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How can firms locate proactive strategic flexibility in their new product development process?: The effects of market and technological alignment

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ABSTRACT

This study examines proactive decision-making and design flexibilities in new product development (NPD) as critical forms of strategic flexibility. The conceptual framework identifies market and technological alignment as drivers of proactive strategic flexibility, and examines their association with strategic NPD performance and fit with market demands. The model is tested using data collected from a sample of 103 European manufacturing firms. The results suggest that market and technological alignment are important in developing proactive decision-making and design flexibilities, which in turn have significant effects on strategic NPD performance and NPD fit with market demands. Overall, the study will help managers develop a better understanding of key similarities and differences in proactive strategic flexibility practices and decide how to allocate resources to achieve market and technological alignment supporting their NPD activities. The paper provides novel insights into proactive strategic flexibility in NPD, its alignment with market and technological environments, and its effects on product development performance.

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Introduction

Strategic flexibility plays a crucial role in product competition, as it allows firms to adapt to uncertain and rapidly changing environments by building and using a pool of flexible product development resources (Dai et al., 2018; Kortmann et al., 2014; Li et al., 2017; Magnusson & Pasche, 2013; Sanchez, 1995; Waleczek et al., 2019; Wei et al., 2013; Zhou & Wu, 2010). Quick technological shifts, rapid product proliferation, higher product customisation, and riskier product launches pressure firms to increase flexibility in their new product development (NPD) so they can change their new product strategies and reposition themselves quickly (Eisenhardt et al., 2010; Gerwin, 1993; Narasimhan & Das, 1999; Sanchez, 1995; Zhou & Wu, 2010). In such dynamic product competition, which necessitates creating customer value by providing both high variety and high speed, proactive strategic flexibility becomes especially critical for changing game plans, surprising competitors, and/or leading a transformation of

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the business environment (Celuch et al., 2007; Evans, 1991; Johnson et al., 2003; Koste & Malhotra, 1999; Li et al., 2017; Sushil, 2015).

Proactive strategic flexibility in NPD can be described as a dynamic capability that enables firms to adapt to and/or anticipate future NPD requirements by acquiring, transforming, and reconfiguring resources (Eisenhardt & Martin, 2000; Sanchez, 1995). However, there is little knowledge of whether and how different forms of proactive strategic flexibility might better enhance firm performance and product competition, and what kind of strategic alignments are required to develop them. Most research on proactive strategic flexibility focuses on single forms such as strategic flexibility in decision-making (Sharfman & Dean, 1997) and network structures (Young-Ybarra & Wiersema, 1999). The current understanding of the determinants and roles of different forms of proactive strategic flexibilities in product performance is still in the developmental stage. This research indicates that for firms to derive value from proactive strategic flexibility in NPD, managers must clearly define the link between the development and coordination of capabilities (such as technological and market alignment) in NPD capability strategies (e.g., flexibilities of design and decision-making). Therefore, there is an urgent need to develop theoretical explanations of the underlying antecedents and consequences of proactive strategic flexibility in the NPD context. To fulfill this gap, this research aims to examine 1) the drivers of proactive strategic flexibility, 2) the development of different forms of proactive strategic flexibilities, and 3) the impact of proactive strategic flexibilities on NPD performance.

Innovating firms must decide where they should locate their proactive strategic flexibility in the NPD process to achieve the most competitive advantage in dynamic markets. Sanchez (1995) suggests that strategic flexibility depends jointly on the flexibility of firms' resources and abilities such as design, and on their flexibilities in applying those to multiple courses of NPD related decisions. Johnson et al. (2003) supported Sanchez's (1995) argument that firms need to develop a portfolio of capabilities to trigger a variety of options to develop strategic flexibility. Design and decision-making flexibility are closely intertwined with the NPD process. Design flexibility helps a firm 'pursue a more efficient development strategy that can tolerate a higher risk of design changes' (Thomke & Reinertsen, 1998, p. 14). Product design is indeed an important 'strategic activity' (Whitney, 1988) that is closely linked to marketing (Hsu, 2011; Prabhaker et al., 1995; Souder & Moenaert, 1992; Woodside et al., 1999), as it may be used strategically to ensure flexible market responses. As such, this research considers proactive design flexibility as one important form of flexibility capabilities.

However, the NPD process involves not only activities but also decisions, from idea generation through to market launch (Schmidt et al., 2001), and NPD decision-making is very dynamic owing to constantly changing consumer preferences, competitive moves, and available technologies. Hence, it is also essential for firms to develop their ability to make fast and effective strategic decisions by maintaining multiple simultaneous decision alternatives during the NPD process (Aaker & Mascarenhas, 1984; Atuahene-Gima & Li, 2004; Eisenhardt & Zbaracki, 1992; Sharfman & Dean, 1997). The capabilities associated with strategic decision-making can be viewed as part of a 'surprise management' approach, which necessitates early detection and analysis of strategic options (Ansoff, 1975). Hence, this study views proactive strategic decision-making flexibility as another important form of strategic flexibility to enhance firm's peformance and defines it as a firm's ability to seek and foresee new opportunities as well as to adopt strategic decisions for an unknown environmental contingency (Ansoff, 1975).

Accordingly, this study brings together product design activity and NPD decision-making in identifying the sources proactive strategic flexibility, and thus provides a complete view of the NPD process. Proactive strategic flexibilities embedded in both design and decision-making are necessary in dynamic product competition, as firms with dynamic capabilities can quickly foresee and/or proact to possible changes in the environment and identify a wide range of product options or alternatives. These flexibilities in NPD become critical for creating uncertainties for a firm's rivals, and thus putting them in the position of having to respond to successful product market initiatives (Dess & Lumpkin, 2005; Gerwin, 1993).

