Marketing involvement in product platform creation: The role of personal and structural coordination mechanisms

Ties van Bommel1,2 | Edwin J. Nijssen1 | Alex A. Alblas1

1Department of Industrial Engineering and Innovation Sciences, Eindhoven University of Technology, Eindhoven, The Netherlands
2Signify, Eindhoven, The Netherlands

Correspondence
Ties van Bommel, Department of Industrial Engineering and Innovation Sciences, Eindhoven University of Technology, Eindhoven, The Netherlands.
Email: t.v.bommel@tue.nl

Integrating market knowledge in the architecture of product platforms can be a challenge for firms. In this study, we draw on knowledge-based theory to propose the importance of bilateral knowledge: a marketer’s knowledge of product platforms and a platform architect’s knowledge of the market opportunity for securing marketing involvement and platform success. Along with these two personal coordination mechanisms, we examine the impact of a marketing department’s level of product platform knowledge as a structural coordination mechanism and account for its moderating effects on these personal mechanisms. To test our model, we conducted a survey at a multinational electronics company, with the architects of product platforms as key informants. Our results show that an architect’s knowledge of market opportunities for the product platform fuels marketing’s involvement and improves financial performance, as does the marketer’s knowledge of product platforms, although this is entirely mediated by marketing’s involvement. A marketing department’s product platform knowledge has a strong, direct and moderating impact; it acts as a substitute for the individual marketer’s personal knowledge, yet enhances the impact of the architect’s knowledge of the market opportunity. Therefore, innovation managers are advised to foster their marketing department’s understanding of product platforms.

KEYWORDS
digitalization, knowledge-based theory, product platform, R&D-marketing interface

1 | INTRODUCTION

Product platforms enable firms to innovate by efficiently creating a variety of products for a market (Facin et al., 2016; Jose & Tollenaere, 2005; Salvador, 2007). Research suggests that developing platforms requires strong intraorganizational collaboration, which is not always easy to achieve in technology driven organizations. Research by Cenamor et al. (2017), for example, shows the impact of back-end unit creators, and front-end unit offering developers operate separately, in a sequential rather than concerted way. This can lead to a serious mismatch between a platform and its market and therefore considerably hamper a new platform’s market success (Sanchez, 1999). Academic research has not systematically examined this important phenomenon.

Research on the research and development (R&D)–marketing interface follows two major streams (see Table 1): One focuses on coordination, enhanced communications, structural/cultural factors regarding new product performance and/or how collaboration affects innovation performance through knowledge integration; the other stream takes a social–political perspective and considers power and influence as antecedents of decision-making. It looks at marketing’s lack of control and its influence tactics to achieve outcomes.
### TABLE 1  Overview of relevant literature

<table>
<thead>
<tr>
<th>Authors (year)</th>
<th>Coordination mechanism</th>
<th>Type of study</th>
<th>Investigated levels</th>
<th>Marketing's technical knowledge</th>
<th>Respondent</th>
<th>Setting</th>
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<tbody>
<tr>
<td></td>
<td>Structural</td>
<td>Personal</td>
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<tr>
<td>Structure, culture and communication</td>
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<tr>
<td>Calantone and Rubera (2012)</td>
<td>√</td>
<td>Empirical</td>
<td>Programme</td>
<td>√</td>
<td>RD&amp;E managers</td>
<td>80 companies operating in the U.S. auto industry</td>
</tr>
<tr>
<td>Rubera et al. (2012)</td>
<td>√</td>
<td>Empirical</td>
<td>Product/project</td>
<td></td>
<td>R&amp;D &amp; marketing managers</td>
<td>5 firms in the food and shoes industry</td>
</tr>
<tr>
<td>Song and Song (2010)</td>
<td>√</td>
<td>Empirical</td>
<td>Product/project</td>
<td></td>
<td>Project managers/members, IT officers and marketers</td>
<td>R&amp;D based firm(s)</td>
</tr>
<tr>
<td>Leenders and Wieringa (2008)</td>
<td>√</td>
<td>Empirical</td>
<td>Product</td>
<td></td>
<td>Respondents with marketing or R&amp;D background</td>
<td>Companies in the pharmaceutical industry</td>
</tr>
<tr>
<td>Song et al. (1997)</td>
<td>√</td>
<td>Empirical</td>
<td>Project</td>
<td></td>
<td>R&amp;D, manufacturing, and marketing managers</td>
<td>High-tech Mexican companies</td>
</tr>
<tr>
<td>Moenaert and Souder (1996)</td>
<td>√</td>
<td>Empirical</td>
<td>Project</td>
<td></td>
<td>R&amp;D engineers and managers, marketing/sales</td>
<td>40 Belgian R&amp;D-based companies</td>
</tr>
<tr>
<td>Gupta et al. (1986)</td>
<td>√</td>
<td>√</td>
<td>Conceptual</td>
<td>Product</td>
<td>n.a.</td>
<td>n.a.</td>
</tr>
<tr>
<td>Schweitzer et al. (2018)</td>
<td>√</td>
<td>Empirical</td>
<td>Product/project</td>
<td></td>
<td>R&amp;D managers, project leaders and members</td>
<td>Technology-intensive firms in Austria</td>
</tr>
<tr>
<td>Açkgöz, Günsel, Kuzey, and Seçgin (2016)</td>
<td>√</td>
<td>Empirical</td>
<td>Project</td>
<td></td>
<td>NPD team members</td>
<td>79 Turkish technology firms</td>
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<tr>
<td>Moenaert, Souder, de Meyer, and Deschoolmeester (1994)</td>
<td>√</td>
<td>Empirical</td>
<td>Project</td>
<td></td>
<td>Marketing and R&amp;D respondents</td>
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<td>de Luca and Atuahene-Gima (2007)</td>
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<td>Empirical</td>
<td>Product</td>
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<td>High-tech firms</td>
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<td>Workman (1993)</td>
<td>√</td>
<td>√</td>
<td>Case study</td>
<td>Product (platform)</td>
<td>a</td>
<td>Managers and engineers</td>
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<tr>
<td>Atuahene-Gima and Li (2000)</td>
<td>√</td>
<td>Empirical</td>
<td>Project</td>
<td></td>
<td>R&amp;D participants</td>
<td>114 high-tech firms in China</td>
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key questions: How important are the structural versus personal
marketing's involvement in and contribution to the PPC team's deci-
sion-making role in the innovation challenge. This awareness will help secure
architect with more market knowledge will be more aware of market-
customer needs and the market at large. We anticipate that a platform
the design and integration of components to ensure fit with specific
bilateral knowledge. A platform architect is an engineer who oversees
whereas at the individual level, it is personal and generally intangible.
The knowledge at unit or department level is shared and tangible,
and the individual's bilateral knowledge as a personal mechanism.
individual marketer collaborating with the PPC team. We consider the
Rubera, 2012; de Luca & Atuahene-Gima, 2007; Grant, 1996), we
This study addresses these gaps by focusing on the role of bilateral
knowledge and accounting for both personal and structural coordi-
amination mechanisms. Drawing on knowledge-based theory (Calantone &
Rubera, 2012; de Luca & Atuahene-Gima, 2007; Grant, 1996), we
define bilateral knowledge as the knowledge that an actor or unit has
of a counterpart's functional domain. Bilateral knowledge helps
counterparts trust the other actor's ability to effectively contribute to
integrating market and technical knowledge for the platform. We dis-
tinguish the marketing unit/department's knowledge and that of the
individual marketer collaborating with the PPC team. We consider the
marketing department's bilateral knowledge as a structural mechanism
and the individual's bilateral knowledge as a personal mechanism.
The knowledge at unit or department level is shared and tangible,
whereas at the individual level, it is personal and generally intangible.
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ing's role in the innovation challenge. This awareness will help secure
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sion-making.

