Behind the scenes: Addressing dual pressures for product standardization and adaptation in new product development in multinational corporations

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Abstract

Purpose: Prior studies on product standardization-adaptation in multinational corporations (MNCs) have revealed environmental factors that can influence the choices of MNCs. However, these studies have not shown how these choices are made behind the scenes in new product development (NPD). In many industries, MNCs face the dual pressures for product standardization and adaptation from the environment. This study explores how MNCs facing dual pressures can make choices of product standardization-adaptation in NPD.

Design/methodology/approach: A qualitative case study of four high-performing MNCs was conducted. The four MNCs were selected using the theoretical sampling approach. Data was collected, mainly through 74 semi-structured interviews. Coding was conducted, and four aggregate dimensions were generated.

Findings: This study reveals that choices of product standardization-adaptation are made through a process in MNCs' NPD, including four steps – organizing for NPD, organizational diversity, cross-unit integration, and combination of design practices. In addition, MNCs adopt different process variants to address different environmental pressures.

Research limitations/implications: This research focuses on high-performing MNCs in manufacturing industries. Future research can explore different types of firms.

Practical implications: Managers in MNCs should focus more on the process of choices for product standardization-adaptation, than on the level of product standardization-adaptation. They should also keep monitoring the environmental pressure and employ experienced engineers.

Originality/value: By focusing on NPD, we shift the attention from product standardization-adaptation to product feature standardization-adaptation in MNCs, which is a fresh and refined perspective. We show a process in NPD composed of activities and mechanisms that managers might utilize for handling product standardization-adaptation challenges in MNCs. We contribute to the area of cross-unit integration in MNCs' NPD by revealing mental mechanisms for mitigating tensions in cross-unit interactions.

Keywords: multinational corporations, standardization-adaptation, new product development, integration, qualitative research

1. Introduction

For multinational corporations (MNCs), global standardization and local adaptation of marketing are among the important choices needed to be made in order to achieve superior performance in global markets (Chung, 2009; Jain, 1989; Samiee and Roth, 1992; Zou and Cavusgil, 2002). Making such choices are quite challenging, as many factors need to be taken into account (Douglas and Wind, 1987; Roper, 2005). Research has been done for five decades to address this issue (Schmid and Kotulla, 2011). While standardization-adaptation has been analyzed for the whole marketing mix, the product element[1] has received more attention than others. The importance of product standardization-adaptation is evidenced by many relevant articles published in marketing, international business, and innovation journals (De Brentani et al., 2010; Schmid and Kotulla, 2011; Zou and Cavusgil, 2002).

Many prior studies have adopted the environment-strategy fit approach, revealing environmental factors that can influence product standardization-adaptation choices of MNCs, such as market demand heterogeneity, price elasticity of demand, technology velocity, and potential for economies of scale (Chung, 2010; Douglas and Wind, 1987; Katsikeas et al., 2006; Rao-Nicholson and Khan, 2017). The literature has also indicated the dual pressures from the environment existing in many industries where MNCs need to cater to product standardization and adaptation simultaneously (Bartlett and Ghoshal, 1998; De Brentani et al., 2010). Addressing the dual pressures is a real challenge for MNCs, because there is no clear-cut choice and a

[1] In this study, we focus on product design regarding product features and product quality. Brand names, packaging, and positioning are not examined.

multifocal organization is needed (Prahalad and Doz, 1987). However, despite numerous articles published, we still have very limited knowledge regarding how MNCs can address such dual pressures from the environment. This hinders our understanding of how product standardization-adaptation choices are made in MNCs.

New product development (NPD) is an important task where product-related choices like those of product standardization-adaptation are made (Robertson and Ulrich, 1998). Utilizing market requirements information is fundamental to making the right choices of product standardization-adaptation (Gunzenhauser and Bongulielmi, 2008). However, NPD is a complex task due to its cross-functional nature (Souder, 1988; Ulrich and Eppinger, 2012). In NPD, tensions often arise during interactions of different organizational units or functions (Beverland et al., 2016; Keller, 2001). However, such interactions are necessary for firms to leverage their dispersed information and knowledge (Carlile, 2002). Prior studies have not sufficiently addressed the issue of how product standardization-adaptation choices are made through such interactions in NPD, particularly in MNCs with more complex organizational structures and more tensions than domestic firms (Meyer et al., 2011). Research in the NPD field has identified some cross-functional integration mechanisms (Griffin and Hauser, 1996; Nakata and Im, 2010; Tang et al., 2015), but we still have very limited knowledge of the mental mechanisms that can mitigate the tensions in NPD. To fill the research gaps identified above, we propose the research question as: *How can MNCs facing dual pressures make choices of product standardization-adaptation in NPD?*

To answer the research question identified above, we conducted a qualitative case study of

four high-performing MNCs in different industries. We found that MNCs utilized market requirements information and made choices of product standardization-adaptation through a process containing ten themes in four steps (as aggregate dimensions). These four steps are organizing for NPD, organizational diversity, cross-unit integration, and combination of design practices. Moreover, we found two process variants (approaches) as a consequence of different environmental pressures across industries. The divergence of the two process variants started from the level of centralization in organizing for NPD.

This study has three contributions. First, by focusing on NPD, we shift the attention from product standardization-adaptation to product feature standardization-adaptation in MNCs, which is a fresh perspective. Prior research considered standardization-adaptation choices from an aggregate perspective. This study presents a refined conceptualization regarding standardization-adaptation choices. Managers do not simply choose a level of product standardization-adaptation as the literature implies, but make choices for each individual product feature which can affect the overall level. Second, in the NPD context, we show a process composed of activities and mechanisms that managers in MNCs might utilize for handling product standardization-adaptation challenges under dual pressures. The process model reveals the linkages among environmental factors, integration mechanisms, and standardization-adaptation decisions. Finally, we advance our understanding of cross-unit integration in MNCs' NPD by revealing key mental mechanisms for mitigating tensions in cross-unit interactions.

2. Theoretical background

2.1. Product standardization-adaptation

For product standardization-adaptation, MNCs position themselves on a continuum between two extremes. For high global standardization, a firm offers products with the same design globally; for high local adaptation, a firm offers the specific, customized design of products for each country (Kotabe, 1990; Samiee and Roth, 1992). Standardization can offer cost benefits and the ease of managing product portfolios (Katsikeas et al., 2006; Levitt, 1983), but it can also cause suboptimal sales in some countries (Kotler, 1986). Organizational design, in terms of control (favorable for standardization) vs. flexibility (favorable for adaptation) (Quinn and Rohrbaugh, 1983), can influence the outcome. Therefore, product standardization-adaptation can be a dilemma for MNCs and a number of factors need to be taken into account when making a choice (Schmid and Kotulla, 2011).

Prior studies have adopted the environment-strategy fit approach and revealed environmental factors that can affect the level of product standardization-adaptation of MNCs. For example, market demand heterogeneity (related to the economy, regulation, culture, and customer characteristics) is positively associated with local product adaptation (Chung, 2010; Jain, 1989; Katsikeas et al., 2006; Rao-Nicholson and Khan, 2017). This is because adapted products are more appealing to local customers with distinct preferences, and more likely to meet varied local regulations (Kotler, 1986). Price elasticity of demand is likely to positively influence global product standardization, as customers are willing to sacrifice preferences for a lower price if the price elasticity of demand is high in an industry (Bahadir et al., 2015; Douglas and Wind, 1987; Levitt, 1983). Technology velocity (the pace of technological change) is positively associated with product standardization, because high technology velocity requires more

investment in new technologies and production tools, calling for global efficiency (Katsikeas et al., 2006; Samiee and Roth, 1992). Potential for economies of scale is likely to positively affect product standardization due to the cost-saving benefit (Douglas and Wind, 1987; Theodosiou and Leonidou, 2003). Studies have also tested the effects of other environmental factors, such as product life cycle and competitive intensity (Katsikeas et al., 2006; Tan and Sousa, 2013).

