

**PURCHASING AND SUPPLIER INVOLVEMENT IN  
DISCONTINUOUS INNOVATION: A LITERATURE REVIEW**

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## Summary

This paper investigates the question: *what is the role of Purchasing and supplier involvement in discontinuous innovation?*

The paper defines new product development and innovation, focusing on the differences between radical, discontinuous and disruptive innovation. The paper reviews the existing literature on

both purchasing and supplier involvement, formulates propositions and constructs an initial typology identifying the role of purchasing and supplier involvement in innovations of different degrees of change.

Keywords: discontinuous innovation, supplier involvement, purchasing involvement

## Introduction

Early and extensive involvement of key suppliers is widely regarded as critical to improving New Product Development (NPD) performance (Petersen, Handfield and Ragatz, 2005; van Echtelt, Wynstra, van Weele and Duyesters, 2008). Early Supplier Involvement (ESI) is seen as a way to capitalise on suppliers' complementary capabilities and a route to achieve superior design for manufacture. Various organisational functions interact with suppliers as part of technological development activities, not least Purchasing, which can perform an important go-between function and facilitate ESI processes (Wynstra, Axelsson and van Weele, 2000; Lakemond, van Echtelt and Wynstra, 2001). However, recent research has begun to question the relevance of ESI in radical product innovation. For example, Song and Parry (1999), Ragatz, Handfield and Petersen (2002), Primo and Amundson (2002) and Song and Benedetto (2008) have explored the role of ESI in projects characterised by high technological uncertainty. Although studies show some disagreement (see Petersen et al, 2005), research is beginning to evolve suggesting that existing suppliers may be less important than new suppliers in conditions of technology uncertainty i.e. radical innovation. These studies suggest that ESI may not be beneficial when companies are faced with radical technological changes. This paper investigates the role of Purchasing and suppliers in discontinuous innovation, reviewing the existing literature, identifying research gaps and future research opportunities.

Bessant, Lamming, Noke and Phillips (2005) and Phillips, Lamming, Bessant and Noke (2006) explored the role of suppliers in discontinuous innovation; in other words innovations that fundamentally break with existing technological paradigms (Martin, 1984), suggesting that under the conditions

of discontinuous innovation the "rules of the game" change necessitating the need to look in unfamiliar "dark" areas and developing relationships with organisations from unfamiliar zones. Arguing that discontinuous innovation calls for involvement of suppliers located outside existing supply chains, Phillips et al (2006) suggested that long-term stable supplier partnerships may have limited innovative potential; supplier 'dalliances' (new unknown suppliers) rather than alliances are required. According to this emerging idea, innovating companies should therefore seek to develop short-term relationships with actors that are located on the periphery or even outside the company's usual perceived supply chain boundary. Pursuing traditional ESI may therefore be the wrong strategy if companies want to pursue discontinuous innovation. Very little research exists that have explored how discontinuous – or disruptive – innovation may change the need for and processes of ESI and the role of Purchasing in facilitating this process is more or less entirely unknown a represents and major research gap. Therefore this paper investigates the question: *what is the role of Purchasing and supplier involvement in discontinuous innovation?* The paper begins by defining NPD and innovation, focusing on the differences between radical, discontinuous and disruptive innovation. The paper reviews the existing literature on both purchasing and supplier involvement and constructs a typology identifying the role of purchasing and supplier involvement in innovations of different degrees of change. The paper concludes by outlining conceptual and managerial contributions and a future research agenda.

## Radical, Discontinuous, or Disruptive Innovation? Defining the Concepts

"Innovation is the introduction of a new product, process, system or device – to be

distinguished from invention which is a new idea, a sketch, or model for a new improved device, product, process, or system.” (Freeman, 1992). The concepts of change and newness are therefore central to understanding innovation. However, the terms ‘product innovation’ and ‘(new) product development’ appear to be used interchangeably in the literature; often product innovation implies a higher degree of product change than NPD (Hart, 1996) but it is not a clear cut definition as innovation takes account of both small and large degrees of change.

