International-market-information use across new-product-development stages: Antecedents and performance implications

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Abstract

Purpose – Investigates how firms can better manage new product development (NPD) for international markets (IMs). This is not a trivial task as, for most firms, NPD still tends to be rooted in domestic operations.

Design/methodology/approach – Proposes IM information (IMI) use across three stages of the NPD process (concept development, product development, and commercialization) as a key driver of international NPD performance. Examines two antecedents of such usage: international firm experience; and international innovation culture. A conceptual framework is tested using structural equation modelling, based on data from 137 strategic business units of German firms.

Findings – The use of IMI during commercialization has a U-shaped (positive quadratic) relationship with international NPD performance, whereas curvilinear relationships in the concept and product-development stages cannot be confirmed. Having an internationally-oriented innovation culture increases the level of IMI usage in all NPD process stages, while a firm's international experience

only does so in the commercialization stage. Thus, international experience does not necessarily impact access to and understanding of IMI in the early NPD stages.

Research limitations/implications – Furthers understanding of NPD phenomena in an international context. However, future studies might consider exploring the mixed patterns of IMI use and NPD performance by looking at new forms and tools of market information management. Moreover, they may uncover more drivers of IMI use and test their frameworks in different contexts.

Practical implications – Managers should emphasize IMI use throughout the whole NPD process, even in the traditionally more R&D-focused product-development stage. Managers should strive to establish a corporate culture that views IMs as opportunities rather than liabilities.

Originality/value – This is the first study both to examine the relative impact of IMI use across all distinct NPD stages simultaneously on international NPD performance and to use quadratic effects to explain the relationship.

Article classification – Research paper.

Keywords – New product development performance, Market information use, Innovation culture, Firm experience.

1. Introduction

The story of the cold reception of Kellogg's Corn Flakes in India is told in business circles as a classic example of how firms fail to develop new products that cater to the specific needs of customers in international markets (IMs) (Bijapurkar, 2007; Bloomberg, 2006; Bolton, 2012; Cayla and Penaloza, 2012). By 2010, after being present in India for 16 years, Kellogg's Corn Flakes had captured less than 1% of the Indian market, with a meagre revenue of US$70 million, while on home soil in the US, Kellogg's is a market leader with a huge 40% share of the ready-to-eat cereal market and revenues of US$3.8 billion (Bolton, 2012). This disparity is attributed by observers in the business press and academia to Kellogg's inability to develop breakfast meals for the Indian market by considering local tastes, preferences, habits, and dietary needs (Bijapurkar, 2007; Bloomberg, 2006; Bolton, 2012; Cayla and Penaloza, 2012).

Kellogg's struggle to develop the right product for IMs is not an isolated case. Numerous firms have experienced similar difficulties when developing products for IMs (Immelt et al., 2009; Wakayama et al., 2012). This is because, for most firms, new product development (NPD) still tends to be rooted in their domestic operations, based on domestic-market understanding and information (Ernst et al., 2015; Immelt et al., 2009; MacPherson, 2000; Sheth, 2011). Such a domestic focus is an obvious practice for a firm serving solely its home market and a possibly harmless practice for a firm involved in some degree of exporting. However, when a firm's commitment to IMs increases, and new products need to be developed for those markets, a purely domestic NPD focus becomes detrimental (Immelt et al., 2009; Li et al., 1999). This leads us to ask why Kellogg's, an internationally highly experienced and committed firm, still acted like one just about to internationalize its NPD?

Among the many difficulties a firm faces while developing products for IMs, the incomplete understanding of these markets, caused either by missing or insufficient use of IM information (IMI), is an alarming one (Immelt et al., 2009; MacPherson, 2000; Sheth 2011; Wakayama et al., 2012).

This is because decision-making and problem-solving in NPD is dependent on accurate market information use (Ottum and Moore, 1997). Hence, international NPD performance can increasingly be attributed to what is done with IMI and not, for instance, to its mere possession (Souchon and Diamantopoulos, 1996; Souchon et al., 2003).

Existing research points to three challenges associated with the use of IMI in the NPD context. First, compared to the domestic setting, using IMI is costlier because such usage incurs higher expenditures associated with the analysis and evaluation of information from foreign markets, involves time-consuming processes of spotting trends in heterogeneous foreign markets, and requires complex handling of information from dispersed foreign markets (Ellis, 2005, 2007; Li et al., 1999). It is therefore questionable if the associated costs outweigh the potential benefits of IMI use. Second, there is little and inconclusive empirical evidence regarding where exactly in the NPD process, i.e. in which NPD process stages (concept development, product development, or commercialization), the use of IMI is most helpful (Ayal and Raban, 1990; Kleinschmidt and Cooper, 1988; Kleinschmidt et al., 2007). Third, there is little insight into the antecedents driving the use of IMI in all three NPD stages (Kleinschmidt et al., 2007; Li et al., 1999).

Our study addresses these challenges by answering the following research questions:

1. Given the higher costs associated with higher expenditures, higher time-investment, and higher complexity of using IMI, does its incorporation still increase international NPD performance, i.e. do the benefits outweigh the costs of IMI use?

2. Does the effect of IMI use on international NPD performance vary across multiple stages of the NPD process, i.e. concept development, product development, and commercialization?

3. What factors drive the level of IMI use across all three NPD process stages?

We attempt to make four contributions to the international marketing and NPD literature. First, we address recent calls by scholars for more research on the drivers of international NPD

performance (Ernst et al., 2015; Kleinschmidt et al., 2007; Murray et al., 2011; Sheth, 2011). IMs differ from much more familiar domestic markets in terms of cultures, customs, tastes, and unique institutional environments (Ernst et al., 2015; Bruce et al., 2007; Griffith et al., 2014; Sheth, 2011). However, our understanding of NPD performance is predominantly rooted in firms' experiences with domestic operations (Evanschitzky et al., 2012). We address this limited understanding by investigating how the use of IMI is driving international NPD performance.

Second, this study advances the international marketing and NPD literature by offering a granular, i.e. stage-specific, perspective on the effects of IMI use on international NPD performance. It shows that using IMI, although important in all stages of the NPD process, has a different impact in each stage. Specifically, during commercialization, the use of IMI has a U-shaped relationship with international NPD performance while, in the concept and product-development stages, such curvilinear relationships cannot be found. Instead, we provide some evidence that these relationships may be of a linear nature. To the best of our knowledge, this is the first study to show such a nuanced relationship between IMI use and NPD performance in each stage of the NPD process. The quadratic relationship allows us to respond to calls made by marketing scholars for more quantitative research on NPD-related information management in general and on non-linear relationships between the use of market information and NPD performance (Frishammar and Ylinenpää, 2007; Zahay et al., 2004). It has been argued that non-linear relationships better reflect the complexities of information-management challenges (Frishammar and Ylinenpää, 2007).

Third, this study, unlike previous research, evaluates the impact of using IMI in individual NPD stages on NPD performance simultaneously. This approach has two advantages: we test the relative importance of IMI usage across NPD stages in a single model; and such simultaneous testing helps us to minimize the impact of a potential omitted variable bias (Szymanski et al., 2007).

Finally, given the importance of IMI use for international NPD performance, we examine its key antecedents. Given the unit of analysis of our data (a firm's strategic business unit (SBU)), we

chose antecedents measurable at the SBU level and, given the international setting of our study, we focus on antecedents specific to the international context (international firm experience and international innovation culture). Most past studies have not examined the antecedents of IMI use, particularly in a stage-specific manner (Ayal and Raban, 1990; Chryssochoidis and Wong, 1998; Kleinschmidt and Cooper, 1988).

The remainder of our paper is structured as follows: First, we discuss the conceptual background and research framework. Next, we introduce the hypotheses section followed by an explanation of our methodology. Then, we present our results. The paper concludes with a summary and discussion.

