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FIRM CHARACTERISTICS AND NPD PROGRAM SUCCESS: THE SIGNIFICANT INFLUENCE OF GLOBAL DISCOVERY MANAGEMENT

ABSTRACT

Managing the new product development (NPD) with a global point of view is argued to be essential in current business more than ever. Accordingly, many firms are trying to revitalize their NPD processes to make them more global. Therefore, examining global NPD management is one of the top priorities for research. While scholars have examined global launch management, there has been scant attention on the direct effect of global discovery management on NPD success. Therefore, the study investigates how a globally-managed discovery phase enhances a firm's overall NPD success. Drawing upon the resource-based view (RBV) and using Kotabe's (1990) generic model for market success in global competition as the overarching framework, the study examines four drivers of NPD success: global discovery management, the firm's 'global footprint', its inbound knowledge sourcing practices (i.e., 'open innovation proclivity'), and nationality of the teams (i.e., 'cross-national global NPD team use'). The hypotheses are tested using a sample of 255 business units from multiple industries, headquartered worldwide, and surveyed during the 2012 PDMA Comparative Performance Assessment Study (CPAS). The PLM-SEM analyses show that, of the four drivers examined, only global discovery management strongly influences a firm's NPD program success. The findings enhance our understanding of the particularities in global NPD. Based on the study's results, suggestions are provided as to how multinationals can leverage their international operations in the course of their front-end activities.

Practitioner Points:

- A global perspective on new product development (NPD) is necessary to better meet the demands of increasingly globalized competition.
- To increase the likelihood of NPD success in both domestic and foreign markets, firms should take into account inputs from international markets as early as possible in the NPD process.
- A number of distinct firm activities such as global scanning or listening to the voice of customers globally can be undertaken to glean essential insights from international markets.

- NPD success is more a function of firm-wide actions (i.e., managing the NPD front-end with a global point of view) rather than simply being present globally or utilizing cross-national global NPD teams.

Keywords: Global discovery management, discovery, global footprint, open innovation proclivity, cross-national global team, NPD success, resource-based view

INTRODUCTION

In recent years, pervasive and evermore powerful communication technologies resulted in increased universal consumption patterns both in the business-to-consumer (B2C) and business-to-business (B2B) domains (De Mooij, 2011). To better respond to this novel nature of their customers and to leverage some economies of scale by developing more uniform products, many leading firms are increasingly implementing global new product development (NPD) processes. Therefore, foreign markets are becoming valuable input sources to leapfrog competition more than ever. Accordingly, some scholars urge future research to adopt a more global view when examining NPD (Perks and Wong, 2003). In fact, those that have examined global NPD practices found general support for the effect of a global perspective on NPD (cf. de Brentani, Kleinschmidt, and Salomo, 2010).

The findings in extant research are very valuable for extending our understanding of the effects of globalization on NPD in general. However, several research gaps regarding the specific effect of global NPD processes on firm success remain. First, the investigation of global NPD processes' influence on firm success must be done separately for discovery, development, and launch phases since there is increasing consensus that the product innovation process has to be decomposed when its nomological network is assessed in research (Durmusoglu and Barczak, 2011; Ernst, Hoyer, and Ruebsaamen, 2010; Troy, Szymanski, and Varadarajan, 2001; Veldhuizen, Hultink, and Griffin, 2006). In this vein, some progress has been made in examining the global launch stage (cf. Bruce, Daly, and Kahn, 2007; Chryssochoidis and Wong, 1998; Harvey and Griffith,

2007), but there is comparatively less research looking into the front end of the NPD process (Kleinschmidt, de Brentani, and Salomo, 2007; McPherson, 2000).

In contrast, there are only anecdotal evidences that global discovery management influences NPD success. Beiersdorf, the owner of the internationally well-known Nivea brand, in one such example where their recent "Black & White" antiperspirant was the result of a globally set up discovery management (Bilgram, Bartl, and Biel, 2011; Dubiel, Brexendorf, and Gloeckner, 2014). When developing this new product, the firm first screened more than 200 social media sites in three languages (Brazilian, English, and German) to validate the worldwide market opportunity. Second, the voices of international customers were taken into account by extracting virtual discussion threads from the social media sites, revealing numerous perspiration-related problems and even proposing ready-made solutions to overcome them or prevent them altogether. Subsequently, this globally managed discovery phase enabled Beiersdorf to identify a new product concept with a unique value proposition, where the envisioned new product would primarily concentrate on stainless protection, but not on maximum protection duration. The resulting deodorant was Nivea's most successful product introduction ever, as its sales surpassed those of competitors' annual figures in just nine months (Dubiel et al., 2014). The case of the "Black & White" deodorant illustrates how managing the discovery phase of the NPD process globally can help achieve enhanced NPD success.

Second, extant literature presents equivocal results for the influence of global discovery on innovation success. On the one hand, albeit very limited, there is some evidence that proficient global discovery activities may not influence performance (cf. Kleinschmidt et al., 2007; Ozer and Cebeci, 2010). On the other hand, some scholars

demonstrate the positive effect of global discovery on success (Ayal and Raban, 1990; Golder, 2000; Kleinschmidt and Cooper, 1988; Lee et al., 2008; Santos, Doz, and Williamson, 2004), while some others show a curvilinear effect (Kotabe et al., 2007).

Third, in their quest for globalizing NPD processes, firms' efforts for utilizing foreign markets as valuable input sources require them to conduct scouting, sourcing, and applying external knowledge. Extant research provides some examination of these inbound open innovation activities. For example, Laursen and Salter (2006) and Leiponen and Helfat (2010) both examine the impact of inbound knowledge sourcing on NPD success. However, the former focuses only on 'new to the world' and 'new to the firm' products for British firms and the latter focuses on new to the firm technological innovations, which includes both products as well as processes in a sample of firms from another developed country in Europe: Finland. As a result, a research gap remains for a study investigating the influence of inbound open innovation for products at all innovativeness levels and using a sample that includes both developed and developing countries from different regions of the world. Finally, since both of the abovementioned works focus on the effect of the entire innovation process, research focusing on specific phases is also warranted (See Table 1).