The specific objective of this study is to seek the answers to two
key questions: How important are the structural versus personal
coordination mechanisms of bilateral knowledge for securing market-
ing's involvement in a technology-driven firm's PPC? And, does higher
marketing involvement in PPC provide additional benefits, for exam-
ple, positively impact the platform's performance?

The study contributes to the literature in three significant ways.
Firstly, we extend prior work on product platform management and
marketing (Cenamor et al., 2017; Sanchez, 1999) by detailing how
market knowledge can be integrated with technical knowledge in
PPC and demonstrating the importance of bilateral knowledge in the
process. By focusing on modern platforms, we recognize and address
the tension between the technical creation and commercial exploita-
tion of these platforms. Although there are many qualitative, case-
like studies (e.g., Cenamor et al., 2017; Coreynen et al., 2017;
Workman, 1993), few quantitative efforts have been undertaken.
Second, we simultaneously consider structural and personal coordi-
nation mechanisms from a bilateral knowledge perspective, to
explore how they work together and potentially reinforce each other.
This complements prior work on the above-mentioned interplay
(Ayers et al., 2001; Workman, 1993) and the importance of market-
ing having adequate technical knowledge (Calantone &
Rubera, 2012). By taking the platform architect's viewpoint, we offer
a new perspective on the R&D–marketing relationship (under
'Respondent' in Table 1). Because the platform architect oversees
both the technical and market side, we circumvent the unilateral per-
spective and bias generally associated with how marketers or R&D
people judge their and others' contribution and importance
(Atuahene-Gima & Evangelista, 2000).

We begin by presenting findings from a preliminary study and dis-
cussing the theoretical background of the study, before presenting
the model and developing hypotheses. The methodology of the
empirical study is then discussed, followed by the results. We close
with a discussion followed by the theoretical and managerial impli-
cations as well as limitations of the research.

| Authors (year) | Coordination mechanism Type of study Investigated levels Marketing’s technical knowledge Respondent Setting |
|---------------|----------------------|------------------|------------------|------------------|------------------|
| Ernst, Hoyer, and Rübsaamen (2010) | Structural Personal | Empirical | Product/ project | Marketing and general managers | Firms in packaged goods or machinery |
| This study | √ | √ | Empirical | Platform | Platform architects | High tech |

Abbreviations: IT, information technology; NPD, new product development; R&D, research and development.

*Recognize the importance but not central to their study.

Although this rich body of research has provided useful insights
into the integration and collaboration between engineering and market-
ing, some important issues remain underexplored. Table 1 shows three
research gaps. First, most studies have focused on project and not pro-
grame management (see column 'Investigated Levels'). However,
product platform creation (PPC) particularly is related to the programme
level, and thus, opening the black box of how engineers and marketers
work together in this context is important. Second, prior research has
not accounted for the role of marketing's level of technical knowledge
(see relevant column). However, for marketing to be able to contribute
to platform creation and management, some level of platform knowl-
edge is required. Third, although coordination mechanisms have been
studied extensively, structural and personal coordination mechanisms
are not often studied together (see column 'Coordination mechanism').
So, whether these are substitutes or complements remains unclear.

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cations as well as limitations of the research.

2 | PRELIMINARY STUDY

To better understand product platform decisions, team composition
and marketing's role in PPC processes, we conducted 11 interviews

| TABLE 1 | (Continued) |
with platform managers and architects at a multinational electronics firm. To ensure diverse perspectives, interviewees had different roles, at different management levels, and worked in different divisions. The semi-structured format allowed for a discussion during the half to 1-h interviews, conducted over a 1-month period.

The findings (see Appendix 0) confirm the importance of both the architect’s knowledge of the market opportunity and the marketer’s understanding of product platforms for marketing’s involvement in PPC. Interviewees commented: ‘it is important that platform developers understand the role of marketing’ and that ‘architects speak the language of the market.’ Respondents stated: ‘marketers need to have knowledge about marketing and technology,’ and ‘marketers can help determine a product’s functions and make technological decisions.’ The interviewees also differentiated between perceptions regarding marketing individuals and departments. For example, one respondent said, ‘it is also beneficial if the marketing department understands what is possible to develop and what is not,’ suggesting an increased general understanding and appropriate work routines on the marketing side. This underlines the roles of personal and formal structural coordination mechanisms and confirms our findings that marketing involvement in PPC and bilateral knowledge are key factors.

Using the findings from the preliminary study interviews, we reviewed relevant concepts in product platform development, knowledge-based theory and organizational coordination mechanisms to develop our model and hypotheses (see Figure 1).
3.2 | Knowledge theory: The importance of bilateral knowledge

As knowledge-based theory predicts knowledge, it is a firm’s strategically most important resource (Grant, 1996), and knowledge integration is key to its competitive success. Because knowledge is ‘sticky,’ it is difficult to combine inside an organization (Galunic & Rodan, 1998) and makes departments interdependent (Calantone & Rubera, 2012). It requires close collaboration between marketing and R&D and between the back-end and front-end units of the innovation process (Cenamor et al., 2017). This interdependence means it is important that every department recognizes each other’s value.

‘However, in high technology firms, the interdependence may be asymmetrical, with marketing having relatively lower power and a net dependence on R&D’ (Atuahene-Gima & de Luca, 2008, p. 667). Marketing will probably struggle to gain influence—under conditions of unequal power, the weaker party loses influence as communication frequency decreases and the stronger party ignores suggestions. Given its more powerful position, R&D then acquires control over the new product development (NPD) process at the expense of marketing. It will dictate its own ideas more and more.

Under these conditions in a dominantly technical culture, structural and personal coordination are marketing’s main opportunities to affect PPC decisions (Maltz et al., 2001; Workman, 1993). Formal structures—like units or departments—strengthen communication flows, favorableness of message reception and cross-functional cooperation in NPD (Moenaat & Souder, 1990; Song & Parry, 1992). With formal status come specifically formulated duties and activities, and thus structural influence. However, only if R&D believes the marketing unit or department has adequate technical knowledge will this extend to PPC decisions (Workman, 1993). Knowledge of platforms’ policies and design is necessary for R&D to trust that the marketing department and staff are capable of adding value to the new platform development process. Absence of this bilateral knowledge will have the opposite effect: R&D will distrust the marketing department, disqualify its expertise and ignore its market and customer information (Calantone & Rubera, 2012; Maltz et al., 2001).

