

New Product Development Process Execution, Integration Mechanisms, Capabilities and Outcomes: Evidence from Chinese High-Technology Ventures

Matthew J. Robson ¹, Fu-Mei Chuang,² Robert E. Morgan ^{1,3},
Nilay Bıçakcıoğlu-Peynirci ⁴ and C. Anthony Di Benedetto⁵

¹Cardiff Business School, Cardiff University, Cardiff, CF10 3EU, UK, ²Rennes School of Business, Rennes, 35065, France, ³Department of Marketing, Copenhagen Business School, Frederiksberg, DK-2000, Denmark,

⁴University of Sussex Business School, University of Sussex, Brighton, BN1 9RH, UK, and ⁵Fox School of Business, Temple University, Philadelphia, PA, 19122, USA

Corresponding author email: robsonm@cardiff.ac.uk

This study examines new product development (NPD) processes in high-technology new product ventures in the emerging market context. Drawing upon the knowledge-based view and the capability-based view, we propose a model that characterizes relationships between NPD process execution stages and product competitive advantage, and accounts for the moderating effects of NPD integration mechanisms on these relationships. Our model also explains how pricing capabilities can become a liability that undermines how product advantage impacts new product performance. We test this framework within an emerging market context that has been notably absent from the literature. Our data are generated from 187 new product projects and a follow-up of 83 projects, from Chinese high-technology ventures. We identify important theoretical interdependencies within our structural model results. Specifically, marketing–technical integration positively moderates the relationship between product development and testing capability and commercialization capability, while new product implementation capability positively moderates the relationship of commercialization capability and product competitive advantage. Yet, penetration pricing capability negatively moderates the link between product competitive advantage and new product performance.

Introduction

New product development (NPD) typically emphasizes staged processes which seek to manage project outcomes by guiding decision-making across *planning* and *execution* activities (Bianchi, Marzi and Guerini, 2020; Kagan, Leider and Lovejoy, 2018). Though characteristics of NPD processes have received attention in the management literature, a limited number of studies have devoted attention to knowledge management within NPD staged processes (Cooper and

Sommer, 2016; Rubera, Chandrasekaran and Ordanini, 2016; Van Oorschot, Eling and Langerak, 2018). A prerequisite for NPD staged processes is that diverse but integrated knowledge is essential for delivering new product advantages (Cooper and Sommer, 2016). In particular, product innovations that realize high levels of advantage are developed by firms via NPD processes that act on market knowledge. That is, NPD processes are able to *create* and *integrate* knowledge about customers, competitors and how the market functions (Sullivan and Marvel, 2011). Maintaining

a clear orientation of NPD processes to market demands is an especially difficult product management task for firms in emerging economies, given an institutional emphasis on improving and exploiting technical knowledge and fast-moving market conditions.

Studies have shown that the management task varies across the NPD process (Cooper, 2019; Urbig *et al.*, 2013). Within NPD processes, the planning phase (i.e. idea generation and development) precedes the go/no-go decision, and the execution phase (i.e. product development and testing, commercialization) follows it. Applying the capability-based view, NPD processes consist of stage capabilities that are the product of specialized assets embedded within the firm (Claudy, Peterson and Pagell, 2016; Kim, Im and Slater, 2013). Specialized stage capabilities create new knowledge (Ethiraj *et al.*, 2005; Mauerhoefer, Strese and Brettel, 2017) but this must be transferred onwards and integrated in the development of new products. The knowledge-based view underscores the potential importance of knowledge integration within NPD process execution, which is difficult even for fast-moving competitors in emerging markets to replicate (Verbeke and Yuan, 2013).

Previous research has mainly advocated the importance of NPD process planning (Akbar and Tzokas, 2013; Bianchi, Marzi and Guerini, 2020; Cooper, 2008). Yet emerging market firms' use of process execution would appear to challenge the view from developed firms that a proficient front-end planning phase contributes most to project success (Gan and Govindarajan, 2018). Studies have shown that Chinese technology firms are adept at pushing a new product into the market and thereafter adapting and improving it using new knowledge created in commercialization activities (Orr and Roth, 2012). Such processes concentrate managerial effort and attention on enhancing the proficiency of execution activities generally, and of the commercialization stage specifically (Dubiel *et al.*, 2018; Rubera, Chandrasekaran and Ordanini, 2016). Still, characteristics of process execution in dynamic transitional markets are absent in the new product management literature (Calantone, Di Benedetto and Song, 2011).

The challenge of achieving superior product advantage and performance outcomes from NPD staged processes is raised by the likelihood that a firm's capability inventory includes both strengths and weaknesses (Sirmon *et al.*, 2010). While the

NPD process literature indicates the presence of complementary capabilities (e.g. stage capabilities and integration mechanisms) (Ernst, Hoyer and Rubsaamen, 2010), it is largely silent regarding capabilities which are strategic liabilities that might dampen the outcomes of new product projects.

In the light of these gaps, we draw from the knowledge-based view and the capability-based view to address the following questions. How do emerging market firms: (a) use NPD process execution to drive product competitive advantage and, in turn, new product performance? (b) use NPD integration mechanisms to facilitate such effects? (c) face liabilities linked to pricing capabilities in their attempts to enhance new product performance? Our model posits that the integration of new knowledge occurs efficiently – during the course of NPD execution – in emerging market settings and boosts product competitive advantage. Yet this is not the end of the story, as emerging market firms' pricing capabilities could weaken the link between new product advantage and performance. To test our model, we examined 187 new product projects and a follow-up of 83 projects from Chinese high-technology ventures.

The findings contribute to the management literature in different ways. First, we extend the knowledge-based view to address the gap in our understanding of firms' execution activities to create and integrate knowledge to achieve product competitive advantage (Calantone, Di Benedetto and Song, 2011; Kim, Im and Slater, 2013; Sullivan and Marvel, 2011). We highlight the key role of commercialization capability in NPD staged processes for emerging market firms in China, which provides an ideal setting for the study (cf. Rubera, Chandrasekaran and Ordanini, 2016). Unlike developed firms' need to perfect a new product idea prior to launch, Chinese high-technology venture managers use new knowledge created in commercialization to develop product advantage. Moreover, we reveal that the way market knowledge is created and integrated through NPD execution and integration mechanisms is all important. We add to existing research that has not provided a sufficient understanding of market knowledge in dynamic NPD staged processes.

Second, our study is novel in its conceptualization of NPD integration mechanisms, which are internal structures and capabilities that integrate knowledge for process execution (Morgan, Vorhies and Mason, 2009). Specifically, we posit

two types of NPD integration mechanisms: (1) *marketing–technical integration*, defined as the level of coordination between marketing and technical functions (R&D/manufacturing) within the focal NPD process (De Luca and Atuahene-Gima, 2007); (2) *new product implementation capability*, pertaining to competence in executing, controlling and evaluating marketing activities applied to NPD processes generally (Vorhies and Morgan, 2005). Our framing of NPD integration mechanisms is distinctive in recognizing that firms can integrate knowledge across business functions, but also across new product projects.

Third, we explicate the capability-based view by demonstrating how different capabilities (i.e. marketing–technical integration, new product implementation capability and penetration pricing capability) at different junctures help or hinder process execution and outcomes. The NPD capabilities literature focuses on surfacing strengths and complementarities of capabilities (Ernst, Hoyer and Rubsaamen, 2010). We find positive moderation effects involving the NPD integration mechanisms. Our study also reveals that *penetration pricing capability* has a negative moderation effect on the association between product competitive advantage and new product performance.