In gaining proactive strategic flexibility in NPD, firms should achieve strategic alignment by continously creating and renewing their knowledge base shaped by market and technology dependencies (Boyer & Lewis, 2002; Carayannis & Alexander, 2002; Wang & Tarn, 2017; Wheelwright, 1984). An important shortcoming of the literature is that proactive strategic flexibility has rarely been considered from a strategic marketing perspective (Johnson et al., 2003; Yee & Ogunmokun, 2013). The notion of market-focused flexibility emphasises that creating a superior customer value proposition, and hence a sustainable competitive advantage, requires market alignment strategies to be incorporated into the bundle of strategic options (Johnson et al., 2003). That is, changes in competition creates the need for more market information and associated gathering, interpreting, and synthesising capability, which in turn may lead to changes in NPD (Deshpandé et al., 1993; Gatignon & Xuereb, 1997). This approach is thus based on the assumption that organisations are more effective and flexible when there is a match between the market requirements of their NPD strategy and their information processing capacities in the market. Therefore, market alignment is the first critical strategic alignment we examine in the present study. It refers to the extent to which market information guides a firm's strategic flexibility in its NPD activities (Gatignon & Xuereb, 1997; Jaworski & Kohli, 1993; Narver & Slater, 1990). Market alignment is a firm's ability to identify and acquire the current and future market needs and integrate market knowledge into its NPD activities (Deshpandé et al., 1993; Narver & Slater, 1990).

However, in identifying technology-based drivers of proactive strategic flexibility, the extant literature tends to regard technological resources as being located mainly within the firm's boundaries, such as in manufacturing technologies, information technology capabilities and/or digital technologies (Ashravi & Ravasan, 2018; Celuch et al., 2007; Chen et al., 2015; Dai et al., 2018; Narasimhan et al., 2004; Rajala et al., 2012; Reddy, 2006; Tsou & Cheng, 2018). However, in developing proactive strategic flexibility, firms should consider technology-linking activities and guide their NPD strategy by identifying and learning about technological advances outside their boundaries (Bierly & Chakrabarti, 1996; Gatignon & Xuereb, 1997; Voss & Voss, 2000; Zhou & Wu, 2010; Zhou et al., 2005). As firms process knowledge about available technologies in their environments and embed knowledge-processing routines, this knowledge becomes more valuable and sometimes inimitable in product competition (Hamel & Parahalad, 1994). Therefore technological alignment is an important determinant for a firm's proactive strategic flexibility. Technological alignment refers to a firm's ability to identify and monitor technological development and apply new technologies to its new products (Gatignon & Xuereb, 1997; Zhou et al., 2005). To address these important deficiencies relating to market and technology dependencies, this study views strategic alignment with the external environment as an important driver of proactive strategic flexibility. Market alignment and technology alignment are distinct but complementary dimensions of strategic alignment.

We believe that this examination of strategic flexibility in the context of NPD enhances the existing literature in several major ways. First, in exploring meaningful new knowledge about proactive strategic flexibility in NPD and the role of strategic alignment, we introduce a new theoretical model for future studies of proactive strategic flexibility. Second, this research focuses on the development of proactive strategic flexibility in NPD through considering two forms of external knowledge (market and technological) together. The existing strategic flexibility literature only considers the absorption of one aspect of external knowledge (either technological or market) and largely in the context of manufacturing. Third, we differentiate between two types of proactive strategic flexibility (i.e., decision-making and design flexibilities) and argue that strategic alignment can have positive effects on flexibilities. We present an initial effort to distinguish empirically between decision-making and design flexibilities and to assess their differential effects on strategic NPD performance and fit with market demands.

In the remainder of this article, we provide an overview of the theoretical base and develop the hypotheses. Next, the research methodology is described and the analyses and findings are presented. Then, we discuss the theoretical and managerial implications of the results. Finally, we outline some limitations of this study and avenues for future research, and then draw some conclusions.

Theoretical background

Proactive strategic flexibility in NPD as a dynamic capability

Several scholars have noted that a firm's capabilities associated with product development are the cornerstone of its dynamic capability (Dosi et al., 2000; Eisenhardt & Martin, 2000; Waleczek et al., 2019). Drawing on the notion that dynamic capabilities embedded in NPD processes enable firms to acquire, coordinate, and transform resources to generate value-creating activities (Eisenhardt & Martin, 2000; Teece et al., 1997; Winter, 2003), proactive strategic flexibility in NPD emerges as an important dynamic capability to achieve rapid and flexible product innovation (Sanchez, 1995; Wei et al., 2013). Firms with higher proactive strategic flexibility are expected to sense market and technological shifts and proact to rapid changes in market preferences and available technologies (Biazzo, 2009; Bierly & Chakrabarti, 1996; Iansiti & MacCormack, 1997; Luo & Tung, 2018; MacCormack et al., 2001; Sanchez, 1995). Resources for NPD should be flexible so that they can be deployed in alternative product development activities, and managers should be flexible in coordinating the use of product development resources to enable their reconfiguration and redeployment in NPD activities (Sanchez, 1995). Accordingly, proactive strategic flexibility in NPD must involve flexibly using and coordinating resources to quickly develop alternative courses of action (Sanchez, 1995).

Conceptualising proactive strategic flexibility as a dynamic capability accords with the managerial and dynamic facets of dynamic capabilities (Teece et al., 1997). Proactive strategic flexibility consists of a variety of managerial capabilities that match possible opportunities and threats emerging in a firm's market and technological environments (Volberda, 1996). For this reason, management plays a key role in coordinating and deploying firm-specific resources and skills to achieve new product goals and objectives. In addition, management must be able to activate the necessary capabilities in time to capitalise on the opportunity or mitigate the threat (Volberda, 1996). Thus, proactive strategic flexibility is dynamic in nature, reflecting its capacity to renew its competencies to achieve fit with a changing business environment.

Identifying proactive strategic flexibilities in NPD: decision-making and design flexibility

The NPD process has two aspects: activities required to move a new product idea from a concept to a design and eventually to a market offering (Cooper, 1993; Schmidt et al., 2001), and decisions required from idea generation to market launch (Krishnan & Ulrich, 2001; Schmidt et al., 2001). Drawing on the elements of the NPD process, this study proposes that firms should consider NPD decision-making and design activities as sources of proactive strategic flexibility in product development.

Rapid and unexpected market and technological shifts increase pressure on firms to accelerate the product development cycle (Clark & Fujimoto, 1991), necessitating faster decisions. Indeed, shorter product development time has been linked with flexibility in NPD decision-making (Karagozoglu & Brown, 1993; Liberatore & Stylianou, 1995; Zirger & Hartley, 1996). In complex and uncertain business environments, managers may need to include new decision criteria and/or change priorities associated with product development (Liberatore & Stylianou, 1995). Accordingly, it is suggested that proactive decision-making flexibility in NPD is an important dynamic capability, allowing firms to seek and foresee new product opportunities and modify strategic NPD decisions in a timely manner (Evans, 1991; Hitt et al., 1998; Kandemir & Acur, 2012; Sanchez, 1995; Verganti, 1999).

