Customer Heterogeneity and Innovation-Based Competitive Strategy: A Review, Synthesis, and Research Agenda *

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Abstract

Managing customer heterogeneity (CH), i.e., differences among customers (e.g., consumers, business firms) is an important, yet challenging consideration for firms seeking innovation-based competitive advantage. To facilitate better understanding of the opportunities and challenges that CH presents, we conducted a systematic literature review linking CH with innovation-based competitive advantage. Initially, we synthesize extant CH literature to propose a multidimensional conceptualization and definition of the CH construct comprising three dimensions: customer need heterogeneity, customer knowledge heterogeneity, and customer relationship heterogeneity. Customer need heterogeneity refers to the extent to which customers' needs/preferences for a product offering differ from each other, customer knowledge heterogeneity indicates the degree to which customers have different knowledge levels regarding how their needs can be satisfied, and customer relationship heterogeneity indicates the extent to which customers have different preferences toward engaging in relationships with the firm. Next, we present an integrative summary of the empirically tested as well as theoretically proposed links between each CH dimension and its antecedents/outcomes. Finally, we draw upon the paradox literature to identify specific tensions associated with each CH dimension and rely on the dynamic capabilities literature to suggest how these tensions can be effectively managed.

Collectively, we contribute to the emerging resource-based perspective of CH by offering a propositional model of how CH can be managed for innovation-based competitive advantage.

Practitioner points

- Managers should regard Customer Heterogeneity (CH) as a resource that can be managed to achieve innovation-based competitive advantage.
- This resource-based viewpoint is based on the recognition that CH is multidimensional and includes customer need heterogeneity, customer knowledge heterogeneity, and customer relationship heterogeneity.
- Each of the three CH dimensions gives rise to paradoxical tensions that require managerial acceptance and resolution.
- Managers should proactively act to develop dynamic capabilities in order to accept and resolve the tensions arising from CH.

Introduction

Managing customer heterogeneity (CH), i.e., differences among customers (e.g., consumers, business firms) is an important consideration for firms seeking innovation-based competitive advantage. Customer differences are prompted by a myriad of factors that motivate distinctive preferences and behaviors (c.f., Palmatier and Crecelius, 2019) which means that firms have to strategically target innovation resources in order to cater to increasingly niche market segments. Diverse customer needs provide incentives for firms to develop innovations based on idiosyncratic preferences; these offerings help firms differentiate themselves from other providers in the face of increasing competition. Recently, emerging data sources and digital technologies have enhanced firms' abilities to take advantage of such opportunities (Zhang and Xiao, 2020).

But CH also presents firms with several challenges. Noted challenges of CH include: resource constraints that hamper appropriate responses to new entrants in emerging market segments (Adner, 2002; Bohlmann, Golder, and Mitra, 2002), difficulties in deciding suitable value propositions for different segments (DeSarbo et al., 2010), and uncertainties with respect to the technological solutions firms should adopt to meet diverse needs (Khandwalla, 1972; Miller and Friesen, 1983). These challenges are magnified by a rapidly changing marketing landscape. For example, digital technologies (e.g., social media) have strengthened customers' bargaining position by facilitating access to greater and richer information and empowering them to be heard (Lemon and Verhoef, 2016). Further, direct to customer marketing approaches that eliminate marketing intermediaries give customers immediate access to firms which can increase demands for satisfying unique needs (Berry et al., 2010). Not surprisingly, the role of CH as source and impetus for innovation-based outcomes has received increasing research attention. Although these studies have significantly improved understanding in the area, important gaps remain.

First, the literature lacks a consistent conceptualization of CH. Also, while CH has traditionally been defined in terms of differences in customer needs and preferences, there is increasing evidence that CH is best regarded as a multi-dimensional construct that incorporates additional customer differences related to their knowledge levels (e.g., Franke and von Hippel, 2003) and willingness to engage in relationships with firms (e.g., Reynolds and Beatty, 1999). Second, extant literature does not offer a cohesive overview of the links between CH and its

antecedents and innovation related outcomes. Such a synopsis can help advance a nomological network of CH theory. In turn, this nomological network can guide greater understanding of the nature of CH, the factors that impede or drive its effective management and its impact on organizational performance. Third, while the current literature notes product customization and customer involvement as relevant CH management strategies, it has largely ignored strategic contradictions that mediate the relationship between CH and its outcomes. In particular, the mechanisms that enable firms to use CH attributes to enhance performance remain unexplored.