In many industries, MNCs face dual pressures for product standardization and adaptation from the environment, as customers demand low cost, high quality, and distinct product features simultaneously (Bartlett and Ghoshal, 1998; De Brentani et al., 2010; Prahalad and Doz, 1987; Rigby and Vishwanath, 2006). Such dual pressures can cause internal tensions in MNCs, as different organizational units can have different orientations (Jain, 1989; Pant and Ramachandran, 2017). Addressing the dual pressures is critical for MNCs to achieve high performance in global markets (Bartlett and Ghoshal, 1998). Studies have contradicting results regarding the relationships between product standardization-adaptation and performance (Schmid and Kotulla, 2011; Zou and Cavusgil, 2002). Uncovering how MNCs address the dual pressures and manage tensions can contribute to our understanding of such relationships as it has performance implications.

2.2. New product development

NPD is a cross-functional task where organizational members make numerous product-related choices, such as product features, product variants, and target markets (Ulrich and Eppinger, 2012; Wheelwright and Clark, 1992). For product standardization-adaptation, choices are made during the NPD process (Robertson and Ulrich, 1998). However, NPD has not

been a major focus in previous studies on product standardization-adaptation of MNCs. The black box of making standardization-adaptation choices in NPD reflects the status-quo that studies of the internal organizations and processes of MNCs have been relatively rare due to lack of qualitative research (Birkinshaw et al., 2011). This research aims to generate some insights in this area.

To make the right choices, organizational members need to collect and process market requirements information from the beginning of NPD (Ulrich and Eppinger, 2012). Failure to consider key requirements in early stages can cause costly late redesign, lowering performance (Gunzenhauser and Bongulielmi, 2008; Liu et al., 2018). Therefore, it is vital to research how organizations utilize information to make choices in NPD. In this regard, many studies have been done on assisting tools such as Quality Function Deployment (Griffin and Hauser, 1993), but much fewer studies have been done on how information is utilized through interactions between organizational units or functions to make choices.

Research has shown that tensions often arise in NPD during interactions between organizational units or functions (Beverland et al., 2016; Carlile, 2002; Lovelace et al., 2001). For example, studies on R&D-marketing integration show that tensions emerge because of different knowledge, objectives, and cultures between the two departments (Dougherty, 1992; Gupta et al., 1986; Souder, 1988). While interactions of diverse organizational units are necessary to product innovation, managing tensions is a challenge (Carlile, 2002; Keller, 2001), especially in MNCs. MNCs possess more complex organizational structures than domestic firms. For example, an MNC can own an internal R&D network – multiple R&D centers in different

countries with different roles and expertise (Birkinshaw, 2002; Liu, 2019). MNCs' organizational units have different roles, horizons, and local contexts, therefore, they are likely to have more tensions (e.g. a global mindset vs. a local mindset) in interactions (Meyer et al., 2011).

Prior research has identified (cross-functional) integration mechanisms in NPD. For example, Griffin and Hauser (1996) indicated relocation, informal social systems, reward systems, and formal processes as the mechanisms for integrating R&D and marketing. Moenaert et al. (1994) pointed out role flexibility of members as a key integration mechanism. Nakata and Im (2010) identified internal team mechanisms (social cohesion and superordinate identity) and external team mechanisms (reward systems, process formalization, and managerial encouragement). Reid et al. (2016) emphasized the use of information technology (IT) resources for cross-functional integration. Some recent research has also focused on the effect of NPD project types on integration mechanisms (Jugend et al., 2018; Tang et al., 2015). However, while mitigating tensions can enhance trust and thus cross-unit integration or collaboration (Lewis, 2000; Smith, 2014; Smith and Lewis, 2011), we still have limited knowledge of organizational members' mental mechanisms for mitigating tensions in MNCs' NPD, especially for the global-local tensions. This research aims to uncover the process of product standardization-adaptation choices in MNCs' NPD where tensions between organizational units can be mitigated.

3. Methods

To answer the research question we identified, that is, how MNCs facing dual pressures can make standardization-adaptation choices in NPD, we conducted a qualitative multiple-case study. Qualitative research was conducted due to the exploratory nature of this study and the absence of

well-developed theory for this topic (Birkinshaw et al., 2011). Through combining data collection methods (e.g. interviews and archives), the case study approach can reveal dynamics within single settings (Eisenhardt, 1989). Multiple cases can create more robust theory through the replication logic (Eisenhardt and Graebner, 2007; Yin, 2009). Therefore, the multiple-case study approach was adopted.

3.1. Sampling

In this study, we employed theoretical sampling – rather than random sampling – in an effort to focus on theoretically useful cases – ones that are particularly suitable for answering the research question (Eisenhardt, 1989; Eisenhardt and Graebner, 2007; Siggelkow, 2007). Responding to the calls for contextualized theorizing (Bamberger, 2008; Welch et al., 2011), we use certain (valuable) contextual factors to select a certain type of MNCs as specified next.

We sampled high-performing (i.e. profitability and sales volume higher than industrial average) MNCs that operate in manufacturing industries with market demand heterogeneity across countries, facing dual pressures for global standardization and local adaptation. We chose manufacturing rather than service industries because of inseparability and intangibility of services (Kotler and Armstrong, 2010). Services are produced and consumed at the same time. A lot of service features are determined by service providers when serving, rather than in the new service development process. Also, because services are intangible, data collection regarding service features can be difficult. Therefore, manufacturing firms are more suitable for this study, because we can observe how specific product features are determined and how standardization-adaptation choices are made in NPD (but our findings can draw implications for MNCs in

service industries). Market demand heterogeneity is a necessary condition because, with highly homogeneous market requirements across countries, firms are not under dual pressures for standardization and adaptation of products (Kotler, 1986), so the NPD task is likely to be much simpler. We chose to study high-performing MNCs because they tend to be more sophisticated in internal organizations and processes, and thus are likely to better utilize market requirements information in NPD to make standardization-adaptation choices (Bartlett and Ghoshal, 1998; Gunzenhauser and Bongulielmi, 2008).

In 2012, we sampled the case MNCs in the pool of Forbes Global 2000 (2011 version). For the 2000 companies, we first excluded ones in the service sectors (e.g. banking and retailing) and sectors with highly homogeneous requirements across the globe (e.g. computer) through discussions with four senior business consultants. With 344 remaining firms, we checked annual reports and news articles, and discussed with the four senior consultants to identify the MNCs that addressed pressures for standardization and adaptation well and achieved high performance (i.e. sales volume and profit). We also paid attention to the geographical scope of their businesses and excluded ones with low levels of internationalization (e.g. some Chinese state-owned companies which mainly operate in China). Twenty-one companies were identified and we gained access to four of them. For the four MNCs, we accessed their lead R&D centers, which then connected us to people in other organizational units (other R&D centers and marketing departments). Eisenhardt (1989) argued that four to ten cases can work well in terms of generating theory with complexity and providing convincing empirical grounding. We focused on four cases which allowed us to have more depth.

3.2. Research setting

Table 1 provides an overview of the case MNCs. They operate in the industries of automobiles, fast-moving consumer goods (FMCG), industrial power products, and home appliances. We focused on certain product categories. They operate globally, covering different regions. Prior research documents that these industries have heterogeneous market demands across countries in terms of customer preferences and local conditions (Kotler, 1986; Ohmae, 1989; Rugman and Hodgetts, 2001), and this was confirmed in our research. For example, Americans prefer higher power engines in small cars while Europeans prefer higher energy efficiency due to greater fuel prices.

Insert Table 1 about here

All four MNCs addressed dual pressures for standardization and adaptation in NPD very well and achieved high performance. For example, AutoCo developed global cars with fewer variants over time to save costs, yet still met local requirements to maintain its market position. An automotive industry expert commented on AutoCo: “There are detailed differences [adaptation of product features] for the front-end, for the styling of the vehicle, but there is even more commonality … the basic product is common, but there is some uniqueness developed for specific market requirements … it turned out to be a recipe for success.” The new cars were among the bestselling models in the global market, according to industry experts and the media.

The case MNCs organized NPD activities globally. For a certain product category, there was a (global) lead R&D center, which was nominated by company headquarters due to its expertise

in that product category. There were some support R&D centers in other places. The roles of the lead R&D center and support centers depended on the organizational structure (see Section 4.1.2). Marketing functions were organized regionally (less integrated compared with R&D), and regional marketing departments collected market requirements related to their specific countries and provided this information to R&D.