Theoretical background and framework

Knowledge-based view of NPD processes

The knowledge-based view maintains that heterogeneous and inimitable knowledge resources are the main drivers of competitive advantage differences across firms (Desyllas *et al.*, 2018; Droge, Claycomb and Germain, 2003; Grant, 1996). To this point, NPD processes involve the dynamic transition from embedded knowledge resources (i.e. within the individual NPD team members' tacit knowledge) to embodied or applied knowledge resources (i.e. in the explicit new product itself) (Kim, Im and Slater, 2013; Madhavan and Grover, 1998). Completion of this transition depends on two knowledge processes: the creation of specialized knowledge resources, followed by their integration (Morgan, Vorhies and Mason, 2009).

Knowledge-based view theorists have long explored integration mechanisms through which firms coordinate the specialist knowledge of their members (Grant, 1996). Similarly, product management scholars have placed increasing emphasis

on the need to understand how to integrate knowledge across functions in staged processes (Troy, Hirunyawipada and Paswan, 2008). These studies suggest knowledge integration is not a panacea (Harmancioglu, Droge and Calantone, 2009). Excessive integration can protract the development process and decrease new product fit to market demands that is pivotal in fast-moving, emerging economies (Song and Thieme, 2006). Critically, new product success is more likely when a firm systematically coordinates both function- and stage-specific integration, rather than full integration across the product development process (Song, Di Benedetto and Song, 2010).

Advances in NPD studies typically focus on developed firms and maintain the criticality of market knowledge creation within front-end NPD planning (Cooper, 2008). The premise lies in that knowledge created in the idea generation and development stage provides clear direction to back-end NPD execution by informing product development and testing activities (Akbar and Tzokas, 2013). For emerging market firms, however, interactions with local customers and other actors (e.g. distributors) at the commercialization end of innovation processes can lead to resource combinations that adapt to, and capitalize on, new product opportunities (Dubiel *et al.*, 2018). We thus contend that NPD management in emerging markets has created an approach wherein market knowledge transfer from front-end planning is augmented by the role of NPD integration mechanisms within back-end execution. Our conceptualization of NPD integration mechanisms adds nuance to intrinsically difficult process execution procedures. Unlike previous NPD studies, we focus not only on the *managerial* competence of the firm at integrating marketing with technical knowledge resources during the focal NPD execution, but also on how managers employ *organizational* implementation capability to harness market knowledge for focal product advantages (Kiss and Barr, 2017; Morgan, Vorhies and Mason, 2009).

Capability-based view of NPD processes

Capabilities refer to the capacities of a firm to conduct particular tasks and reach a desired end (Grant, 1991; Wernerfelt, 1984). From the standpoint of the capability-based view, it can be claimed that firms would benefit *inter alia* from having capabilities to perform NPD

execution. Based upon the innovation literature (e.g. Ernst, Hoyer and Rubsaamen, 2010) and our pre-study fieldwork on Chinese high-technology ventures, we conceptualize NPD process execution as two sequential staged capabilities: *product development and testing capability*, reflecting competence in technical product development and the execution of prototype tests and market testing; and *commercialization capability*, denoting competence in directing and managing the new product launch. Each NPD stage capability is the product of specialized knowledge and nuanced processes involving marketing/technical resources (Helfat and Peteraf, 2003). Product development and testing has a mainly internal emphasis on technical information, whereas commercialization involves competence in managing the firm's interface with the marketplace, and so has an external focus (Harmancioglu, Droge and Calantone, 2009; Tatikonda and Montoya-Weiss, 2001). The latter allows the firm to exploit deep understanding of latent and expressed customer preferences (Cheng and Krumwiede, 2018) which imbues the process with effective market sensing to enable the value proposition to be articulated (Kindström, Kowalkowski and Sandberg, 2013). Fundamentally, this involves the ability to translate customer needs into a competence that enables firms to guide and govern their new product launch (Hernandez and Kreye, 2021).

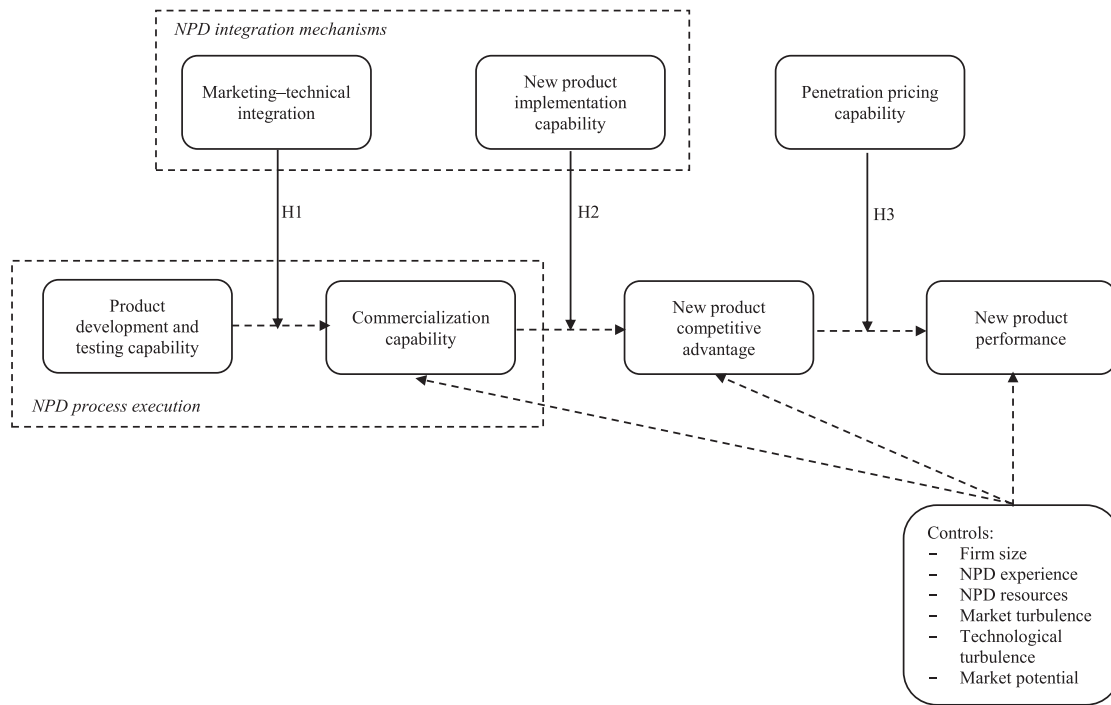
In addition, we assert that firms require complementary capabilities (i.e. NPD integration mechanisms and pricing capability) to steer NPD process execution towards a successful launch within an emerging market setting. The dominant view in the literature is that firms possess several resources and capabilities that once built should have a favourable effect on competitive advantages. Still, the reality is that capabilities are a consequence of repeated strategic choices a firm makes, and these choices might not align well. The firm's capabilities can be strengths or weaknesses (Ernst, Hoyer and Rubsaamen, 2010; Sirmon *et al.*, 2010). Herein, we contend that NPD integration mechanisms, regarded as capability strengths, reinforce NPD process execution, while penetration pricing capability, considered as a strategic liability, deteriorates the effect of product competitive advantage on new product performance.

The execution of a firm's strategy can be hampered by an inability to price effectively. Indeed, pricing capability is critical to the firm's efforts to

appropriate value from NPD strategies that themselves create value (Dutta, Zbaracki and Bergen, 2003). It is notoriously difficult to set the right price that can capture the added value presented by a new product in an untested and dynamic marketplace. Penetration pricing capability, which refers to the firm's prioritization of using lower prices for products with the aim of appealing to customers to gain higher market share (Armstrong and Kotler, 2013), is not the solution. Yet, Chinese firms have traditionally viewed pricing capability as a way of helping meet price competition in the market and facilitating the implementation of cost-saving measures (Zou *et al.*, 2003).