In today's dynamic competitive markets, it is becoming increasingly important for firms to accommodate evolving product requirements in a timely and cost-efficient manner to meet changing customer needs and incorporate technological requirements. Product design is a critical strategic activity in NPD, enabling the creation of products with capabilities, features, styling and/or operating characteristics superior to those of competing products (Calantone et al., 1995). Hence, this study identifies design flexibility as an important source of proactive strategic flexibility in NPD. Firms with high proactive design flexibility develop the ability to foresee competitive threats, customer demands, and technological improvements, and to make design changes during product development with lower time and cost penalties (Chiva & Alegre, 2009; Koste et al., 2004; Sanchez, 1995; Thomke, 1997; Upton, 1994). As a result, firms will use fewer design resources and offer products with better design solutions, resulting in a higher profit margin and greater customer satisfaction (Boehm et al., 1984). Collectively, proactive decision-making and design flexibilities should allow firms to offer new products and hence influence markets through 'creative destruction' (Schumpeter, 1934).

Strategic alignment as a driver of proactive strategic flexibility in NPD

Driven by Teece et al.'s (1997) dynamic capability framework, we position strategic alignment as a driver of proactive strategic flexibility. Proactive decision-making and design flexibilities are dynamic capabilities embedded in unique and idiosyncratic processes that involve repetitive patterns of activity (Eisenhardt & Martin, 2000; Teece et al., 1997). The development of dynamic capabilities are significantly shaped by the evolutionary path the firm has adopted (Teece et al., 1997). Thus, proactive decision-making and design flexibilities reflect an organisation's ability to achieve new and innovative forms of competitive advantage given path dependencies or strategic alternatives (Leonard-Barton, 1992; Teece et al., 1997). As suggested by Teece et al. (1997), firms can choose from an infinite range of technologies and markets in developing dynamic capabilities. Firms develop these flexibilities by accumulating bundles of routines generated through learning by doing (Nelson & Winter, 1982), and which are shaped by technological and/or market opportunities.

Strategic alignment in NPD, also referred to as 'fit' (Venkatraman & Camillus, 1984), involves strategic directions taken by firms to achieve new product goals and objectives. Firms identify strategic directions in NPD by continuously learning about customer demands, technological evolution, and competitive positions, and thus seek to align their product development with their market and technological environments (Andrews, 1971; Miles et al., 1978; Mintzberg, 1979). Consequently, market and technological alignment are proposed as important drivers of proactive strategic flexibility in NPD.

Market alignment is defined as a firm's ability to achieve fit between its NPD strategy and markets by identifying and acquiring knowledge on current and future market needs (Acur et al., 2012; Jaworski & Kohli, 1993; Narver & Slater, 1990). Similarly, technological alignment refers to a firm's ability to achieve fit between its NPD strategy and technological environment by monitoring technological developments and acquiring new technologies (Acur et al., 2012; Gatignon & Xuereb, 1997).

Hypotheses

Strategic alignment and proactive decision-making flexibility in NPD

Firms may need to develop proactive flexible responses in their NPD to cope with adverse consequences or opportunities arising from changes in markets or available technologies (Johnson et al., 2003; Volberda, 1996). Firms can achieve flexibility in decision-making by employing 'a rational process of identifying goals and setting priorities, collecting information, and generating and evaluating alternatives' (Bourgeois & Eisenhardt, 1988, p. 827). This rational view emphasises the importance of acquiring and analysing external information in the decision-making process (Dean & Sharfman, 1993). The current study argues that firms can become more flexible in their NPD decision making by quickly identifying and evaluating multiple strategic product options as a result of continuously acquiring information pertaining to markets and technologies. Indeed, several studies have shown that strategic alignment may help firms achieve high flexibility in their strategic NPD operations (Harris et al., 1998; Sinkovics & Roath, 2004).

Firms emphasising market alignment focus on learning about the marketplace, identifying current and latent customer needs, and analysing their competitors' actions. They then integrate these insights into their NPD strategy (Kohli & Jaworski, 1990; Narver & Slater, 1990). Such firms are expected to make better and quicker NPD decisions by maintaining multiple NPD approaches, since future events cannot be perfectly predicted in dynamic markets, and one approach may turn out to be more effective than others (Sanchez, 1995). Firms can proactively generate a range of quick and flexible new product decisions by continuously searching for information about customer preferences and/or competitors' strategies and integrating these into their product development (Gerwin, 1993; Johnson et al., 2003; Sanchez, 1995). Therefore:

Hypothesis 1a. The greater a firm's market alignment, the greater its proactive decision-making flexibility.

Technological alignment focuses on a commitment to anticipating future changes in the technological environment, and thus achieving better fit with future technological demands (Celuch et al., 2007; Zhou & Wu, 2010). Firms with greater technological alignment are more likely to invest resources in monitoring existing technology trends and determining the most up-to-date technologies (Gatignon & Xuereb, 1997). Technological alignment allows a firm to foresee the nature of technological advances more accurately (Zahra & George, 2002) and lead changes in the technological environment. Firms with sufficient knowledge of and insight into this environment can deploy their knowledge flexibly, and therefore develop proactive decision-making flexibility in NPD to quickly redefine and reconfigure new product choices (Dai et al., 2018; Sanchez, 1995). Hence:

Hypothesis 1b. The greater a firm's technological alignment, the greater its proactive decision-making flexibility.

Strategic alignment and proactive design flexibility in NPD

Scholars view design flexibility as a firm's ability to build a variety of response mechanisms to deal with future design drivers. Thomke (1997) associates design flexibility with the incremental cost and time of modifying design possibilities: when the cost and time of modifying a design increases, design flexibility decreases.

Flexibly designed NPD models have been shown to be strongly linked with the ability to acquire and assimilate new market information during product development (Krishnan et al., 1997; MacCormack et al., 2001). As product design requirements are driven by rapidly evolving user needs in dynamic markets, firms must integrate customer research and market analyses into product design to initiate competitive changes (Ulrich & Ellison, 1999; Veryzer & De Mozota, 2005). A flexible model of NPD adopts an evolutionary process of learning and adaptation (MacCormack et al., 2001; Tushman et al., 1997) in which multiple, simultaneous design iterations (i.e., prototyping) are used to gain an intuitive feel for the sensitivity of the parameters and the robustness of the design, to collect feedback on whether the design meets customer requirements, and to guide activities in the next development stage (Eisenhardt & Tabrizi, 1995). Firms with strong market alignment are thus expected to achieve time and cost efficiencies in design changes by employing experimentation accelerated by market information. The flexibility of a firm's product design depends on its effective use of market information. Therefore:

Hypothesis 2a. The greater a firm's market alignment, the greater its proactive design flexibility.