Conceptual background and research framework

2.1 IMI use in NPD

The concept of IMI use is central to our study (Souchon and Diamantopoulos, 1996; Souchon et al., 2003; Toften and Olsen, 2003). Extant studies have shown that IMI use is decisive for overall firm performance in IMs because IMI use is fundamental for decision-making and problem-solving in the context of IMs (Ellis, 2007; Souchon and Diamantopoulos, 1996; Souchon et al., 2003; Toften and Olsen, 2003). Therefore, we apply the concept of IMI use to the international NPD context and extend it into the NPD domain. We define IMI use during NPD as a firm's ability to apply IM-related information during NPD activities that entails not only well-established customer- and competitor-related data but also broader characteristics of IMs that relate to technology, institutions, and trends (Ellis, 2007; Murray et al., 2011; Sheth, 2011; Souchon et al., 2003). Such application of IMI becomes evident when, for instance, decisions are made to move product concepts for further development based on detailed foreign market research or when product prototype features are fine-tuned following beta-testing with foreign customers.

We argue that IMI use during NPD is a key predictor of international NPD performance and draw upon prior studies that have demonstrated how decisive the integration of domestic-market

information (DMI) in the NPD process is for domestic NPD success (Evanschitzky et al., 2012; Ottum and Moore, 1997). However, despite insights from these studies of the domestic context, it is uncertain how DMI can be utilized in the international context and how the practice of using DMI is applicable to improve international NPD performance.

Table I clearly shows how the use of IMI during the NPD process requires higher expenditure, higher time-investment, and higher complexity than the use of DMI. Table I builds on past research that has argued that it is difficult for firms to adopt new practices (e.g. using IMI) in IM contexts (Ellis, 2005, 2007; Li et al., 1999). Hence, not all firms succeed in these adoptions. This should make us cautious about generalizing and applying findings from a domestic context to an international context without appropriate theorizing and empirical testing (Bass, 1995; Sheth, 2011). This also provides opportunities to develop new theories for international contexts and explore international contexts for empirical testing.

<<Please insert Table I about here>>

To provide more fine-grained and detailed insights into IMI use and its impact on international NPD performance, we introduce a stage-specific conceptualization of the NPD process. We believe that the use of IMI during NPD may vary across its different stages. Firms routinely divide the NPD process into separate stages to streamline its management (Ernst et al., 2010; Song and Parry, 1997). While the number of stages in a NPD process can vary, previous research has often acknowledged the existence of three fundamental stages: concept development; product development; and commercialization (Ernst et al., 2010; Veldhuizen et al., 2006; Zahay et al., 2011).

Concept development is mainly concerned with the generation and selection of new product ideas based on identifying and assessing market needs and risks in line with the company's NPD strategy. It also encompasses the refining of these ideas into product concepts that are evaluated, prioritized, and authorized for further development (Ernst et al., 2010; Song and Parry, 1997). The subsequent product-development stage focuses on prototype development and testing as well as

preparation of the commercialization concept (Ernst et al., 2010; Song and Parry, 1997). Finally, the commercialization stage encompasses the actual product launch, e.g. final market tests, distribution, promotion, and in-market success assessment (Ernst et al., 2010; Song and Parry, 1997).

Although developing new products for IMs has become increasingly important over recent decades, the role of IMI has received little attention (Ayal and Raban, 1990; Kleinschmidt and Cooper, 1988; Kleinschmidt et al., 2007¸ Lee and Wong, 2010). This leaves several gaps in our understanding. Existing research on the relationship between the use of IMI and international NPD performance can be delineated in terms of both content and methodology (see Table II).

<<Please insert Table II about here>>

Regarding content, some studies have examined the use of IMI in an aggregate manner, i.e. they do not distinguish between the different NPD process stages (Kleinschmidt et al., 2007; Lee and Wong, 2010; Lee et al., 2008; Li et al., 1999; Subramaniam, 2006). Past studies provide insights into the importance of IMI for international NPD success; however, they fall short of explaining where exactly in the NPD process such input is most important. This is a major shortcoming because the use of IMI requires higher expenditure, higher time-investment, and is more complex. This shortcoming has been addressed in a few studies examining IMI use in some NPD stages, mostly the concept-development and commercialization stages, highlighting the importance of IMI use in these stages (Chryssochoidis and Wong 1998; Kleinschmidt and Cooper, 1988). They emphasize the early or late stages of NPD because of the importance attached by research to well-executed pre-development activities and the marketing department's traditionally strong role at the beginning and end of the NPD process (Evanschitzky et al., 2012). The stage-specific focus of these studies on pre-selected NPD stages precludes them from simultaneously examining all stages and demonstrating the relative importance of IMI usage in all three stages of the NPD process. By leaving out certain NPD process stages, mainly the product-development stage, they are also prone to omitted variable bias (Szymanski et al., 2001).

In summary, while use of IMI during NPD is expected to differ considerably from DMI, there is little research in this area. Although prior work has suggested that using IMI is a precondition for international NPD success (Kleinschmidt et al., 2007; Lee and Wong, 2010; Lee et al., 2008; Li et al., 1999; Subramaniam, 2006), where exactly in the NPD process IMI should be incorporated for maximum effect remains an unanswered question.

2.2 Antecedents of IMI use

Given the importance of IMI use during NPD, it is vital to recognize its key drivers or antecedents (Kleinschmidt et al., 2007; Li et al., 1999). Prior research has suggested that a firm's internationalization process is largely determined by its accumulated experience in target markets and its cultural distance from them (Banerjee et al., 2015; Eriksson et al., 1997; Johanson and Vahlne, 2009; Yeniyurt et al., 2007). Drawing from past research, we propose that the internationalization level of a firm may be manifested in the level of IMI usage during NPD. Consequently, we assume that the two antecedents (the level of a firm's IM experience and its international innovation culture) may strongly influence the level of IMI usage in NPD.

Experience in IMs forms the basis for organizational learning, which in turn enhances firm activities in existing and newly entered foreign markets. In other words, accumulated international experience supports recognizing patterns of best-suited activities in one foreign market and repeating those activities in other foreign markets (Yeniyurt et al., 2007). In the NPD context, international experience may help in recognizing and repeating best practices in utilizing IMI in distinct activities during the NPD process (Cadogan et al., 2002; Souchon et al., 2003; Yeniyurt et al., 2007).

Similarly, international innovation culture, conceptualized as a firm's readiness to engage with the differences and unfamiliarity of IMs (de Brentani and Kleinschmidt, 2004; Kleinschmidt et al., 2007; Sheth, 2011; Tellis et al., 2009), may help to increase the usage of IMI during NPD.

International innovation culture helps to overcome the cultural distance, i.e. all factors making it difficult to understand and exploit foreign environments (Johanson and Vahlne, 2009).

Figure 1 depicts our research framework, conceptualizing IMI use in the three stages of the NPD process, its antecedents, and NPD performance implications. Using this research framework, we aim to narrow the above-mentioned research gaps: the scarcity of research into the drivers of international NPD performance; the lack of stage-specific insights into how to best use IMI in NPD; and which antecedents are related to usage.

<<Please insert Figure 1 about here>>

3. Hypotheses

3.1 IMI use and international NPD performance

3.1.1 Concept-development stage

The concept-development stage primarily encompasses the selection and evaluation of new product ideas and their stepwise refinement into a final product concept (Ernst et al., 2010; Song and Parry, 1997). Market information plays a central role as it helps to better align the product concept with the demands of the target market (Immelt et al., 2009; Lindqvist et al., 2001; Wakayama et al., 2012). Nevertheless, particularly in the international context, market information is associated with considerable costs (Ellis, 2005, 2007). Thus, benefits and costs associated with IMI depend on the level of its usage. We argue that an increase in IMI usage in the concept-development stage is only beneficial to a certain extent: up to a certain level, the benefits of IMI usage are relatively high, while the associated costs remain manageable. Beyond a certain level, IMI usage is likely to offer diminishing returns because the associated costs grow while the additional benefits tend to be marginal. We argue this because market feedback related to an "abstract" product concept as opposed to a "touchable" test product may be of limited depth, i.e. it provides some initial understanding of how the market values a conceptual idea but the "abstract" nature of the concept limits the usefulness of further feedback.