NPD processes in Chinese high-technology ventures

Successful NPD processes are particularly important for emerging markets such as China, as new technology ventures are critical for the growth and development of China's emerging economy (Abrami, Kirby and McFarlan, 2014; WIPO, 2018). China has a world-leading stance on nurturing new technology ventures, achieved via several high-technology industrial parks that encourage Western firms to establish technology ventures in these locations (Atuahene-Gima and Murray, 2007). Industry commentators and policymakers suggest that the success of Chinese high-technology ventures is associated with their innovative use of NPD staged processes (Song, Di Benedetto and Parry, 2009). A particular issue for Chinese firms concerns marketing's involvement in NPD processes, which often focuses on acquiring technical skills and resources (Song, Di Benedetto and Song, 2010). In the previous centrally managed system, Chinese firms were not concerned with marketing resources as production was mandated via planning agencies (Abrami, Kirby and McFarlan, 2014). Work on cross-cultural innovation informs us that market knowledge employed by managers remains lower in China than in developed economies such as the United States (Song and Thieme, 2006). The literature has not provided a sufficient understanding of market knowledge in fast-modernizing Chinese NPD staged processes, even if it is clear from the China Innovation Index (National Bureau of Statistics of China, 2020) that progress on most of its innovation input, environment and effectiveness indices indicates a sustained improvement.



Note. The dashed arrows denote non-hypothesized, control paths.

Figure 1. Conceptual model

Based on the above discussion, the present study suggests that two challenges of market knowledge integration can undermine NPD execution in the Chinese high-technology context. First, there is a danger of the specialized technical task for product development and testing disconnecting process execution from market considerations, effectively dampening commercialization capability. Second, there is a risk of the commercialization activities themselves not proceeding in a well-managed manner. We propose that marketing-technical integration facilitates market knowledge integration across specialized marketing and technical functions, and that new product implementation capability organizes launch resources across projects to harness market knowledge in the focal new product project (Morgan, Vorhies and Mason, 2009).

Figure 1 illustrates our conceptual framework. We theorize moderated effects linking product development and testing capability with commercialization capability, commercialization with product competitive advantage and competitive advantage with new product performance. Chinese high-technology ventures' proficient NPD execution, facilitated by the coordination mechanisms, is crucial to enhancing product competitive

advantage. Yet, these firms' ability to translate competitive advantage into superior new product performance is undermined by the presence of penetration pricing capability.

Hypotheses

Product development and testing commences NPD process execution. This complex stage oversees the technical process of transforming the new product idea into a physical product ready for production start-up, and tests market acceptance of the prototype prior to commercialization (Mauerhoefer, Strese and Brettel, 2017; Rubera, Chandrasekaran and Ordanini, 2016). The main task of product development and testing is to gain a deep technical understanding of product design aspects to set up commercialization, wherein marketing information takes over to complete the execution process (Claudy, Peterson and Pagell, 2016; Song, Di Benedetto and Parry, 2009). Yet, at its best, product development and testing capability unites diverse technical with marketing resources in producing a new product for market launch (Harmancioglu, Droge and Calantone, 2009). In

this regard, NPD staged processes necessitate the marketing department's ability to convert customer preferences into technical skills – involving R&D and manufacturing skills – to achieve product competitive advantage and ultimately superior performance (Drechsler, Natter and Leeftang, 2013). In fast-changing emerging markets, a poorly executed product development and testing stage will struggle to create marketable new knowledge for timely and proficient commercialization. Indeed, it is likely that the product development and testing capability to commercialization capability link is strengthened by marketing–technical integration.

NPD success requires the exploitation of broad-based knowledge and skills via the cooperation of organizational functions such as R&D, marketing and manufacturing (Ernst, Hoyer and Rubsamen, 2010). Still, evidence shows that cooperation between marketing and technical functions may be most effective during the product development and testing stage (Ernst, Hoyer and Rubsamen, 2010). The role of the marketing function is crucial in acting as a bridge between the customer and the product design team, as they work on technical specifications to take the new product forward (Moorman and Rust, 1999). Ideally, knowledge integration should incorporate both specialized market knowledge and specialized technical knowledge in the lead-up to commercialization. Chinese high-technology ventures' efficient execution strategies can lack an emphasis on preliminary market research (Abrami, Kirby and McFarlan, 2014), which potentially causes an issue for market knowledge creation and its transfer onwards in the NPD process. Such strategies risk the technically oriented product development and testing stage decoupling the process from commercialization considerations. On the other hand, product development and testing capability is likely to enhance commercialization capability when market knowledge has been utilized in interactions of the marketing department with R&D and other staff on the technical side. In doing so, R&D knowledge would also be codified into a useable form and shared within the NPD project team (Krasnikov and Jayachandran, 2008; Troy, Hirunyawipada and Paswan, 2008). Therefore, a high level of marketing–technical integration allows a smoother transition from product development and testing through to commercialization. We conclude that:

H1 : The positive relationship between product development and testing capability and commercialization capability is stronger when the degree of a firm's marketing–technical integration is greater.

Emerging market firms have traditionally embodied a manufacturing focus on delivering technically superior new products to market (Liu, Hodgkinson and Chuang, 2014). The new product has full exposure to marketplace realities and the wide range of phenomena that exert influence to determine whether the new product process has generated product competitive advantages (Langerak, Hultink and Robben, 2004). A firm's commercialization proficiency in directing and managing the new product launch can create novel insights into marketplace realities essential for ongoing product technical developments (Kim, Im and Slater, 2013). Unlike Western firms' need to research and perfect their go-to-market strategies *a priori*, Chinese firms can maintain a level of flexibility during commercialization to take advantage of incrementally increasing knowledge of competitive dynamics (Abrami, Kirby and McFarlan, 2014). Such firms use commercialization capability to focus on making iterative technical improvements to new products needed to achieve differential advantages over competitors. Moreover, we expect that the commercialization capability to product competitive advantage relationship in the particular new product project is strengthened by organization-level implementation capability.

Commercialization elicits superior product competitive advantage when its task-specific marketing activities are themselves coordinated and effectively deployed to achieve product advantage goals (Dubiel *et al.*, 2018). Managers can utilize implementation capability that harnesses knowledge across NPD processes to direct the coordination of marketing activities in the particular new product project and, thus, focus resource deployments to achieve a promising new product position (Vorhies, Morgan and Autry, 2009). Its description is in accordance with the literature on marketing capability, encompassing a range of activities such as marketing mix decisions and their execution and evaluation (Ngo and O'Cass, 2009). An emerging market firm's implementation capability, concentrating on operational implementation, should bolster its efforts to execute commercialization activities to gather and

incorporate new knowledge on the latest competitive offerings. Firms with new product implementation capability are able to leverage accumulated launch know-how to understand: where to look for competitive intelligence within their process execution and which competitors to track; how to interpret and use competitor insights to fashion feasible commercialization activities (Kiss and Barr, 2017). Firms within high-technology industries without new product implementation capability would lack the know-how required to gain new insights into competitors' offerings, and to deploy available competitor knowledge to optimize commercialization decisions. Accordingly:

H2 : The positive relationship between commercialization capability and new product competitive advantage is stronger when the degree of a firm's new product implementation capability is greater.

Within our model, new product performance is an outcome of product competitive advantage. New product performance is defined as economic (i.e. profitability and sales revenue) outcomes achieved by the NPD project (Griffin and Page, 1996; Katsikeas, Leonidou and Zeriti, 2016). Product competitive advantage should drive performance as the relative superiority of a firm's value offering determines target customer purchasing behaviour. A firm that develops superior products would be better placed to meet the changing needs of customers in high-technology settings (Im and Workman, 2004). Further, delivering to market products that are technically superior to those of competitors can serve to enhance the firm's ability to appropriate resource-based economic rents (Henard and Szymanski, 2001). However, there is reason to expect that the relationship between product competitive advantage and new product performance is dampened by the firm's penetration pricing capability.