Four MNCs faced different pressures for standardization-adaptation due to varied environments across industries. AutoCo and IndCo faced higher pressure for standardization than adaptation. This is because, in these two industries, although customers do have different tastes, overall they care more about product quality (i.e. new technology, safety, and durability) and price. An automotive industry expert mentioned: “I am sure there are many [market requirements] differences, although over the years they become smaller and smaller. The main trend is … people pay more attention to running costs, [and] they show more interest in cheap vehicles.” The power products industry had a similar situation. In comparison, PacCo and AppCo faced higher pressure for adaptation than standardization. Customers’ tastes, habits, and local conditions play a more important role than product quality and price in FMCG and home appliance industries. A home appliance industry expert commented on refrigerator products: “If you take an American product, produced for the American market, they will look like a monster in a European kitchen because of the measurements, the size of the product … they will not be possible to sell in the European market.” PacCo had a similar situation.

3.3. Data collection

There are several sources of data as elaborated below: interviews with company informants

and industry experts, non-participant observation, and documents.

The main data source of this study consisted of interviews conducted between 2013 and 2016. They were conducted with company informants and industry experts. In total, we conducted 74 semi-structured interviews (56 with company informants and 18 with industry experts). The interviews lasted for about 1.5 hours on average. All interviews were recorded and transcribed for analysis. Company informants held major positions involved in NPD, such as executives, product directors/managers, R&D managers, marketing managers, and engineers (see Table 1 for more information). We asked them the following questions: How do you conduct NPD in your company (i.e. the processes and activities)? What is your organizational structure for NPD? How do you handle specific market requirements (i.e. approaches and when to use them) in NPD? What are the roles of different organizational units (R&D centers and marketing teams)? How do they interact? What are the challenges (in terms of interactions and handling market requirements) and how to resolve them?

We interviewed 19 industry experts (through one-to-one interviews, except one interview with two experts). They are senior members in consulting firms or competitor firms. We connected to them through our personal networks. They provided three types of information. The first one was about general industrial environments, especially pressures for product standardization and adaptation for companies. This was used for understanding the research setting. The second one was specific market requirements in different countries to be considered in NPD (e.g. the cup holder requirement for cars) – whether they were heterogeneous across countries/regions. This contributed to our understanding of design practices (i.e. compromise,

overdesign, and decoupling). The third one was the MNCs' performances. They confirmed the high performances of the case MNCs, which is related to the research setting. Information provided by industry experts was used to cross-check company informants' responses. The company informants' responses were supported in all cases.

We adopted the following approaches to enhance the quality of the interview data. At the start of data collection, we promised confidentiality in order to motivate company informants to provide accurate information (Davis and Eisenhardt, 2011; Huber and Power, 1985; Miller et al., 1997). In each company, we cross-checked the responses among informants to mitigate bias, and validated responses with documents whenever possible, which reflects data triangulation (Eisenhardt, 1989; Huber and Power, 1985; Yin, 2009). As mentioned above, the interviewees are diverse in positions, enabling complementary perspectives to offset biases (Huber and Power, 1985; Santos and Eisenhardt, 2009).

We conducted non-participant observations of project meetings and NPD activities in R&D centers in all case MNCs. We did not record meetings and employees' conversations but took notes when observing. For project meetings, we sat at the back of the room and took notes. For NPD activities, we stood in the field, listened to the discussions of employees from a certain distance, and took notes. The notes were not coded in data analysis but they helped us to interpret interviews more precisely. The total time of observations in four cases was 22 hours.

The case MNCs provided the internal documents, including meeting slides, business plans, organizational structure charts, NPD process files, project files, and product design files. These documents contain detailed information on business strategies, organizational structures, NPD

activities, and product specifications. We also collected public information from various sources. These include books, company product websites, annual reports, press releases, and news articles providing information about the companies' histories, organizational structures, product features, and financial performances. The documents were used for the purpose of understanding the contexts of firms and data triangulation (Yin, 2009). They were not coded in data analysis.

3.4. Data analysis

The overall strategy of data analysis was to discover relevant theoretical themes through coding and examine linkages between these themes to build a theoretical model. As exemplified by many qualitative studies in recent years (Ben-Menahem et al., 2016; Byron and Laurence, 2015; Harrison and Rouse, 2015; Smith, 2014), a theoretical model or process containing causal relationships among theoretical themes derived from coding offers solid theoretical contributions. It shows a thorough understanding and clear explanation for a phenomenon. To achieve that, we utilized multiple analytical methods. We used NVivo for coding.

We maintained constant comparison during data collection and data analysis (Burgelman, 2011; Glaser and Strauss, 1967). To ensure the trustworthiness of our analysis, we conducted member checks throughout the study (Miles et al., 2013). These took the form of email communications with respondents, in which we shared our understandings and case study reports and invited feedback. Respondents in none of the cases contradicted our understandings but, in a few instances, helped to elaborate on them. The data analysis is summarized as three phases below, which were highly iterative.

Phase 1: Developing thick descriptions. Combining data from various sources, case study

reports were written for each MNC with detailed descriptions of strategies, organizational units, NPD activities, market requirements, challenges in NPD, organizational members' responses to challenges, and design practices. Writing case study reports guided data collection and reports were refined throughout the data collection process (Yin, 2009).

Phase 2: Discovering theoretical themes through coding. Coding was done to discover theoretical themes that are related to the research question. We first conducted open coding for the interview data in an effort to generate first-order categories, focusing on the meaning of data chunks to the research question (Strauss and Corbin, 1998). The items that emerged repeatedly in the data were identified and coded using short descriptions, such as "giving up unimportant features." We then conducted axial coding to understand the relationships among first-order categories generated from open coding, focusing on their meanings (Strauss and Corbin, 1998). Through comparing and relating, we reduced these first-order categories to fewer (ten) second-order themes, such as "compromise." Through further comparing and linking to the relevant literature, we further aggregated the ten second-order themes into four dimensions (of addressing pressures for standardization and adaptation in NPD), namely, organizing for NPD, organizational diversity, cross-unit integration, and combination of design practices. The data structure is shown in Fig. 1. The coding process was first conducted for each case (within-case analysis) and then compared across the cases (cross-case analysis) (Miles et al., 2013; Yin, 2009). Such comparative analysis also guided data collection, and coding was iterative. For example, when we discovered that AutoCo gave up unimportant product features in NPD, we scrutinized the other cases in an attempt to identify if similar practices existed in the other firms or not.

Insert Fig. 1 about here

Phase 3: Creating a theoretical model and explaining the variation. In this phase, we first analyzed causal links among four aggregate dimensions, utilizing data and the literature. We moved from understanding meanings of categories/themes to explanation-building (Yin, 2009). We examined interview data (first within-case and then cross-case analysis) to detect potential causal linkages among themes/dimensions (Harrison and Rouse, 2015). We found quotes linking these dimensions (shown in Section 4.5). The result of the analysis is a theoretical (process) model explaining how MNCs under dual pressures can make standardization-adaptation choices in NPD. Next, we compared the four MNCs and found that they adopted different approaches (process variants) to product standardization-adaptation in NPD. With the case firms divided into two groups (high vs. low centralization), we found that their environments could explain the variation.

4. Findings: Product standardization-adaptation choices in NPD under dual pressures

In this section, we first present the findings of the theoretical themes related to product standardization-adaptation in NPD (in Sections 4.1-4.4). Then, we show a process model and two approaches to product standardization-adaptation in NPD (in Section 4.5).

We found four relevant aggregate dimensions. These are organizing for NPD, organizational diversity, cross-unit integration, and combination of design practices. These dimensions and its second-order themes, as elaborated below, happened in *all four MNCs*.

4.1. Organizing for NPD: Determining involved units and relationships

Organizing for NPD is defined as making necessary organizational arrangement in a company in order to conduct the NPD task. The case MNCs organized for the NPD task through involving certain organizational units (mainly R&D centers and marketing departments) and defining their relationships (in terms of decision-making power and the information flow pattern). The approach to organizing for NPD can affect standardization-adaptation choices as it can influence how market requirements were processed in NPD. In four MNCs, organizing for NPD differed in the level of centralization. Two MNCs (AutoCo and IndCo) had high centralization and the other two (PacCo and AppCo) had low centralization. Fig. 2 illustrates organizing for NPD in the four MNCs.