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The distinct activities undertaken in the concept-development stage (see Table I) form the basis for a cost−benefit analysis of using IMI in several ways. First, more IMI may, initially, help to generate more new product ideas, better reflecting the needs of the target markets (Golder, 2000; Kleinschmidt and Cooper, 1988; MacPherson, 2000; Yeniyurt et al., 2007). However, generating too many new product ideas, based on input from an increasingly diverse set of potential target markets, may lead to significant increases in expenditure. Second, more detailed IMI may allow for better sense-making of this information and provide a basis to better prioritize the generated new product ideas (Ernst et al., 2010). However, making sense of a growing amount of IM research might become very time-consuming. Finally, more IMI might help the NPD team to prepare better new product concepts (Golder, 2000; Kleinschmidt and Cooper, 1988; MacPherson, 2000; Yeniyurt et al., 2007). However, fine-tuning too many new product concepts simultaneously may prove too complex, especially when conducted within internationally dispersed NPD teams.

In summary, in the concept-development stage, our reasoning is that the expected benefits at lower levels of IMI usage outweigh the associated costs, while at higher levels of IMI usage, the respective costs outweigh the benefits:

- H1: In the concept-development stage, there is an inverted U-shaped relationship between the level of IMI use and international NPD performance

3.1.2 Product-development stage

The product-development stage focuses on designing product prototypes based on the parameters tentatively pre-defined during concept development and prototype testing with selected customers (Ernst et al., 2010; Song and Parry, 1997). Market information constitutes a vital input for these activities. Even if it has already been considered during concept development, it remains crucial to recalibrate the prototype and better align it with target markets (Ayal and Raban, 1990; Bruce et al., 2007). Market information is even more important for the often unfamiliar and distant foreign

markets (Ayal and Raban, 1990; Immelt et al., 2009; Lindqvist et al., 2001), which may require new prototypes to match different market conditions. Unlike in domestic markets, the NPD team may not be able to draw upon prior experiences and existing customer relationships. However, like the concept-development stage, the benefits and costs in the product-development stage are expected to change with the level of IMI usage. We argue that using more IMI is beneficial only to a certain degree, i.e. as long as its benefits exceed the associated costs. Beyond a certain usage level, it is likely that IMI will deliver diminishing returns because the ongoing adjustments of the product prototype based on increasingly costly IMI become less visible to the customer and thus less beneficial for the firm.

Given the distinct activities undertaken in the product-development stage (see Table I), the balance of benefits and costs of using IMI could be as follows. First, more IMI may, to a certain extent, help to better define the features of the prototype important to the customers (Golder, 2000; Kleinschmidt and Cooper, 1988; MacPherson, 2000). Different regulatory requirements from the envisioned target markets may be considered early in the prototype development to make it better suited for the technological-/product-safety-related peculiarities of the target markets (Bruce et al., 2007; Chryssochoidis and Wong, 2000). However, too much, too diverse IMI from even peripheral markets may easily lead to out-of-control expenditure. Second, more IMI may constitute a better basis for a superior commercialization concept targeting many foreign markets (Bruce et al., 2007; Yeniyurt et al., 2007). However, if the IM input becomes too heterogenous, the preparation of a commercialization concept catering to the specificities of every single foreign market may become too time-consuming. Finally, more interaction with IMs, e.g. through prototype tests with foreign customers, should help to better adjust the prototype to the nuanced needs of these customers (Golder, 2000; Kleinschmidt and Cooper, 1988; MacPherson, 2000). However, reconciling too many potentially contradictory customer requests may eventually become too complex or even technically infeasible.

To summarize, we argue that the benefits associated with lower levels of IMI usage in the product-development stage outweigh the costs, while at higher levels of IMI usage, the costs outweigh the benefits:

- H2: In the product-development stage, there is an inverted U-shaped relationship between the level of IMI use and international NPD performance.

3.1.3 Commercialization stage

The commercialization stage encompasses market-acceptance tests and the fine-tuning of placement, pricing, and promotion strategies (Ernst et al., 2010, Song and Parry, 1997). Market information is important here as it enables final adaptations of the product to meet the realities of target markets, as well as helping firms to customize their accompanying launch tactics (Ayal and Raban, 1990; Bruce et al., 2007; Yeniyurt et al., 2007). While the costs of IMI are expected to remain comparable, the information's validity and reliability is typically considerably greater compared to the preceding NPD stages (di Benedetto, 1999). This is because, for instance, customers can provide more accurate estimations during market tests with an almost developed product than with concept and prototype tests conducted in earlier NPD stages. Thus, like concept and product development, the respective benefits and costs of IMI usage during commercialization are expected to depend on the usage level, albeit following a different trajectory. We argue that lower usage levels are beneficial, despite some potential for compromise on the degree of product alignment with target market needs. Lower levels of usage are not only less expensive but also less time-consuming and less complex, allowing firms to enjoy additional benefits through early market entries (Chryssochoidis and Wong, 1998; Yeoh, 1994). Gradually increasing costly usage of IMI may, though enhancing product alignment with the target market, temporarily lead to diminishing benefits as the product launch is delayed due to ongoing product adjustments based on additional market information. Firms can no longer exploit early-mover advantages as other firms may launch products faster (Chryssochoidis and

Wong, 2000; Yeoh, 1994). At high levels of IMI use, the benefits may again prevail because such information, though costlier, helps to better align the new product with the nuances of the target market, helping the firm to compete, or even win, against early entrants who have launched less customized products.

If distinct exemplary activities carried out in the commercialization stage (see Table I) serve as illustrations, the balance of benefits and costs of using IMI could look as follows. First, interacting with few customers during market-acceptance tests, i.e. using little IMI, may be sufficient to draw "good-enough" conclusions to profit from an early product launch (Ayal and Raban, 1990; Bruce et al., 2007). Similarly, this may be beneficial when competing with products explicitly tailored to the needs of diverse target markets, thus already based on feedback from a high number of customers. In contrast, the relatively high costs of an average amount of IMI used may easily prevail over the benefits of a mediocre product−market alignment. Second, low amounts of IMI may suffice to design and implement launch tactics, e.g. product pricing and promotion, to benefit from an early launch (Bruce et al., 2007; Kleinschmidt and Cooper, 1988; Yeniyurt et al., 2007). Analogously, a far-reaching customization of launch tactics in target markets based on broad market input may be beneficial. However, competing based on half-heartedly individualized launch tactics, presupposing a disproportionate time-investment in processing IMI, may show limited overall benefits. Finally, focusing on monitoring the reactions of some initial customers, i.e. using low levels of IMI, may suffice to learn if the newly introduced product requires further improvements to retain the early-market-entry advantages (Bruce et al., 2007). Likewise, if a firm follows the strategy of highly customized market launches, i.e. uses high levels of IMI, it may benefit from better catering to the target markets' individual needs. However, if a firm starts to monitor the reactions of too many customers and competitors simultaneously, without converting this complex feedback into better conclusions on post-launch product enhancements, it may be of limited help.

In summary, considering both the benefits and costs of IMI use in the commercialization stage, we argue that both at lower and higher levels of usage the benefits outweigh the costs:

- H3: In the commercialization stage, there is a U-shaped relationship between the level of IMI use and international NPD performance.

3.2 Antecedents of IMI use

Using IMI during different stages of the NPD process can be considered a function of a firm's international experience (Cadogan et al., 2002; Souchon et al., 2003; Yeniyurt et al., 2007). Firms active abroad longer are more likely to use more IMI while performing distinct NPD-related activities, possibly because, in general, experience will help in recognizing and repeating best practices during the NPD process. In the international context, such best practices can encompass better access to IMI and, as a result, a better usage of such information. Therefore, we argue that firm experience influences IMI usage in at least two ways.