A view in the NPD literature is that there can be a trade-off between the product advantage and the economic performance of new products (Harmancioglu, Droge and Calantone, 2009; Kyriakopoulos and de Ruyter, 2004). Even when a firm has created value through manifestly novel and superior new products, it might not develop economic rents due to the difficulty of changing

customers' purchasing intentions. Because it is difficult to set a price for a new product in a new market, firms require capabilities both for creating product advantages and for pricing. Central to the successful pricing of a new product that offers an advantage is the understanding of how customers perceive the product's benefits (Ingenbleek *et al.*, 2010). Firms require value-based pricing capabilities to stimulate product diffusion (Dutta, Zbaracki and Bergen, 2003). Against this backdrop, penetration pricing capability – that moves pricing decisions towards competitive calculations and, in effect, cedes the value created – is a strategic liability in the resource inventory (Sirmon *et al.*, 2010). A firm with a record of undercutting competitors to drive up market share is likely to have conditioned the market to view its new products as commodities that possess little realized advantage. By contrast, firms without a penetration pricing capability are more likely to be able to adequately incorporate customer value into pricing decisions and maximize sales and profits from new product advantages. Thus:

H3 : The positive relationship between product competitive advantage and economic performance is weaker when the degree of a firm's penetration pricing capability is greater.

Methodology

The empirical study context, sample and procedure

The research hypotheses were tested using data generated from a survey of Chinese firms from the high-technology sector. China has established its position as a leading global patent filer, second only to the United States (WIPO, 2018). Along with this R&D intensity, China is one of the largest markets in the world, has growing pools of R&D resources and has firms and a government which acknowledge their long-term future lies in the ability to augment NPD processes. Therefore, Chinese new product ventures constitute an important context in which to study emerging market NPD processes. The study used the firm's individual new product project as the standard unit of analysis. We followed the industrial classification system of the China National Bureau of Statistics in defining the specific population of interest in the study – the high-technology electronic information

industry,¹ which is a leading industry within the Chinese high-technology sector that has a considerable growth rate (Fu, Diez and Schiller, 2013).

We drew up a random sample of 750 high-technology electronic information firms based in Shanghai.² After telephone contact, 203 informants (and firms) consented to a structured personal interview. Due to the complexity of the issues studied and the concomitant difficulty in securing responses from high-level Chinese executives, use of structured interviews to administer our questionnaire was deemed necessary to generate comprehensive, accurate and reliable data (Pereira *et al.*, 2019). Interviews were conducted at the offices of the informants during 2007 (t_1), and each lasted approximately one hour. Each informant was asked to complete the questionnaire with respect to the firm's most recently developed new product project – regardless of its level of success – that has been in the market for a minimum of 12 months (Slotegraaf and Atuahene-Gima, 2011). Sixteen informants failed a post-hoc competency test included in the questionnaire. With 187 competent responses, an effective response rate of 25% was achieved.

The final set of informants had various job titles: General Manager (26%), Project Manager (15%), Sales Manager (42%) and Marketing Manager (17%). In terms of the firms, a high proportion are small in size (<50 employees = 67%), with fewer medium (50–250 employees = 23%) and large (>250 employees = 10%) firms in the sample. They are well spread across the electronics information industry: computer-related firms

(45%), telecommunications-related firms (21%) and mechanical instrument-related firms (34%).

Because testing NPD process against relatively short-term performance indicators could be biased (Henard and Szymanski, 2001), a follow-up survey was mailed to the 187 informants in the final sample 12 months after the original survey in 2008 (t_2). We collected a total of 83 usable responses in this follow-up survey, for a 44% usable response rate.³ We performed additional tests using ordinary least squares (OLS) regression with the original and longitudinal samples, to compare results and examine the moderation role of penetration pricing capability on the link between product competitive advantage and performance (see 'Supplementary analyses' subsection below). Our use of the follow-up data as a validation check enhances confidence that the original subjective data are not subject to serious method bias as well (Im and Workman, 2004).

Potential non-response bias was assessed by comparing respondents with a random sample of 80 non-participating high-technology firms for which we had data on firm sales, number of employees and age. Analysis of variance indicated no significant differences between the two groups on these characteristics. Hence, non-response bias does not appear to be an issue of concern in this study.

Questionnaire and measure development

We developed multi-item scales for the study constructs following a review of the NPD literature. To ensure the rigour of our survey instrument's development, a translation and back-translation process involved academic specialists and a qualified translator. We pretested the revised instrument in multiple phases of in-depth field interviews (approximately 60 h duration) with 28 knowledgeable Chinese executives. The focus of this work moved from investigating the relevance of the conceptual model and construct conceptualizations through

¹The high-technology electronic information firms include computers (accessories, hardware, network products and software), telecommunications (telecommunication equipment, telecommunication services, television and broadcasting equipment) and mechanical instruments (accessories, apparatus and meters, electric instruments and mechanical machinery).

²The sampling frame of 11,283 high-technology electronic information firms was provided by a prestigious local consultancy company: Sinotrust Business Information & Consulting Ltd (www.sinotrust.cn). Randomization was achieved by selecting every fifteenth firm from the list. Note: Each of the firms was contacted by telephone by the lead author to pre-notify the execution of the study and locate the most appropriate (key) informant by name. The key informant was identified as the person most knowledgeable about and involved in the firm's NPD processes. All key informants were sent a personalized letter outlining the objectives of the study and requesting their participation.

³In the process of administering the follow-up survey, the lead author telephoned each of the original 187 firms. This contact revealed that the mechanics of performing longitudinal research in the setting of Chinese high-technology businesses are problematic, as has been found elsewhere (Jiang, Baker and Frazier, 2009). In particular, significant upheaval and labour turnover in the firms (e.g. the key informant had left) was responsible for non-participation in the follow-up survey.

to establishing the face validity, clarity and appropriateness of the measures and questions in the Chinese context.

Previous studies of Chinese NPD processes (Perks, Kahn and Zhang, 2009) and our pre-study field interviews suggested a short, staged NPD process is apposite for Chinese high-technology ventures (Cooper, 2008; Ernst, Hoyer and Rubsamen, 2010). We thus conceptualized and assessed two execution capabilities: *product development and testing capability* (six-item scale) and *commercialization capability* (four-item scale) (Cooper, 2008). We employed a three-item measure to tap *marketing–technical integration*, which addresses the integration of marketing with R&D and manufacturing – two technical areas usually emphasized in Chinese firms (e.g. Perks, Kahn and Zhang, 2009). *New product implementation capability* was measured using four items adapted from Vorhies and Morgan (2005). As implementation capability examines across new product projects, it was not preceded with the instruction to focus on the specific new product project. The same applies to *penetration pricing capability*, which was measured using four items adapted from Venkatraman (1989). *Product competitive advantage* for the new product project was captured using three items modified from Griffin and Page (1993, 1996). Finally, *new product performance* was measured using six items that tap the economic effectiveness and efficiency (e.g. sales and profits, respectively) of the new product in the marketplace since launch (Calantone, Chan and Cui, 2006).