3.3 | Personal versus structural coordination mechanisms

Besides structural coordination, the literature emphasizes the importance of personal influence (Atuahene-Gima & de Luca, 2008; Gupta et al., 1987; Workman, 1993). This comprises personal relationships between organization members that typically cut across organizational units and hierarchical levels, including ‘direct contact, liaison roles, task forces and teams’ (Galbraith, 1973, p. 89; see also Mom et al., 2009). Especially, individuals with bilateral knowledge will be trusted and effective. Displaying personal knowledge of platforms signals a marketing/sales individual’s ability to contribute to the platform team’s goal and trustworthiness (Joshi, 2010; Workman, 1993). Consequently, these individuals will be more involved and able to influence decisions, thus adding to the success of the platform and its (derived) products in the market.

On the basis of the above, we propose the marketing department and the individual marketer’s bilateral knowledge as key variables in their successful contribution to marketing’s involvement in a firm’s PPC. In a similar vein, we distinguish and make a case for the importance of the platform architect’s market knowledge as the architect is the key actor in the product development team. The platform architect’s bilateral knowledge concerns their awareness of market issues and customer needs affecting applications that are or can be built on the platform. More bilateral knowledge means greater awareness of the importance of market issues and marketing for innovation success and thus a higher likelihood that marketing’s role will be recognized and a marketer involved.

4 | RESEARCH MODEL AND HYPOTHESES

Figure 1 shows our conceptual model. The structural and personal coordination mechanisms on the left include the impact of the marketer’s bilateral knowledge, that is, the marketer’s product platform knowledge (Marketer PP knowledge) and the architect’s bilateral knowledge and the architect’s market opportunity knowledge (Architect MO knowledge) on Marketing PPC involvement. The formal structural coordination mechanism is marketing department product platform knowledge (Marketing Dept PP knowledge) and refers to its bilateral knowledge, which also directly affects marketing’s involvement. However, we anticipate this structural mechanism will moderate the effects of the two personal mechanisms with marketing’s involvement. The right side of Figure 1 shows the impact of marketing involvement on the product platform’s financial performance. To develop our hypotheses, we begin with the architect as pivotal actor in the platform development process.

The architect plays a key role in decisions regarding platform design and derivative products. By optimizing commonality and configurability, the architect aims to create a family of potential product variants that resonate in the current market and can also cater to future needs (Karlsson & Sköld, 2007; Zwerink et al., 2007). The greater the architect’s knowledge of the market and its opportunities, the better they are able to make the right design decisions about the platform and its components. Knowledge about factors such as market size, trends and evolving customer needs will enhance decisions and prevent overdesign as well as unnecessary variation (Salvador, 2007). In other words, an architect with market knowledge can make better commonality—diversity trade-offs, benefiting the platform’s financial returns. Thus, we hypothesize as follows:

H1a. The greater the architect’s market knowledge, the better the product platform’s financial performance.

An architect who appreciates the value of market knowledge is more likely to vigorously pursue activities that generate this knowledge and will therefore be aware of the need to conduct market
research for the platform and its (future) products (Sanchez, 1999). This architect will see more detail and better understand the difficulties involved in identifying customers' latent needs and how to address them. Aware of the importance and understanding the details, the architect will appreciate that marketing is a profession and that the marketing challenge requires expertise. Consequently, the architect is also more likely to involve marketing staff in the process. For example, Jaworski and Kohli (1993) found that the amount of emphasis managers placed on market information not only enhanced their firm's involvement in generating market intelligence but also increased the organization's interdepartmental coordination and thus interaction with marketing. Therefore, we hypothesize as follows:

**H1b.** The greater the architect's marketing knowledge, the greater marketing's involvement in PPC.

In order to align a product platform with the market, a marketer needs to understand the platform's underlying technology and engineering principles (Sanchez, 1999; Workman, 1993). This knowledge helps them understand how to create variety from a platform and its components that are efficiently tailored to customer segments. The greater the marketer's knowledge of platform design (architecture, components and technical opportunities/limitations), the better they will be able to match platforms and needs while accounting for and safeguarding communalities. This knowledge will also help develop compelling pricing and advertising arguments that individually take into account technical information and competitive products. Thus, we hypothesize as follows:

**H2a.** The greater the marketer's product platform knowledge, the better the product platform's financial performance.

Although the marketer's knowledge of product platforms can directly affect a platform's success in the marketplace, this will probably be mediated by the collaboration with other PPC team functions (Li & Atuahene-Gima, 1999). The greater the marketer's product platform knowledge, the more likely they will be actively involved in the PPC process. The marketer's product platform knowledge fosters mutual understanding, which, in turn, stimulates interfunctional collaboration (Calantone & Rubera, 2012). Such collaboration improves the PPC team's competence in addressing issues of uncertainty when integrating technical and market knowledge in the new platform design (Workman, 1993). Therefore, we hypothesize as follows:

**H2b.** The greater the marketer's product platform knowledge, the greater marketing's involvement in PPC.

Marketing's greater involvement increases the likelihood that the marketer can influence the PPC team and its decisions (Li & Atuahene-Gima, 1999). It will result in a better transfer of market (ing) knowledge and ensure a better fit between the platform and its market. Regarding platforms, not just a single product but an entire product family built on the platform is affected. Moreover, because future customer preferences are generally unformed and uncertain, modular architectures offer a flexible vehicle to unlock and develop markets, making marketing's contribution even more important and necessary (Sanchez, 1999). Marketing involvement will help us reflect on these market developments and effectively create a match with the platform and its components, enhancing the platform's new product advantage and profitability (Griffin & Hauser, 1996; Li & Atuahene-Gima, 1999). Hence, we hypothesize as follows:

**H3.** The greater the marketer's involvement in PPC, the greater the product platform's financial performance.

Finally, we turn to the formal, structural mechanism and thus the impact of the marketing department and its level of product platform knowledge. The structural influence that comes with formal status means that to be effective, the department needs to be considered competent and trustworthy. A marketing department with a high level of product platform knowledge will be better equipped to address uncertainties the firm is facing (Sanchez, 1999) and convince engineers because they speak the same language. Marketing's platform knowledge fosters mutual understanding of what is going on in other functions and facilitates interfunctional coordination and collaboration (Grant, 1996) and influences decisions. Calantone and Rubera (2012) confirm that a marketing department's technical knowledge indeed increases marketing involvement and effectiveness. Thus, we hypothesize as follows:

**H4.** The greater the marketing department's product platform knowledge, the greater marketing's involvement in PPC.

A marketing department's product platform knowledge arguably also has a moderating influence on personal knowledge mechanisms. By nature, engineers and architects are sceptical about marketers' technical knowledge and role (Atuahene-Gima & Evangelista, 2000; Workman, 1993). Both communities develop their own interpretative schemes to selectively filter information. These different perspectives, goals and languages pose challenges for collaboration between R&D and marketing.

Attribution theory explains how people offer causal explanations for events, as well as the behavioural outcomes or consequences of those explanations (Kelly, 1972). We draw on attribution theory to posit that a marketing department's high levels of perceived product platform knowledge will benefit R&D's attributions that the individual marketer acting on their behalf also has this knowledge and can enhance PPC outcomes by effectively integrating technical and market knowledge. This ensures marketing will be involved, independently of the individual marketer's actual level of bilateral knowledge; it is attributed to the department or unit instead.