-- Insert Table 1 about here --

Drawing from a theoretical framework developed by Kotabe (1990) and applying the resource-based view (RBV), our study aims to fill the abovementioned three gaps in extant literature. The remainder of the article is organized as follows: First, the theoretical foundation is described and then the hypotheses delineated. The next section explains the method and analyses. Then, the results are presented, followed by some post hoc

analyses. The article concludes with a discussion of the results, including implications for theory and practice as well as suggestions for future research.

THEORETICAL BACKGROUND

This article draws from the resource-based view (RBV) and adopts the framework developed by Kotabe (1990) for the determinants of innovative behavior and market performance in global competition as the foundation to develop the underlying model. Hence, first, the main tenets of RBV will be summarized. Then Kotabe's framework for success in global competition will be explained.

Resource-based View

The resource-based view (RBV) explains and aims to predict why some firms establish a position of competitive advantage as a result of firm heterogeneity (Wernerfelt, 1984). In fact, it relies on the idea that firms may achieve above normal returns mostly because of the distinctive competence in deploying their idiosyncratic resources and capabilities optimally (Penrose, 1959). Therefore, internal managerial choices determine a firm's economic performance (Prahalad and Bettis, 1986) where 'sustained competitive advantage' can be achieved by firms conceiving and then implementing strategies that enable them to exploit market opportunities via their resources and capabilities (Barney, 1991). RBV explains the source of sustainable superior performance to result from the specific resources and capabilities: that they are valuable, rare, inimitable, and non-substitutable (Adner and Helfat, 2003).

According to RBV, resources are mostly observable and can be physical or intangible, while unobservable resources can be called capabilities (Barney, 1991). More specifically, capabilities are accumulated knowledge and skills that enable the firm to

leverage their resources (Murray, Gao, and Kotabe, 2011). Land, raw material inputs, human resources and know-how (e.g., managerial talent), technological resources (e.g., process technology), and financial assets are resources while organizational processes and a firm's reputation are examples of capabilities. RBV also posits that firm-level barriers to imitation can be in the form of resource scarcity/property rights, casual ambiguity, time compression diseconomies, as well as asset stock interconnectedness. That is, accumulated stock of resources, rather than the flow of resources, play a significant role (Dierickx and Cool, 1989). Accordingly, a firm's 'global discovery management' practices are 'capabilities' since they are embedded in an organizational process that is built over time. Moreover, another firm characteristic such as the global footprint of a company can be seen as a tangible resource, while the sourcing tendencies in a firm such as its open innovation proclivity and cross-national global team use can all be considered as capabilities under RBV.

Superior Performance in Global Market Competition

In a framework for examining determinants of success for firms competing globally, Kotabe (1990) contends that four types of firm characteristics play the most influential role for higher performance in global markets. These essential characteristics of the firm are grouped into 'product policy', 'regions', 'sourcing', and 'nationality'. Kotabe (1990) argues that firms pursuing 'worldwide standardized products' would be more successful in global competition. Hence, in essence, Kotabe's arguments are for a 'global NPD process', where firms deliver new products that are going to be solving the needs of 'global' consumers. Next, Kotabe (1990) asserts that firms that operate in markets that constitute a greater portion of the world's consumption would be more

successful. In other words, firms that have larger global footprints are more likely to reap these benefits. Third, the issue of sourcing strategy revolves around outsourcing certain parts of a firm's operations to its suppliers. Kotabe (1990) visualizes this to be mostly about production. However, following the recent trends in open innovation, nowadays firms are doing more than simply outsourcing their production function to external parties; they are also incorporating them into their product innovation processes. Lastly, Kotabe (1990) argues that there are nationality effects on a firm's innovativeness and its subsequent success. In the NPD context, this translates into new product teams comprising of members from different countries and perhaps located in different parts of the world.

HYPOTHESES DEVELOPMENT

Adopting Kotabe's (1990) framework for market success in global competition as the overarching model and drawing from the RBV, this study argues that a firm's global discovery management practices (i.e., its 'product policy'), its global footprint (i.e., its 'regions'), its open innovation proclivity (i.e., its 'sourcing strategy' in product innovation) and its use of cross-national global teams (i.e., 'nationality' of the NPD teams) enhance the firm's NPD program success (i.e., market success in global competition). Figure 1 depicts our research framework.

-- Insert Figure 1 about here --

Global Discovery Management and NPD Program Success

As is known, the NPD process is conceptualized as a sequence of phases focusing on specific NPD-related activities (Cooper, 2008; Troy et al., 2001; Veldhuizen et al., 2006). The early phase, more commonly referred to as the discovery phase, comprises

activities around the generation and selection of new product ideas on the basis of identified and assessed market needs and risks in line with the firm's NPD strategy (Markham et al., 2010). It further encompasses the refining of these ideas into product concepts, which are successively evaluated, prioritized, and authorized for further development (Ernst et al., 2010; Song and Parry, 1997). Specifically, throughout the discovery phase, more market input enhances product ideation, recognition of market opportunities, evaluation of initial product concepts, and the overall alignment of the product development with market requirements (Troy et al., 2001; Veldhuizen et al., 2006). This phase further includes business plan preparation (Markham et al., 2010). Earlier research asserted that discovery phase management has the most significant effect on successful NPD (Smith and Reinertsen, 1992). Further, recent research empirically demonstrated that discovery phase independently influences overall NPD success (Markham, 2013; Verworn, 2009).