First, more experienced firms should have better access to diverse information sources in IMs, e.g. different customer groups used to generate new product ideas, involved in product-prototype tests, or surveyed to assess post-launch market reactions (Cadogan et al., 2002). Such IM access may also be enhanced by means of local firm subsidiaries that allow a more direct interaction with foreign markets (Banerjee et al., 2015; Li et al., 1999). The longer a firm is active in foreign markets, the more likely it is to have its own local subsidiary network (Cantwell and Mudambi, 2005, Johanson and Vahlne, 2009). Thus, international experience, which helps to leverage involvement with local subsidiaries and direct interaction with foreign customers, allows firms to make greater use of IMI. Second, international experience allows firms to better understand and interpret the wants and needs of foreign customers throughout the NPD process (Cadogan et al., 2002; Calantone et al., 2004). International experience supports the understanding and interpretation of new product concepts, new prototype features, and distinct customized launch tactics. Thus, more internationally experienced

firms are expected to use more IMI in each stage of the NPD process, allowing them to better align

their new products with the target markets (Calantone et al., 2004; Cavusgil and Zou, 1994). In

contrast, less experienced firms are more likely to use less IMI during the NPD process, as they tend

to look for the closest fit between their existing, usually domestic, offerings and foreign market

conditions to minimize new product alignment (Cavusgil and Zou, 1994). We therefore propose:

- H4: The level of a firm's international experience is positively related to the use of IMI
  in all stages of the NPD process.

We also argue that a more international innovation culture may potentially help to increase

the level of IMI usage. Following de Brentani and Kleinschmidt (2004, p. 313), we define

international innovation culture as an "international mind-set and a global readiness on the part of

managers and employees to deal effectively with the complexities and opportunities that result from

different national cultures, geographic dispersion of markets and participants, building trust and

cooperation among dispersed affiliates, and cross-locational/-cultural idea generation and resource

utilization." An international innovation culture may help to bridge the gap between familiar domestic

and unfamiliar foreign markets, in turn helping firms to increasingly utilize the more expensive, time-

consuming, and complex IMI in all stages of the NPD process (Kleinschmidt et al., 2007; Moorman,

1995). An international innovation culture increases usage of IMI for at least two reasons.

First, an international innovation culture provides the unique ability for firms to not only

detect IM opportunities that competitors cannot, but also to better exploit such opportunities

(Kleinschmidt et al., 2007; Levy et al., 2010). This is because a strong international innovation

culture, for instance, fosters an environment in which the firm is more receptive to new opportunities

coming from IMs (Kleinschmidt et al., 2007) and more tolerant when it comes to risks associated

with unfamiliar IMI (Sheth, 2011; Tellis et al., 2009). Such receptiveness to new opportunities and

risk tolerance allows greater usage of IMI in all stages of the NPD process. Second, an international

innovation culture helps firms to better manage market information flows between different internationally scattered firm entities cooperating during the NPD process (Chryssochoidis and Wong, 1998; Moorman, 1995). This is because such culture values input from distant firm subsidiaries not necessarily primarily involved in NPD-related tasks (Immelt et al., 2009). We therefore propose:

- H5: The level of a firm's international innovation culture is positively related to the use of IMI in all stages of the NPD process.

4. Methodology

We used a survey to test our hypotheses. We drew our sample from a variety of large German manufacturing firms from both business-to-business (B2B; 75%) and business-to-consumer (B2C; 25%) industries. Germany, as one of the world's top exporters (World Bank, 2014) relies heavily on products developed to meet IM demand. We used the Hoppenstedt database to identify internationally active firms and confirmed, through an extensive internet search, that all these companies were headquartered in Germany. We focused on German companies to have a homogenous sample and avoid potential biases caused by differences in national culture (Nakata and Sivakumar, 1996). All selected firms were predominantly developing products at their domestic premises to sell abroad. We contacted all the companies by phone and requested their participation and asked for an appropriate contact person, i.e. most knowledgeable about the firm's international operations and its NPD activities. The informants had been with their respective firms for several years and typically held senior management positions in R&D, international marketing, and business development departments [1]. To increase the response rate, we made follow-up phone calls and sent two reminder emails approximately two and four weeks after the first mailing. In line with previous research, we used the SBU as our unit of analysis (Calantone et al., 2004; Kleinschmidt et al., 2007). Respondents were therefore asked to assess a typical NPD project aimed at IMs.

Out of 378 companies initially selected, a total of 128 companies participated. We obtained responses from 137 SBUs as in nine companies more than one of their SBUs participated in our survey. Our response rate of 34 % is comparable to other surveys examining international NPD activities in industrialized countries (Li et al., 1999; Subramaniam, 2006). The participating SBUs had mean annual revenues of US$2.48 billion, out of which, on average, 64% came from IMs. They were, on average, active in 58 countries. The non-response bias test between early and late responders did not yield significant results (Armstrong and Overton, 1977).

4.1 Measures

We developed our measures over several stages. First, we conducted a literature review to identify usable scales that had been used previously in empirical studies. Second, we conducted a series of 13 exploratory in-depth interviews with senior managers from multiple companies to discuss and adapt possible items intended to measure our constructs. We used this information to build the first version of our questionnaire. Third, the questionnaire was pre-tested with nine academics and seven senior managers. Based on their feedback, we adjusted the scales and created the final design of the questionnaire (see the Appendix).

4.1.1 IMI use

We operationalized IMI use during individual activities in each of the three distinct stages of the NPD process. Following Ernst et al. (2010) and Song and Parry (1997), we identified 15 key activities within the entire NPD process. For each of these 15 NPD activities, respondents were asked to assess the degree of IMI use. All items were measured on a seven-point Likert scale ranging from 1 (not at all) to 7 (to a very high degree) (see the Appendix).

4.1.2 International NPD performance

We measured the dependent variable international NPD performance through four items adapted from Cooper and Kleinschmidt (1995). Sample items include "the impact of new products launched in the last three years in IMs on your business unit's current international sales" and "the profitability of new products launched in the last three years in IMs relative to the spending on developing and launching them". We used a seven-point Likert scale to measure the anchor points, from 1 (small) and 7 (very high) (see the Appendix).

4.1.3 International innovation culture

Following de Brentani and Kleinschmidt (2004) and Kleinschmidt et al. (2007), international innovation culture was measured using four items. They reflected the company's attitude towards enhancing international NPD-related information processing across country markets. The scale aimed to assess whether a firm tries to create an authentic international innovation culture throughout the organization worldwide. Sample items include "we strongly emphasize knowledge sharing across different geographical subunits" and "we strongly endorse informal communication and coordination of NPD activities across country units". We used a seven-point Likert scale to measure the anchor points, from 1 (totally disagree) to 7 (totally agree) (see the Appendix).

4.1.4 International experience

Following Cadogan et al. (2002), we measured international experience by the number of years a business unit had been active in IMs.

4.1.5 Control variables

As several other factors may influence international NPD performance, we used various control variables. First, as large firms may be more successful with their new products abroad

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because of greater resources, we controlled for firm size. We measured a firm's size as the logarithm of a business unit's level of international revenues (in millions of US$). Second, we controlled for a firm's level of international R&D expenditure as the investment in R&D may influence new product success. We measured the level of international R&D expenditures as the percentage (from total R&D) of R&D spent in IMs. Third, as our sample cuts across different industries, we controlled for industry effects by including one dummy variable (1=pertaining to a B2C industry, 0=pertaining to a B2B industry). Finally, since a firm's dependence on IMs may lead to greater investments in these markets, we controlled for the percentage of sales (from total sales) derived from IMs.

5. Results

5.1 Reliability and validity assessment

We used AMOS 23 to evaluate the reliability and validity of each construct. Our final confirmatory factor analysis (CFA) results show that an acceptable model fit was obtained: $\chi 2$ (df)=409.20 (216); p<0.000; root mean square error of approximation (RMSEA)=0.081; non-normed fit index (NNFI)=0.91; and comparative fit index (CFI)=0.93 (Blunch, 2013; Cadogan et al., 2002; Lee and Wong, 2010; Story et al., 2015).