Firms aligned with their technological environment systematically monitor trends in existing technologies, identify the latest technologies, and acquire substantial technological knowledge (Chiesa et al., 1996; Gatignon & Xuereb, 1997). Consequently, firms with better technological alignment are able to develop a number of longer-range scenarios of future technology trends (Teece, 1986). They are more likely to create a capacity to be agile and versatile by anticipating product design specifications and developing a variety of response repertoires in their product designs (Evans, 1991). Technological alignment also enables firms to acquire flexible technology-related resources, and thus efficiently utilise technologies for multiple NPD projects to quickly enact and adapt their product designs (Nobeoka & Cusumano, 1997; Verganti, 2009). Therefore:

Hypothesis 2b. The greater a firm's technological alignment, the greater its proactive design flexibility.

Proactive strategic flexibility in NPD and strategic NPD performance

Previous empirical research has demonstrated that firms can achieve superior performance by frequently introducing new products or increasing product variety as a result of strategic flexibility (Cottrell & Nault, 2004; Grewal & Tansuhaj, 2001; Koste & Malhotra, 1999; Menor et al., 2007; Nadkarni & Narayanan, 2007; Nerkar & Roberts, 2004; Rosenbusch et al., 2019; Suarez et al., 1996). Several empirical studies have linked new product flexibility with market success (Larso et al., 2009; Swink et al., 2005), and some studies have shown that strategic flexibility stimulates a firm's innovation activities and increases its innovation performance (Bierly & Chakrabarti, 1996; Camisón & López, 2010; Gutierrez-Gutierrez et al., 2018; Zhou & Wu, 2010).

Building on previous research (Kandemir & Acur, 2012), the current study also examines the link between proactive strategic flexibilities and NPD strategic performance, which represents long term NPD success regarding windows of opportunities in terms of new product, market and technological opportunities.

Firms with greater proactive decison-making flexibility can sense and exploit future market demands by generating multiple new product options simultaneously, and hence adapt to changing customer preferences and technologies (Gutierrez-Gutierrez et al., 2018; Kortmann et al., 2014; Sharfman & Dean, 1997). Indeed, fast decision-making has been shown to lead to early adoption of successful new products (Jones et al., 2000) and firm growth (Baum & Wally, 2003). By pursuing flexible options, firms can make fast, effective decisions pertaining to their NPD strategy, and with multiple options, managers can reduce their commitment to any one option (Eisenhardt, 1989) and quickly switch between options to offer better new product solutions or enter new markets ahead of the competition. In addition, if one alternative fails, managers can easily follow another option and steer new product initiatives to their advantage. As a result, firms that are able to create a wide range of flexible product options benefit from a diverse set of favourable future product market options, maximising their strategic NPD performance (Kandemir & Acur, 2012; Kortmann et al., 2014). Hence:

Hypothesis 3a. The greater a firm's proactive decision-making flexibility, the greater its strategic NPD performance.

Proactive design flexibility enables firms to tolerate the risk, cost, and time associated with identifying, configuring, and deploying design resources by foreseeing and maintaining future design options. Firms with proactive design flexibility can recalibrate and adapt their NPD strategies and reconfigure product development resources at successive decision points, thereby taking advantage of new product market opportunities. Thomke (1997) has demonstrated that product development teams with greater design flexibility avoid large investments in early product definition and specifications, and are thus able to allocate less time and fewer resources to completing NPD projects by making design commitments late in the process. Indeed, it has been shown that the cost and time of engineering changes often increase towards the end of development projects (Boehm, 1981). Firms with high proactive design flexibility not only hold flexible design technology resources (e.g., computer-aided design and engineering tools, prototyping technologies), but also adopt design approaches that minimise interdependence in their product development systems (Eisenhardt & Tabrizi, 1995; Krishnan & Bhattacharya, 2002; MacCormack et al., 2001; Magnusson & Pasche, 2013; Thomke, 1997). As a result, they can quickly incorporate evolving customer preferences and technological solutions into their product development (Hsu, 2011), sometimes resulting in radical innovations that enable them to create diverse markets (Li et al., 2017). Firms pursuing proactive design flexibility are thus expected to identify and leverage new product market opportunities more quickly than their competitors. Therefore:

Hypothesis 3b. The greater a firm's proactive design flexibility, the greater its strategic NPD performance.

Proactive strategic flexibility in NPD and fit with market demands

Fit with market demands reflects the extent to which firms were able to develop new products with the attributes of unique benefits, timeliness, cost, and quality, and thus can be viewed as 'product concept effectiveness'(Brown & Eisenhardt, 1995). Little empirical research has been conducted on whether flexibility affects firms' NPD performance in meeting customer demands such as product cost, quality, and delivery time (Larso et al., 2009; Tatikonda & Rosenthal, 2000; Zhang et al., 2003).

This study proposes that firms with proactive decision-making flexibility achieve a better fit with market demands in their product development. Firms with proactive decision-making flexibility in NPD can quickly amend their NPD decisions and align their NPD processes with future time requirements to take advantage of potentially beneficial new product outcomes. Proactive decision-making flexibility in NPD allows firms to introduce new products in a timely manner and/or upgrade existing products more rapidly (Sanchez, 1995), which in turn allows them to be more responsive to the product needs of distinct customer groups (Swink et al., 2005). For example, Karagozoglu and Brown (1993) have revealed that flexible decision-making at the stages of idea generation, resource allocation, and project planning can accelerate the completion of NPD tasks. Therefore:

Hypothesis 4a. The greater a firm's proactive decision-making flexibility, the greater its fit with market demands.

Proactive design flexibility in NPD accrues as a firm develops its ability to foresee time and cost constraints on product redesign and act on those insights ahead of the competition. Design flexibility allows firms to avoid making complete product changes by delaying design commitments until late in the process (Thomke & Reinertsen, 1998). Several studies have found that firms with higher design flexibility are more likely to modify their designs as more current information becomes available, thereby achieving closer conformity with customer requirements, higher quality, and greater efficiencies (Hsu, 2011; Iansiti, 1995; Pisano, 1996; Thomke, 1997). Thus, firms can pre-empt their competition by offering newer, better product designs and achieving better new product fit with market demands. Hence:

Hypothesis 4b. The greater a firm's proactive design flexibility, the greater its fit with market demands.