Recent research into the management of innovation has focused on open innovation (Chesbrough 2003). In order to deal with today’s rapid changes in its external environment the innovation process has become collective and combinatorial (Coombs and Metcalfe, 2000) in character and emphasis has shifted towards firms’ external relationships as a means of accessing and acquiring new capabilities. Through increased collaboration and co-operation with other firms, the firm is able to access a further range of capabilities and create a ‘pool of resources’ (Loasby, 1994).

Discontinuous technologies should not be confused with, or considered being akin to radical innovations; the two are discrete and different. Radical innovations involve the development of a new technological paradigm that creates new knowledge and understanding and potentially new industrial sectors. This, in turn, has a significant impact on the firm in terms of establishing new competencies and skills that are appropriate for the technologies associated with this paradigm (O’Connor and Veryzer, 2001; Rice *et al*, 2002). In contrast, discontinuous innovations involve a paradigm shift - a move across to an existing technological paradigm. This does not require the development of new knowledge or skills but rather the application of existing knowledge in an alternative field or sector. For example, Danish medical devices company

Coloplast hired an astrophysicist to help think about products of the future, which enabled them to apply a different mindset to help them identify how they could employ their existing capabilities in alternative ways (Bessant and von Stamm, . For the firm this will involve acquiring the necessary competencies and skills and adjusting the mindset of the organisation to view its technological base in a new or different light. As Linton (2002) highlights: “*disruptive technologies are discontinuous, but discontinuous technologies are not necessarily disruptive.*

From further research into disruptive technologies, we contend that the focus of analysis is primarily the end-user or customer (Abernathy and Clark, 1985; Moore, 1991; Bower and Christensen, 1995; Christensen, 1997). We interpret from this that a disruptive technology is not disruptive *per se* to the firm but more so to the customer and market, altering end-users perception of a product in terms of performance, value and their willingness to pay for added features. This has a knock-on effect on an industry or sector, as customer preference moves away from the current market leader towards the producer of the emerging disruptive technology. For example, Dyson’s dual cyclone vacuum cleaner may not have seemed like a radical innovation in terms of new technology, but it disrupted the existing business model of vacuum cleaners, making vacuum cleaners with bags that need replaced when full, redundant. For incumbents, a discontinuous technology becomes disruptive when they are unprepared and surprised by the emergence of an emerging discontinuous technology, or lack the necessary experience to cope, requiring the necessary competencies and skills to either exploit or counteract this technology. This is supported by Tripsas (1997) and Rothaermal (2002) who reveal incumbents’ survival is more likely if they have the necessary complementary assets required to commercialise the technology.

In the Innovator's Dilemma, Christensen (1997) proposes that the close linkages between organisations within the same value network may prevent firms from perceiving the threat of a potentially disruptive technology. This relates to the work of Abernathy and Clark (1985) which addresses the difficulties that firms face when changing their broader capabilities when confronted with discontinuous conditions. Phillips et al (2006a) have adapted Abernathy and Clark's model in order to better understand the explored the role of suppliers in discontinuous innovation. Abernathy and Clark's identification of *regular* innovation, in which existing competencies and relationships may suffice, indicates the need for customers and suppliers to work together (not necessarily equally) for continuous improvement. Where competencies must be replaced but existing relationships are considered able to support such change, Clark's *revolutionary* innovation is present. *Niche creation* means finding new outlets for existing strengths. When a firm seeks to disrupt a marketplace, or must respond to another firm doing so, it may be necessary to replace both competencies and supply relationships. This is Abernathy and Clark's *architectural* state, the extreme case equating to discontinuous innovation, here Phillips et al (2006a) propose the need for strategic dalliances' - short term, high diversity encounters amongst players in an emerging new network.

### **Supplier Involvement in Incremental NPD**

Research on early supplier involvement (ESI) in NPD has grown substantially over the last three decades and a body of research, which has analysed the potential benefits as well as challenges, has developed (Johnsen, 2009). Most of the early studies of ESI focused on incremental NPD projects, especially in the automotive industry. Although studies have now examined a range of different

industries it is not until relatively recently that projects involving a high degree of technological uncertainty has been considered: Eisenhardt and Tabrizi (1995) analysed supplier involvement as one of many other variables and their study was the first to question supplier involvement benefits in situations of technological unpredictability. Later studies that focused more on supplier involvement also supported this viewpoint (Swink, 1999; Primo and Amundson, 2002).