This article aims to address these deficiencies and stimulate CH related research in the following three ways: First, we offer an integrative reconceptualization of CH as a multidimensional construct that encompasses differences in customers' needs and preferences, knowledge levels, and preferences toward engaging in relationships with firms. Second, we present an integrative summary of the empirically tested as well as theoretically proposed links between each CH dimension and its antecedents/outcomes. Third, drawing on insights from the paradox and dynamic capabilities literatures, we identify how managers reconcile CH related strategic contradictions to propose that effective CH management and creating/sustaining superior firm performance involves addressing these tensions via dynamic capabilities. To achieve these aims, the next section outlines the methodology used to conduct the literature review, including the search strategy and selection criteria. Following discussions of the three contributions noted above, we conclude by outlining directions for future research.

Methodology

To achieve the desired research objectives, we followed the process outlined by Denyer and Transfield (2009). Only peer-reviewed journals were considered because they disseminate validated knowledge and have the highest impact (Crossan and Apaydin, 2010). The Web of Science Social Sciences Citation Index (SSCI) database was used in this study because it is regarded as one of the most comprehensive databases of peer-reviewed journals in the social sciences (Crossan and Apaydin, 2010; West and Bogers, 2014). Relevant articles were located using three subsets of Boolean search terms. The first subset included words with the prefix *innovat** (such as innovate, innovations, and innovative) and *strateg** (such as strategy, strategic, and strategies) to define the domain of the study. The second subset looked at heterogeneity with the prefix *heterogene** to capture variation in the word such as heterogeneity or heterogeneous and *diversity* as a commonly used synonym for heterogeneity. Further, *segment** OR *differenti**

was included to represent segmentation and differentiation. The third subset specified the type of heterogeneity with the words *demand, consumer, customer, user, need, preference, market* and *want*. Using these Boolean search terms (all three subsets were included at once) a *topic* (title, keywords, or abstract) search was conducted in SSCI database for the period from 1978 to 2020 (42 years) because this time frame has witnessed a surge of research on CH. This search generated 28,550 articles.

To ensure selection of the most relevant articles, only articles published in either the top 50 technology and innovation management journals (Thongpapanl, 2012) or the *Financial Times* top 50 journals were included. This resulted in 4337 articles from 78 journals. Next, articles that focused on CH and firm level innovation-based competitive strategy were identified while excluding articles related to (1) national level innovation, (2) other organizational strategies (e.g., diversification, segmentation, collaboration) that had no reference to innovation and (3) other types of heterogeneities such as top management, actors, and resources. As a result, 99 articles, published in 38 journals, that matched the inclusion criteria were identified for further analysis (supplementary document will be provided upon request). Our initial focus was on the conceptualization of CH which is described next.

Conceptualization of Customer Heterogeneity

Extant literature has long emphasized supply-side factors like resource endowments and technological capabilities as critical determinants of firm-level innovation (Adner and Levinthal, 2001). With evidence that demand-side factors like customer heterogeneity and customer dynamism are just as important in guiding firms' innovation efforts (Priem, Li, and Carr, 2012), there have been calls for increased attention to demand-side dynamics as drivers of firm-level innovation (Adner and Levinthal, 2001). Added urgency for this emphasis comes from research findings that value-adding strategies based on customer heterogeneity can lead to sustainable competitive advantage even when firms have obsolete or easily imitable resources (Adner and Snow, 2010; Ye, Priem, and Alshwer, 2012).

Such demand-side considerations are not new to marketing scholars. While early marketing strategies emphasized a *mass marketing* paradigm, by the late twentieth century, acknowledgement of increasing customer heterogeneity led to a transition toward *niche marketing* strategies (Palmatier and Crecelius, 2019). Tools such as cluster analysis (Green, 1971) and perceptual maps (Schmalensee and Thisse, 1988) were applied to understand how

customers differ and to guide segmentation, targeting, and positioning strategies. These strategies were predicated on the recognition that customers have differing needs and preferences (Wang and Seidle, 2017) and that market segments are composed of customers with similar needs and preferences (Adner, 2002). Because the divergent needs and preferences of customers afford opportunities for innovation-based competitive advantage (Miller and Friesen, 1983), customer need heterogeneity has received considerable research attention as described next.