Driven by management's decisions and encouragement over time, capabilities are integrated within the firms' interconnected actions (Krasnikov and Jayachandran, 2008). During the discovery phase, conducting worldwide scanning and ideation activities as well as global collection of the voice of the customer are skills that are acquired over time and require constant management guidance. Therefore, they can be considered as capabilities that reside in firm wide processes that are hard to replicate quickly. Accordingly, 'global discovery management' refers to the capability of a firm capability for organizing NPD-related activities across national borders.

Numerous studies point to a high extent of international knowledge input during the global NPD process (Golder, 2000; Hedlund and Ridderstråle, 1995; Kleinschmidt

and Cooper, 1988). For example, Ayal and Raban (1990) demonstrate that successfully innovating firms spend more on up-front international market research and listen more extensively to international customers. Successful innovators increasingly build on international knowledge sources to identify unique product ideas, to observe market trends as well as to generate product concepts in the early stage of the NPD process (Golder, 2000). By sourcing and integrating knowledge from various geographic locations worldwide, companies can generate more innovations of higher value and lower cost (Santos et al., 2004). The ability to utilize localized pockets of technology, market intelligence and capabilities can be seen as a new and powerful competitive advantage (Santos et al., 2004).

In general, internationalizing the radius of NPD management helps to turn broader knowledge horizons into increased performance (Kleinschmidt and Cooper, 1988; MacPherson, 2000). One recurring key aspect is hereby that knowledge, market trends or capabilities important during the discovery phase not only can be found worldwide, but also that the ability to transfer these insights internally is crucial. Consequently, Lee et al. (2008) demonstrate that a working knowledge transfer mechanism between headquarters and their subsidiaries is positively related to new product outcomes. This is in line with Kleinschmidt et al.'s (2007) findings, where "windows of opportunity" can be better recognized through global knowledge integration. Hence:

Hypothesis 1: A firm's global discovery management is positively related to its NPD program success.

Global Footprint and NPD Program Success

The global footprint refers to the number of countries a firm operates in. Today's international arena truly offers a plethora of opportunities for NPD endeavors. Gone are

the times when domestic markets were the only likely source of highly innovative ideas and concepts (Cantwell, 1989; Vernon, 1966). Valuable knowledge sources have started to mushroom in far-flung geographic locations and in unlikely lead markets (Immelt, Govindarajan, and Trimble, 2009; Tiwari and Herstatt, 2012). Clearly, geographical diversity enhances the pool of know-how the firm can access, which in turn, benefits the innovative process (Leonard-Barton, 1995). Existing research points to the benefits of tapping into foreign, exclusive "pockets" of knowledge for developing a competitive advantage (Santos et al., 2004) or the necessity to renew firm NPD capabilities to maximize innovative output by sourcing knowledge from international advantageous locations (Kotabe et al., 2007). Additionally, firms may want to use or piggyback on innovation efforts of other market participants scattered internationally to overcome fixed R&D hurdles (Chung and Yeaple, 2008).

Moreover, many firms extend their international NPD-related presence. For instance, international R&D budgets of German multinational corporations (MNC) have more than doubled between 1995 and 2009 (Belitz, 2012). Furthermore, many MNCs grant more autonomy to their foreign subsidiaries, allowing them a more pro-active role in NPD (Birkinshaw and Hood, 2001; Brockhoff and Schmaul, 1996; Ghoshal and Bartlett, 1988). This international presence not only allows to get access, but also to leverage international knowledge sources for utilization in NPD activities.

As geographic configurations and roles of national subsidiaries are manifold, the individual firm's global footprint is fairly unique. Built up over years and intertwined with the firm's domestic network, the global footprint is neither interchangeable between

firms nor easy to imitate. Thus, by being heterogeneous and immobile, it can readily be seen as a key resource (Penrose, 1959; Rumelt, 1984; Wernerfelt, 1984, 1989).

Managing NPD is a complex process, constantly presupposing the alignment of knowledge and specialists from diverse functional fields. Tasks vary from ideation to product launch (Song and Montoya-Weiss, 1998). As knowledge and expertise residing within firm headquarters is limited, the number of ideas and solutions that can be derived from recombining this knowledge is limited as well (Ahuja and Katila, 2002). Therefore, a global footprint can be leveraged to increase the amount and heterogeneity of NPD inputs: First, as environmental conditions differ by country, knowledge gained from different countries is likely to be distinct (Porter, 1990). Second, as R&D activities vary by country, domain-specific market and technological knowledge can be collected (Cantwell, 1989; Phene and Almeida, 2008; Tallman and Phene, 2007). Third, the sheer number of local knowledge sources tapped increases the probability of finding useful and relevant NPD knowledge (Santos at el., 2004) as well as novel relationships between existing ideas and new perspectives (Amabile, 1983; Osborn, 1963). A more fine-grained global footprint also allows for more direct customer contact and more unfiltered listening to the voice of the local customer. In line with this theoretical and empirical evidence, we hypothesize the following:

Hypothesis 2: A firm's global footprint is positively related to its NPD program success.

Open Innovation Proclivity and NPD Program Success

Open innovation is the firm-wide belief that collaboration with the outside world is highly beneficial to solve tasks at hand (Chesbrough, 2003). Only ongoing interaction with external stakeholders can help to minimize the widespread not-invented-here

reservations impeding NPD (Katz and Allen, 1982). Consequently, more and more firms are experimenting with opening up their once-heavily-guarded (i.e., 'closed') NPD processes in order to leverage the expertise of others from around the world (Lindegaard, 2011; Noble and Durmusoglu, 2014).