We validated five of our constructs (IMI use in the concept-development, product-development, and commercialization stages, international innovation culture, and international NPD performance) by following the standard procedures suggested in the literature (Blunch, 2013; Bagozzi and Yi, 1988; Churchill 1979). We first assessed item reliability by computing the item loadings, which all exceeded 0.70, and were all significant at the 1% level. Next, on the construct level, we assessed the reliability by calculating composite reliability (CR) and the average variance extracted (AVE). All value thresholds met or exceeded recommended levels, indicating reliability of all our constructs (especially CR>0.70, AVE>−0.50). Finally, we assessed the discriminant validity both on the item and construct level. In none of the scales did an item correlate more strongly with another

than its own construct and the square root of the AVE values exceeded the correlations of the respective constructs with all other constructs.

Table III lists the relevant descriptive statistics of all variables and the respective correlation coefficients.

<<Please insert Table III about here>>

5.2 Common method bias (CMB) assessment

To analyse the extent of CMB – a potential issue because the independent and dependent variables were collected from a single informant – we applied the Harman's one-factor test and the partial-correlation adjustment suggested by Lindell and Whitney (Jayachandran et al., 2005; Lindell and Whitney, 2001; Malhotra et al., 2006). Both tests suggest that a CMB is not present in our data. Specifically, the CFA model, in which all items load on a single factor, yielded a poor fit: $\chi 2$ (df)=834.87 (226); p<0.000; RMSEA=0.14; NNFI=0.74; and CFI=0.77 (Story et al., 2015). Similarly, the correlations between the dependent and independent variables remained significant after we partial out the effect of the marker variable [2] (Jayachandran et al., 2005; Malhotra et al., 2006).

5.3 Hypothesized effects

To test the hypotheses, we used the maximum likelihood estimation method implemented in AMOS 23 (Blunch, 2013). To analyse the structural equations, we created single indicants for each construct, based either on the construct's arithmetic mean or, in the case of quadratic effects, on the squared arithmetic mean to reduce model complexity (Cadogan et al., 2002; Story et al., 2015). Subsequently, our model was estimated to test the hypotheses.

The overall chi-square for our model was significant ($\chi 2$=130.58, df=43, p<0.000). Analogous to the CFA model, the other measures of goodness of fit were as follows: CFI=0.90; TLI=0.81; and

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RMSEA=0.122. This reveals a rather modest fit (Blunch, 2013; Cadogan et al., 2002; Lee and Wong, 2010; Story et al., 2015). Nevertheless, there exists evidence that a point estimate for RMSEA – a key fit index in such type of model specifications – may not be particularly helpful to assess the fit of models based on relatively moderate samples with relatively moderate degrees of freedom (df) (Kenny et al., 2015). Instead, Kenny et al. (2015) recommended that, for moderate samples and df levels, researchers should consult the confidence interval (CI) of RMSEA and its width. More specifically, for a given sample size and df, researchers should determine if the desired value of RMSEA, i.e. <0.1, is within the CI interval. According to Kenny et al. (2015, p. 499), a model with about 50 df, a sample size between 100 and 200, and a CI width between 0.043 and 0.064 is acceptable. In our model, the 90% CI of RMSEA ranged from 0.099 to 1.47, thus exhibiting a width of 0.048. Given that our model exhibits 43 df, with a sample size of 137, it can be considered acceptable. Thus, we report the standardized structural paths estimates and their respective t-values in Table IV.

<<-- Please insert Table IV about here -->>

H1 posited that IMI use during concept development has an inverted U-shaped relationship with international NPD performance. The path estimate of IMI use in concept development squared relates non-significantly to international NPD performance ($\gamma=-0.05$, t=-0.38). Hence, H1 is not supported. Similarly, we do not find support for H2, which posited that the relationship between the level of IMI use in the product-development stage and international NPD performance has an inverted U-shape. This path estimate is not-significant ($\gamma=-0.07$, t=-0.62). Table IV shows that there is support for H3 (the level of IMI use in the commercialization stage was proposed to have a U-shaped relationship with international NPD performance) in our sample as the path estimate is significant ($\gamma =0.25$, t=1.99).

Next, we examined the antecedents of IMI use. H4 stated that the level of international firm experience has a positive impact on the use of IMI in all three NPD process stages. We obtained

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mixed results for this hypothesis (see Table IV). While, in the concept- and product-development

stages, the paths are non-significant (γ=0.04, t=0.56; γ=0.09, t=1.24), in the commercialization stage,

the path is positive and significant (γ=0.15, t=2.03). Therefore, H4 is partially supported. Finally, H5

argued that the level of international innovation culture has a beneficial impact on the use of IMI in

all stages of the NPD process. For our sample, all respective path estimates are positive and

significant (γ=0.47, t=6.28; γ=0.48, t=6.49; γ=0.45, t=5.92), providing support for H5.

6. Summary and conclusion

This study enhances our understanding of how to best develop new products for IMs.

Developing such products has become increasingly important over recent decades as numerous firms

have increased their international commitment (Ernst et al., 2015; de Brentani and Kleinschmidt,

2004; Kleinschmidt et al., 2007). Our initial example of Kellogg's Corn Flakes in India vividly shows

how crucial and non-trivial developing new products for IMs is, even for established multinationals.

Critics say that Kellogg's should have taken Indian market information more seriously and used that

information during its NPD process to develop new cereal products more in tune with the tastes,

preferences, habits, and dietary needs of Indian consumers (Bijapurkar, 2007; Bloomberg, 2006;

Bolton, 2012; Cayla and Penaloza, 2012). Such IMI use during NPD would have significantly

increased Kellogg's chances of success in India.

Our study contributes to the marketing and international NPD literature by proposing IMI use

as a key driver of international NPD performance. We tested the impact of IMI in all three NPD

process stages simultaneously. Such simultaneous and stage-specific testing, not considered before,

demonstrates the relative importance of using IMI in each of the three NPD stages as well as lowering

the risk of omitted variable bias. We focused on non-linear relationships between IMI usage and NPD

performance, a type of relationship largely neglected by existing studies. Received wisdom holds that

using IMI in the concept and commercialization stages is particularly beneficial (Chryssochoidis and

Wong 1998; Kleinschmidt and Cooper, 1988). In line with existing insights, our results show the varying importance of IMI use throughout the NPD process. While our data does not provide support for the existence of a curvilinear relationship between IMI use and NPD performance during concept and product development, it does in the commercialization stage. This means that, for concept and product development, increasing usage levels of IMI do not necessarily entail more costs than benefits. Our results extend existing findings by providing evidence that IMI usage during commercialization shows a curvilinear U-shaped relationship with NPD performance. Thus, the relationship between IMI use and international NPD performance seems to be based on a nuanced cost−benefit ratio. A U-shaped relationship means that both low and high levels of IMI usage enhance international NPD performance, while average usage levels have a negative effect. Given the overall importance of IMI use for international NPD performance, we also examined two of its context-specific antecedents: international firm experience; and international innovation culture. While international innovation culture enhances the use of IMI in NPD, international experience only partially does so.

6.1 Research implications

Our study offers new and additional insights for marketing and NPD scholars. First, international aspects of NPD have received disproportionately low research attention in the past (Ernst et al., 2015; de Brentani and Kleinschmidt, 2004; Kleinschmidt et al., 2007). Despite calls to study international NPD from several sources (academic papers, journal editorials, and business press/magazines like Bloomberg BusinessWeek and Harvard Business Review), such studies remain rare in marketing and NPD literature. This is particularly troublesome because IMs can differ greatly from familiar domestic settings, hence necessitating several adaptations to NPD practices. Thus, our study broadly demonstrates the opportunity that exists in studying international NPD phenomena. By

offering some new insights on drivers of international NPD performance, such as IMI use, we hope to encourage further examinations of this important and relevant topic.