Customer Need Heterogeneity (CNH)

That all customers differ in their needs is regarded as the basic starting principle of effective competitive strategy (Palmatier and Crecelius, 2019). Not surprisingly, CH is most commonly conceptualized in terms of customer need heterogeneity (CNH). Authors who equate CH with CNH refer to general needs (e.g., Alexiev, Volberda, and Van den Bosch, 2016; Cui and Wu, 2016) or to more specific ones such as heterogeneous needs/preferences for quality (Adner and Zemsky, 2006; Chen, Tomlin, and Wang, 2013; Lahiri and Dey, 2013; Sun, Xie, and Cao, 2004; Zhou, Brown, and Dev, 2009) or variety (Bohlmann et al., 2002). Additional variations in specific needs refer to technology adoption (Moe and Fader, 2002; Rietveld and Eggers, 2018; Sood and Kumar, 2017), environmental impact of consumption (Chen, 2001; Windrum, 2005; Windrum, Ciarli, and Birchenhall, 2009a), and delivery channels (Ba, Stallaert, and Zhang, 2010).

Several researchers provide explicit CNH based conceptualizations of CH. Cui and Wu (2016, p. 520) define consumer heterogeneity as "the degree to which customers' needs for a product are different from each other, i.e., each customer has unique preferences for product features and specifications." Kamrad, Schmidt, and Ülkü (2017, p. 99) state that customer heterogeneity is "the extent to which consumers differ in their needs and wants," while Franke and von Hippel (2003, p. 1206) characterize customer heterogeneity as "the degree to which the needs of *i* individuals can be satisfied with *j* standard products which optimally meet their needs." These definitions reflect the notion that CNH is an integral dimension of CH. However, von Hippel's (1986) seminal insights on lead users points to the relevance of customer knowledge heterogeneity (CKH) as another important dimension of CH.

Customer Knowledge Heterogeneity (CKH)

von Hippel's (1986) groundbreaking studies on lead users motivated further investigations regarding the role that customers can play as sources of innovation. Subsequently, Nahuis,

Moors, and Smits (2012) also noted that knowledgeable customers are not only capable of articulating their needs but also of contributing to solutions. Füller et al. (2014) elaborated that because customers are highly heterogeneous in terms of their skills, experiences, and backgrounds, they have different knowledge bases and therefore differ in their ability to contribute to the innovation process.

Bonner and Walker (2004) argued that exposure to knowledgeable customers' ideas can provide a variety of benefits to innovation projects. In particular, the diversity of knowledge gained allows for significant leaps in technical performance and for the development of new market opportunities. To reflect these advantages, they defined CKH as "the degree of diversity of product-related information and competencies among the most influential customers on technical, market, strategy, and social dimensions" (p. 158).

Not surprisingly, considerable research has also investigated how customers can contribute to knowledge creation and sharing during the innovation process (Füller et al., 2014). Recommended methods to involve customers include crowdsourcing (Chesbrough, 2003), innovation toolkits (Franke and von Hippel, 2003), and innovation co-development (Cui and Wu, 2016). Such interactions aim to reduce uncertainty about the match between the innovation and the customer's demand characteristics (Nahuis et al., 2012).

Bonner and Walker (2004) caution that managers face difficult decisions regarding the nature and extent of customer involvement in innovation projects. As Bellos and Kavadias (2019) state, CKH implies an information asymmetry since firms do not know the exact capability of each customer. Also, while CKH refers to a customer's *ability* to contribute to innovation, it does not capture a customer's *motivation* to do so (Füller et al., 2014). As Berry et al. (2010) point out, customers differ in their relationships with firms and consequently in their motivation to collaborate. This suggests that besides CNH and CKH, customer relationship heterogeneity (CRH) is another important dimension of CH.

Customer Relationship Heterogeneity (CRH)

Customer relationships have received increased attention from both academics and practitioners because retained customers drive sustained growth and profitability (Guo, Gruen, and Tang, 2017). Evidence suggests that these outcomes are the result of customer satisfaction, loyalty, and positive word of mouth (Reynolds and Beatty, 1999). However, research shows that not all customers seek close relationships with firms. While some customers respond positively to

firms' relational overtures, others do not, and some may even respond unfavorably (Guo et al., 2017). Eriksson and Mattsson (2002) noted that customer relationships often seem to be more heterogeneous than homogenous while Berry et al. (2010), observed that customer relationship preferences lie on a continuum that range from transactional to long-term, stable relationships.