NPD execution and performance can be influenced by a range of phenomena but of particular note are the firms' size, relevant experience and resources, and environmental factors (Jaworski and Kohli, 1993; Song and Parry, 1997). We therefore included as control variables: *firm size* (the number of full-time employees in the firm), *NPD experience* (the firm's years of experience running new product activities), *NPD resources* (the number of co-workers involved in executing new product activities in the firm), *market potential* (four-item scale), *market turbulence* (five-item scale) and *technological turbulence* (five-item scale). Larger firms and those that possess greater levels of NPD experience and resources may achieve advantage via the uniqueness of their marketing and technical assets and know-how (Chandy and Tellis, 2000; Song, Di Benedetto and Parry, 2009). NPD execution is of critical importance for managers in emerging mar-

ket settings, where opportunity and dynamism are heightened (Calantone, Garcia and Dröge, 2003). Market potential, or the potential demand for the new product in the market, may shape NPD outcomes (Im and Workman, 2004). Market and technological turbulence, implying rapid changes in these domains, can surface the drawbacks of NPD processes. Environmental forces exert a barrier to developing capabilities and maintaining firm competitiveness (Ju, Jin and Zhou, 2018).

Results

Measurement model results

Prior to hypothesis testing, we used confirmatory factor analysis to test the validity of the measures. The measurement model and subsequent structural model were fitted using the maximum likelihood estimation procedure with the raw data as input in STATA. Table 1 presents descriptive statistics for the measures and the correlation matrix, while Table 2 reports the measurement model results. The fit indices for this model ($\chi^2_{(df = 380)} = 558.95$, $p < 0.01$; Tucker–Lewis index (TLI) = 0.92; comparative fit index (CFI) = 0.93; incremental fit index (IFI) = 0.93; root mean square error of approximation (RMSEA) = 0.050) suggest that it represents a reasonable fit to the data. Our results also exhibit high standardized loadings, significant at $p < 0.01$. Therefore, the measurement model offers evidence of convergent validity.

We assessed discriminant validity of the measures in two ways. First, we tested whether correlations between each pair of latent constructs were significantly different from unity (Anderson and Gerbing, 1988). This test surfaced no discriminant validity problems. Second, we used Fornell and Larcker's (1981) more stringent test of discriminant validity, which involves assessing whether the square root of the average variance extracted for every construct is larger than the correlations of that latent construct with other constructs in the model. All square-root estimates exceed their corresponding correlations (see Table 1), showing discriminant validity.

Hypothesis testing results

We assessed the relationships theorized in Figure 1 using structural equation modelling. To test for moderation effects of the NPD integration

Table 1. Correlation matrix and descriptive statistics of measures

Variable	1	2	3	4	5	6	7	8	9	10	11	12	13
1 Product development and testing capability	0.68												
2 Commercialization capability	0.63	0.73											
3 Marketing–technical integration	0.47	0.41	0.70										
4 New product implementation capability	0.53	0.61	0.30	0.72									
5 Penetration pricing capability	0.01	0.07	0.04	0.07	0.78								
6 New product competitive advantage	0.32	0.42	0.19	0.44	-0.17	0.83							
7 New product performance	0.35	0.49	0.28	0.49	-0.17	0.62	0.72						
8 Firm size	-0.04	-0.10	0.02	-0.17	-0.06	-0.07	-0.02	—					
9 NPD experience	-0.01	-0.06	0.01	-0.06	-0.07	0.02	0.00	0.23	—				
10 NPD resources	-0.02	-0.19	0.05	-0.20	-0.09	-0.12	-0.05	0.23	0.60	—			
11 Market potential	0.22	0.36	0.25	0.34	-0.15	0.40	0.37	-0.10	-0.17	-0.15	—		
12 Market turbulence	0.28	0.36	0.12	0.34	0.03	0.22	0.30	-0.13	-0.09	-0.12	0.42	—	
13 Technological turbulence	0.14	0.22	0.17	0.16	0.06	0.21	0.28	-0.11	-0.11	-0.08	0.41	0.23	—
Mean	5.16	5.23	4.99	5.23	3.53	5.50	5.30	81.69	7.05	17.96	5.29	4.82	4.99
Standard deviation	1.02	1.05	1.18	0.98	1.48	1.05	0.91	161.84	9.57	41.19	1.16	0.99	1.03

Note: N = 187.

The italicized diagonal elements are square roots of the average variance extracted; the lower-left triangle elements are correlations among the latent variables.

Table 2. Measurement model results

Study constructs and measures	Standardized loading	z-Value
Product development and testing capability (CR = 0.84) ^a		
Executing prototype or 'in-house' sample product testing	0.65	13.34
Determining the final product design and specifications	0.67	13.82
Specifying a detailed programme for full-scale manufacturing	0.67	13.30
Working continuously for cost reduction and quality control	0.68	14.84
Selecting customers for testing market acceptance	0.66	13.88
Executing test marketing programmes in line with plans for commercialization	0.75	18.42
Commercialization capability (CR = 0.82) ^a		
Completing the final plan for marketing	0.77	20.97
Establishing the overall direction for commercialization of this product	0.75	18.73
Designating the individuals responsible for each part of the commercialization programme	0.76	19.79
Studying feedback from customers regarding this product	0.62	11.93
Marketing–technical integration (CR = 0.75) ^b		
This product was developed from frequent interactions between customers and our cross-functional product development team; it was truly a cross-functional team effort	0.62	10.41
The degree of integration between marketing and R&D was high during the entire development process	0.71	12.56
The degree of integration between marketing and manufacturing was high during the entire development process	0.78	14.87
New product implementation capability (CR = 0.81) ^b		
Ability to translate new product plans into action	0.76	18.89
Allocating appropriate resources to execute new product plans	0.79	21.21
Organizing activities/processes to effectively execute new product plans	0.64	120.64
Monitoring the performance of new product plans	0.69	14.94
Penetration pricing capability (CR = 0.86) ^b		
We often sacrifice profitability to gain market share	0.84	27.10
We often cut prices to increase market share	0.84	27.21
We often set prices below competition	0.72	17.38
We often seek market share position at the expense of cash flow and profitability	0.73	18.11
New product competitive advantage (CR = 0.87) ^c		
Relative to your competitors, your product met the quality specifications	0.85	29.12
Relative to your competitors, your product met the performance specifications	0.85	29.16
Relative to your competitors, your product provided a competitive advantage	0.78	21.93
New product performance (CR = 0.87) ^c		
Your new product met sales goals	0.62	12.06
Your new product attained margin goals	0.71	16.27
Your new product attained profitability goals	0.75	19.43
Your new product met revenue goals	0.78	22.54
Your new product met revenue growth goals	0.79	23.01
You are satisfied with the return on investment	0.65	13.84

Note: CR = composite reliability (Fornell and Larcker, 1981).

^a Scale anchored by (1) = 'Done very poorly' and (7) = 'Done excellently'.

^b Scale anchored by (1) = 'Not at all like us' and (7) = 'Very much like us'.

^c Scale anchored by (1) = 'Strongly disagree' and (7) = 'Strongly agree'.

mechanisms and pricing capability, estimation involves specifying interaction latent variables in a structural equation model using products of indicants (Kenny and Judd, 1984).

Table 3 (see hypothesized model) shows the structural model outputs of standardized parameter estimates, z-values and significance levels for the structural paths. Although the χ^2 (df = 608) value of 859.43 is significant (at $p < 0.01$), the ratio of

χ^2 to degrees of freedom (1.41) corresponds to a satisfactory fit. The other fit indices (TLI = 0.90; CFI = 0.91; IFI = 0.96; RMSEA = 0.047) are all within acceptable ranges and imply that the model fits the data.