Second, in the domestic NPD context, researchers have focused on offering detailed insights into how to fine-tune the NPD process to achieve above-average performance (Ernst et al., 2010; Veldhuizen et al., 2006; Zahay et al., 2011). Most existing studies on international NPD do not offer a similar degree of depth (Ayal and Raban, 1990; Kleinschmidt and Cooper, 1988; Subramaniam, 2006). We address this lack of depth in international NPD research by conducting a more fine-grained, stage-specific examination on the use of IMI during the NPD process. Our SEM-based methodology further allows us to simultaneously test the impact of IMI use in each NPD stage on international NPD performance. Therefore, we also contribute to the international marketing literature examining the concept of IMI use in more general terms as a driver of overall firm performance (Souchon and Diamantopuolos, 1996; Souchon et al., 2003; Toften and Olsen, 2003). A stage-wise examination is particularly important as IMI tends to be much more costly, time-consuming, and complex to use than its domestic counterpart.

Our results clearly highlight the idiosyncrasies of NPD for IMs. Utilizing IMI in concept development does not exhibit a curvilinear effect on NPD performance. The relationship may be a positive linear one. The control paths in our model may provide some first evidence of this. In such a case, the usage of IMI in concept development would be associated more with benefits than costs. These linear results echo findings of previous studies, which assumed a beneficial impact of IMI use during concept development on international NPD performance (Kleinschmidt and Cooper, 1988). IMI seems crucial during concept development as it helps to generate better new product ideas (Golder, 2000; MacPherson, 2000; Yeniyurt et al., 2007). It further provides a basis for preparing and evaluating new product concepts aimed at IMs (Golder, 2000; MacPherson, 2000).

We did not find a curvilinear relationship between the usage of IMI in the product-development stage and international NPD performance. However, by evaluating the control paths in

our model, we found a positive linear relationship supporting the notion that the benefits of using IMI in product development outweigh the associated costs. These results are particularly interesting as our study is among the first to examine the impact of IMI use on international NPD performance during product development. We show how those firms that consistently proceed with physical product development based on meaningful, ongoing market information are more likely to succeed (Golder, 2000; Kleinschmidt and Cooper, 1988; MacPherson, 2000). This is important because new products in the international context often vary across both domestic and target markets, as well as across target markets. Consequently, they must be developed through close exchanges with their target markets.

Finally, we found a significant U-shaped effect of IMI use during commercialization on international NPD performance. This finding supports the commonly held belief that market information use is important for NPD performance in this stage (Ayal and Raban, 1990; Kleinschmidt and Cooper, 1988). However, our findings allow a more refined interpretation of the cost−benefit ratio in this NPD stage. A U-shaped relationship means that both low and high levels of IMI usage enhance international NPD performance. We attribute this effect to the different characteristics of IMI in the commercialization stage. Specifically, the information may be more valid and reliable because the customer's feedback in this stage relates to an almost developed product as opposed to concepts and prototypes being evaluated in earlier NPD stages. Moreover, using less IMI may allow earlier launches that exploit early-entrant market advantages. High levels of IMI usage, in contrast, helps to better align both the product and the launch tactics with the target markets, which again enhances international NPD performance. In summary, we found significant effects of the importance of utilizing IMI in all three stages of the NPD process.

Third, a significant proportion of NPD research focuses on different success drivers (Evanschitzky et al., 2012). While being of great importance in itself, it does not directly answer the question of how to boost those success factors. Scholars have been asking for more managerially

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relevant levers to influence such identified success factors (Ernst et al., 2010; Evanschitzky et al., 2012; Ottum and Moore, 1997). We address this broader request by examining two firm-level- and international-context-specific antecedents of IMI use in NPD. By doing so, we also echo more explicit calls from the international marketing domain that encourage the investigation of further antecedents of IMI use (Kirca et al., 2011; Souchon et al., 2003; Toften and Olsen, 2003). Our results suggest that the length of a firm's international experience drives the level of IMI use only in selected NPD stages, while international innovation culture exerts an influence throughout the whole NPD process.

Overall, our mixed results on the impact of experience on market information use during NPD mirror the divergent findings of existing studies on the effect of experience on IMI use in a broader firm context. For example, while Souchon et al. (2003) and Hart et al. (1994) did not find any significant influence of experience on IMI use, Calantone et al. (2004) and Cavusgil and Zou (1994) reported positive effects. However, our results, unlike existing studies, offer a much more fine-grained perspective on the influence of international experience on IMI use in three distinct NPD process stages.

We demonstrate that, while international experience is not significantly related to the level of market information usage in concept and product development, such an effect exists during commercialization. These results suggest that even relatively less experienced firms can still use excessive IMI in concept development. Clearly, promising new product ideas may flourish at unexpected locations, like novel lead markets, that develop dynamically around the globe (Tiwari and Herstatt, 2012). Thus, long-lasting ties may not necessarily grant better access to such novel sources. Similarly, less experienced firms seem not to be excluded from the benefits of IMI usage in the product-development stage. Potentially, this is owing to new tools, like rapid or virtual prototyping, that may considerably enhance the interpretation and understanding of IMI and, thus, at least partly compensate for experience.

Finally, international experience drives the level of IMI usage in the commercialization stage. One reason for this finding might be that some of the activities taking place in this stage, e.g. product acceptance tests, may derive an over-average benefit from repeatedly reaching out to customer groups contacted earlier in the NPD process. Thus, accumulated experience would enhance access to these customer groups. Another reason for this finding may be attributed to the type of experience we measured in our study. Most firms internationalize by first establishing international marketing and sales offices, which are focused mainly on existing product sales rather than on contributing pro-actively to NPD-related activities (Li et al., 1999; Immelt et al., 2009; Wakayama et al., 2012). Only later do firms open manufacturing or R&D-related subsidiaries (Johanson and Vahlne, 2009). Thus, we may have primarily measured the level of international sales-and-marketing experience of firms related to existing products. This marketing-and-sales experience also seems to enhance the level of IMI usage in NPD while customizing launch tactics or monitoring post-launch customer and competitor reactions regarding new products in foreign markets.

In contrast to international experience, our data reveals that international innovation culture is a strong and highly significant driver of IMI use across all stages of NPD. This supports the idea that an international mind-set and a global readiness of employees are important catalysts for market information use (Kleinschmidt et al., 2007; Levy et al., 2010; Sheth, 2011). Thus, our findings provide further evidence as of how important a firm culture is for successful NPD (Tellis et al., 2009).

6.2 Managerial implications

Our study offers several recommendations for managers involved in NPD for IMs. First, in contrast to prior research, which mostly underscored the necessity of using IMI only in selected NPD stages, our findings suggest that managers should use IMI throughout the whole NPD process, albeit in a different manner. Existing studies have mostly focused on concept development, and even more

so on commercialization, as the stages where IMI is of particular importance (Kleinschmidt and Cooper, 1988). The prevalence of studies in the international NPD context focusing on product launch (Bruce et al., 2007; Lee et al., 2011; Yeniyurt et al., 2007) and the traditional dominance of domestic markets for many firms might have created the impression that some product adjustments prior to international launch may suffice. Our results suggest that this is not the case. Consequently, managers should design the NPD process to ensure that IMI is factored in during the whole NPD process. One possible approach to such a re-design of the NPD process is to better integrate the international marketing department – traditionally the main channel of IMI processing – throughout the NPD process. Specifically, the product-development stage, typically very R&D- and technology-intensive, should not be completely left to the discretion of the R&D department (Li and Wong, 2010; Li, 1999). Consequently, our findings may also provide a tentative blueprint for managers entrusted with the task of NPD team configuration.

Second, our study suggests two potential drivers of IMI use in NPD that managers can activate: international firm experience; and international innovation culture. Notably, international experience, i.e. the duration of a firm's IM presence, has a varying impact on the level of IMI usage. Experienced firms can particularly profit from their accumulated expertise in the commercialization stage.