A firm's open innovation proclivity refers to the degree to which a firm gets access available external knowledge to complement its innovation activities (Hung and Chiang, 2010). That said, open innovation proclivity is like a strategic orientation (e.g., technology orientation, entrepreneurial orientation) and therefore can be considered a capability (cf. Zhou, Kim, and Tse, 2005). Moreover, such an open innovation proclivity, built up within the firm over the years, is unique, and therefore heterogeneous and immobile. In that regard, it is an important capability with the potential to significantly increase performance (Penrose, 1959; Rumelt, 1984; Wernerfelt, 1984, 1989).

Open innovation proclivity is beneficial for global discovery management in several ways. First, open innovation proclivity can be seen as an important element of the organizational culture (Goers, 2011). De Brentani and Kleinschmidt (2004) stress the importance of openness as part of the globalization culture to recognize worldwide market opportunities. Open innovation proclivity not only fosters this climate, but also helps the firm to find external solutions for identified needs. Cooperation with the outside world is important for scientific knowledge acquisition as well (McMillan, Hamilton, and Deeds, 2000; McMillan, Klavans, and Hamilton, 1995). Second, with a growing number of worldwide opportunities, external knowledge and skills can fill the gap between needed and existing expertise, thereby increasing the NPD resources that can be managed within the process. Therefore, we hypothesize the following:

Hypothesis 3: A firm's open innovation proclivity is positively related to its NPD program success.

Cross-national Global NPD Team Use and NPD Program Success

Given the increasing pervasiveness of information technologies, the use of NPD team members that reside in different countries has been practiced for more than two decades now (Sivakumar and Nakata, 2003). Cross-national global NPD teams consist of team members that are globally dispersed, but also belonging to different nationalities (Subramaniam, Rosenthal, and Hatten, 1998). In other words, team members being located in different countries is not a sufficient condition for an NPD team to be labeled as 'cross-national'. If the members of an NPD team belong to the same country and these members are globally dispersed, then they may still be labeled as 'global NPD teams', but not as 'global cross-national NPD teams'. This distinction is important since cross-national global teams can process more tacit than explicit overseas knowledge compared to global teams that are not cross-national. By exhibiting unique combinations of people and locations, these types of team constitute a key firm capability.

Cross-national teams support the global NPD management in several ways: First, by forming cross-national teams, cross-national communication is enhanced (Subramaniam, 2006). Accordingly, market- and technology-related knowledge from across the firm's different units can be shared more efficiently (Bartlett and Ghoshal, 1989). Further, more tacit knowledge is shared that would have been challenging to transfer otherwise (Subramaniam, 2006). Second, the amount of knowledge shared also increases as employees are more willing to share knowledge with their teammates as compared to other colleagues outside the specific project (Ghoshal, Korine, and Szulanski, 1994). Third, through the diverse background and environmental conditions of

the single team members, individual knowledge can jointly be recombined in new ways (Huber, 1991; Sinkula, 1994). Therefore, cross-national teams can be regarded as boundary spanners that support the firm's ability to learn (Iles and Hayer, 1997). We thus propose the following hypothesis:

Hypothesis 4: A firm's cross-national global NPD team use is positively related to its NPD program success.

METHOD

Data from the "2012 PDMA Comparative Performance Assessment Study" was used to test the proposed hypotheses. This data, compiled by the PDMA Foundation, is the outcome of a large scale, cross-border and cross-industry survey conducted to examine the latest trends and the most important NPD success drivers in current practice (for details please see Markham and Lee, 2013). The key informants for the surveys were product development professionals. In total, more than 25,000 product developers worldwide were invited via email to fill out the survey, with a total of 453 firms participating. For this study, of the 453 surveys received, 18 surveys from not-for-profit organizations, 77 cases due to missing data among the dependent and/or independent variables, and 103 firms due to only being active in their domestic market were eliminated. This procedure resulted in a data set of 255 surveys for further analysis. Respondents were based in North America (127 surveys), Asia (63), Europe (47), and others (4)[1], comprising firms from a broad range of manufacturing and services industries.

As can be seen in Table 2, the responding firm have varying degrees of success compared to their primary competitors. About 10% are considered among the most

[1] In 14 cases, the respondents did not provide information regarding their country of residence.

successful firms in their industries and approximately 12% are among the least successful group. Further, radical, more innovative, and incremental innovations contribute to the profits of these firms in varying degrees as well. On average, 15.9% of profits come from radical new products and 34.5% come from more innovative new products. The remaining 49.6% is attributed to profits from incremental innovations. With respect to technology importance, 30% of the firms regard it as high, while another 30% regard it somewhat high, leaving the remainder 40% as low.

Table 2 also shows that the majority of the firms operate in B2B markets (71.8%). Moreover, 60.4% of the firms are in various manufacturing industries. These firms also operate in many regions in the world. Many of them operate in Asian, in North America, and/or in Europe. Finally, firms in our sample have various sizes.

--Insert Table 2 about here –

Measures

To develop the survey for the "2012 PDMA Comparative Performance Assessment Study", the PDMA Foundation, along with an advisory council of academics and practitioners, assembled the most pressing and important questions related to NPD. All questions were tested and refined by the PDMA Foundation with the help of 18 MBA students and 62 practitioners in several rounds.

NPD Program Success. The dependent variable was measured with three different items. In line with extant NPD literature (e.g., Cooper and Kleinschmidt, 1995), the items were based on self-assessment of success, industry comparison, and the degree of meeting own performance objectives. A four-point and seven-point Likert scale was used for measurement (See Appendix).

Global Discovery Management. Global discovery management was operationalized through distinct activity and process-related items. Exemplary items are "global opportunity identification (e.g., global scanning)" or "global collection of the voice(s) of the customer(s)". A five-point Likert scale was used for measurement (See Appendix).