Insert Fig. 2 about here

4.1.1. Involving organizational units

In the case MNCs, the NPD task was not done by only one organizational unit, but by multiple organizational units in collaboration to achieve high product quality and customer satisfaction. High-level managers organized for NPD to involve R&D centers and marketing departments located in different countries in an effort to leverage and integrate dispersed (technological and market) knowledge globally. An executive in AutoCo mentioned: “The product development organization is now a global operation, which is [we do] not looking at it so much on a regional basis …” The objective, as mentioned by an engineer in AppCo, was to “have the maximum cooperation.” An executive in PacCo explained how R&D and marketing were involved:

> When it is approved, you enter into [the] Feasibility phase, the Feasibility phase, the game is played mainly by marketing [departments] and development [R&D centers], development starts to make prototypes … Marketing evaluates the prototypes.

4.1.2. Decision-making power

In NPD, decision-making power can be centralized to the lead R&D center or distributed across all R&D centers. Under high R&D centralization, the lead R&D center decided on features of new products, and assigned NPD tasks to support R&D centers. An R&D manager in AutoCo explained: "Each vehicle has one lead product engineering setting. For the small cars, that would be Europe … once they [the lead R&D center] get to the point where they [have] decided on the style, they [have] decided on what it's gonna look like and [then] the design is frozen." An R&D manager in IndCo said that the company conducted "distributed development," and "work packages" were assigned by the lead R&D center to support R&D centers.

Under low R&D centralization, support R&D centers in each region had some power in determining the features of new products for their own regions. They were required to decide, together with the lead R&D center, on the core components and technologies to use, but they themselves could still decide on many features of products. The lead R&D center coordinated support R&D centers to push new technologies for global use. A PacCo scientist explained:

> The region [R&D center] would do for their countries, the formulations would still be different … they [lead R&D center] don't just sort of develop one thing and that's it, so that, the global center will work in conjunction with the regions to define which technologies are most appropriate.

AppCo showed a similar pattern of decision-making, as an engineer noted: "There is an interaction until everyone in the steering committee has fulfilled their requirements. So every

region says: ‘OK, for me the feasibility of the [control] board is OK.’”

4.1.3. Information flow

Market requirements information can flow from regional marketing departments to the lead R&D center directly, or through support R&D centers. Under high R&D centralization, the information on market requirements was supplied from regional marketing departments directly to the lead R&D center. A product director in AutoCo noted: “It [the car] was developed in Europe, and it had the [marketing] representatives from each market [region], onsite with the [lead] development team in Germany.” Therefore, the lead R&D center was in control of the information and then communicated with support R&D centers in order for support R&D centers to complete the assigned tasks. An engineer in a support center of AutoCo for engine development offered an example of market requirements provided by the lead center: “All the intended power packs are known at the start of a program. The intended markets are known … The brackets, mounts, and clearances have to be accounted for.” IndCo had a similar pattern.

A minor difference between AutoCo and IndCo is that IndCo created a position, global product manager, who was responsible for collecting all market requirements and providing the lead R&D center with this information. He/she sat in the lead R&D center but reported directly to the headquarters. AutoCo did not have such a position.

Under low R&D centralization, the information on market requirements was supplied from regional marketing departments to support R&D centers. For example, in AppCo, the North American support R&D center received requirements about the dimensions and user interfaces from marketing. The support R&D center then communicated with the lead R&D center in order

to share key components across regions. Therefore, the support R&D centers were in control of the information. AppCo had a similar pattern.

A minor difference between PacCo and AppCo is that, in AppCo, the European support R&D center and the lead R&D center were in the same location. However, they had different functions, evaluation criteria, and thus orientations. In PacCo, the European support R&D center and the lead R&D center were in separate locations.

4.2. Organizational diversity: Experiencing tensions

Organizational diversity means different orientations, routines, and objectives across organizational units in a company. In the case MNCs, we found that members in different organizational units were diverse in terms of orientations (global efficiency vs. local responsiveness) because they faced different environmental pressures and had different horizons (Fig. 2). Global efficiency was the motivation for standardization. Local responsiveness was the motivation for adaptation. Therefore, organizational members encountered some tensions during their interactions in NPD.

4.2.1. Different orientations

In all four MNCs, organizational members in lead R&D centers emphasized more on global efficiency as a major orientation (because they focused on commonalities across the globe). They were in direct contact with corporate headquarters pushing them to lower costs and generate better innovation. They faced the pressure of technological innovation with limited budgets and engineering capacities. The headquarters also pushed them towards the global success of products. Therefore, they focused more on commonalities across the globe than on specific

requirements from a specific region. As an example, an R&D manager in the lead R&D center of AutoCo expressed the global efficiency orientation: “Well, if you think about how much money it costs to actually launch a vehicle, right? It can be billions of dollars, so if I take a common platform, I save a lot of money.”

In all cases, members in regional marketing departments emphasized more on local responsiveness as their main orientation (because they focused on distinct local markets). This was because marketing functions were more locally-based (usually managed at a regional level) to better serve local customers. They were dealing with local customers on a daily basis, and facing the pressure of catering to customers’ specific requirements for higher sales volumes. Members focused on the local product success and did not care much about costs. A marketing executive in AutoCo noted the local responsiveness orientation in regional marketing: “Having unique vehicles for their regions is what they needed, that’s what the market needed.” Tensions emerged at AutoCo when regional marketing communicated with the lead R&D center.

The orientation in support R&D centers differed across MNCs, following either a lead R&D center (in AutoCo and IndCo) or a regional marketing department (in PacCo and AppCo), depending on the level of R&D centralization (detailed analysis in Sections 4.5.1 and 4. 5.2).

4.3. Cross-unit integration: Mitigating tensions

Cross-unit integration is defined as effective collaboration among different organizational units in a company. Despite the tensions caused by different orientations, the organizational members in the MNCs managed to mitigate tensions through three mental mechanisms (spirit of collaboration, eliminating the stereotype, and overcoming the home bias) for cross-unit

integration. Thus, members understood different orientations, market requirements, and product designs. They forged trust, and were open to discussion to find solutions to the reconciliation of different orientations in NPD.

4.3.1. Spirit of collaboration

The organizational units (R&D centers and marketing departments) were dispersed globally. With the spirit of collaboration, members proactively reached out to each other to communicate and collaborate, mitigating the obstacles of geographical distances. It is through the communication and collaboration that members understood the importance of both global efficiency and local responsiveness for the companies. For example, members in AppCo showed the spirit of collaboration, as an engineer noted: “We are discussing day by day solutions with other colleagues, making the regions’ requests become global.” Members achieved a mutual understanding as a result.

A marketing manager in AutoCo also mentioned the spirit of collaboration in NPD:

> So they [R&D members] all actually try to get the customer feedback from every market. And they will take criticism and suggestions from every market, and if they are good ideas, they will incorporate them if they fit.

4.3.2. Eliminating the stereotype

Regional marketing departments (or support R&D centers in some cases) eliminated the stereotypes of local products. Instead of distinguishing “American products” from “European products,” for example, and sticking to products with local styles, the members focused on product features. They were flexible and open-minded in the sense that the features originated

from one region may be acceptable to customers in other regions. They also eliminated the "not-invented-here syndrome," embracing technologies or designs originated from any regions in the world. They maintained their effort of eliminating the stereotypes as they were subject to the influence of local products in local markets. As a result, members in the lead R&D center trusted marketing (or support R&D centers) members regarding taking global efficiency into account while addressing local responsiveness.

AutoCo, for instance, once suffered from a product stereotype in regional marketing. A marketing manager in the U.S. recalled the mindset of the marketing before: "For one thing, there was a traditional idea that this is the kind of the car, American car is the kind of car that American customers want." The stereotype was then eliminated in AutoCo, as noted by an R&D manager: "It's more accepted to see some of the different styles."