The product development and testing to commercialization link becomes stronger as marketing–technical integration increases; the coefficient for product development and testing

Table 3. Hypothesis testing results

Relationships	Hypothesized model		Supplementary analysis 1		Supplementary analysis 2	
	Estimate	z-Value	Estimate	t-Value	Estimate	t-Value
Theorized paths						
PD and testing capability → Commercialization capability	0.75	9.61***				
Marketing–technical integration → Commercialization capability	0.17	1.70*				
Marketing–technical integration × PD and testing capability → Commercialization capability (H1)	0.20	3.10***				
Commercialization capability → NP competitive advantage	0.22	1.91*				
NP implementation capability → NP competitive advantage	0.42	3.48***				
NP implementation capability × Commercialization capability → NP competitive advantage (H2)	0.22	3.16***				
NP competitive advantage → NP performance	0.68	11.16***	0.54	8.68***	0.60	6.12***
Penetration pricing capability → NP performance	-0.10	1.48	-0.06	-1.11	-0.09	-0.97
Penetration pricing capability × NP competitive advantage → Commercialization capability (H3)	-0.14	2.40**	-0.13	-2.49***	-0.11	-1.22
Control paths						
Firm size → NP competitive advantage	-0.03	-0.47				
Firm size → NP performance	0.09	1.40	0.10	1.00	0.07	1.10
NPD experience → Commercialization capability	0.09	1.30				
NPD experience → NP performance	-0.05	-0.64	-0.12	-0.51	0.01	0.08
NPD resources → Commercialization capability	-0.25	-3.42***				
NPD resources → NP competitive advantage	0.08	1.18				
NPD resources → NP performance	0.08	1.03	0.19	0.83	0.06	0.32
Market potential → NP competitive advantage	0.20	2.67***				
Market potential → NP performance	-0.02	-0.32	0.04	0.52	0.01	0.09
Market turbulence → NP performance	0.15	2.32***	0.15	2.42**	0.08	0.78
Technological turbulence → NP performance	0.14	2.15***	0.11	1.86*	0.03	0.26
Technological turbulence → Commercialization capability	0.09	1.60*				
Hypothesized model: χ^2 (df = 608) = 859.43, p < 0.01; TLI = 0.90; CFI = 0.91; RMSEA = 0.047						

Note: Hypothesized model reports structural model results for the main sample (n = 187), whereas supplementary analysis 1 reports OLS regression results for the main sample and supplementary analysis 2 reports OLS regression results for the follow-up sample (n = 83). ***p < 0.01; **p < 0.05; *p < 0.10 (two-tailed test). NP = new product; PD = product development.

capability \times marketing–technical integration is positive ($\beta = 0.20$, z -value = 3.10, $p < 0.01$), in line with H1. Further, new product implementation capability \times commercialization capability is positively related to product competitive advantage ($\beta = 0.22$, z -value = 3.16, $p < 0.01$), in support of H2. The results also uphold H3, as penetration pricing capability negatively moderates the relationship between product competitive advantage and new product performance ($\beta = -0.14$, z -value = -2.40 , $p < 0.05$).

The graphical illustration of these three interaction plots is depicted in Figures 2a–c. Panel (a) indicates that under high levels of marketing–technical integration, the positive link between product development and testing capability and commercialization capability strengthens (i.e. steeper positive slope). Panel (b) likewise shows that under high levels of implementation capability, the relationship of commercialization capability and new product competitive advantage strengthens. Panel (c) indicates that under the low penetration pricing capability condition, there is a stronger positive link between new product competitive advantage and performance (see panel (c)).

Supplementary analyses

We conducted supplementary analyses to examine the longitudinal effect of H3. Here, given the limited size of the follow-up dataset, we ran a comparison across the original and longitudinal samples using OLS regression analyses. Supplementary analysis 1 (see Table 3) comprises the original data ($n = 187$), while supplementary analysis 2 covers the longitudinal data ($n = 83$). These analyses show that the negative moderation role of penetration pricing capability on the positive association between product competitive advantage and performance does not sustain in the long run ($\beta = -0.11$, t -value = -1.22 , $p > 0.01$). The implication is that, eventually, genuine product advantages will cut through and be rewarded in the marketplace, overcoming the firm's previous price-based conditioning of the market to view its new products as commodities.

Since new product implementation capability is a marketing capability that builds from project-level marketing resources, there could be a path from commercialization capability to new product

implementation capability.⁴ We do not theorize such a path as the relationship is likely to be reciprocal – organization-level implementation capability may shape project-level commercialization capability. As a robustness check, we controlled for both effects. Although they are significant (at $p < 0.01$), our hypothesized paths remained stable.

Common method bias

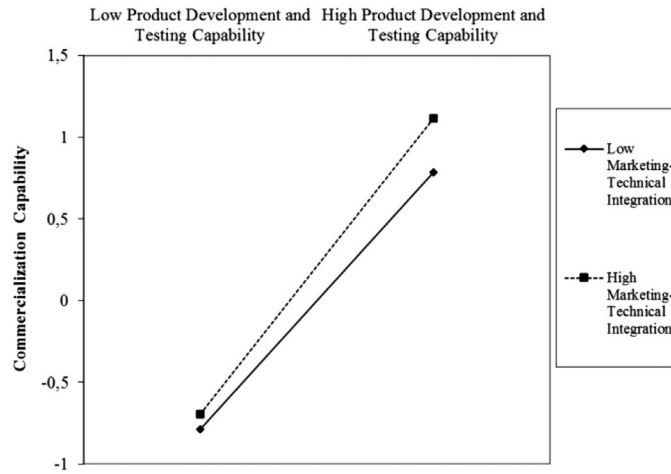
We followed Podsakoff *et al.*'s (2003) steps for controlling and assessing common method bias (CMB). First, most construct items were not grouped together by variable and, instead, were placed together within general topic categories (e.g. NPD process capabilities). Second, we assured informants of the confidentiality of responses and their anonymity at the start of every interview. Third, we conducted an OLS regression analysis for the 83 cases completing both the main and follow-up surveys to check, longitudinally, the linear effect of product competitive advantage on new product performance.⁵ Specifically, we re-estimated the performance variable predictions using t_2 new product performance data and t_1 product competitive advantage and control variable data. Capturing new product performance in a later time period addresses its susceptibility to social desirability bias (Im and Workman, 2004). The product competitive advantage to new product performance path is equally strong in the original and follow-up samples (both at $p < 0.01$), lowering the possibility of CMB being a problem in our data.

Fourth, we employed Lindell and Whitney's (2001) marker variable technique that assesses potential CMB by estimating and accounting for a common method-related correction. As an uncorrected correlation is shaped by true covariance but also by CMB, the second smallest positive value in the correlation matrix would be a conservative estimate of bias (Malhotra, Kim and Patil, 2006). Based on this marker estimate (rounding to two decimal places, $r_M = 0.01$), we computed the CMB-adjusted correlations between all the variables in the study. We then estimated a structural model using CMB-adjusted correlations to acquire corrected relationships for the linear

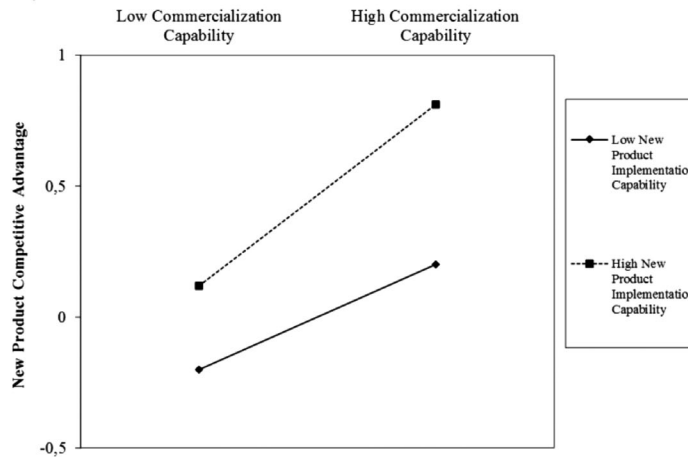
⁴We thank an anonymous reviewer for this insight.