Global Footprint. Global footprint was operationalized by the number of countries the responding business unit operates in (See Appendix).

Open Innovation Proclivity. In line with Chesbrough (2003), open innovation proclivity was operationalized as the belief that valuable knowledge resides outside the firm as well as pursuing collaborations with external partners. Sample items include "find that key problems that must be solved with skills that reside outside our firm" and "external collaboration with supplier of component parts". A five-point Likert scale was used for measurement (See Appendix).

Cross-national Global NPD Team Use. Cross-national global NPD teams use was operationalized as the extent to which such teams are deployed to transfer ideas, learning, know-how and skills globally in the context of NPD activities. A sample item is for instance, "manage multinational NPD project teams". A five-point Likert scale was used for measurement (See Appendix).

Control Variables. A number of other factors may influence NPD success. Therefore, several control variables were used. First, since large firms may be more successful with their new products because of greater resources they possess, a control for firm size was introduced. Further, a one-way ANOVA for global discovery management and open innovation proclivity versus firm size was conducted and it was found that the mean responses differ for global discovery management ($F(1, 197)=18.94$, $p=.00$), but not for

open innovation proclivity (F(1, 196)=.55, p=.46). Size was measured as the logarithm of the business unit's annual sales (in millions of USD).

Second, a control for a firm's level of R&D expenditure was added since the investment in R&D may influence innovation success. The level of R&D expenditures was measured as the percentage of revenues spent on R&D/NPD. Third, as radical innovations are related to higher risks, but also promise higher returns, a control for product portfolio balance was included. A Herfindahl-Index was calculated using the percentages of profits stemming from three types of products: radical, more innovative, and incremental. Further, to control for more predictable B2B environments, a measure capturing the extent of B2B vs. B2C customers of the business unit was added. Finally, as the NPD program success of a business unit may be affected by technological turbulence of its environment, the technology importance was controlled for. The technology importance was assessed as a single-item measure (See Appendix).

ANALYSIS AND RESULTS

The dependent and independent variable data are collected from the same informant when the CPAS 2012 survey was administered. Fortunately, since this survey is 30 pages long, the predictor and criterion variables are separated proximally. Moreover, our predictor variables are captured in several different sections of the survey. Therefore, the item priming effects are assumed to be minimal (Podsakoff et al., 2003). Nonetheless, before testing the hypotheses, the impact of common method bias was assessed. Similar to other studies on NPD (e.g., Atuahene-Gima and Murray, 2004), a Harman's one-factor test was conducted (Harman, 1967). It can be concluded that common method bias may not be a serious problem as no single factor accounts for the

majority of the variance and the first emerging factor accounts for 26.5% of it (Podsakoff and Organ, 1986). A factor analysis (varimax rotation, eigenvalue >1, and factor interpretation; 67% of variation explained) was also performed to probe for the dimensionality of our constructs. The analysis indicated a four-factor solution to be in line with our expectation.

Hypotheses Testing

Structural equation modeling (SEM) was used to test the hypotheses. To evaluate both the measurement models (i.e., the constructs) as well as the structural model (i.e., the relationships among the constructs) Partial Least Squares (PLS) was applied (Hair et al., 2014). Specifically, SmartPLS2 M3 was used (Ringle, Wende, and Will, 2005). This method was employed following suggestions in extant literature (Ringle, Sarstedt, and Straub, 2012). First, the primary objective of this study was the prediction and explanation of the target construct "NPD program success". Second, the model is relatively complex and the sample size rather small (Chin and Newsted, 1999). Third, the study aimed at the simultaneous testing of hypotheses with both single- (i.e., "global footprint") and multi-item scales (i.e., "open innovation proclivity"). Fourth, a rather newly conceptualized construct, i.e., "open innovation proclivity" with a not-yet-well-established measurement was investigated (Chin and Newsted, 1999). Last but not least, PLS-SEM does not have any distributional assumptions suiting the non-normally distributed data.

Construct assessment. The four reflective constructs, namely: global discovery management, NPD program success, open innovation proclivity, and cross-national global NPD team use, were validated by following the standard procedures suggested in

the literature (Hair et al., 2012; Hair et al., 2014). First item reliability was assessed by computing the item loadings, which all exceeded .40, being a satisfactory threshold for newly developed scales. Next, on the construct level, the reliability was assessed by calculating McDonald's omega (McDonald, 1999), Cronbach's alpha coefficients, composite reliability (CR), as well as the average variance extracted (AVE). All value thresholds were met or exceeded recommended levels, indicating reliability of all our constructs (Nunnally and Bernstein, 1994). Finally, the discriminant validity, both on the item and construct level, was assessed. In none of the scales, did an item correlate stronger 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 (Fornell and Larcker, 1981). Table 3 lists the relevant descriptive statistics of all variables and constructs and the respective correlation coefficients.

--Insert Table 3 about here –

Model assessment. To evaluate the model, the recommendations of Hair et al. (2012) and Hair et al. (2014) were followed and the path coefficients, the coefficient of determination (R2), and the Stone-Geisser-Test-Criterion (Q2) were examined. The path coefficients in PLS can be interpreted similarly to the standardized beta weights in multiple regressions. The extent and direction of a path coefficient determines whether a hypothesis can be accepted or not. However, only the significance level allows making an exact statement on the exploratory power of the path coefficient. The respective t-values were determined by using the bootstrapping method (Hair et al., 2012; Hair et al., 2014). Further, the R2 values for the dependent variable, i.e., NPD program success, was examined. With a value of .22, the model has an acceptable estimation quality (Hair et

al., 2012; Hair et al., 2014). Lastly, the predictive relevance of the model is satisfactory since the Q2-value is well-above the threshold of 0 (Hair et al., 2012; Hair et al., 2014).