Johnsen's (2009) review of the literature suggests a set of success factors grouped under three headings:

1. Supplier Selection:
  - Early supplier involvement
  - Clear distinction between supplier roles & levels of involvement
  - Supplier selection & evaluation prioritizing innovative capability & complementarity
2. Supplier Relationship Development & Adaptation:
  - Shared training
  - Mutual trust
  - Risk & reward sharing
  - Agreed performance targets & measures
  - Supplier representation on NPD team
  - Mutual commitment: no opportunistic abuse of power
3. Internal Customer Capabilities:
  - Top management commitment
  - Internal cross functional coordination

This set of success factors is echoed in other research such as Ragatz et al (1997). Research suggests that best practice supplier selection processes need to ensure involvement of suppliers of high value and risk items during the concept stage or during early feasibility studies (e.g. Takeishi, 2001). Such suppliers in turn should be selected and evaluated according to their innovative capability and

complementarity (Petersen et al, 2005). The need for supplier relationship development and adaptation includes for example shared training (Ragatz et al, *ibid*), mutual trust and commitment (LaBahn and Krapfel, 2000; Song and Benedetto, 2007), risk and reward sharing (Ragatz et al, *ibid*), agreed performance targets and measures (Petersen et al, 2005; Echteit et al, 2008), and supplier representation on the customer's NPD team (Ragatz et al, *ibid*; Petersen et al, 2003). Internal capabilities of the customer include top management commitment (Ragatz et al, 1997) and internal cross-functional coordination (Takeishi, *ibid*).

The relatively small amount of research to date on ESI in NPD projects characterised by high technological uncertainty suggests a need for a particularly careful supplier selection process to ensure that supplier technical capabilities are emphasised and requires high asset specificity (Wasti and Liker (1997) and Song and Benedetto (2008). Ragatz et al (2002) and Petersen et al (2003) make less specific suggestions but suggest that technological uncertainty calls for careful supplier integration of suppliers on customer NPD teams. However, high technological uncertainty and radical innovation are not the same as discontinuous innovation, as discussed in the first part of our paper, and the literature on the relevance of ESI in such conditions is scarce.

### **Early Purchasing Involvement (EPI) in NPD: the challenge of discontinuous innovation**

Buyers are well placed to connect NPD to external resources. In fact, 30 years ago Farmer (1981) advocated a continuous dialogue between engineering and purchasing in order to improve NPD performance, but compared with ESI there is little research on the purchasing-focused equivalent: Early Purchasing Involvement (EPI). Nevertheless, some empirical

evidence of the positive impact on NPD can be found (Atuahene-Gina, 1995; Handfield et al., 1999; Nijssen et al. 2002).

Burt and Soukup (1985) specified the nature of the purchasing contribution identifying six points in the design process where purchasing should provide information and advice to engineering. In their description, purchasing does not only appear as a facilitator between NPD projects and supplier development ability, but they are also a contributor *per se*. For example, in the investigative phase, purchasing can provide information about cost, performance, market availability, quality, and reliability of components that suppliers can furnish. Thus, their unique knowledge of the supply market and high level of interaction with other functions involved in NPD give buyers a unique opportunity to facilitate the transfer of supply and supplier needs. Crozier and Friedberg (1977) define such a boundary-spanning role as "marginal-secant" - "the position of an actor that is the stakeholder of different systems of action, playing the role of a go-between and interpreter" (p 86). They suggest that in a steady state of the environment, the importance of this role is low; however, when faced with uncertainty and discontinuity, such actors gain importance and power within the organisation.