In contrast, low levels of marketing department platform knowledge will cause suspicion. As 'The most fundamental effect that suspicion has on perceivers is that it causes them to hesitate to take behaviour at face value. Suspicion renders ambiguous the implications of a variety of behaviours for making dispositional inferences about
the actor, (Fein, 1996, p. 1165). Thus, marketing’s involvement becomes completely dependent on the individual marketer’s bilateral knowledge, interacting with the PPC team. As an marketing unit’s platform knowledge increases, team members will become less suspicious, and marketing’s involvement will likewise increase.

We also expect that a marketing department’s perceived level of product platform knowledge will moderate the relationship between the architect’s market knowledge and marketing’s involvement. If the marketing department has high product platform knowledge, the architect will be confident of the individual marketer’s ability to provide the necessary input for market demand and the platform’s product range. The result is more marketing involvement. If the marketing department’s perceived product platform knowledge is low, confidence will be replaced by suspicion. Consequently, the architect will rely on their own knowledge rather than involve marketing in the PPC process.

We thus expect the formal structural coordination mechanism to have different moderating effects on the architect’s and marketer’s bilateral knowledge of marketing involvement. Formally we state the following:

\[ H5. \] The marketing department’s product platform knowledge will (a) negatively moderate the marketer’s product platform knowledge–marketing involvement relationship and (b) positively moderate the architect’s market opportunity knowledge–marketing involvement relationship.

5 | METHODOLOGY

5.1 | Data collection and sample

We collected data at a multinational electronics firm to test our framework, by compiling an electronic survey using the organization’s architects as key respondents (excluding those involved in a pilot study). Invitations and a reminder were sent via email to 690 persons in the firm’s Platform Architectural Community. The respondents were asked to report on a platform they had been involved in, with products that had been on the market for 6 months or more. To solicit collaboration in the survey, we approached people personally.

We received 135 questionnaires, a response rate of 20 per cent (135/690). Of these, 35 could not be processed because the architect had not been involved in PPC, the platform was still being developed or the platform’s products had not been on the market long enough to allow a meaningful performance evaluation. This left us 100 responses for our analyses. Table 2 shows a demographic profile of the sample. Most architects had more than 5 years’ experience (72 per cent). Of the product platforms, 39 per cent involved hardware development, and 50 per cent focused on business-to-business (B2B) markets.

5.2 | Questionnaire and measurements

The questionnaire was carefully designed, and the respondents purposely selected to minimize method biases (MacKenzie & Podsakoff, 2012). The survey questions and response options were clear and concise, in varying formats. Participants were informed that their responses would remain anonymous, strictly confidential and that only aggregated data would be reported. Finally, the survey was pretested, resulting in only minor changes.

Several of our measurements are grounded in existing theoretical literature (see Appendix 0). The dependent variable for product platform financial performance, for example, was adapted from Worren et al. (2002). One item we added to the three-item measurement captured the performance of the platform’s derivative products. The operationalization of the independent construct of marketer’s knowledge of product platforms was adapted from Calantone and Rubera’s (2012) measurement of marketer’s technological knowledge, using four items. To better account for PPC context, we added one item for the marketer’s command of platform jargon. We borrowed the measurement of marketing involvement in PPC from Danese and Filippini (2010). It also used four items. We created measurements for the architect’s knowledge of market opportunities (three items) and the marketing department’s general platform knowledge (four items) specifically for this study, building on work by de Luca and Atuahene-Gima (2007) and Sanchez (1999). Per scale items were created and then refined through discussions with managers.

5.3 | Data analyses

We analysed the data in two stages. First, we assessed the quality of the measurement model and explored correlations. Table 3 shows the internal reliability, correlations between the focal measurements and

<p>| TABLE 2 | Demographic profile of our sample |</p>
<table>
<thead>
<tr>
<th>Architect Years (%)</th>
<th>Department (%)</th>
<th>Platform Type (%)</th>
<th>Years in use (%)</th>
<th>Customer (%)</th>
<th>Marketer Experience (%)</th>
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<td>Research</td>
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<td>Hardware</td>
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<tr>
<td>2 &lt; 5</td>
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<td>53</td>
<td>Software–hardware</td>
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<td>31</td>
<td>Other</td>
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<td>5 &lt; 7</td>
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<td>&gt;7</td>
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<table>
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<tr>
<th>Construct</th>
<th>Mean</th>
<th>SD</th>
<th>Cronbach's α</th>
<th>1.</th>
<th>2.</th>
<th>3.</th>
<th>4.</th>
<th>5.</th>
<th>6.</th>
<th>7.</th>
<th>8.</th>
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<td>1. Architect MO knowledge</td>
<td>4.98</td>
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<td>.77</td>
<td>.82</td>
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<td>2. Marketer PP knowledge</td>
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<td>.81</td>
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<tr>
<td>3. Mark'g Dept PP knowledge</td>
<td>2.74</td>
<td>1.03</td>
<td>.91</td>
<td>.18</td>
<td>.63**</td>
<td>.88</td>
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<td>4. Marketing PPC involvement</td>
<td>3.41</td>
<td>0.96</td>
<td>.75</td>
<td>.28**</td>
<td>.48**</td>
<td>.54**</td>
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<td>5. Financial performance</td>
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<td>1.60</td>
<td>.86</td>
<td>.42**</td>
<td>.27**</td>
<td>.28**</td>
<td>.38**</td>
<td>.84</td>
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<td>6. B2B</td>
<td>0.50</td>
<td>0.50</td>
<td>1.00</td>
<td>.10</td>
<td>.03</td>
<td>.01</td>
<td>.02</td>
<td>.13</td>
<td>1.00</td>
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<tr>
<td>7. Division A</td>
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<td>.09</td>
<td>-.13</td>
<td>-.09</td>
<td>.03</td>
<td>-.06</td>
<td>-.47**</td>
<td>1.00</td>
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<tr>
<td>8. Hardware</td>
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<td>0.48</td>
<td>1.00</td>
<td>-.16</td>
<td>.02</td>
<td>-.01</td>
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<td>-.07</td>
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<tr>
<td>9. Research affiliation of architect</td>
<td>0.10</td>
<td>0.30</td>
<td>1.00</td>
<td>-.14</td>
<td>-.11</td>
<td>-.14</td>
<td>-.02</td>
<td>-.12</td>
<td>.14</td>
<td>-.13</td>
<td>-.64**</td>
</tr>
<tr>
<td>10. Team size</td>
<td>3.38</td>
<td>1.60</td>
<td>1.00</td>
<td>-.36**</td>
<td>-.09</td>
<td>-.24</td>
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<td>-.12</td>
<td>-.21*</td>
<td>-.32**</td>
<td>-.47**</td>
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<td>11. Division B</td>
<td>0.32</td>
<td>0.47</td>
<td>1.00</td>
<td>-.36**</td>
<td>-.09</td>
<td>-.24</td>
<td>-.07</td>
<td>-.12</td>
<td>-.21*</td>
<td>-.32**</td>
<td>-.47**</td>
</tr>
</tbody>
</table>

Abbreviations: B2B, business-to-business; MO, market opportunity; PP, product platform; PPC, product platform creation.

*The square root of the average variance extracted (AVE) is listed on the diagonal in italics.

*Correlation is significant at the .05 level (two-tailed).