Four firm resources were hypothesized to potentially enhance the firm's NPD program success in global competition. The results show that global discovery management has a positive and significant impact on NPD program success (β=.26, $p<.01$). This supports hypothesis 1. Hypothesis 2 predicted a positive relationship between a global footprint and NPD program success and is not supported (β=-.07, n.s.). Hypothesis 3, predicting a positive relationship between an open innovation proclivity and NPD program success, is not supported either (β=.01, n.s.). Finally, hypothesis 4 is also not supported: Cross-national global NPD team use does not have a significant impact on NPD program success (β=-.05, n.s.). Table 4 summarizes our findings.

--Insert Table 4 about here –

Post-hoc Analyses

Due to the insignificant effects obtained for some of the hypothesized relationships and some argument in extant literature that the relationships might be curvilinear rather than linear (cf. Laursen and Salter 2006 for a nonlinear relationship between open innovation and performance), some post-hoc analyses were conducted. Specifically, due to the characteristics of the data set, only Spearman correlation analyses between the NPD program success and the squared values of antecedent variables of footprint, global discovery management, open innovation proclivity, and cross-national global NPD team use scales could have been performed. Potential non-linear effects for (global discovery management)^2 (.40, $p<.05$), (open innovation proclivity)^2 (.15, $p<.05$),

and (cross-national global NPD team use)² (.18, p<.05) were observed, but not for the (footprint)² variable (p<.05).

DISCUSSION

Foreign markets are increasingly gaining in importance for NPD activities (de Brentani et al., 2010; Kleinschmidt et al., 2007; Santos at el., 2004). However, studies adopting a global view on the NPD process have not received much research attention in the past and moreover produced heterogeneous results. The present study narrows this research gap in the NPD literature by focusing on the foreign market input side of NPD processes and its impact on NPD program success. Specifically, the study zooms into a key part of the NPD process, namely the discovery phase. The vast global sample comprising firms in developed and developing markets provides a unique study setting. In the following the multiple implications of the study for research and practice are discussed.

Theoretical Implications

The study makes some valuable theoretical contributions by employing RBV to a model that is based on Kotabe's (1990) theoretical framework. When doing so, this framework is applied in global NPD settings and expands Kotabe's original variables. First, global discovery management practices are used as a proxy for a firm's product policy. Second, a specific type of knowledge sourcing practices of a firm, namely, open innovation proclivity, is examined. Finally, cross-nationality of NPD teams is used for the 'nationality' variable suggested by Kotabe (1990). These results demonstrate that a globally-managed discovery significantly enhances a firm's overall NPD success. Therefore, this study broadens the understanding of international aspects of NPD management, specifically in the front-end of the NPD process.

The findings also indicate that NPD success is not a direct outcome of a vast international operational presence. In order to benefit from worldwide operations in the NPD process, managers need to ensure that these markets are directly tapped for NPD-related information (Immelt et al., 2009). Similarly, the sole presence of cross-national global teams does not enhance NPD performance. In order to more efficiently use them and support NPD-related knowledge transfer on an everyday basis, other mechanisms have to be deployed. For example, respective incentive systems and training can be implemented. Other than such moderating effects, scholars can examine the role of internal team dynamics, potentially mediating the relationship between the cross-national global NPD team use and performance. Cross-functional integration, cohesion, and superordinate identity are among those potential mediators. Moreover, a change in firm structures and responsibilities is helpful so as to share NPD-related responsibilities with foreign firm locations. Finally, an open innovation proclivity is not directly related to success. Firms thus may want to additionally establish more operational NPD capabilities helping to specifically implement the more strategic notion of open innovation (Murray et al., 2011).

This study finds that an open innovation proclivity does not lead to NPD success in a global context. This result corroborates with extant research that state that making open innovation work successfully is a big challenge (cf. Ollila and Elmquist, 2011). Correspondingly, future research should investigate variables that assess the contingencies involved between the ‘open innovation proclivity’ and ‘global NPD success’. In doing so, scholars can make a distinction between the types of open innovation. For example, Phillips (2011) discusses four different open innovation types:

directed and invitational, directed and participative, suggestive and invitational, and suggestive and participative. One would expect external collaborations with suppliers or with many other smaller firms to take different turn when directed and invitational to some firm members versus when suggested and everyone is free to participate.

Another construct affecting the relationship between open innovation proclivity and NPD outcomes is a firm's strategic orientation type. For example, Cheng and Huizingh (2014) find that open innovation activities interact with entrepreneurial orientation as well as with market orientation to influence NPD program performance, but not with resource orientation. Finally, the effect of inbound open innovation might be fully mediated by certain variables to have a significant impact on innovation outcomes. Durmusoglu et al. (2014) emphasize the differentiating effect of 'knowledge gained' and 'knowledge shared'. Hence, the knowledge scouted via open innovation activities may need to be successfully "gained" before making a noticeable impact on performance.

Managerial Implications

The findings obtained in this study lead to some specific suggestions for managers because they clearly show how important it is to globalize the discovery phase in a firm's NPD process. In other words, it is beneficial for firms to factor in information from international markets as early as possible in their NPD. This can happen through a number of specific activities like global scanning, listening to the voice of customers globally, managing the idea creation process internationally and finally, making sure that all this information is efficiently transferred. Of all those activities, in particular, listening to the voice of international customers is most highly correlated with NPD program success. The reason might be that this measure may specifically help to develop new

products having the right level of modularity to ease their adaptation to diverse customer needs worldwide. Tapping faraway information sources for NPD can clearly provide a competitive edge to firms and help to enhance their NPD program performance both in domestic and overseas markets.

