechanisms presented in literature from the viewpoint of companies?

This study provides an overview of the state of knowledge on supplier innovations. Still, there are some limitations. We wanted to select articles that focus on supplier innovation and have a managerial viewpoint. These criteria were not always easy to judge based on the abstract, or not even the full text, which may affect the sample. Furthermore, we have

specifically used the term 'innovation' in our article searches. This choice has left out articles that have omitted this term, but that concern development or improvement of products, services or processes in the same sense as articles that have actually used the term.

References

Bercovitz, J.P., Feldman, M.P. (2007). Fishing upstream: Firm innovation strategy and university research alliances. *Research Policy*, 36 (7) pp. 930–948.

Chesbrough, H. (2003). *Open innovation: The new imperative for creating and profiting from technology*. Boston, MA: Harvard Business Press.

Cui, A.S., O'Connor, G.C. (2012). Alliance portfolio resource diversity and firm innovation. *Journal of Marketing*, 76(4), pp. 24-43.

Denyer, D., Tranfield, D. (2009). Producing a systematic review. In: Buchanan, D.A., Bryman, A., (Eds.). *The SAGE Handbook of Organizational Research Methods*. Thousand Oaks, CA: SAGE Pub, 671-689.

Ellis, S.C., Henke Jr., J.W., Kull, T.J. (2012). The effect of buyer behaviors on preferred customer status and access to supplier technological innovation: An empirical study of supplier perceptions. *Industrial Marketing Management*, 41(8), pp. 1259-1269.

Enkel, E., Gassmann, O., Chesbrough, H. (2009). Open R&D and open innovation: Exploring the phenomenon. *R&D Management*, 39(4), pp. 311-316.

Fagerberg, J. (2005). Innovation: a guide to the literature, in Fagerberg, J., Mowery, D.C. and Nelson, R.R., In: *The Oxford Handbook of Innovation*, Oxford University Press, New York, pp. 1-26.

Fox, G.L., Smith, J.S., Cronin Jr., J.J., Brusco, M. (2013). Weaving webs of innovation. *International Journal of Operations and Production Management*, 33(1), pp. 5-24.

Gassman, O., Enkel, E., Chesbrough, H. (2010). The future of open innovation. *R&D Management*, 40(3), pp. 1-9.

Grunwald, R., Kieser, A. (2007). Learning to reduce interorganizational learning: An analysis of architectural product innovation in strategic alliances. *Journal of Product Innovation Management*, 24(4), pp. 369-391.

Joglekar, N.R., Rosenthal, S.R. (2003). Coordination of design supply chains for bundling physical and software products. *Journal of Product Innovation Management*, 20(5), pp. 374-390.

Leiponen, A. (2008). Control of intellectual assets in client relationships: Implications for innovation. *Strategic Management Journal*, 29(13), pp. 1371-1394.

Nielsen, B.B., Nielsen, S. (2009). Learning and innovation in international strategic alliances: An empirical test of the role of trust and tacitness. *Journal of Management Studies*, 46(6), pp. 1031-1056.

Paasi, J., Luoma T., Valkokari K. (2010). Knowledge and intellectual property management of customer-supplier relationships, *International Journal of Innovation Management*, 14(4), pp. 629–654.

Pulles, N., Veldman, J., Schiele, H. (2014). Identifying innovative suppliers in business networks: An empirical study, *Industrial Marketing Management*, 43(3), pp. 409-418.

Roy, S., Sivakumar, K., Wilkinson, I. F. (2004). Innovation generation in supply chain relationships: A conceptual model and research propositions. *Journal of the Academy of Marketing Science*, 32(1), pp. 61-79.

Schiele, H. (2006). How to distinguish innovative suppliers? Identifying innovative suppliers as new task for purchasing, *Industrial Marketing Management*, 35(2), pp. 925-935.

Schiele, H. (2010). Early supplier integration: The dual role of purchasing in new product development, *R&D Management*, 40(2), pp. 138-153.

Un, A.C., Cuervo-Cazurra, A., Asakawa, K. (2010). R&D collaborations and product innovation. *Journal of Product Innovation Management*, 27(5), pp. 673-689.

Wagner, S.M, Bode, C. (2014) Supplier relationship-specific investments and the role of safeguards for supplier innovation sharing, *Journal of Operations Management*, 32(3), pp 65-78.