**Correlation is significant at the .01 level (two-tailed).
the average variance extracted (AVE) for the constructs. All the multi-item reflective measurements were reliable (Cronbach’s alpha ≥ .7) and had an AVE exceeding .5, confirming convergent validity (Bagozzi & Yi, 1988). Moreover, the square root of AVE for each construct exceeded the highest variance shared with any other construct in the model, confirming discriminant validity (Fornell & Larcker, 1981).

To check whether common method bias might inflate the relationships in the perceptual data, we examined the smallest correlation among the variables, which provided a reasonable proxy for the absence of common method bias (Lindell & Whitney, 2001). The smallest observed correlation in the model variables is .18 (p < n.s.) between the architect’s marketing knowledge and the marketing department’s product platform knowledge (see Table 3). We also performed Harman’s one-factor test on the study items (McFarlin & Sweeney, 1992). The maximum variance explained by a single factor is 27 per cent, thus less than the 50 per cent required. This outcome suggests it is unlikely that common method bias will affect our results.

Next, to test the hypothesized relationships, we used SmartPLS 3.0 (Ringle et al., 2015). Partial least squares (PLS) is a powerful instrument for analysing small samples. As it requires fewer assumptions about data distribution than other covariance matrix techniques, the findings are less sensitive to data skewness and kurtosis. We used bootstrap with 1000 samples for stable estimates.

To ensure correct model estimates, we included several controls in the analysis: architect’s department, division, customer type, platform type and team size. The divisions operate in different industries and markets, with different product technology and customer characteristics, which may affect marketing’s involvement as well as platform outcomes. The size of the PPC teams as well as the complexity of the platform can also impact marketing’s involvement and influence. We estimated two nested models, one with controls and main effects only and one including the anticipated moderations. Finally, to ensure our model’s robustness, we performed additional endogeneity checks.

6 | RESULTS

6.1 | Main effects model

Table 4 shows the results of the PLS estimates for the main effects-only model, Model 1. The model explains a fair amount of variance in marketing involvement in PPC and the platform’s financial performance, that is, 36 and 24 per cent, respectively.

As anticipated, the architect’s level of market opportunity knowledge positively impacts the product platform’s financial performance (β = .31, p < .01), which supports H1a. The architect’s level of market opportunity knowledge also has a positive effect on marketing involvement in PPC (β = .21, p < .05), supporting H1b.

Contrary to our expectations, the marketer’s level of product platform knowledge has no direct positive effect on the platform’s financial performance (β = .09; p > .1). Thus, there is no support for H2a. However, we find that the marketer’s knowledge of product platforms has a significant and direct positive effect on marketing’s involvement in PPC (β = .23, p < .05), supporting H2b.

The results also confirm the positive effect of marketing’s involvement in PPC on the product platform’s financial performance, supporting H3 (β = .23; p < .05). The marketing department’s product platform knowledge also has a strong, positive and direct effect on marketing’s involvement in PPC (β = .44; p < .01), which supports H4.

6.2 | Moderating effects

Model 2 shows the results for the model including main and moderating effects. We note a significant increase in R² for marketing involvement (ΔR² = .07, p < .05), which confirms that including these interactions adds to the variance and is meaningful. Specifically, the findings confirm that the marketing department’s level of product platform knowledge significantly and negatively moderates the marketer’s product platform knowledge—marketing involvement relationship (β = -.16; p < .10). It supports H5a. Figure 2 shows the result of simple slope analysis that facilitates interpreting the moderation. It illustrates how the relationship between the marketer’s product platform knowledge—marketing involvement behaves under different moderator values (one standard deviation above and below the mean). For high values of marketing department knowledge, the individual marketer’s product platform knowledge does not play a role in marketing’s involvement. However, if the marketing department’s product platform knowledge is low, the marketer’s product platform knowledge does have a strong positive effect on involvement. It suggests that the personal mechanism with the marketing individual’s platform knowledge then compensates, at least partially, for the low level of knowledge at department or unit level. The marketing department variable does not moderate the architect’s market knowledge—marketing involvement relationship (β = .22, p > .1), implying there is no support for H5b.

Turning to the control variables, we note that marketing involvement is positively correlated with larger PPC team size and with hardware PPC (compared with software-hardware PPC). Marketing is thus less involved in the development of solution-oriented software–hardware platforms. Furthermore, platforms supervised by a research architect perform worse than from development, probably because these platforms are more uncertain and complex to create.

6.3 | Endogeneity check

We acknowledge that there could be a case of reverse causality. Marketing involvement can provide architects with more market opportunity knowledge. The fact that marketers are more involved could lead to a transfer of market opportunity-related information to the architect. To check for this potential endogeneity effect, we applied an instrument-free method using Gaussian copulas (Hult et al., 2018). Gaussian copulas describe the dependence between the endogenous component of a regressor and the error term, thus capturing the
TABLE 4  Results of the partial least squares analysis

<table>
<thead>
<tr>
<th>Dependent variable:</th>
<th>Model 1</th>
<th></th>
<th></th>
<th></th>
<th>Model 2</th>
<th></th>
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<tbody>
<tr>
<td></td>
<td>Marketing involvement</td>
<td>Financial performance</td>
<td></td>
<td></td>
<td>Marketing involvement</td>
<td>Financial performance</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Coef</td>
<td>SD</td>
<td>t</td>
<td>p</td>
<td>Coef</td>
<td>SD</td>
<td>t</td>
<td>p</td>
</tr>
<tr>
<td>Architect MO knowledge</td>
<td>0.21*</td>
<td>0.09</td>
<td>2.28</td>
<td>.02</td>
<td>0.31**</td>
<td>0.09</td>
<td>3.46</td>
<td>.00</td>
</tr>
<tr>
<td>Marketer PP knowledge</td>
<td>0.23*</td>
<td>0.11</td>
<td>2.13</td>
<td>.03</td>
<td>0.09</td>
<td>0.10</td>
<td>0.88</td>
<td>.38</td>
</tr>
<tr>
<td>Mark’s Dept PP knowledge</td>
<td>0.44**</td>
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<td>4.08</td>
<td>.00</td>
<td>0.48**</td>
<td>0.11</td>
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<td>.00</td>
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<tr>
<td>Marketing PPC involvement</td>
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<td>0.11</td>
<td>2.17</td>
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<td></td>
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<td></td>
<td></td>
</tr>
<tr>
<td>Mark’s Dept PP knowledge × architect MO knowledge</td>
<td>0.22</td>
<td>0.18</td>
<td>1.24</td>
<td>.22</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Mark’s Dept PP knowledge × marketer PP knowledge</td>
<td>−0.16***</td>
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<td>1.70</td>
<td>.09</td>
<td></td>
<td></td>
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<tr>
<td>Controls:</td>
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<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>B2B</td>
<td>0.01</td>
<td>0.10</td>
<td>0.06</td>
<td>.96</td>
<td>0.08</td>
<td>0.11</td>
<td>0.72</td>
<td>.47</td>
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<td>Hardware</td>
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<td>0.11</td>
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<td>.01</td>
<td>0.06</td>
<td>0.12</td>
<td>0.48</td>
<td>.63</td>
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<td>Research affiliation of architect</td>
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<td>0.09</td>
<td>0.06</td>
<td>.95</td>
<td>−0.16***</td>
<td>0.09</td>
<td>1.88</td>
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<td>−0.06</td>
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<tr>
<td>Consumer lifestyle</td>
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<td>0.11</td>
<td>1.38</td>
<td>.17</td>
<td>−0.05</td>
<td>0.11</td>
<td>0.43</td>
<td>.67</td>
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<td>Health</td>
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<td>0.04</td>
<td>0.14</td>
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<td>.77</td>
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<tr>
<td>$R^2$ adj.</td>
<td>0.36</td>
<td>0.24</td>
<td>0.43</td>
<td>0.24</td>
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</table>

Abbreviations: B2B, business-to-business; MO, market opportunity; PP, product platform; PPC, product platform creation.