4.3.3. Overcoming the home bias

In each MNC, the lead R&D center overcame the home bias, so that marketing departments (or support R&D centers) in other regions could trust the lead R&D center regarding considering local responsiveness while addressing global efficiency. It was a continuous effort as well. As the lead R&D center was geographically closer to the marketing department (or the support R&D center) in its own region, it could potentially have a home bias, attending to market requirements from its own region significantly more than ones from other regions. To overcome the home bias, the lead R&D center in each MNC viewed the global market as a whole and paid attention to requirements from all regions from a business perspective, rather than a geographical perspective. That did not mean that the lead R&D center would satisfy all of the requirements, but it would

give careful consideration for each. The aim was to have a centralized structure, but not a "centralized view" in NPD according to a scientist in PacCo.

For example, the scientist in PacCo noted how the home bias was overcome: "If you don't even attempt to understand local consumers and you just have a centralized view of the world, you will develop inappropriate products." He further explained the consequence of overcoming the home bias: "The global center is to identify technologies with global applicability, so it would test technologies under a range of conditions and habits which broadly covered the range of wash habits across the globe." A global product manager in IndCo also noted how the home bias was overcome in the lead R&D center: "The local people might come and say 'I need this and that,' you do something, but it will be considered in the global context, always."

4.4. Combination of design practices: The contingency approach in NPD

Combination of design practices means organizational members leverage several different practices in a flexible manner. Members tend to leverage all for the benefit of the company, but can have preferences for certain practices.

With positive attitudes toward reconciling competing orientations, organizational members in the MNCs identified small overlaps between global efficiency and local responsiveness when determining product features. They adopted a contingency approach comprised of three modes (compromise, overdesign, and decoupling respectively) in handling market requirements in NPD. Each mode contributed to addressing both global efficiency and local responsiveness, but the extent of addressing the two somewhat differed. Which mode to adopt was contingent on certain factors, such as the importance of a feature to customers, the cost of a design, and the preference

(for a certain mode) of the MNCs. Members used all three modes in all cases.

4.4.1. Compromise

The NPD team members made compromises and developed the products not exactly as needed by local customers. They did so through abandoning unimportant requirements or only fulfilling the minimum of required functions (instead of fully customizing all features) for the products to be acceptable. The contingency here was that the features or functions in question represented small global volumes or were not very important to customers' buying decisions. The team members focused on satisfying more important requirements in a better way.

An example of compromise occurred at AutoCo because customers' tastes with regard to wheel rims were heterogeneous across regions. Many Americans demonstrated a preference for wheel rims with shiny chrome finish, as an American industry expert noted: "They love chrome." However, Europeans preferred a silver finish, as a European industry expert stated: "Shiny chrome wheels are evaluated as not classy in Europe." However, AutoCo abandoned the chrome wheels, and instead offered silver wheels globally, because the chrome wheel was considered less important, and the car was still acceptable to American customers. An R&D manager in AutoCo explained:

> So the local customer may suffer some compromises on one hand, but by the same token may have the opportunity to appreciate some additional content that would not have been affordable to develop for a single market.

As another example, IndCo abandoned the requirements of the oil technology from some countries due to small sales volumes.

4.4.2. Overdesign

Some product features required by one region were not necessary (although not unappealing) for another region. The MNCs conducted overdesign to offer these features globally, even if they were not needed in all regions. Alternatively, it could be that some countries required higher parameters (i.e. more stringent) than others, in which case the MNCs offered the highest parameters for all countries. Firms might do so when such requirements were important and the additional costs of production could be offset by the saved costs in product designing and testing.

The case of AppCo illustrates overdesign very well. Ambient temperature was different across countries, which could influence the design of refrigerators. However, the NPD team members in AppCo adopted the highest standard globally, as an R&D manager noted:

> There was the refrigerator, class T [tropical], that was 43 degree [maximum ambient temperature], then there were 38 and 35 … now we are moving more and more [towards] 43 … because 43 is better than 38 in terms of functionality, so 43 became our standard.

An engineer in AppCo explained the rationale of overdesign: “On the first analysis, we say here [overdesign] costs more; on the second step [of analysis], we say because we reduce the number of components, we optimize, then the volume of the component is going to be higher … and then we have a better price [from the supplier].”

Similarly, AutoCo conducted overdesign for different requirements on cup holders and crash tests. An R&D manager noted: “So again, it becomes a business case … knowing how many million dollars they spent on testing … we overdesigned the components because that made it cheaper.”

4.4.3. Decoupling

A final mode of the contingency approach occurred because developing product variants usually involve modifying a number of interrelated components. Through fully considering variants in the earliest stages of NPD, NPD team members decoupled interfaces of components relevant to the variants – an effort to *make components less likely to affect each other* in design. They did so by defining common interfaces and considering worst-case scenarios for interfaces. Therefore, when modifying some components in later stages to generate product variants, other components were not changed. The whole product was not necessarily highly modular, as such decoupling could be limited in scope. Despite some benefits of decoupling, it was not always desirable. The contingency for this mode was that the requirements were important, the cost of decoupling was low, and decoupling would not cause loss of functionality or esthetics.

One example of decoupling occurred at AppCo. For refrigerators, different regions needed different functions and designs of refrigerators (e.g. body types, capacities, user interfaces, and refrigerants). For example, an industry expert noted: “American people prefer side-by-side and French-door refrigerators, but most European people want different types [e.g. top-freezer and bottom-freezer].” AppCo developed different refrigerators for different regions. However, the interfaces of interior components were decoupled so that some components (e.g. control boards) were shared globally. An engineer in AppCo explained that the interfaces between control boards and other components were decoupled through considering possible variants from the beginning:

> We are trying to fit more when possible, a wider range of products, so could be that some regions are working, starting to work on the project because they will start first for the

production, and then other regions come to request the same board, so they find the work already done by others.

Another example happened at PacCo. Different formulations were developed due to different requirements on detergents across countries (e.g. cleaning performance, cost, water temperature, and bleach). However, some ingredients in base formulations were shared across countries through “understanding how they will interact with each other” well in advance, according to a scientist.

4.5. A theoretical model and two approaches to product standardization-adaptation in NPD

Through analyzing the relationships between aggregate dimensions identified above, we created a theoretical model of the 4-step process of product standardization-adaptation choices in NPD (see Fig. 3). Considering the environment of the company, high-level managers in MNCs organize for the NPD task – involving certain organizational units (R&D centers and marketing departments) in NPD and defining the relationships between them (decision-making power and information flow). Different organizational units possess different knowledge, expertise, and orientations which lead to organizational diversity. Members experience tensions, but can leverage mental mechanisms (spirit of collaboration, eliminating the stereotype, and overcoming the home bias) for cross-unit integration. With mutual trust, organizational members are able to reconcile different orientations through the combination of design practices (compromise, overdesign, and decoupling) in a contingent way.

Insert Fig. 3 about here

The four MNCs showed two different approaches (process variants) to product

standardization-adaptation in NPD (see Fig. 4). The variation of environmental pressures (for standardization and adaptation) can explain the adoption of a certain approach in an MNC.

Insert Fig. 4 about here

4.5.1. The high-centralization approach

AutoCo and IndCo were similar in the sense that they both adopted the high-centralization approach. In the two MNCs, with higher pressure for standardization than for adaptation from the environment, NPD was organized as high centralization (see Fig. 2 AutoCo and IndCo). The lead R&D center holding decision-making power and market requirements information was likely to enhance standardization while still taking care of heterogeneous market requirements across countries. An executive in AutoCo commented that adopting this structure was due to higher pressure for standardization: “Given the complexity and expense when developing the modern car, it is not sustainable to carry on doing things regionally.”

The approach to organizing for NPD affected the organizational diversity pattern. With high centralization, support R&D centers had a global efficiency orientation, because they were controlled and influenced by the lead R&D center (with a global efficiency orientation). They did not communicate with regional marketing departments directly, therefore, they were not influenced by regional marketing’s local responsiveness orientation. For example, in AutoCo, an engineer in the support R&D center in the U.S. noted the global efficiency orientation:

> The cost is going up, but we tried to control the cost. If you get the volumes up, sometimes it can help get your cost down, and if you negotiate with the suppliers, you may be able to get your cost down.

Similarly, in IndCo, an R&D manager noted the global efficiency orientation of support R&D centers due to close alignment with the lead center: “It’s feasible to have the big scale. It’s good from the cost point of view and from the quality point of view actually.”