Our study also provides useful insights for less internationally experienced firms. Lacking first-hand experience may not prevent them from using vital IMI during concept and product development. However, less experienced firms should seek ways to compensate for the lack of first-hand, i.e. direct, international experience to boost the usage of IMI during commercialization. An alternative to direct experience accumulated through a firm's own presence abroad may be the so-called indirect experience gained through firm managers or other firms being part of the same business group (Banerjee et al., 2015). Thus, it may prove helpful for less experienced firms to hire

internationally experienced managers or maintain dialogue with more experienced firms within their business group.

Our findings also strongly advocate the role of international innovation culture in driving the level of IMI usage. Thus, managers should strive to establish a corporate culture that views the orientation towards IMs in its core processes, despite a high level of unfamiliarity and costs, as an opportunity rather than a liability. Such change to the corporate mind-set towards IMs is a fundamental prerequisite for NPD activities, beyond just market information use, requiring a systematic and strategic focus on international matters (Dubiel and Ernst, 2013; Sheth, 2011; Wakayama et al., 2012).

6.3 Limitations and future research

Developing new products for IMs is a complex phenomenon, and we hope this paper will serve as an initial basis for future research into this interesting and relevant topic. Our work has several limitations, some of which might offer avenues for further research. First, although our findings are general in scope for a variety of markets, our empirical context is limited to a single country market: Germany. Germany seems particularly well-suited for our investigation as it is among the world's leading economies in terms of exports and innovation (World Bank, 2014). However, there is still scope to investigate different empirical contexts, specifically economies with varying institutional frameworks.

Second, we have measured the level of IMI use during individual activities conducted in each of the NPD process stages. We are among the first to have merged existing measurement models of market information usage in general (Souchon and Diamantopoulos, 1996) with existing scales assessing the level of performing different activities during the NPD process (Ernst et al., 2010). This helped us to provide more granular insights into the nuances of using IMI during NPD. Nevertheless, we did not directly assess the costs or benefits of such usage. We encourage future studies to assess

the cost−benefit ratio of IMI use or the efficiency of its use more directly. We also encourage examinations into how new forms of information usage in NPD, like big data and social media, or new tools of information management, like netnography and rapid prototyping, may change existing cost−benefit relationships (Barczak et al., 2012; Zahay et al., 2011).

Third, we explored the impact of two important antecedents of IMI use: international firm experience; and international innovation culture. We have offered insights on IM-specific, firm-level levers that can be influenced by managers. Nevertheless, other antecedents, e.g. top management attributes (Jaworski and Kohli, 1993), governance models, or open innovation strategies (Homburg et al., 2004), may be worthy of attention.

Fourth, we focused on the firm level and took the headquarters' perspective on managing NPD. As most firms tend to develop new products for IMs at home, this seems a reasonable approach (Deloitte, 2006). However, international firm subsidiaries are becoming increasingly involved in NPD. Future research could, therefore, shift attention to international firm subsidiaries and their attributes, e.g. their degree of identification with headquarters or their degree of autonomy (Kirca et al., 2011), to learn more about IMI flows in NPD.

Endnotes

1. Out of 137 managers participating in the survey, 47 worked in marketing, 41 in R&D, and 17 in business development. A total of 30 managers indicated working in another department, e.g. sales or product management. Two respondents did not disclose this information.
2. We chose "international R&D expenditure" as our "marker variable", i.e. a scale exhibiting a small correlation with our dependent variable, "international NPD performance". Both variables had a non-significant correlation of 0.06 (see Table IV). This correlation was used to partial out its effect from all other variable correlations in our model. All correlations that were significant at the $p<0.05$ level before this procedure remained significant afterwards, providing support for the notion that they do not merely existing due to CMB.

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Table I. Contrasting the use of DMI and IMI during the NPD process.

Cost types	NPD stage	Domestic context	International context
Expenditures		lower	higher
	Concept development	Generating new product ideas using input from domestic customers located relatively closeby	Generating new product ideas using input from customers located in several, faraway foreign markets
	Product developement	Determining the product prototype features based on input from domestic customers located relatively closeby	Determining the prototype features based on input from customers located in several, faraway foreign markets and making sure it meets different regulatory requirements
	Commercialization	Resorting to familiar customers in the domestic market for test marketing measures	Finding new, potential customers in foreign markets willing to market test the new product
Time-consumption		lower	higher
	Concept development	Sense-making of a market research study conducted in the firm's employees' native language	Sense-making of a market research study, e.g. trends, wants or needs of customers conducted in a language foreign to most firm employees
	Product developement	Reviewing the commercialization concept before product introduction in the likely homegenous domestic market	Reviewing the commercialization concept before product introduction in several, potentially heterogoneous foreign markets
	Commercialization	Implementing a product launch in a single, domestic market	Implementing up to several, potentially customized product launches across foreign markets
Complexity		lower	higher
	Concept development	Preparation and evaluation of a new product concept within a co-located NPD team at firm headquarters	Preparation and evaluation of a new product concept within an internationally dispersed NPD team
	Product developement	Adjusting the product prototype after tests with domestic, well-known customers	Adjusting the product prototype after tests with different, less-familiar foreign customers
	Commercialization	Monitoring customer and competitors reactions in a familiar domestic market	Monitoring customers and competitors reactions across many foreign markets

Table II. Overview of empirical studies examining the impact of IMI use on international NPD performance.

No.	Author (Year)	Journal	Content — Stages examined				Content — Impact on int'l NPD performance				Methodology — Sample			Methodology — Type of analysis for stages	
			Aggregate	Stage 1	Stage 2	Stage 3	Aggregate	Stage 1	Stage 2	Stage 3	Country	Industry	Size	Separate	Simultaneous
1	Kleinschmidt et al. (2007)	JPIM	■				■				N. America, Europe	B2B	387	X	
2	Lee and Wong (2010)	IMR	■				■				S. Korea	B2B/B2C	232	X	
3	Lee et al. (2008)	JIM	■				■				USA	B2B/B2C	139	X	
4	Li et al. (1999)	IMR	■				■				USA	B2B	130	X	
5	Subramaniam (2006)	JPIM	■				■				Mostly USA	B2B/B2C	90	X	
6	Ayal and Raban (1990)	IEEE		■	■			■		■	Israel	B2B	51	X	
7	Chryssochoidis and Wong (1998)	JPIM		■		■		■		■	UK	B2B/B2C	30	X	
8	Kleinschmidt and Cooper (1988)	EJM		■				■		■	N. America	B2B	203	X	
	Our study			■	■	■			■		Germany	B2B/B2C	137		X

Note: EJM = European Journal of Marketing; IEEE = IEEE Transactions on Engineering Management; IMR: International Marketing Review; JIM = Journal of International Marketing; JPIM = Journal of Product Innovation Management.

Table III. Descriptive statistics and inter-construct correlations.