*p < .05. **p < .01. ***p < .10 (two-tailed).
correlation between their explanatory variables and the error term (Park & Gupta, 2012). For an appropriate estimate, the endogenous regressor must be non-normally distributed (Park & Gupta, 2012). The Shapiro–Wilk test indicates that the null hypothesis of normality for the model can be rejected ($W = .974, p < .05$) and thus that copula correction for the architect's level of market knowledge could be assessed.

Concerning the impact of marketing involvement on a marketer's knowledge of product platforms, we have fewer endogeneity concerns. A marketer's knowledge regarding platforms and their creation builds up overtime, across platforms, and thus will be less affected by marketing's involvement in a single platform development. However, the composite scores from the endogenous construct of marketer's knowledge of product platforms proved to be normally distributed, avoiding an empirical check using copula correction.

The results of the Gaussian copula-corrected model for the effects of an architect's bilateral knowledge are shown in Table 5. Although the copula coefficient is significant, the correlation between the endogenous regressor and the error is relatively small ($\rho = .087$). The endogeneity issue is thus limited. Moreover, the corrected results are similar to the original findings, except that the significant main effect of the architect's market knowledge switches to a significantly moderated effect with the marketing department's knowledge of product platforms. Figure 3 shows the simple slope plot of this moderation. Consistent with H5b, we find a reinforcing effect of the marketing department's platform knowledge

![Simple slope analysis results of marketing department's product platform knowledge—Marketer product platform knowledge interaction](image)

**FIGURE 2**

<table>
<thead>
<tr>
<th>Dependent variable: Marketing PPC involvement</th>
<th>Point estimate</th>
<th>Boots SE</th>
<th>Lower Boots CI (95%)</th>
<th>Upper Boots CI (95%)</th>
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<tbody>
<tr>
<td>(intercept)</td>
<td>0.032</td>
<td>0.096</td>
<td>-0.162</td>
<td>0.218</td>
</tr>
<tr>
<td>Architect MO (market opportunity) knowledge</td>
<td>0.147</td>
<td>0.120</td>
<td>-0.154</td>
<td>0.309</td>
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<tr>
<td>Marketer PP knowledge</td>
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<td>0.129</td>
<td>-0.055</td>
<td>0.448</td>
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<tr>
<td>Marketing Dept PP knowledge</td>
<td>0.486**</td>
<td>0.120</td>
<td>0.213</td>
<td>0.684</td>
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<tr>
<td>Marketing Dept PP knowledge × architect MO knowledge</td>
<td>0.186**</td>
<td>0.098</td>
<td>0.028</td>
<td>0.430</td>
</tr>
<tr>
<td>Marketing Dept PP knowledge × marketer PP knowledge</td>
<td>-0.193**</td>
<td>0.092</td>
<td>-0.375</td>
<td>-0.010</td>
</tr>
<tr>
<td>B2B</td>
<td>0.051</td>
<td>0.104</td>
<td>-0.131</td>
<td>0.262</td>
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<tr>
<td>Consumer Lifestyle</td>
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<td>0.115</td>
<td>-0.041</td>
<td>0.406</td>
</tr>
<tr>
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<td>0.118</td>
<td>0.084</td>
<td>0.564</td>
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<tr>
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<td>0.261</td>
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<td>Team size</td>
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<td>0.078</td>
<td>0.527</td>
</tr>
<tr>
<td>Rho</td>
<td>0.087**</td>
<td>0.095</td>
<td>0.024</td>
<td>0.404</td>
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<tr>
<td>Sigma</td>
<td>0.954**</td>
<td>0.078</td>
<td>0.781</td>
<td>1.078</td>
</tr>
</tbody>
</table>

Note: Bootstrap with 500 iterations.
Abbreviations: B2B, business-to-business; CI, confidence interval; MO, market opportunity; PP, product platform; PPC, product platform creation.

**p < .05.**
on the architect's market knowledge. Specifically, if the marketing department's knowledge of platforms is absent, the architect's level of market knowledge has little effect on the level of marketing involvement (it seems that if the architect has more market knowledge, this leads to less marketing involvement), whereas if the marketing department's level of platform knowledge is high, the architect with market knowledge will involve marketing more than a counterpart without it.

7 | CONCLUSION AND DISCUSSION

In this study, we note that bilateral knowledge is imperative for successful marketing involvement and financial performance. Three different elements of bilateral knowledge affect the marketing integration process: the marketer's knowledge of product platforms, the architect's bilateral knowledge of market opportunities and the marketing department's knowledge of product platforms.

Our results show that the marketing department's platform knowledge increases the likelihood of marketing staff involvement in PPC. This platform knowledge acts as a formal, structural solution that stimulates this interfunctional collaboration. It probably helps remove the PPC team's suspicion of marketing's general lack of technical expertise, in turn, increasing marketing's acceptance of platform development decisions. If the marketing department has a great deal of platform knowledge, the individual marketer's platform knowledge is not questioned and is thus immaterial for involvement in the PPC process.

On the other hand, if the marketing department lacks product platform knowledge, the personal coordination mechanism becomes important. Marketing's involvement in the PPC process then depends on the individual marketer's level of product platform knowledge. Interesting in Figure 2 is that at the first deviation of extra platform knowledge compared with the mean, the level of involvement is still close to zero. The positive slope suggests that at least twice the standard deviation may be required for marketing to be taken seriously and effectively involved. This corroborates prior results by Workman (1993), who found that individual marketers had to work hard and use soft influence tactics to sway platform and new product decisions in firms with a strong engineering culture. However, current results extend these prior findings by stressing the importance of the marketer's technical and thus bilateral knowledge. This fuels trust (Joshi, 2010) and creates the opportunity for the marketer to start influencing platform development decisions.

The results reveal that architects who are knowledgeable about market opportunities manage product platforms more successfully than their less knowledgeable counterparts. They are better at dealing with the trade-offs between a product platform's variety and commonality, resulting in greater financial success. Their market knowledge also has an important positive indirect effect on the product platform's financial performance through marketing's increased involvement in the PPC process. An architect's understanding of market opportunities helps ensure the integration of technical and market knowledge for a product platform by increasing marketing involvement. This finding extends prior research by identifying the architect as an important extra integrating mechanism.

The link between the architect's knowledge of market opportunities and marketing involvement is contingent on the marketing department's knowledge of the platform approach. This moderation became significant after we controlled for potential endogeneity. It suggests that architects with market knowledge are more aware of the importance of marketing intelligence and consequently stimulate marketing involvement. However, they only do so if the marketing department has adequate product platform knowledge. Then, the department understands the type of market research required. As Sanchez (1999, p.104) states, '... rather than suggesting an optimal set of product attributes for each identified market segment, marketing research in a modular product market must help determine both the optimal number of modular architectures that should be created to serve the various consumer preferences in a product market and the optimal range of component-based functionalities, features, and
performance levels that each modular architecture should be designed to accommodate. The department will be aware of flexibility and technological constraints that may limit variation and the performance of derivative products. The architect and marketing’s joint bilateral knowledge facilitates market knowledge integration in the architecture of the product platform, benefiting the platform’s market and financial performance and thus success.