Methodology

Data collection

The data used in this study were drawn from a common database involving information about companies' NPD configurations in each participating European country as well as reporting their 'operational effectiveness' and 'strategic flexibility' performance. 103 companies in Denmark (30), Finland (13), Norway (8), and the Netherlands (52) participated in data collection. The industries of the participating companies mainly included manufacturing (e.g., dairy products, beverages, lumber and wood products, electronic and other electrical equipment, special industry machinery), services (e.g., pre-packaged software, computer integrated systems design), and transportation, communications, electric, gas and sanitary services (e.g., natural gas tranmission and distribution). NPD/R&D managers were the main respondents. As research has indicated that the European countries included in this study show similar NPD practices (e.g., Souder & Jenssen, 1999; Van Riel et al., 2004), the data were pooled and used to test the hypotheses proposed in this study.

We used the Dillman (2000) method for mail- and internet-based surveys to develop a questionnaire. Initially, the questionnaire was evaluated by ten NPD managers and six academics to avoid any unfamiliar or unclear wording. Then, the survey was administered (in English) by research coordinators in each country. In this study, the primary unit of analysis was the NPD programme of independent firms and the strategic business unit (SBU) of larger firms. An email list was compiled from several databases provided by the European Patent Office (EPO), the Dutch Federation for the Metal and Electrotechnical Industry (FME), the Danish Industry Names and Numbers (NN Erhverv) database, and Voitto in Finland. The managers were contacted by telephone and asked to participate in the survey. As an incentive, they were offered a report including the findings of the study. The questionnaire was sent to only those who were willing to participate. After mailing the questionnaire, two reminder emails were sent at two-week intervals, and follow-up telephone calls were made. The response rate for the total sample was approximately 12%. The participating firms' annual sales ranged from one million to 4.5 billion Euros. Firm size, measured by the number of full-time employees, ranged from six to 30,000.

Finally, we assessed a non-response bias. Accordingly, a test was conducted to compare the average annual sales and number of employees of early and late respondents (Armstrong &

Overton, 1977). As the data collection started at the same time in all four countries, the responses were initially pooled and then divided into early and late responses according to the date on which they were received. T-tests for the mean responses of early and late respondents for the annual sales and number of employees showed no statistically significant differences at the 0.05 level. Thus, there was no problem of non-response bias in the data.

Measures

Some measures in this study were developed from the existing literature. When there were no existing scales, new measures were developed using the framework proposed by Churchill (1979). After defining the constructs, an item pool was generated, and the measurement format determined (De Weerd-Nederhof et al., 2008). Next, multiple-item scales were developed based on the NPD, operations management, marketing, and strategy literatures. Initially, the item pool was reviewed by experts in academia and industry. Based on this review, some statements were dropped and others were modified. Table 1 provides a list of the final measurement items.

Market alignment was measured using three items adapted from existing NPD strategy/market alignment scales (Albright & Kappel, 2003; Clark & Wheelwright, 1993; Cooper et al., 2004), addressing the extent to which firms' market strategy related to their NPD efforts. *Technological alignment* was assessed using three items adapted from existing NPD strategy/technology alignment scales (Albright & Kappel, 2003; Clark & Wheelwright, 1993; Cooper et al., 2004), addressing the degree to which technological developments and trends were integrated into the firms' NPD efforts.

Proactive decision-making flexibility in NPD was assessed using six items adapted from Griffin (1997), addressing firms' ability to forecast total development time constraints, and the requirements for speed and commitment in the NPD decision-making process. This construct was intended to capture firms' ability to adjust their NPD decision-making processes to these future requirements and time constraints.

Proactive design flexibility in NPD was assessed using a six-item scale adapted from Thomke (1997), addressing firms' ability to anticipate the time and cost of redesign, and adjust their NPD processes to these requirements.

Strategic NPD performance was measured using six items adapted from Kleinschmidt et al. (2007) 'windows of opportunity' and Cooper and Kleinschmidt (2000) 'opportunities' associated with market and technological conditions. It assessed the extent to which firms' NPD projects opened up new market, product, and technological arenas.

Fit with market demands was measured using four items adopted from Chiesa et al. (1996) to determine the extent to which firms were able to develop new products with the attributes of unique benefits, timeliness, cost, and quality (Brown & Eisenhardt, 1995; Draaijer, 1993).

Participants responded to the market and technological alignment measures using a seven-point Likert scale, ranging from 1 (*strongly disagree*) to 7 (*strongly agree*). Similarly, a seven-point Likert scale ranging from 1 (*not at all achieved*) to 7 (*very well achieved*) was used for decision-making flexibility, design flexibility, strategic NPD performance, and fit with market demands.

Unit size (Tsai, 2001), industrial product level (Subramaniam & Venkatraman, 2001), and local competition (Nerkar & Roberts, 2004; Tsai, 2001) were included as control

Table 1. Results of confirmatory factor analysis.