To tackle the variety of orientations, the cross-unit integration mechanisms were adopted between the lead R&D center (including the global product manager in IndCo) and regional marketing departments. Members in regional marketing departments eliminated the stereotypes of regional products, and members in lead R&D centers (and the global product manager in IndCo) overcame the home bias to consider requirements from all the regions. These facilitated mutual trust. For example, an R&D manager in IndCo noted such interactions between the lead R&D center (with the global product manager) and regional marketing departments: “Here is global product manager, GPM, and he is collecting [market requirements] information and he is communicating to the lead technology center … not all the wishes can be fulfilled by technical solutions, but we try to implement in the development.” The cross-unit integration mechanisms were not needed between R&D centers due to the same orientation.

With cross-unit integration, the lead R&D center used the combination of design practices in NPD involving three modes (compromise, overdesign, and decoupling), taking into account regional marketing departments’ opinions. However, R&D centers preferred the compromise mode to the decoupling mode. With contingencies taken into account, they tried to apply compromise and avoid decoupling for borderline cases. The priority of overdesign was in-between. An R&D manager in AutoCo expressed their preference for compromise: “What happens is you’d compromise in the design, right? So you compromise the design, so you have

something that will work in both regions, in both sets of demographics." Similarly, an R&D manager in IndCo confirmed their tendency towards compromise in NPD and pointed out that decoupling was not preferred due to the difficulties caused by "physical limits."

In fact, the three modes of the contingency approach have different implications for the two orientations. Compromise, though denoting reconciliation of the two orientations, can fulfill global efficiency better than local responsiveness. In contrast, decoupling is somewhat leaning more towards local responsiveness than global efficiency. Overdesign is a neutral mode in this sense, with global efficiency and local responsiveness equally fulfilled. For AutoCo and IndCo, power was more centralized to the lead R&D center with the global efficiency orientation. This preference contributed to higher product standardization.

4.5.2. The low-centralization approach

PacCo and AppCo were similar, as they both adopted the low-centralization approach. In the two MNCs, with higher pressure for adaptation than for standardization from the environment, NPD was organized as low centralization (see Fig. 2 PacCo and AppCo). For new products, the lead R&D center needed to decide together with (regional) support R&D centers which still had some power of determining product features. Market requirements information was held by support centers. Support R&D centers taking care of different market requirements were likely to enhance adaptation while, with the coordination by the lead center, trying to standardize products whenever possible. An executive in AppCo explained that such a structure was adopted due to higher pressure for adaptation: "There are local differences, clearly in habits and so on … we can differentiate on the design part of it, and by that we can become more agile

towards local needs."

Low centralization caused support R&D centers to have a local responsiveness orientation, because support R&D centers in each region conducted the NPD task for its region. They were more aligned with regional marketing departments than with the lead R&D center, and only considered market requirements from their own regions. Therefore, they were less influenced by the lead R&D center in terms of orientation. A product director in a support R&D center in PacCo expressed the orientation of local responsiveness: "They [customers] are in the different environment … the water amount is different, the type of foam consumers need is different, the stain types could be different."

An R&D manager in a support R&D center in AppCo mentioned the local responsiveness orientation: "Marketing, it all depends on them … what they can sell, and what they want, because they need to ask for what they want, and if they are good, you offer what they want."

The cross-unit integration mechanisms were adopted mainly between the lead R&D center and support R&D centers as they had varied orientations and they were in direct contact. The support R&D centers eliminated the stereotypes of regional technologies and the lead R&D centers overcame the home bias to consider different conditions in all the regions. An engineer in AppCo noted the interactions between the lead R&D center and support centers: "We need to have a central R&D here to deliver the board [module], and [receive input from] the local R&D … to understand better if the global board is fulfilling their requirements."

With cross-unit integration, the R&D centers used the combination of design practices in NPD with three modes to handle market requirements. However, R&D (as a whole) preferred

decoupling (as it better fulfilled local responsiveness) to compromise. Again, the priority of overdesign was in-between. A PacCo scientist stated the tendency toward adopting decoupling: "We are just using a limited number of components to make our detergent powder's base formulation, and then you can customize it as much, or as little as you want …"

Similarly, an R&D manager in an AppCo support R&D center mentioned the tendency toward decoupling in NPD, because "things are really different from a country to another."

The compromise mode was adopted usually when decoupling and overdesign were very costly or the requirements were clearly unimportant. In borderline cases, decoupling was adopted. As a result, the preference for decoupling contributed to higher product adaptation.

5. Discussion

5.1. Theoretical implications

This study advances our understanding through shifting our attention from product standardization-adaptation (an aggregate perspective) to product feature standardization-adaptation (a refined perspective). In prior studies, product standardization-adaptation has been measured in a way to reflect its overall level (i.e. including all product features) (Katsikeas et al., 2006; Zou and Cavusgil, 2002). In this study, an NPD view offers a more concrete idea of product standardization-adaptation. We found that each feature of a product is carefully considered in NPD, based on market requirements information. Therefore, in NPD, the product standardization-adaptation issue is converted into the issue of product feature standardization-adaptation. We argue that managers in MNCs may not directly choose a specific level of standardization-adaptation of a whole product as some prior studies imply,

though they may have a strategy of increasing or decreasing the level. An overall level of product standardization-adaptation is a natural result of the choices made for all features of a product through a process in NPD an MNC adopts.

This study presents a process model composed of activities and mechanisms in NPD that managers in MNCs might utilize for handling product standardization-adaptation challenges under dual pressures. These activities and mechanisms are behind the scenes, which have not been revealed in prior studies on product standardization-adaptation. Integrating our findings and prior studies, we present an integrated framework that explains MNCs' choices of product standardization-adaptation (see Fig. 5). We show that, in NPD, there is a process with interactions of organizational units to make the choices. The process determines a certain level of product standardization-adaptation, and it is subject to the influence of environmental pressures.

Insert Fig. 5 about here

Prior studies have highlighted the effect of individual environmental factors on product standardization-adaptation (Katsikeas et al., 2006; Samiee and Roth, 1992). Adopting an NPD view, we found that, in practice, these factors as a whole exerts a certain effect on product standardization-adaptation. While each of these factors can individually contribute to the pressure of standardization or adaptation, high-level managers actually take into account these factors altogether and organize for NPD based on overall pressures for standardization and adaptation – which pressure is higher is particularly important. The comparative approach is evident in NPD but has not been revealed in prior studies.

Prior studies on cross-functional integration in NPD have identified a number of integration mechanisms, such as reward systems, process formalization, informal social systems, role flexibility, and IT usage (Griffin and Hauser, 1996; Moenaert et al., 1994; Reid et al., 2016). We argue that, while these mechanisms are helpful, mental mechanisms (to mitigate tensions) are more fundamental to facilitating high integration in NPD through the mutual trust of members across organizational units. Nakata and Im (2010) proposed superordinate identity as a mental mechanism, but it is not clear how it can be achieved in MNC's context with global-local tensions. In this research, we show that the lead R&D centers overcame the home bias, and the regional marketing departments (or support R&D centers) eliminated the stereotypes. With these two mechanisms and the spirit of collaboration, cross-unit integration was facilitated.

5.2. Managerial implications

This study has managerial implications for product standardization-adaptation. Firstly, managers in MNCs should focus more on the process of making choices for product standardization-adaptation, than on the level of product standardization-adaptation. They should aim to establish a suitable and effective process. For one aspect, they need to consider whether to adopt a high centralization approach or a low centralization approach, depending on the environmental pressure. Also, they need to ensure certain steps and mechanisms are in place, as shown in our findings. These include different orientations across organizational units, mental mechanisms for cross-unit integration, and combination of design practices to handle heterogeneous market requirements. Managers should work on the process to see whether there is room for improvement. Secondly, managers should keep monitoring the environment

regarding the relative pressures for standardization and adaptation (i.e. which one is higher). When the relative pressures change, they should alter the process, starting with changing the organizational structure for NPD. Finally, we show that MNCs should use certain design practices (compromise, overdesign, and decoupling) to handle heterogeneous market requirements. Engineers need to be highly experienced and knowledgeable for product design in order to make better choices of the design practices.