Consistent with other studies, we find that marketing involvement positively affects product platform outcomes. Whereas prior research focused on marketing’s contribution to the success of NPD projects (Smits et al., 2015), we extended these results to PPC. How marketing units and their individual staff members’ product platform knowledge impacts financial performance is, however, fully mediated by marketing’s involvement in the process. Without involvement, there is no opportunity to influence decisions (Li & Atuahene-Gima, 1999). This supports and extends findings by Calantone and Rubera (2012): Marketing’s technical knowledge has an indirect positive effect on product programme performance through increased collaboration, by highlighting what roles the personal and structural bilateral knowledge components play.

Finally, we discuss marketing’s higher involvement in creating simple hardware compared with complex software–hardware platforms. Hardware platforms are less complex and easier to grasp than the complex designs for smart products and also for product–service systems, which may require more marketing involvement but for which it may be more difficult to accomplish. This seems to suggest that basic product platform knowledge may not suffice for marketing to become involved under these conditions (see also Cenamor et al., 2017). Knowledge of digital services and IoT platforms that leverage user data analysis to optimize and/or personalize products may be required (Cenamor et al., 2017). Future research could explore this conjecture.

8 | IMPLICATIONS, LIMITATIONS AND FUTURE RESEARCH

8.1 | Theoretical implications

Our work has important implications for research. First, we add to the limited work on the marketing–R&D interface and integration of technological–marketing knowledge at the programme level. Specifically, we help bridge the domains of platform development and the R&D–marketing interface. This is important because, as Sanchez (1999) notes, ‘Deriving the full strategic benefits obtainable from flexible modular architectures, ... requires extensive coordination of the marketing objectives for the architecture with the engineering design, manufacturing processes, and logistics systems needed to create and use the flexibilities in that architecture.’ Our study confirms this observation and highlights that both the architect’s and marketing’s bilateral knowledge are key; marketing involvement benefits from the architect having market opportunity knowledge and the individual marketers and marketing department having knowledge of product platforms. However, the impact of the architect’s market opportunity knowledge is contingent on the marketing department having platform knowledge; only if the marketing department is perceived as knowledgeable will the higher architect market opportunity knowledge lead to marketing’s greater involvement in platform development. This extends work by Calantone and Rubera (2012) on knowledge integration at the programme level.

Second, our results clearly show that the individual marketer’s personal and structural mechanisms and the marketing department’s knowledge of the product platform act as substitutes. A marketing department’s lack of platform knowledge can be compensated by an individual marketer’s knowledge of the platform but only if this individual’s knowledge level is substantial, that is, twice the standard deviation. This extends our understanding of the complementary role of structural and personal coordination as key organizational elements—they influence decision outcomes by shaping relationships and interactions between individuals, groups and organization units (e.g., Martinez & Jarillo, 1989; Mom, van den Bosch, & Volberda, 2009; van de Ven et al., 1976) and in marketing–R&D relations at high-tech firms in particular (Joshi, 2010; Workman, 1993).

Finally, we confirm that marketing’s involvement is higher for hardware platforms than digitalized platforms involving both hardware and software. A remarkable result considering digital platforms and products probably faces a greater marketing challenge. This is consistent with and extends studies by Cenamor et al. (2017) and Sanchez (1999) regarding the difficult collaboration between marketing/sales and engineering for (digital) product–service platforms.

8.2 | Managerial implications

Our study offers important managerial insights too. Innovation managers in high-tech settings should help build their marketing department’s product platform knowledge. A structural solution does not just complement the personal mechanisms of knowledge integration in PPC teams but guarantees that product platforms align effectively with market demand despite individual variations in knowledge. Thus, a firm becomes less dependent on personal coordination mechanisms. This may be relevant for complex platforms that combine hardware and software.

The results highlight the importance of bilateral knowledge at the individual level too. Such knowledge can be developed through training and education. Product platform and technical knowledge should be offered to marketers, whereas architects should learn more about market analysis and marketing intelligence. Senior architects and marketers with experience in platform development could contribute to these training programs.

Finally, staff recruiters should pay more attention to new applicants’ bilateral knowledge, particularly if they will be involved in PPC. People with high levels of bilateral knowledge should be selected for uncertain, complex and high-value product platform tasks. The selection procedure may even lead to new functions and job titles such as ‘platform marketer’ and ‘strategic business architect.’ Such hybrid functions can help improve product platform performance.
8.3 | Limitations and future research

Like most studies, this work has limitations that offer opportunities for future research. Firstly, as our study focused on product platforms in a single firm, which may reduce the generalizability of results, additional studies in other industries (e.g., machinery) would be useful. Future studies could also examine tech firms operating in different phases of the technology and product life cycle (Meyer et al., 2018).

Secondly, we applied a cross-sectional approach to study platforms selling products on the market. A longitudinal approach could offer a more detailed perspective of marketing’s level of involvement and its importance at various stages. Cenamor et al. (2017) as well as Atuahene-Gima and Li (2000) recommend higher marketing involvement later in the platform exploitation than development. Longitudinal quantitative research could also address, in more detail, the issues of endogeneity and reverse causality.

Thirdly, apart from the architect and marketer, other functions are involved in PPC. Future studies could investigate marketing interactions with such as the supply chain manager.

Finally, our study controlled for software–hardware platforms versus hardware platforms and confirmed that marketing’s involvement can vary. We did not check for potential moderations of specific pathways in our model as this was beyond the scope of our study. However, given the shift in industry towards smart products and digital services, this could be explored in future work.

R&D–marketing interface is an old topic but a perennial problem, particularly prevalent in technology-driven companies. Consequently, it is important to keep it on scholars’ research agenda. The increasing use of product platforms and the emergence of digital product platforms bring new questions and challenges and hopefully will give a renewed boost to this important domain of study.

ACKNOWLEDGEMENTS

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ORCID

Ties van Bommel https://orcid.org/0000-0002-9248-3526

ENDNOTES

1. We recognize that we lose the main effect of marketing product platform knowledge, which impacts the conclusion in H2b.

REFERENCES


AUTHOR BIOGRAPHIES

**Ties van Bommel** holds an MSc and PhD in Innovation Management from Eindhoven University of Technology and is a research affiliate at the same university with the Innovation, Technology Entrepreneurship & Marketing (ITEM) group of the School of Industrial Engineering. He works for Signify Intellectual Property where he is responsible for intellectual property management and commercialization. His research interest focuses on the role of serial inventors in innovation processes, technology management and the R&D–marketing interface in product platform context.

**Ed Nijssen** is a Full Professor of Marketing at the Innovation, Technology Entrepreneurship & Marketing (ITEM) group of the School of Industrial Engineering, Eindhoven University of Technology and holds a PhD from Tilburg University (The Netherlands). His research interest focuses on marketing and sales of new products, entrepreneurial marketing and implementation and scale-up of firms’ digital transformation and hybrid offerings. He has published over 80 articles on these subjects and is the author of the books Marketing Entrepreneurship (Routledge) and Marketing Strategy (Noordhoff).