Variables	Mean	S.D.	1	2	3	4	5	6	7	8	9
1 Firm size (ln)	5.46	1.95	**n.a.**								
2 International R&D expenditure	.10	.15	.31**	**n.a.**							
3 Dependence on international markets	0.64	.20	.46**	.11	**n.a.**						
4 Use of international market information in concept development	4.73	1.24	.23*	.29**	.21*	**.79**					
5 Use of international market information in product development	4.86	1.40	.18	.23*	.22*	.75**	**.81**				
6 Use of international market information in commercialization	4.74	1.41	.23*	.16	.33**	.73**	.80**	**.82**			
7 International experience	34.85	28.36	.35**	.22*	.15	.23*	.20*	.30**	**n.a.**		
8 International innovation culture	5.12	1.34	.22*	.30**	.12	.42**	.44**	.44**	.12	**.82**	
9 International NPD performance	4.29	1.14	.15	.06	.31**	.46**	.50**	.47**	.17	.40**	**.82**

Notes: Bold numbers on the diagonal show the square root of the AVE; ** correlation significant at the level of 0.01; * correlation significant at the level of 0.05 (two-tailed test). n=137; S.D.=standard deviation. The number of observations varies due to missing values for the following variables: firm size, n=113; international R&D expenditure, n=96; international experience, n=121; and dependence on international markets, n=118. Before creating the indicants, the missing values were replaced by the series mean.
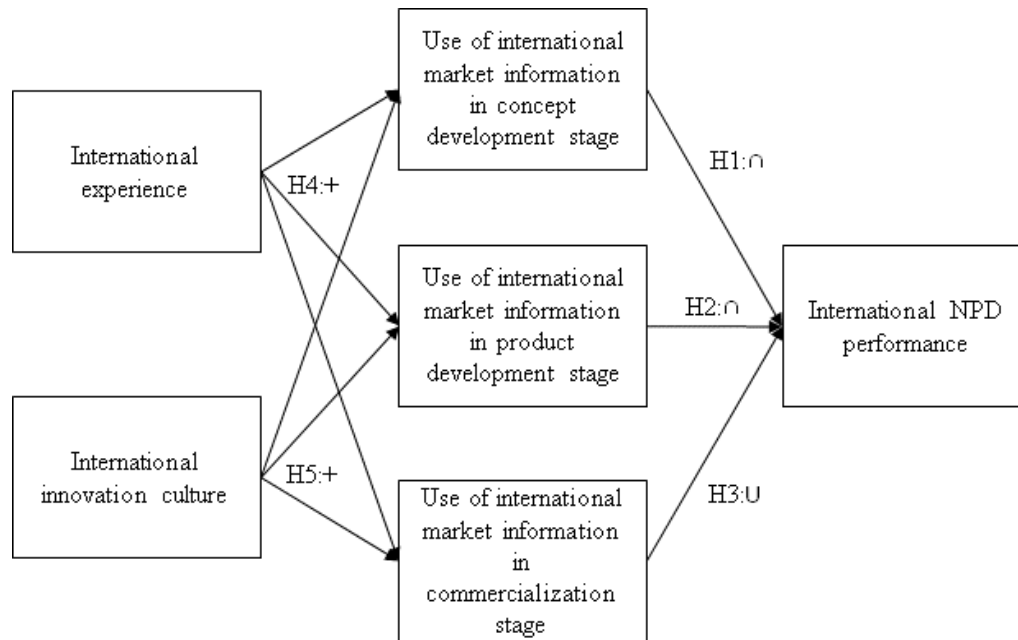
Figure 1. Conceptual model and hypotheses.

International experience

International innovation culture

Use of international market information in concept development stage

Use of international market information in product development stage

Use of international market information in commercialization stage

International NPD performance

H4:+   H5:+   H1:∩   H2:∩   H3:∪

Table IV. Coefficients of structural relationships of the structural model.

Linkages in the model		Standardized Path Estimate	t-Value[a]
Hypothesized paths			
H1	Int'l market information use in concept development *squared* -> Int'l NPD performance	-.05	-.38
H2	Int'l market information use in product development *squared* -> Int'l NPD performance	-.07	-.62
H3	Int'l market information use in commercialization *squared* -> Int'l NPD performance	.25**	1.99
H4	Int'l experience -> Int'l market information use in concept development	.04	.56
	Int'l experience -> Int'l market information use in product development	.09	1.24
	Int'l experience -> Int'l market information use in commercialization	.15**	2.03
H5	Int'l innovation culture -> Int'l market information use in concept development	.47***	6.28
	Int'l innovation culture -> Int'l market information use in product development	.48***	6.49
	Int'l innovation culture -> Int'l market information use in commercialization	.45***	5.92
Control paths			
	Int'l market information use in concept development -> Int'l NPD performance	.24**	1.86
	Int'l market information use in product development -> Int'l NPD performance	.25**	1.78
	Int'l market information use in commercialization -> Int'l NPD performance	.04	.28
	Firm size -> Int'l NPD performance	-.11	-.1.53
	Int'l R&D expenditure -> Int'l NPD performance	.01	.15
	Industry dummy -> Int'l NPD performance	.05	.75
	Dependence on int'l markets -> Int'l NPD performance	.26***	3.74

[a]Critical value ($\alpha = .05$) = 1.645 (5%, one-tail tests), *$p< .05$; **$p< .01$; ***$p< .001$. All hypothesized paths and control paths allowed to take on nonzero values. All indicants were standardized before estimating the path coefficients.

Note: Int'l = international.

Appendix: Constructs, items, and reliabilities

Measure details	Standardized item loadings	Error variances
Use of International Market Information in the Concept Development Stage (1= not at all; 7 = to a very high degree): CR = .81; AVE = .62		
To what extent is international market information used during the following activities in your company:		
1. Planning and formulating new product goals and strategy	.76 (9.19)	.96 (7.53)
2. Idea generation	.77 (9.28)	.87 (7.49)
3. Analysis of trends, market changes and potentials	.85 (10.52)	.51 (6.80)
4. Assessment and selection of new product ideas	.87 (10.77)	.50 (6.55)
5. Assessment of potential technologies for selected new product ideas (eliminated)		
6. Assessment of needed funds, times as well as risk related to the NPD projects	.71 (8.50)	1.31 (7.71)
7. Preparation of a written product concept	.75 (1.00)	1.10 (7.56)
Use of International Market Information in the Product Development Stage (1= not at all; 7 = to a very high degree): CR = .70; AVE = .66		
To what extent is international market information used during the following activities in your company:		
1. Determining the desired product features of the prototype	.84 (10.04)	.65 (6.63)
2. Actual development of the prototype (eliminated)		
3. Preparation of the commercialization concept	.85 (10.06)	.76 (6.62)
4. Execution of prototype tests with customers	.74 (1.00)	1.20 (7.56)
Use of International Market Information in the Commercialization Stage (1= not at all; 7 = to a very high degree): CR = .82 ; AVE = .67		
To what extent is international market information used during the following activities in your company:		
1. Selection of customers for test marketing reasons	.73 (9.99)	1.40 (7.64)
2. Execution of test marketing measures before market introduction of new products	.76 (10.46)	1.24 (8.14)
3. Final evaluation of market acceptance before market introduction of new products	.82 (11.78)	.99 (7.19)
4. Determination of the overall strategy before introducing new products into the market	.86 (12.78)	.61 (6.77)
5. Market introduction of new products (selling, advertising, distribution)	.89 (18.59)	.52 (6.17)
6. Monitoring customers' and competitors' reactions	.85 (1.00)	.65 (6.67)
International Innovation Culture (1= not at all; 7 = to a very high degree): CR = .78; AVE = .68		
1. We apply cross-border coordination mechanisms in NPD processes (e.g. international teams).	.74 (1.00)	1.26 (6.98)
2. We strongly encourage contributions from team members located in different countries or cultures.	.95 (9.43)	.34 (1.57)
3. We strongly emphasize knowledge sharing across different geographical subunits.	.89 (8.86)	.43 (2.91)
4. We strongly emphasize responsiveness to differences in local markets. (eliminated)		
5. We strongly endorse informal communication and coordination of NPD activities across country units.	.70 (8.50)	1.00 (7.42)
6. We achieve a high degree of NPD interdependence among our affiliates worldwide. (eliminated)		
International NPD Performance (1= small; 7 = very high): CR = .84; AVE = .68		
1. Estimate the impact of new products launched in the last three years in international markets on your business unit's current international sales	.82 (11.72)	.64 (6.66)
2. Estimate the profitability of new products launched in the last three years in international markets relative to the spending on developing and launching them	.91 (13.75)	.29 (4.35)
3. Estimate the impact of new products launched in the last three years in international markets on current profitability in international markets	.86 (1.00)	.45 (5.93)
4. Estimate the profitability of new products launched in the last three years in international markets relatively to the new products launch by your most important competitors	.70 (9.26)	.73 (7.52)
5. Estimate the market share of new products launched in the last three years in international markets relatively to your most important competitors (eliminated)		

Note: t-values are in parentheses; CR = construct reliability; AVE = average variance extracted