	Standardised item loadings	*t* value[a]
Market alignment		
AVE = 59.6%; HSV = 16.0%; CR = 0.73		
The focus of our NPD efforts clearly relates to target markets	0.52	4.10
Future markets are explicitly addressed in our NPD planning	0.96	5.42
*Our project portfolio is balanced across markets**		
Technological alignment		
AVE = 66.6%; HSV = 8.0%; CR = 0.79		
We clearly identify technological areas that focus our NPD efforts	0.61	3.99
Future technological trends are important in our NPD planning	0.98	4.64
*Our project portfolio is balanced across technologies**		
Proactive decision-making flexibility		
AVE = 62.6%; HSV = 19.0%; CR = 0.87		
*We can estimate future requirements on our total development time**		
*We are able to adjust our NPD process to future time requirements**		
We can estimate future requirements on the speed of our NPD decision-making process	0.79	9.02
We are able to adjust our NPD decision-making process to future requirements	0.85	10.03
We are able to forecast future requirements on commitment to translating our NPD decisions into actions	0.79	9.00
We are able to adjust commitment to translating NPD decisions into actions to requirements	0.73	8.09
Proactive design flexibility		
AVE = 51.1%; HSV = 19.00%; CR = 0.84		
We are able to forecast requirements on the time of redesign	0.69	7.46
We are able to adjust the average time of product redesign to future requirements	0.86	10.18
We are capable of forecasting future requirements on the cost of product redesign	0.73	8.12
We are capable of adjusting the average cost of product redesign to future requirements	0.74	8.22
We are able to predict changes in specifications	0.51	5.17
*We are able to anticipate changes in specifications**		
Strategic NPD performance		
AVE = 47.0%; HSV = 15.00%; CR = 0.77		
Our current development projects include new product market options	0.54	5.46
*We prefer NPD projects that generate options for future product development**		
NPD is successful in opening new markets to our organisation	0.91	10.17
NPD is successful in leading our organisation into new product areas	0.70	7.39
*Our NPD activities open new technologies to our organisation**		
We incorporate solutions to unarticulated customer needs in our new products	0.52	5.22
Fit with market demands		
AVE = 55.4%; HSV = 14.0%; CR = 0.78		
Our new products meet customer requirements	0.82	8.49
Our new products are delivered on time	0.59	5.96
*The cost of our new products is satisfactory**		
The quality of our new products is good	0.80	8.27

Model fit statistics: χ^2 = 197.55; Degrees of freedom = 155; p-value < 0.05; Bentler-Bonett non-normed fit index (NNFI) = 0.93; Comparative fit index (CFI) = 0.94; Bollen fit index (IFI) = 0.94; Root mean square of error (RMSEA) = 0.05; 90% CI of RMSEA = (0.03, 0.07)

[a]t-values from the unstandardised solution; * deleted items; AVE = average variance extracted; HSV = highest shared variance with other constructs; CR = composite reliability.

variables to account for the effects of extraneous variables because the former have been shown to affect a firm's new product performance. The logarithm of annual sales was used to measure unit size. Industrial product level was determined by the percentage of orders sold to other companies: higher percentages represented higher proportions of industrial products and lower proportions of consumer products in a firm's mix of products. The logarithm (1 + the proportion of industrial products) was used for analysis. Competitive dynamism was assessed using a single-item seven-point semantic scale ranging from 1 (*The nature of the competition is about the same for all products*) to 7 (*The nature of the competition varies a great deal from one product to another*).

Measurement model

The scales for dimensionality, reliability, and validity were tested using confirmatory factor analysis (CFA; Bentler, 1995) before assessing the hypothesised relationships. Consistent with Anderson and Gerbing (1988) suggestion for purifying the measurement model, items that loaded on multiple constructs or had low item-to-construct loadings were eliminated. The loadings of items on their respective factors were highly significant ($p < 0.01$). Composite reliabilities were also examined. As shown in Table 1, the reliabilities for market and technological alignment were 0.73 and 0.79 respectively; those for proactive decision-making and proactive design flexibility were 0.87 and 0.84 respectively; and those for strategic NPD performance and fit with market demands were 0.77 and 0.78 respectively. Thus, all constructs exhibited composite reliabilities that exceeded the threshold value of 0.70 (Nunnally, 1978).

Next, the procedure recommended by Bagozzi and Yi (1988) was followed to evaluate the fit of the measurement model. The χ^2 test was statistically significant ($p < 0.05$). Bentler-Bonett's non-normed fit index (NNFI), the comparative fit index (CFI), and Bollen's fit index (BFI) were 0.93, 0.94, and 0.94 respectively (Table 1), and the root mean square error of approximation (RMSEA) was 0.05. Overall, these fit indices suggested that the CFA model fit the data adequately (Bentler, 1995; Bollen, 1989). Finally, the discriminant validity of the factors was established using the procedures suggested by Fornell and Larcker (1981). As displayed in Table 1, the average variance extracted by the measure of each factor was found to be larger than the squared correlation of that factor's measure with the measures of all other factors in the model. These values suggested that all factors in the measurement model had strong discriminant validity. Having aggregated all aspects of the model's evaluation, it was concluded that the measurement model was clean, with evidence of unidimensionality, convergent validity, reliability, and discriminant validity. Furthermore, we used Harman's one-factor test in CFA to examine common method variance (CMV). We compared the fit indices of the six-factor CFA model with that of the one-factor CFA model. A worse fit for the one-factor model suggested that CMV did not pose a serious threat (Podsakoff & Organ, 1986). The one-factor model had a chi-square of 558.22 with 170 degrees of freedom, and the six-factor measurement model had a chi-square of 197.55 with 155 degrees of freedom. Thus, the chi-square difference was significant ($\Delta\chi^2 = 360.67$, $\Delta df = 15$, $p < 0.05$), suggesting that CMV may not be a problem in the measurement model.

Analysis and results

The proposed conceptual model, as shown in Figure 1, was tested using structural equation modelling with the EQS 6.1 program. The results are summarised in Table 2, along with parameter estimates, their corresponding t-values, and fit statistics. Although the chi-squared test was statistically significant ($\chi^2_{(202)} = 257.64$, $p < 0.05$), the NNFI (0.90), CFI (0.92), IFI (0.92), and the RMSEA (0.06) indicated that the theoretical model fit well with the data (Hu & Bentler, 1999).

To test Hypotheses 1 and 2, the effects of market and technological alignment on proactive decision-making and proactive design flexibility were examined. Regarding the significant control variables (unit size, industrial product level, and competitive dynamism), only

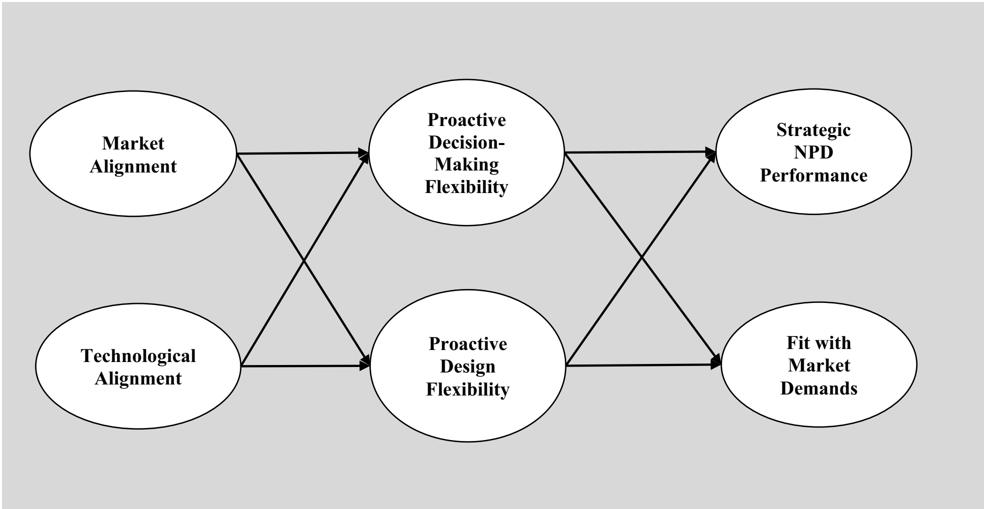

Figure 1. A conceptual model of proactive strategic flexibility in NPD.