**Alex Alblas** is an Assistant Professor of Product and Process Innovation in the Innovation, Technology Entrepreneurship & Marketing (ITEM) group of the School of Industrial Engineering at Eindhoven University of Technology. He previously was on the staff of the University of Groningen. Alex Alblas received his PhD in Innovation Management from the University of Groningen, in 2011, and MSc in Industrial Engineering and BSc in Technology Management from the same University (2006). Alex’s research activity focused on how organizations can successfully manage the invention, development and launch of new product and process innovations.


APPENDIX A.

OVERVIEW OF THE INTERVIEWEES' SELECTION OF RELEVANT QUOTES PER CONSTRUCT/VARIABLE AND CONCLUSIONS

<table>
<thead>
<tr>
<th>Construct/variable</th>
<th>Quotes (# interviewee)</th>
<th>Confirmation of conceptual model</th>
</tr>
</thead>
<tbody>
<tr>
<td>Architect MO knowledge</td>
<td>Q1.1 ‘... it is important that platform developers understand the role of marketing’ (#1)</td>
<td>Confirmed the importance of the architect’s knowledge about a platform's market opportunities in PPD</td>
</tr>
<tr>
<td></td>
<td>Q1.2 ‘... it is important that architects speak the language of the market’ (#7)</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Q1.3 ‘... [an architect’s] market forecast needs to be accurate in the case of platforms’ (#2)</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Q1.4 ‘... an important consideration [for the architect] is the variety of segments that needs to be covered by the platform’ (#1)</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Q1.5 ‘... the ability to anticipate future [market] requirements is important for platforms’ (#3)</td>
<td></td>
</tr>
<tr>
<td>Marketer PP knowledge</td>
<td>Q2.1 ‘... [marketers] need to have knowledge about marketing and [a platform’s] technology’ (#7)</td>
<td>Confirmed the importance of the marketer's understanding of product platforms and their development process</td>
</tr>
<tr>
<td></td>
<td>Q2.2 ‘... marketers [can] help determine a product’s functions and make technological decisions’ (#7)</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Q2.3 ‘it is hard for someone from marketing to understand an entire platform and therefore understand all derivative products’ (#10)</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Q2.4 ‘the platform is a strong guidance for marketing’ (#3)</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Q2.5 ‘it is also important that marketing understands the architects’ (#11)</td>
<td></td>
</tr>
</tbody>
</table>

(Continues)
## APPENDIX B.

### OPERATIONALIZATION OF STUDY CONSTRUCTS

<table>
<thead>
<tr>
<th>Construct/variable</th>
<th>Quotes (# interviewee)</th>
<th>Confirmation of conceptual model</th>
</tr>
</thead>
</table>
| Marketing Dept PP knowledge | Q3.1 'it is also beneficial if the marketing department understands what is possible to develop and what is not' (#2)  
Q3.2 'appreciation and understanding of platforms in marketing are important' (#3)  
Q3.3 'it is important that [the] marketing [unit] speaks a technical language' (#7)  
Q3.4 '… marketing [should] understand the benefits of platform thinking' (#3)  
Q3.5 'marketing [department] should understand and acknowledge the importance of platforms' (#11)  | The interviewees also differentiate between perceptions regarding marketing individuals and departments |
| Marketing PPD involvement | Q4.1 'marketing played an important role in the functions/features side of the platform' (#5)  
Q4.2 '… [it is important to have] a good marketing-technology interface and communication' (#7)  
Q4.3 'it would be best if there is somebody from marketing in the platform team' (#8)  
Q4.4 'the interaction with marketing is important' (#8)  
Q4.5 'it is important that marketing and architects challenge each other' (#9)  
Q4.6 'the link [of platform team] with marketing is important' (#11)  | Confirmed the importance of marketing involvement in PPD |
| Financial performance | Q5.1 'innovation can be achieved with a platform strategy, under the premise that the platform is managed properly' (#2)  
Q5.2 '… more development efficiency can be achieved' (#3)  
Q5.3 'platforms also enable a company to better utilize and align their investments and production line capacity' (#3)  
Q5.4 'A platform approach can be a good strategy to handle competition, as long as the platform is easy to adapt' (#3)  
Q5.5 'leveraging existing platforms can increase the rate of innovation' (#7)  
Q5.6 'savings due to the use of common components [will increase margin]' (#8)  
Q5.7 '… economies of scale for larger quantities of components' (#8)  
Q5.8 '… a key performance indicator is re-use' (#9)  | Confirmed that product platforms can improve financial performance if managed well |

Abbreviations: MO, market opportunity; PP, product platform; PPD, public–private dialogue.

### Construct Items Source

<table>
<thead>
<tr>
<th>Construct</th>
<th>Items</th>
<th>Source</th>
</tr>
</thead>
</table>
| Architect MO knowledge (7-pt scale, 1 = strongly disagree, 7 = strongly agree) | In your role as architect for this platform, to what extent did your decisions account for:  
• market size and cost development? (f: 0.86)  
• future customer needs, market trends and product variety? (f: 0.79)  
• maximizing future product variety given financial constraints? (f: 0.82)  | New    |
<table>
<thead>
<tr>
<th>Construct</th>
<th>Items</th>
<th>Source</th>
</tr>
</thead>
</table>
| Marketer PP knowledge (5-pt scale, 1 = strongly disagree, 5 = strongly agree) | The marketing person:  
- understands the platform creation process (f: 0.82)  
- understands the company’s platform development policies (f: 0.74)  
- knows the platform’s limitations and capabilities (f: 0.83)  
- understands the platform team’s platform language (f: 0.85) | Adapted from Calantone and Rubera (2012) |
| Mark’g Dept PP knowledge (5-pt scale, 1 = strongly disagree, 5 = strongly agree) | In the marketing department, there is sufficient knowledge of:  
- platforms and modularity (f: 0.88)  
- managing product variety based on modular approaches (f: 0.91)  
- opportunities and limitations of product platform architecture (f: 0.89)  
- how to optimize product variety using platform modules (f: 0.85) | New |
| Marketing PPC involvement (5-pt scale, 1 = strongly disagree, 5 = strongly agree) | We work in teams, with members from various areas (marketing and services), to introduce new platforms (f: 0.75)  
- There is clear involvement of marketing, services and sales in platform creation and adjustment (f: 0.88)  
- There is little marketing involvement in the EARLY development of platforms (f: 0.72) (R)  
- Marketing people are involved to a great extent before a new platform launch (f: 0.65) | Adapted from Danese and Filippini (2010) |
| Financial performance (10-pt scale, 1 = strongly disagree, 7 = strongly agree) | Compared with other platforms/products during a 3-year period:  
- financial performance has been outstanding (f: 0.91)  
- financial performance has exceeded that of our direct competitors (f: 0.86)  
- sales growth in our target segments has exceeded our direct competitors (f: 0.80)  
- we are happy with the market performance of derivative products (f: 0.79) | Adapted from Worren et al. (2002) |

Note: f = factor loading; R = reversed item.  
Abbreviations: MO, market opportunity; PP, product platform; PPC, product platform creation.