### *The organisational challenge of EPI: the ambidextrous challenge*

If the existence of a positive effect of ESI is becoming widely acknowledged firms seem to have only a limited understanding of how to organise the inclusion of suppliers in NPD. Schiele (2010) have pointed out the lack of research examining the organisational challenge of ESI. Lakemond et al. (2001) provide an interesting contribution by identifying six different configurations for involving purchasing in NPD mainly based on the degree of integration of the purchaser in the project ranging from "ad-hoc" to

formalised. In their study, the main criteria explaining the choice of a specific configuration are project complexity in terms of the number and newness of technologies and size. Further contingent factors for the organisation of ESI include: the degree of responsibility delegated to the supplier (Le Dain et al., 2010; Olausson et al., 2009), the degree of task dependence (Lakemond, 2006) and the overall risk of the supplied component for the achievement of the project objectives (Le Dain et al., 2010). For other researchers the challenge of an “effective” organisation for ESI success is a matter of fit between the strategic management arena and the operational project management arena (Van Echtel et al., 2008). The two arenas are distinct yet strongly interrelated, so the effectiveness of a configuration for involving purchasing in NPD depends on the firm’s ability to capture both short-term and long-term benefits.

Schiele (2010) resumes the challenge of EPI by stressing its dual role: to support the process of innovation while maintaining cost and integration responsibility over the entire product life cycle for the entire firm. We can identify here a classical *exploration* and *exploitation* paradox of organisation introduced by March (1991). March (ibid) suggests that *exploration* and *exploitation* are self-reinforcing, and because they compete for scarce resources, they tend to crowd each other out. So the challenge of *ambidextrously* seems to be very difficult for a function so intimately connected to the exploitation success as purchasing. Early ambidexterity models suggest that the structural separation of exploration and exploitation activities enables firms to pursue both simultaneously. Structural separation is necessary because individuals who have operational responsibilities cannot explore and exploit simultaneously, as dealing with such contradictory frames creates operational inconsistencies and implementation conflicts (Benner and Tushman, 2003; Gilbert, 2006). As a

validation of the theory, we can observe a possible distinction between a department called ‘advanced (or forward) sourcing’ and another department called ‘strategic sourcing’ (Calvi, 2000). The advanced sourcing team is integrated into all NPD projects while the “strategic sourcing team” have a stronger commercial focus and a connection with internal customers. But, for O’Reilly and Tushman (2004) the effectiveness of organisation depends to the nature of innovation effort sustained by the exploration process; discontinuous innovation requires a different organisational arrangement than incremental innovation. For example, BMW has implemented a third form of EPI organisation with a purchasing innovation department dedicated to the scanning of their supply market for innovations.

In contrast to the authors who advocate the separation of exploration and exploitation, Gibson and Birkinshaw (2004) suggest that ambidexterity is something that should be present in the mind of each employee rather than being incorporated into the structure of the organization. They assert that ambidexterity is achieved by building an organizational context at the business unit level that emphasizes both performance management and social support. According to these researchers, structural separation between exploration and exploitation units can lead to harmful isolation, and frameworks that are based exclusively on organizational structure are top-down by nature. This is in line with the work of Phillips et al (2006b) which highlights the difficulties of ambidexterity and the difficulties of building entrepreneurial activities within established firms where activities need to be integrated, to some degree, with the rest of the organisation. Instead they identify “intrapreneurship” (Buckland et al, 2003) as an alternative to spin-outs or new venture group models.

*Towards a typology of purchasing and supplier involvement in incremental and discontinuous innovation*

Many companies appear to have formalized the processes by which buyers and suppliers should be involved in their NPD projects. But are these processes still appropriate when the context switches from incremental to discontinuous innovation? Although models of best practice exist that define the rules of the game with respect to managing the innovation process, it is evident that even the best firms can stumble and fall, particularly when confronted with discontinuous conditions which may involve radically new or different technological capabilities or market linkages (Christensen and Rosenbloom, 1995; Christensen, 1997). Under such conditions operational routines and processes may fail and upstarts may seize the competitive advantage. Under “steady state” conditions close relationships and the development of strategic alliances are strongly propounded as a means of supporting the process of technological innovation (Lamming, 1993; Spekman *et al*, 1998; Cavusgil *et al*, 2003), enabling a continual flow of product and process innovation. However, discontinuous innovation requires “doing things differently” (Phillips *et al*, 2006b) the process is highly explorative and experimental, involving “probing and learning, rather than targeting and developing” (Rice *et al*, 1998). Under such conditions the strong ties that support continuous innovation may break down and may prevent firms from sensing signals that may emerge from beyond their existing value network, in dark and unfamiliar selection environments (Phillips