5.3. Limitations and future research

While in this study we benefit from contextualized theorizing (Welch et al., 2011), future research can be extended to different contexts to generate more insights. In this study, we examined well established, high-performing MNCs. For these firms, market requirements from all countries are fully considered from the beginning of NPD, and all product variants are well planned (though some product variants may be executed later than others depending on the workload of engineers). This is to avoid significant redesign when other market requirements are taken into account later (Gunzenhauser and Bongulielmi, 2008). However, low-performing MNCs, or small companies, may adopt a different approach because they are not well established in foreign markets and they have limited resources for NPD. They may first develop one product variant for the domestic market (without considering foreign markets) and then adapt or redesign for certain foreign countries based on the feedback from the domestic market. Small companies may not have foreign R&D centers or lack coordination capability for global R&D. Therefore, low-performing MNCs or small companies may need a different process for choices of product standardization-adaptation in NPD, which can be researched in the future.

In this study, we focused on manufacturing industries for reasons mentioned in Section 3.1. For service companies, service standardization-adaptation is determined by both the internal process of new service development and the service provider him/herself when serving. For instance, service templates which set certain instructions of services may be designed internally, while service providers have some flexibility of implementation. Future studies can test whether the process we reveal in this study can apply to standardization-adaptation of service templates. Future studies can also investigate the interactions of service templates and service providers' implementation that may affect service standardization-adaptation.

This research focused on a small sample of four MNCs and developed some insights. Future research can test our findings (the process) with a large sample using quantitative research methods. When measuring the dimensions, the researchers can focus on the variation of the types. For example, we found that there are two types of "combination of design practices" – one with the preference for compromise and one with the preference for decoupling. Researchers can identify the specific type adopted by a company when measuring a dimension.

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Table 1 Description of cases

Case	AutoCo	PacCo	IndCo	AppCo
SBU revenue[a]	$50 billion	$11 billion	$10 billion	$6 billion
Industry	Automotive	Fast-moving consumer goods	Industrial power products	Home appliance
Product category examined	Small and medium car	Laundry detergent	Switchgear	Refrigerator
Headquarters' location	North America	Europe	Europe	Europe
Number of company informants	10	11	11	14
Number of interviews with company informants	12	13	13	18
Positions of company informants	Executive Product director R&D manager Marketing manager Engineer Designer	Executive Product director R&D manager Marketing manager Scientist	Executive Global product manager R&D manager Marketing manager Engineer	Executive Product director R&D manager Marketing manager Engineer Market researcher

[a] 2013 data for strategic business unit (SBU) revenues, converted to U.S. dollar by annual average exchange rates

Fig. 1. Data structure

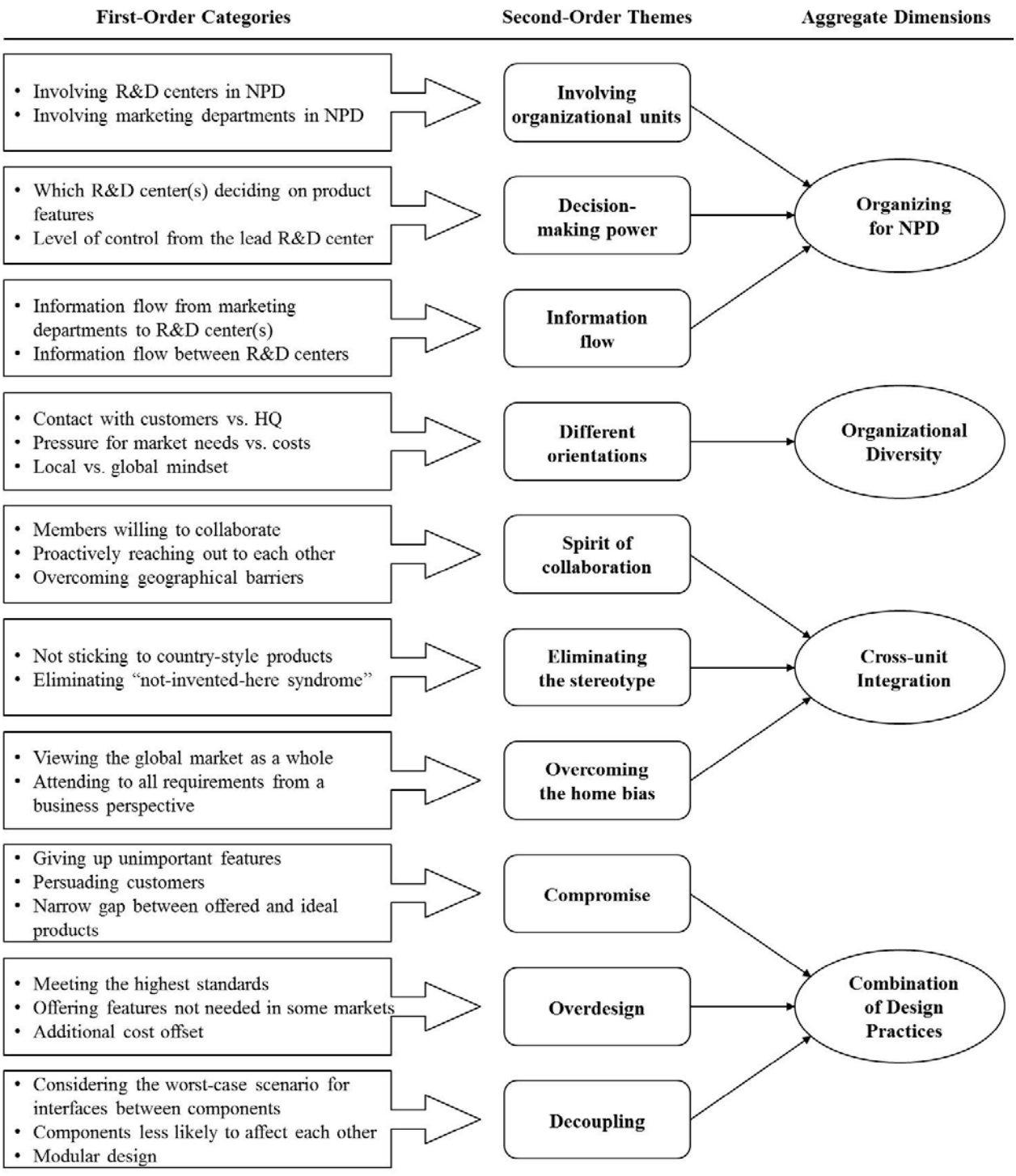
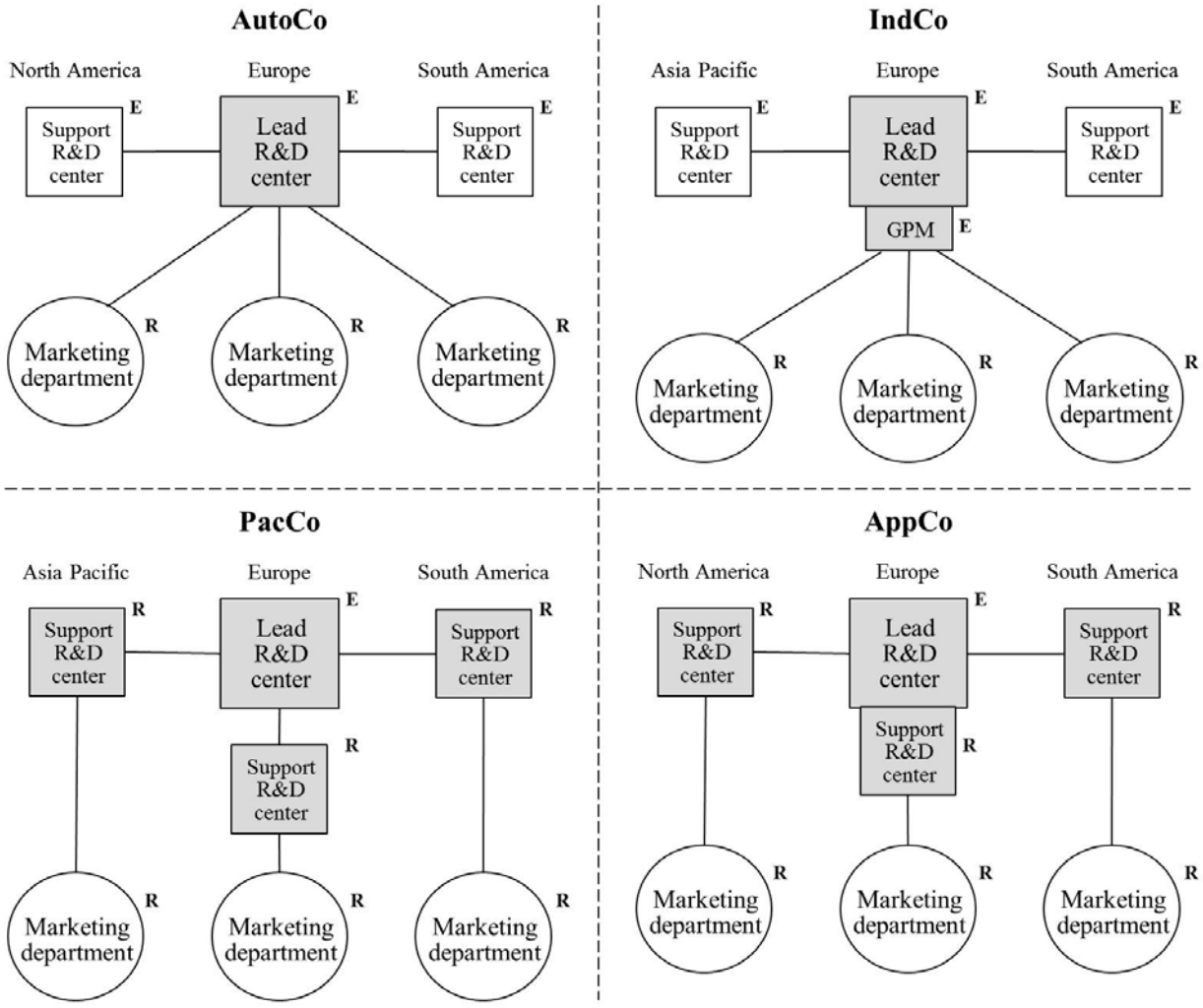