Limitations and Future Research

A few limitations of our study, albeit found in most extant research, are worth noting before discussing the results. First, cross-sectional data was used, which doesn't necessarily suggest causality of the relationships examined. Second, the survey is based on a single key respondent and future studies should try dyadic designs, if at all possible. Third, our investigation was confined only to linear effects. In future research, scholars could examine potential non-linear relationships between the focal antecedent variables and performance. The preliminary post-hoc assessments demonstrate that there is potential for more complex relationships for all antecedent variables, except the footprint variable. These results may provide first evidence that all three variables, namely, global discovery management, open innovation proclivity, and cross-national global NPD team use have a significant beneficial impact on success only to a certain extent. Beyond that, the associated complexity and orchestration efforts may become too high and have a detrimental effect on NPD program success. Future research should examine this in greater detail.

Moreover, the drivers of NPD success were examined solely at the firm level. When extending our study, scholars can use cross-level designs and respective methods like Hierarchical Linear Modeling (HLM). Future research that builds on this study should take these limitations into account. On the bright side, the sample of this study

covers firms in diverse industries and firms headquartered in many different countries. Thus, generalizations of the results can be made with little caution.

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Figure 1. Research Framework

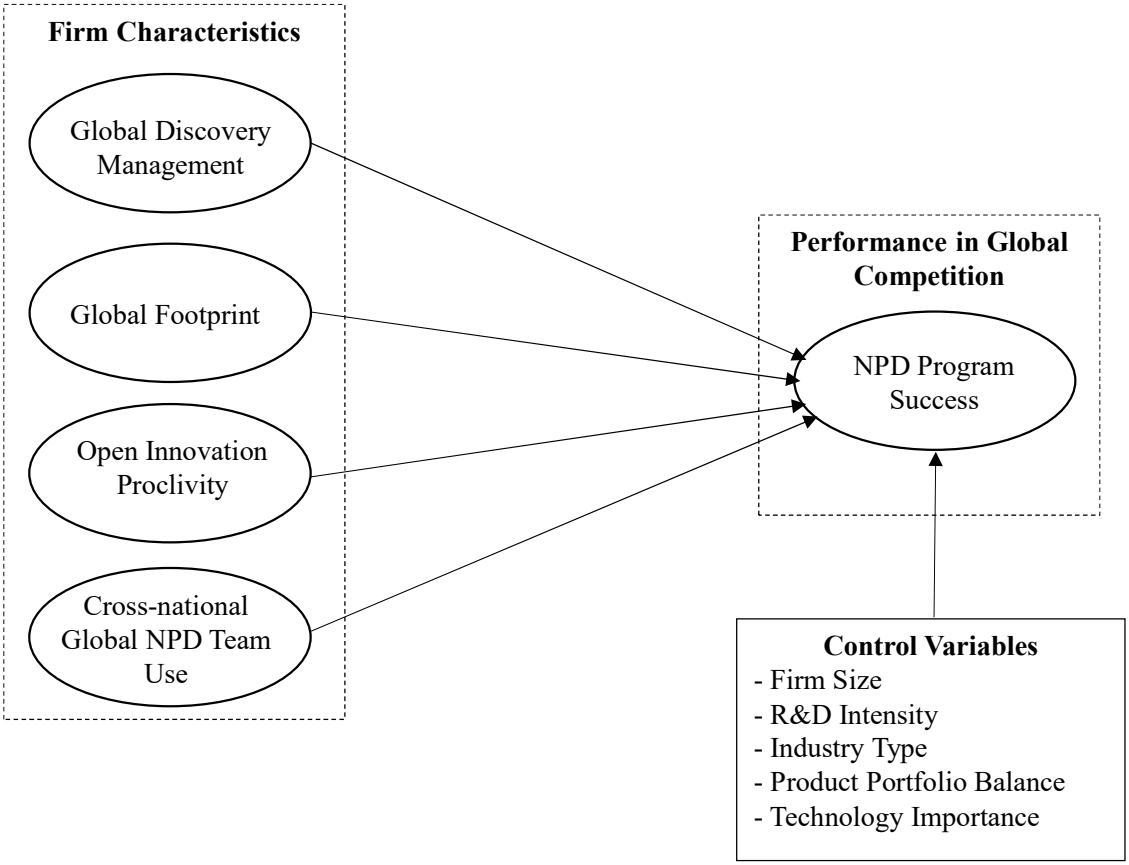

Table 1. Examples of Examinations of Inbound Open Innovation versus Current Study

Study Characteristic	*Study*		
	Laursen and Salter (2006)	*Leiponen and Helfat (2010)*	*Current Study*
Innovativeness level	New to the world and new to the firm	New to the firm	All levels
Dependent variables/constructs	Innovation success (Success of new products)	Innovation success (Success of new products and new processes)	NPD program success (Success of new products)
Dependent variable measurement characteristics	Single item (non-continuous: percentage)	Single item (non-continuous: binary)	Multiple items (continuous variables)
Dependent variable time horizon	Innovations in a 3 year period	Innovations in a 3 year period	Innovations in a 5 year period
Country of data collection	UK (developed country; Europe)	Finland (developed country; Europe)	Global (both developed and developing countries in various continents)
Focal innovation process phase	Entire process	Entire process	Discovery phase

Table 2. Responding Firm Characteristics

	Categories	Frequency		Percentage
New product related				
New product success compared to primary competitors	The most successful in our industry	24		9.4%
	In the top third of our industry	75		29.4%
	In the middle third of our industry	126		49.4%
	In the bottom third of our industry	30		11.8%
				Mean (S.D.)
New products' contribution to profits	Radical innovations	220		15.9% (18.5)
	More innovative projects	220	86.0%	34.5% (19.4)
	Incremental innovations	220		49.6% (25.2)
	Not reported	35	14.0%	
Technology importance	High tech	76		29.8%
	Middle tech	76		29.8%
	Low tech	102		40.0%
	Not reported	1		0.4%
General				
Industry type*	B2B	183		71.8%
	B2C	98		38.4%
	Not reported	7		2.8%
	Manufacturing**	154		60.4%
	Services**	74		29.0%
	Not reported/other	31		12.2%
Regions of operation*	Asia	205		80.4%
	Europe	210		82.4%
	Middle East	136		53.3%
	North America	202		79.2%
	South America	152		59.6%
	South Pacific	120		47.1%
Size (business unit's annual sales in US$)	Less than 25 million	59		23.1%
	25 million to 100 million	32		12.5%
	101 million to 500 million	45		17.7%
	More than 500 million	67		26.3%
	Not reported	52		20.4%

* The sum of frequencies exceeds 255 (similarly, the percentages do not add up to 100%) since informants could select more than one answer.