*et al*, 2006a). Based on the existing extensive literature on EPI and ESI in NPD, and the more recent and limited literature on EPI and ESI and discontinuous innovation we propose the following:

P1: Whereas in incremental innovation it is best practice is to involve existing suppliers in the NPD process, in discontinuous innovation companies need to identify and involve new unknown suppliers located outside existing supply chains.

P2: Whereas in incremental innovation it is best practice is to involve strategic suppliers where a high degree of trust and commitment exist, in discontinuous innovation companies need to be more opportunistic and have short term dalliances with new suppliers.

P3: Whereas in incremental innovation it is best practice is to involve strategic suppliers where a high degree of mutual dependence, strategic alignment and cultural compatibility, in discontinuous innovation companies need to be more opportunistic and have short term dalliances with new suppliers.

P4: Whereas in incremental innovation it is best practice is to have open communication of e.g. requirements and specifications with strategic suppliers, in discontinuous innovation companies need ask suppliers for solutions as they do not know what they need.

Based on these propositions we construct the following initial typology:

**Table 1. Purchasing and Supplier Involvement in Incremental NPD vs. Discontinuous Innovation: Initial Typology**

	<b>Incremental</b>	<b>Discontinuous</b>
<i>Supplier Selection</i>	Search in existing supply base: evaluate according to innovative capability and complementarity	Search outside existing supply base Attract new unknown suppliers from other industries. Innovative capabilities particularly important
<i>Trust</i>	Built on established norms and values, past experience and reputation	Established through formal measures. Parties protect knowledge close to core business
<i>Early supplier involvement (timing)</i>	Early involvement is critical i.e. during concept or feasibility development	Possibly very early
<i>Commitment</i>	Long-term Demonstrated by sharing of sensitive information. Shared training.	Short-term, limited to duration of project Limited sensitive information shared. Easy to break off
<i>Interdependence</i>	Partners must co-operate if their goals are to be achieved; other party is important business partner	Need for opportunistic behavior; little need for interdependence
<i>Communication</i>	Open and multi-interface	Information-sharing limited to project
<i>Cultural compatibility:</i>	High compatibility supporting close working - joint culture	Low compatibility
<i>Strategic alignment &amp; risk &amp; reward sharing</i>	Objectives and technology roadmaps aligned; performance targets agreed; suppliers share in risks and rewards	Limited – future of relationship is not hanging in the balance
<i>Sourcing boundary-spanning role</i>	Connecting to existing close suppliers	Scanning for new potential suppliers in distant locations
<i>Purchasing communication with suppliers</i>	Giving suppliers clear instructions through functional specifications	Asking suppliers for solutions

### **Conclusions and Avenues of Further Research**

This paper has investigated the question: *what is the role of Purchasing and supplier involvement in discontinuous innovation?* We have defined new product development and innovation, focusing on explaining the differences between radical, discontinuous and disruptive innovation. The paper reviewed the existing literature on both purchasing and supplier involvement and we have put forward a set of propositions and an initial typology identifying the role of purchasing and supplier involvement in

innovations of incremental and discontinuous innovation.

The literature review and the propositions indicate avenues of further research. There is clearly a need for further conceptual and empirical research on the role of supplier involvement in discontinuous innovation but even more so there is a need to explore the role of purchasing within this context. The propositions and typology have been developed on the basis of existing research and we have included some purchasing aspects from existing research but there is clearly a need for much more research into

this issue. Our future research plans are to explore empirically the propositions that are also captured in the initial typology with a view to provide rich examples of the process of managing supplier, and especially purchasing, involvement in discontinuous innovation.

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