Table 2. Results of hypothesis testing.

	Dependent variables					
Independent variables	Proactive decision-making flexibility	Proactive design flexibility	Strategic NPD performance	Fit with market demands	Hypotheses	Conclusion
Market alignment	0.51*** (3.29)				H_{1a}	Supported
		0.33* (2.27)			H_{2a}	Supported
Technological alignment	0.13^{ns} (1.03)				H_{1b}	Not supported
		0.23* (1.72)			H_{2b}	Supported
Proactive decision-making flexibility			0.37** (2.56)		H_{3a}	Supported
				0.18^{ns} (1.41)	H_{3b}	Not supported
Proactive design flexibility			0.15^{ns} (1.21)		H_{4a}	Not supported
				0.22* (1.75)	H_{4b}	Supported

Model fit statistics: χ^2 = 257.64 (df = 202, p < 0.05); NNFI = 0.90; CFI = 0.92; IFI = 0.92; RMSEA = 0.06; 90% confidence interval of RMSEA = (0.03, 0.07)
*** p < 0.001; ** p < 0.01; * p < 0.05; ns = not significant (one-tailed t-test); t-values in parentheses.

industrial product level was found to be significantly negatively associated with proactive decision-making flexibility (β = −0.21; p < 0.05). The effects of the control variables on proactive design flexibility were not significant. As is evident in Table 2, market alignment (β = 0.51; p < 0.001) was found to be significantly positively associated with proactive decision-making flexibility, whereas technological alignment (β = 0.13; p > 0.10) was found not to be significantly associated with proactive decision-making flexibility. These findings provide support for Hypothesis 1a but not 1b. Regarding the effects of alignment on proactive design flexibility, the results show that firms' market alignment (β = 0.33; p < 0.05) and technological alignment (β = 0.23; p < 0.05) had significant positive effects on their proactive design flexibility, supporting Hypotheses 2a and 2b.

Next, the effects of proactive decision-making and proactive design flexibility on strategic NPD performance (Hypotheses 3a and 3b) were assessed. The results are summarised in Table 2. The control variables did not have significant effects on strategic NPD performance. The results indicate that proactive decision-making flexibility ($\beta = 0.37$; $p < 0.01$) had a significant positive effect on strategic NPD performance, whereas the effect of proactive design flexibility ($\beta = 0.15$; $p > 0.10$) on strategic NPD performance was not significant. Thus, the findings support Hypothesis 3a but not 3b.

Finally, the effects of proactive decision-making and proactive design flexibility on fit with market demands were assessed (Hypotheses 4a and 4b). The control variables were found to have no significant effects on fit with market demands. As displayed in Table 2, the results show that proactive decision-making flexibility was not significantly associated with fit with market demands ($\beta = 0.18$; $p > 0.10$); thus, the findings do not support Hypothesis 4a. However, proactive design flexibility was significantly associated with fit with market demands ($\beta = 0.22$; $p < 0.05$), confirming Hypothesis 4b.

Discussion and implications

This study has examined the drivers and performance outcomes of proactive strategic flexibility in NPD. Proactive strategic flexibility is particularly important in dynamic markets because it may help firms develop capabilities to foresee and proact to changes to achieve a competitive advantage. However, little is known about the defining features or attributes of different types of proactive strategic flexibility in product innovation. This study has focused on the decision-making and design dimensions of proactive strategic flexibility in the context of NPD, and has shown how firms' alignment with their market and technological environments helps them develop proactive strategic flexibility, which in turn may play a crucial role in product development performance.

Drivers of proactive strategic flexibility in NPD

Our results show that market alignment positively affects proactive decision-making flexibility in NPD, whereas technological alignment has no significant effect. When firms clearly identify customer needs and market requirements, they may effectively anticipate future opportunities and define strategic NPD options for uncertain market environments (Cooper et al., 2002). Firms can enhance their proactive decision-making flexibility by acquiring market information and generating a set of alternative strategic product decisions and thus aligning their NPD strategy with the market. However, no support for the hypothesised relationship between technological alignment and proactive decision-making flexibility in NPD was found. This indicates that firms may not consider technological developments when creating their range of strategic options in NPD activities. Rather, they may put more emphasis on understanding market dynamics to develop strategic alternatives, as the robustness of a market, and thus the firm's ability to respond to changes in the market is less certain than the firm's ability to develop new tecnologies (Day, 2007). Thus, in generating product options, the company's ability to clearly define the target segment appears to be more important than how well the company responds to a new technology or a new product offering. Moreover, firms with the abilities to proactively foresee changes in the business environment and establish the nature of the market can prevent costly investments in technology.

The results suggest that both market and technological alignments have positive effects on proactive design flexibility in NPD. Customer and competitor knowledge, as well as market opportunity analyses, appear to play a significant role in design changes and new design creation. Achieving alignment with the market allows firms to develop skills in anticipating changes in market demands and in generating a variety of design responses to better meet the needs of customers ahead of competitors. Moreover, technological alignment appears to be an important mechanism through which design flexibility is leveraged to develop new products that address market needs. This result is consistent with Thomke (1997) suggestion that firms can achieve design flexibility by searching for and investing in technological developments (e.g., computer-aided design and engineering tools combined with rapid prototyping technologies).

The examination of the impact of technological alignment on different flexibilities reveals an interesting picture. Although technological alignment has a significant impact on proactive design flexibility, it does not have a significant effect on proactive decision-making flexibility. These mixed results question the extent to which technological information is used to foresee and develop strategic options in NPD decision-making and product design. They indicate that technological information is more associated with the *activities*, namely design, of the NPD process rather than the *decisions*.