Fig. 2. Organizing for NPD in case firms



——— : Information flow between organizational units

▒ : Decision-making power

GPM: Global product manager

E: Global efficiency as the main orientation in the organizational unit

R: Local responsiveness as the main orientation in the organizational unit

Fig. 3. A theoretical model of product standardization-adaptation in MNCs' NPD

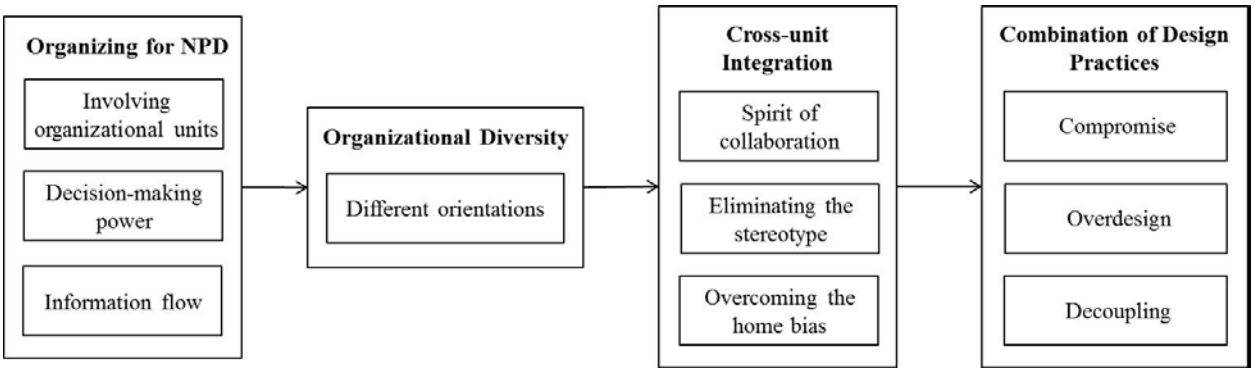
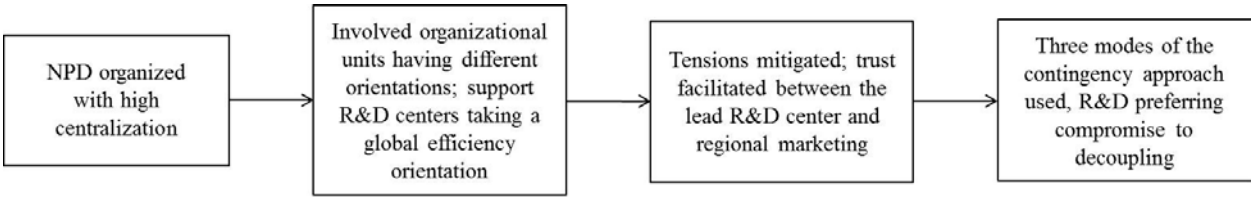


Fig. 4. Two approaches to product standardization-adaptation in MNCs' NPD

(a) The high-centralization approach (AutoCo and IndCo)



(b) The low-centralization approach (PacCo and AppCo)

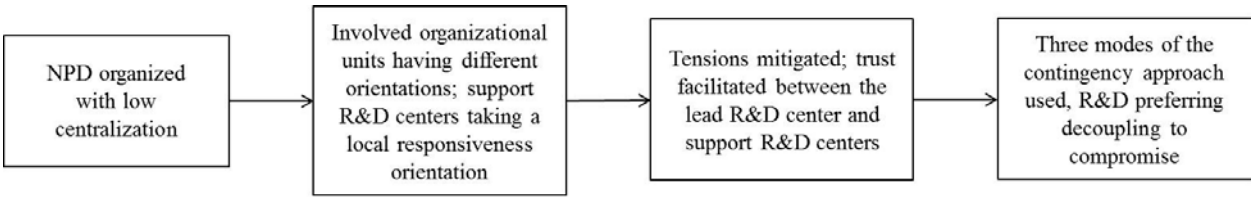
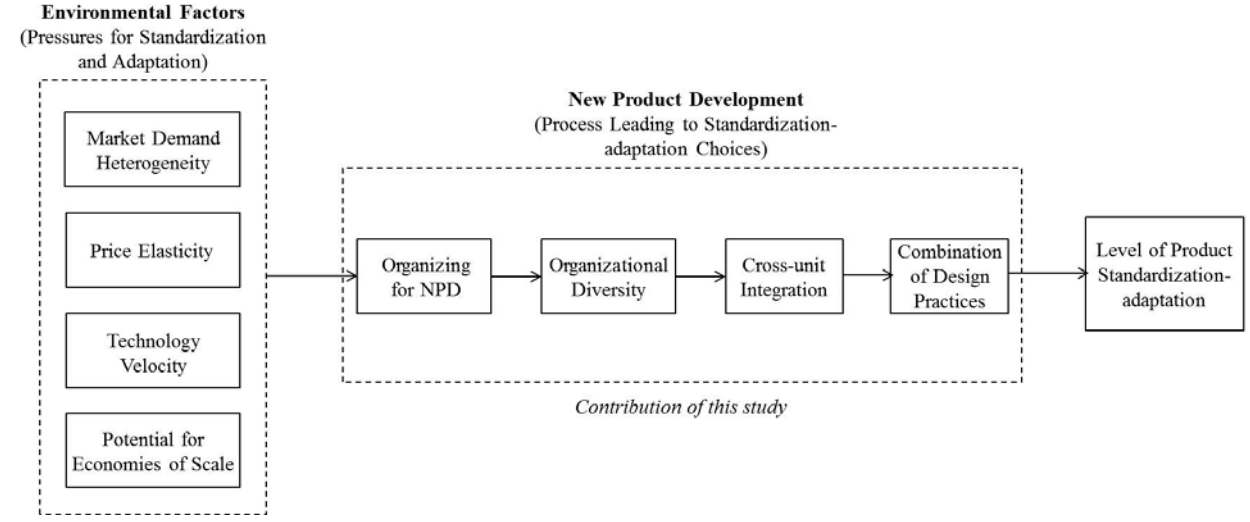


Fig. 5. An integrated framework of product standardization-adaptation in MNCs*



* The environmental factors shown in this figure are not exhaustive.