⁵Hard to predict, moderated effects are unlikely to be shaped by method bias (Lindell and Whitney, 2001).

Panel A. Interaction between Product Development and Testing Capability and Marketing–Technical Integration



Panel B. Interaction between Commercialization Capability and New Product Implementation Capability



Panel C. Interaction between New Product Competitive Advantage and Penetration Pricing Capability

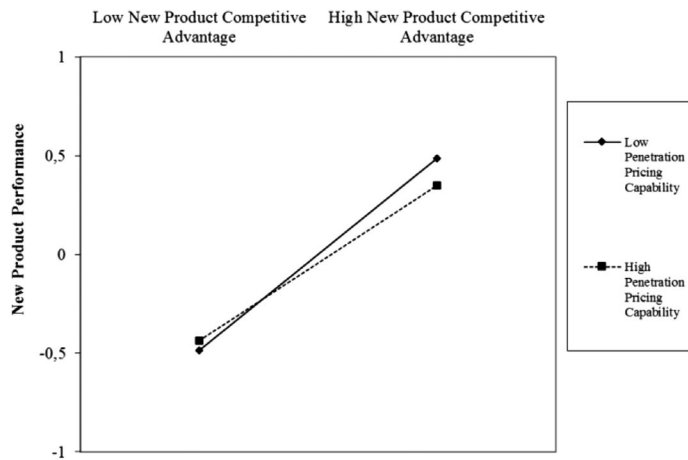


Figure 2. Illustration of moderations on the NPD processes: (a) interaction between product development and testing capability and marketing–technical integration; (b) interaction between commercialization pricing capability and new product implementation capability; (c) interaction between new product competitive advantage and penetration pricing capability

effects. The CMB-adjusted path model yielded results that match our previous structural model results. In sum, our testing indicates that CMB does not explain the study results.

Endogeneity

We posit that the firms sampled derive advantages by concentrating managerial attention on enhancing the proficiency of the commercialization phase. Commercialization capability could be a choice variable subject to the selection bias source of endogeneity. That is, we are not able to make the comparison of product advantages in a setting where firms are randomly assigned on commercialization. To control for such bias, we used STATA to follow Heckman's two-step test procedure (e.g. Katsikeas, Leonidou and Zeriti, 2016). The first step involved a probit model on the choice of commercialization with the earlier NPD stages, idea generation and development capability and product development and testing capability, as the explanatory variables. Here, we used a median split to form low (0) and high (1) commercialization capability. The inverse Mills ratio (λ) that serves as the correction is constructed using probit estimates. The second step involved a regression of product competitive advantage on the three stage capabilities, including λ . The inclusion of λ in the advantage equation provided results consistent with those of our structural model results, and λ itself was not a predictor of product advantage ($p = 0.40$). As such, the effect of commercialization on advantage is robust after accounting for potential endogeneity.

Discussion

This study seeks to gain insights into how different capabilities (i.e. marketing–technical integration, new product implementation capability and penetration pricing capability) condition NPD process execution and its outcomes among emerging market firms in high-technology settings. We demonstrate that such firms utilize NPD integration mechanisms as part of their process execution strategies to generate product competitive advantage. In high-growth emerging markets, firms are required to be adept at the transition of their market knowledge resources (Liu, Hodgkinson and Chuang, 2014). Our results show that Chinese

high-technology ventures can derive advantages from NPD staged processes which efficiently integrate market knowledge for process execution through product development and testing and commercialization capabilities (Orr and Roth, 2012). When marketing–technical integration increases, the product development and testing capability to commercialization capability path strengthens. Similarly, when new product implementation capability increases, the link between commercialization capability and product competitive advantage strengthens. However, the degree to which advantage translates into new product performance is reduced by penetration pricing capability.

Our study of Chinese high-technology ventures provides empirical support for the knowledge-based view premise that firms' competitive position depends on the creation of new knowledge resources within NPD process execution, supported by the integration of knowledge via NPD integration mechanisms. The study contributes to the product management and knowledge management literature in specific ways. First, scholars have previously neglected the status of market knowledge in emerging market firms' NPD processes (Song, Di Benedetto and Song, 2010). We highlight the critical role of market knowledge within NPD process execution and provide new insights into how specialized stage capabilities interact with market knowledge integration capabilities. Our results show that the integration of market knowledge occurs efficiently – during the course of process execution – in emerging market settings. Consequently, we challenge assertions in the literature concerning the importance of creating market knowledge during NPD planning (Akbar and Tzokas, 2013; Sullivan and Marvel, 2011). In developed market settings, strong market orientation would drive market knowledge capabilities (e.g. integration) within NPD and other product-market activities (Ozkaya *et al.*, 2015). Nonetheless, we advance the notion that market knowledge is critical in emerging market settings as the acquisition of such knowledge enhances the firm's ability in NPD execution (Sullivan and Marvel, 2011).

Indeed, this study responds to appeals for research to conceptualize knowledge creation and integration within NPD projects (Cooper, 2019). Our focus on the proficient use of market knowledge to realize execution capabilities represents a new addition to this literature stream. In

accordance with the capability-based view, NPD staged processes cultivate specialized knowledge during the tasks of new product conceptualization, development and launch, to form knowledge resources which reflect deep collective capabilities (Atuahene-Gima and Wei, 2011; Ethiraj *et al.*, 2005). Thus, specialized knowledge created in the planning phase provides direction to process execution by informing product development and testing activities (Kagan, Leider and Lovejoy, 2018). In a dynamic emerging market, however, potential gaps in knowledge transfer from front-end, planning processes are attenuated using NPD integration mechanisms within process execution (Frankort, 2016; Lee *et al.*, 2010). Specifically, our results reveal the importance of commercialization capability for Chinese high-technology ventures. The findings show that commercialization capability yields superior product competitive advantage when this specialized stage capability is directed and deployed using implementation capability. Besides, the relationship of product development and testing capability and commercialization capability becomes stronger when the marketing–technical integration increases.

Second, prior research has examined NPD processes integrating knowledge across marketing and technical functions (De Luca and Atuahene-Gima, 2007; Troy, Hirunyawipada and Paswan, 2008). However, we assert that such integration is necessary but not sufficient for understanding knowledge management within NPD staged processes. We theorize two NPD integration mechanisms, that is, the marketing–technical integration and new product implementation capability that coordinate knowledge in NPD staged execution. This conceptualization of NPD integration mechanisms provides a more comprehensive account of the way in which emerging market firms integrate market knowledge for NPD process execution (Perks, Kahn and Zhang, 2009). Drawing from the capability-based view, we feature both the managerial ability of the firm of integrating market with technical knowledge resources during the focal NPD process, and how managers utilize the organization-level capability, implementation capability, to harness market knowledge from across new product projects to serve the current one (Danneels, 2002; Vorhies, Morgan and Autry, 2009). We add to prior research that has asserted that functionally focused capabilities may be fruitfully separated into those directing strategy-

specific activities and those organizing resources for deployment across strategies (Vorhies, Morgan and Autry, 2009).

Third, our study heeds calls to focus not only on capability strengths but also on capability weaknesses, conceived as strategic liabilities which can lead to competitive disadvantage (Arend, 2004). This study of NPD processes is novel in placing emphasis on how penetration pricing capability – often considered a desirable instrument in the Chief Marketing Officer's repertoire – can be destructive when emerging market firms create value in the form of product competitive advantage and attempt to attain superior performance outcomes. Strategic liabilities linger as a by-product of previous capabilities, and the inconsistency of these can harm net performance (Arend, 2004). Taken together, our results shed new light on both the knowledge-based view and the capability-based view in the practice of NPD management in an emerging market setting.