Performance outcomes of proactive strategic flexibility in NPD

Our results indicate that proactive decision-making flexibility in NPD is significantly associated with strategic NPD performance. Flexible decision-making helps firms anticipate and/or adapt to future market requirements and create new product market opportunities. Generating flexible responses enables firms to better serve customers' latent needs. Contrary to expectations, the results show that proactive design flexibility is not associated with strategic NPD performance, suggesting that being able to modify product designs with lower time and cost penalties has no effect in opening up new product areas. In identifying and creating product market opportunities, it seems more important to develop flexible strategic NPD decision-making capabilities rather than developing flexible design skills. Firms with proactive decision-making flexibility can generate and pursue flexible product options, which enable them to act on new product solutions or new markets. Proactive design flexibility may become important after defining product market opportunities, enabling firms to leverage these opportunities in an efficient manner.

While flexibility in decision-making does not increase fit with market demands, proactive design flexibility plays a significant role in enabling firms to develop products that meet customers' quality, cost, and time requirements. This finding is consistent with scholarly arguments that firms with greater design flexibility are more likely to focus on developing early prototypes and modifying their products to meet customer requirements (Bloch, 1995; Swan et al., 2005), whereas proactive decision-making flexibility does not appear to be effective in creating products that satisfy customer needs. Firms may be able to develop a range of strategic new product options to match changing customer preferences, but must implement these decision options by focusing on design issues *after* choosing a clear target market to achieve positive customer outcomes. This non-significant result suggests that there may be mediating variables between proactive decision-making flexibility and fit with market demands.

Managerial implications

The findings offer practical implications for NPD and marketing managers, especially those who are involved in product development. This study contributes to a better understanding of the nature of proactive decision-making and design capabilities, and their drivers and consequences for European firms. The findings are also important for firms involved in business-to-business activities to understand where to locate proactive strategic flexibilities in their NPD process and thus compete in industrial markets with their new product lines. Adopting a proactive perspective in defining strategic flexibility underlines the importance of anticipating and proacting to future market and technological requirements by developing flexibilities in NPD decision-making and product design. It provides insights into the relevance of proactive decision-making and design flexibilities in NPD, and their positive effects on various performance outcomes associated with product development.

In this study, the focus is on the highest level of new product flexibility, characterised by long-term, strategic capabilities relating to product innovation, which is one of firms' competitive priorities. Thus, it is important for managers to understand the importance of developing such dynamic capabilities in product development and make investment decisions accordingly. Firms with higher proactive strategic flexibility in NPD decision-making and/or product design voluntarily make their own products obsolete and introduce better products earlier than their competitors, and such product proliferation puts pressure on other firms to compete on product range and delivery. Furthermore, after having identified a profitable product market, these firms can leverage their proactive strategic flexibility to commercialise a large cluster of related product models to saturate the market quickly, and thus reducing competitors' market opportunities. This study's findings help managers in making investment decisions regarding developing dynamic capabilities, namely proactive decision-making and design flexibilities.

In addition to identifying where the flexibilities emerge in the NPD process, this study provides managers with a better understanding of how to develop them. Firms may develop flexibility in their decision-making and design activities by aligning their NPD processes with their market and technological environments. They should be skilled in anticipating changes in markets and/or technologies, generating a variety of responses, and proacting to unforeseen changes in the business environment before their competitors do. This paper argues that both market and technological knowledge are crucial to a firm's ability to pursue a variety of strategic design options in a timely and cost-effective manner, and to cope with design pressures. Moreover, in dynamic markets, firms need to accelerate their cognitive processes, review strategic alternatives more comprehensively, and make decisions more quickly by using more market information, but not technological information. This study suggests that firms need to invest in identifying and acquiring both market and technological knowledge to develop proactive design flexibility. However, investing heavily in technological knowledge may not result in better proactive decision-making flexibility; effectively managing customer and technological knowledge alike plays especially an important role in business-to-business markets. A supplier should develop the complex knowledge resources needed for ongoing strategic developments, such as information about customers' needs and wants, the customers' customers, and the technology of customers' products.

Finally, the results also indicate that firms with highly proactive strategic flexibility generate better NPD performance than their less-flexible competitors. Specifically, firms should invest in developing proactive decision-making flexibility in opening new product market opportunities. Additionally, firms should increase attention to proactive design flexibility to achieve better responsiveness to customer requirements in terms of fit, quality, and cost. When firms want to identify and leverage new product market opportunities, they should focus on foreseeing future market and technological requirements and generating a set of strategic options. However, firms' ability to make design changes in an efficient manner can enable them to better serve the current markets and provide a better fit with market needs.

Conclusion

Our findings have some caveats. The results around relationships between strategic alignment, proactive strategic flexibility, and NPD performance are limited by the cross-sectional data drawn from key informants. Further, it may take some time for the effects of proactive strategic flexibility on new product performance to materialise. Moreover, proactive strategic flexibility is a dynamic capability, which is shaped by evolutionary paths. Thus, a longitudinal study is required to further investigate dynamic capabilities and their performance effects. This study has concentrated mainly on the link between strategic alignment – focusing on the firm's external environment – and two types of proactive strategic flexibility: decision-making and design. Additional research might expand this model by considering other important flexibilities in NPD such as cost, and/or internal alignment variables such as the NPD/marketing alignment. Furthermore, the contingency factors can be explored to examine how the hypothesised relationships might differ under certain circumstances.

Notwithstanding these limitations, this study appears to be the first empirical examination into how strategic alignment impacts proactive strategic flexibility, as well as how different types of strategic flexibility affect strategic NPD performance and fit with market demands. The results offer a number of important insights into proactive strategic flexibility in NPD, as well as into its drivers and product development performance outcomes. First, this investigation of strategic flexibility took a proactive approach, rather than the reactive approach that currently dominates the literature, and a preliminary attempt has been made to identify different sources of proactive strategic flexibility embedded in NPD processes, namely decision-making and design. Second, this study integrated the market- and technology-based drivers of proactive strategic flexibility and jointly considered the use of two forms of external knowledge – market and technological – in developing proactive decision-making and design flexibilities' dynamic capabilities in product development. Finally, the findings regarding product development performance provide a new perspective on the role of proactive decision-making and design flexibilities in NPD.

Disclosure statement

No potential conflict of interest was reported by the author(s).

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