****Manufacturing**: Automobiles & Components; Capital Goods; Consumer Durables & Apparel; Food, Beverage & Tobacco; Health Care Equipment & Services; Household & Personal Products; Materials; Pharmaceuticals & Biotechnology; Technology Hardware & Equipment; Utilities.

Services: Banks; Diversified Financials; Energy; Food & Drug Retailing; Hotels; Restaurants & Leisure; Industrial Services & Supplies; Insurance; Media Publishing & Broadcasting; Real Estate; Retailing (other than Food & Drug); Software & Services; Telecommunications Services; Transportation.

Table 3. Descriptive Statistics, Correlations, and AVEs

	Variables	n	Mean	S.D.	Min.	Max.	1	2	3	4	5	6	7	8	9
1	Firm size	203	4.71	2,90	-2.30	11.5	*n.a.*								
2	R&D intensity (%)	220	12.86	16,45	.20	100	-.35**	*n.a.*							
3	Product portfolio balance	220	.52	.16	.33	1	.02	-.22**	*n.a.*						
4	Technology importance	254	3.06	.91	1	4	.06	.21**	.13*	*n.a.*					
5	Global discovery management	250	2.89	1.06	1	5	.33**	.07	-.16	.39**	*.83*				
6	Global footprint	255	40.01	49,68	2	200	.56**	-.16	.08	.14*	.50**	*n.a.*			
7	Open innovation proclivity	250	2.47	.79	1	5	.07	.10	-.25**	.19**	.35**	.11	*.71*		
8	Cross-national global NPD team use	254	2.67	1.08	1	5	.36**	-.02	-.15*	.18**	.56**	.43**	.24**	*.75*	
9	NPD program success	237	4.32	1.28	1	7	.12	.25**	-.27**	.28**	.40**	.12	.14*	.18**	*.79*

Notes: Italics numbers on the diagonal show the square root of the AVE; ** correlation significant at the level of .01; * correlation significant at the level of .05 (two-tailed tests).

Table 4. Overview of Results

	Coefficient estimate	SE	Bootstrap confidence interval (95%)
Dependent Variable: NPD Program Success			
Independent Variables			
Global discovery management	.26**	.09	[.08; .44]
Global footprint	-.07 n.s.	.08	[-.24; .08]
Open innovation proclivity	.01 n.s.	.07	[-.14; .14]
Cross-national global NPD team use	-.05 n.s.	.09	[-.23; .13]
Controls			
Firm size	.07 n.s.	.06	[-.05; .12]
R&D intensity	.06 n.s.	.05	[-.05;.15]
Product portfolio balance	-.25**	.07	[-.35; -.15]
Industry type	-.15*	.06	[-.26; -.02]
Technology importance	.14*	.06	[.02; .26]
Model Assessment			
R^2	.22		
Q^2	.13		

Significance: two-tailed; * p<.05 (1.960); **p<.01 (2.576); ***p<.001 (3.290); n.s.= not significant

n = 255.

PLS algorithm: mean replacement, path weighting scheme.

Bootstrapping: mean replacement; construct level changes, sample of 5000.

Appendix: Construct Items, AVEs, and Reliabilities

Measurement items	Item loading	McDonald's ω	Cronbach's α	AVE	CR
NPD Program Success		.86	.69	.62	.83
anchors: disagree - agree					
How much do you agree that the following statements describe your business					
a. Our new product program meets the performance objectives set out for it	.74				
b. Overall, our new product program is a success	.79				
anchors: in the bottom third of the industry - most successful in the industry					
c. Please mark the one phrase best describing your business unit's overall new product success as compared with your primary competitors over the past 5 years	.82				
Global Discovery Management		.90	.85	.69	.90
anchors: never - virtually always					
To what extent does your company do each of the following?					
a. Global opportunity identification (e.g., global scanning)	.86				
b. Global collection of the voice(s) of the customer(s)	.87				
c. Manage new product idea creation globally	.81				
d. Manage the transnational transfer of ideas, learning, know-how, and skills	.78				
Open Innovation Proclivity		.82	.69	.50	.79
anchors: never - virtually always					
What percentage of more innovative projects involves the following?					
a. External collaboration with supplier of component parts	.80				
b. Facilitate collaboration externally through an externally focused open innovation system	.76				
c. Find that key problems that must be solved with skills that reside outside our firm	.68				
d. External collaboration with a firm much smaller than us	.55				
Cross-national Global NPD Team Use	Spearman correlation = .49**[i]				
anchors: never - virtually always					
a. To what extent does your company manage multinational NPD project teams?					
b. What percentage of the time are teams made up of people that are globally dispersed employed for product development in your business unit?					
Technology Importance					
anchors: technology is not a major issue for our company - we regularly follow up on technological advancements that may improve our current products and/or services, and markets and adjacent technologies that may bring about a complete breakthrough in our activities					
Is technology an important part of your organization?					

[i] Two-tailed test ** p<.01.