Managerial implications

From a managerial standpoint, key implications can be drawn from our results. First, we direct managers' attention to the primacy of NPD process execution capabilities generally, and commercialization capability specifically, as the key driver of new product competitive advantage. Our results evidence that Chinese firms pursue models of efficient NPD which serve to elevate the role of commercialization (Cooper, 2019). Unlike developed market firms with the Western need to research and perfect a new product idea before going to market, Chinese firm managers are content to flexibly use the NPD cycle to iterate a product's development via commercialization. Successful new product managers are those who have achieved best practice standards in new product launch. High-technology Chinese ventures are advised to place extra emphasis on their commercialization activities, as these firms face acute environmental uncertainties due to the fast-changing political and economic conditions (Ju, Jin and Zhou, 2018; Xiao and Anderson, 2022). A remarkable tendency of hyper-adaptive Chinese employees towards innovation practices helps high-technology Chinese ventures adopt and adapt to the commercialization end of innovation in NPD execution processes (Dychtwald, 2021). Further, the implication for Western firms operating in China is that

if they fail to innovate through commercialization, they will fail to keep pace with indigenous competition.

Second, our results indicate to managers that the need to achieve a balance between stage autonomy (i.e. carrying out specialized work within the stage to create new knowledge) and interconnection (i.e. integrating new knowledge to facilitate its transfer across stages). Indeed, NPD research has long recognized that integrating different types of knowledge (e.g. technical and market knowledge) can form the basis of project-level competitive advantages (Grant, 1996). However, knowledge integration is not a panacea for NPD management. Our results reveal that NPD process execution is where Chinese firms can create a knowledge advantage which competitors would struggle to imitate. Our results furnish managers with specific insights into how to cope with technical (i.e. R&D and manufacturing) and marketing disunity within NPD process execution. Emerging market, high-technology firms commonly place emphasis on accumulating technical rather than market knowledge in their product innovation management (Song, Di Benedetto and Song, 2010; Song and Thieme, 2006). Part of the challenge facing these firms is that the disconnection of technical and market knowledge during new product development and testing – which can happen in transitional markets – makes it difficult for managers to engage in and control execution work (Burgers, Bosch and Volberda, 2008). Therefore, high-technology Chinese ventures are recommended to draw more attention to the valuable cooperation of cross-functional departments, particularly marketing, R&D and manufacturing functions, with the aim of integrating customer knowledge gathered through market sensing with technical specifications.

At the market end of NPD process execution, managers are able to leverage industry networks to obtain knowledge on the latest competitive offerings and make iterative adaptations during commercialization (Urbig *et al.*, 2013). Firms should use extensive commercialization activities to gather directly, or indirectly via distributors, the insight required to diagnose whether their market knowledge has translated into a superior product for customers. As part of this, it is important that managers incorporate market knowledge transferred across successive NPD projects to achieve competitive advantage

from the execution of the current new product project.

Third, managers are recommended not only to consider capability strengths, but also capability weaknesses which may undermine the relationship between product competitive advantage and new product performance. More specifically, our results direct emerging market firms' attention to the importance of value-informed pricing, based upon customer perceptions, when launching a new product to the market with the ultimate aim of achieving product competitive advantage and boosting new product performance. Proficiency in penetration pricing is incompatible with the strategy of creating value via proficient NPD process execution.

Limitations and future research directions

Emerging economies experience dramatic changes when moving from planned to market-based economic status, and it is still not sufficiently understood how firms manage new product processes to achieve product advantages in such economies. Our study grapples with this managerial issue but is limited in certain respects. First, caution should be exercised in attempts to generalize from these findings given the sample size of 187 responding venture firms. The data for the study were collected from the high-technology sector. The pattern of findings concerning the technological sector raises the matter of whether our theoretical predictions are as relevant in less technologically rich settings, such as in other parts of China's patchwork of regional markets. For instance, in high- rather than low-technology contexts, marketers face unique impediments to knowledge acquisition as these markets are newly established. Future research may provide insights into whether the observed effects are robust across high- and low-technology sectors in China (e.g. the new service sector), and in other emerging economies.

Second, the cross-sectional nature of our main study limits the ability to make causal inferences. NPD, for instance, cannot be assumed to be a linear process over time (Cooper, 2008). Future work should use experimental and other designs that can capture the complex causal effects of NPD process-related knowledge creation and integration driving new product advantage. Third, Chinese high-technology firms may achieve a level of proficiency in project planning on the

basis of senior managers responding to mistakes observed when launching earlier versions of new products and other market signals and controls. Future research might widen the study scope to scrutinize how market knowledge is transferred across successive NPD projects and explore firm-level conditions which expand such transfers. Moreover, further research should also consider potential reciprocal relationships among the constructs in NPD execution processes, such as the effect of commercialization capability on implementation capability and vice versa.

Finally, the presence of technologically advanced firms from developed countries in an emerging market can affect domestic firms' knowledge intensity and innovation outcomes (Liu, Hodgkinson and Chuang, 2014). While such interdependencies enhance domestic firms' new product creativity, a high level of co-development increases idea-to-launch process inefficiency. A fruitful avenue for future research should follow this line of inquiry by examining effects of knowledge spillovers within our NPD process execution model.

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Matthew J. Robson is a Professor of Marketing and International Management at Cardiff Business School, Cardiff University. His research focuses on international, strategic and relationship marketing. He has published in scholarly journals including *Organization Science*, *Journal of International Business Studies*, *Journal of Marketing*, *Journal of International Marketing* and *British Journal of Management*.

He is an Associate Editor for *Journal of International Marketing* and a former Associate Editor of *British Journal of Management*.

Fu-Mei Chuang is an Associate Professor of Marketing at Rennes School of Business, France. She holds a PhD in Marketing from Cardiff Business School, Cardiff University. Her research interests focus on product innovation, technological competence and business model innovation. Her work has appeared in the *Journal of Product Innovation Management* and *Research Policy*, among others.

Robert E. Morgan holds the Sir Julian Hodge Chair and is a Professor of Marketing and Strategy at Cardiff University. He is a Strategy Research Foundation Scholar. His research focuses on firm capabilities, new product development and technology management from a strategy perspective. His work has appeared in the *Strategic Management Journal*, *Journal of Management Studies*, *Journal of the Academy of Marketing Science*, *Journal of Service Research*, *Strategic Entrepreneurship Journal* and *Journal of Product Innovation Management*, among others.

Nilay Bıçakcıoğlu-Peynirci is a Lecturer in Marketing at the Department of Strategy and Marketing, University of Sussex Business School. She holds a PhD in Business Administration from Dokuz Eylül University and continued her postdoctoral research studies at Cardiff Business School, Cardiff University. Her research interests include international marketing and business-to-business marketing, and cross-cultural consumer behaviour. Her research has appeared in the *Journal of International Marketing*, *International Business Review*, *International Marketing Review* and *Journal of Marketing Management*.

C. Anthony Di Benedetto is a Professor of Marketing and Senior Washburn Research Fellow at the Fox School of Business, Temple University. He holds a PhD in Administration, an MBA in Marketing and a BSc in Chemistry from McGill University. He is Co-Editor-in-Chief of *Industrial Marketing Management* and former Editor of the *Journal of Product Innovation Management*. His research has appeared in *Management Science*, *Strategic Management Journal*, *IEEE Transactions on Engineering Management*, *Journal of Product Innovation Management* and elsewhere.