De Wulf, Odekerken-Schröder, and Iacobucci (2001, p. 38) define relationship proneness as a customer's "relatively stable and conscious tendency to engage in relationships with firms." Based on an empirical study of customer relationships in a variety of service industries, Guo et al. (2017) developed a typology of relationship types and identified four clusters of customers who differed in their willingness to engage in relationships. A key determinant of cluster membership was the psychological contract that a customer forms with the firm, i.e., the extent to which a customer is concerned with self-interest relative to mutual-interest (Guo et al., 2017). Despite these insights, research on customer relationship heterogeneity is relatively scarce and recent, consequently, its findings have yet to be fully incorporated in marketing theory and practice (Berry et al., 2010).

As noted, earlier, CRH is particularly relevant to understanding customers' motivation to collaborate in product development. Berry et al. (2010) point out that customer willingness to participate in product development is contingent on perceptions of trustworthiness because such involvement involves the transfer of proprietary information related to the customer's idiosyncratic environment. Thus, the trust engendered via customer relationships can induce greater customer involvement in product development. CRH is also pertinent to targeting strategies aimed at facilitating innovation diffusion. Voss, Montoya-Weiss, and Voss (2006) note that because relational customers seek to reduce risk, they prefer existing products; in contrast, transactional customers favor greater experimentation and consequently more innovative products. Accordingly, transactional market segments include a higher proportion of innovators and early adopters whereas relational segments are comprised largely of the early majority and late majority. Conventional wisdom suggests that firms should pursue customers in the innovators and early adopter segments because of their word-of-mouth influence on later segments (Mahajan and Muller, 1996). However, Sood and Kumar (2017) found that the profitability of customers in the early and late majority segments is higher than those in the other segments because these customers tend to be the heaviest users of the new product and are also

brand loyal. Thus, collectively, the above insights on CRH point to its relevance as a third important dimension to incorporate while managing CH for innovation-based outcomes.

Synthesis and Proposed Conceptualization

Given the centrality of CH for achieving innovation-based outcomes, one would expect to find a generally accepted definition of the construct. However, as noted in the introduction, our literature review reveals that customer heterogeneity lacks uniform conceptualization. As can be seen from Table 1, CH has been defined in several different ways. While some authors define CH in terms of *individual customer* differences (e.g., Cui and Wu, 2016; Zhang and Xiao, 2020), others consider CH to reflect differences between *market segments* (e.g., Zahra and Bogner, 1999; Adner and Levinthal, 2001; Nahuis et al., 2012; Xie and Li, 2015). Beyond this difference in the unit of analysis, some authors incorporate additional (i.e., not customer related) considerations while defining CH. For example, Alexiev et al. (2016) include variations in the nature of competition in their definition of CH while Miller and Friesen's (1983) conceptualization of CH includes diversity in a firm's production and marketing orientations (to respond to market variations). Thus, current viewpoints of CH extend to additional environmental considerations (e.g., competition) as well as internal strategic responses to environmental variations (e.g., marketing orientation). Also, some authors conflate customer heterogeneity, i.e., *static* variations in customer needs with customer dynamism, i.e., changes in a particular customer's needs *over time* (Palmatier and Crecelius, 2019). As a case in point, Zahra and Bogner (1999) state that *changes* in customer needs are a key component of heterogeneity. Regardless of these differences, what underlies existing definitions of CH is its treatment as a unidimensional construct; i.e., CH is defined in terms of only one of its dimensions (CNH, CKH, or CRH). Further, a closer look at Table 1 shows that CH is most commonly conceptualized as CNH. This is not unexpected because CH has traditionally been regarded as an environmental variable that can vex firms (Palmatier and Crecelius, 2019).

Insert Table 1 about here

As Table 2 indicates, historically CH has been viewed through the strategic lens of environmental complexity. Nahuis et al., (2012) note that heterogeneous customers have diverse

requirements which increases the complexity of matching a firm's offerings to customers' demands. Because this diversity requires firms to move away from "one-size-fits-all" marketing strategies (Palmatier and Crecelius, 2019), managers are challenged to make strategic choices regarding the breadth of their served markets and product offerings (Zahra and Bogner, 1999). As Zahra (1996) points out, heterogeneity challenges firms to maintain a broad line of products to match the diversity of customer needs. But resource constraints restrict a firm's ability to target *all* customers; instead, it has to focus on targeting the *right* customers (Palmatier and Crecelius, 2019). In other words, firms are compelled to react to CH via strategic segmentation, targeting, and positioning approaches that facilitate appropriate competitive strategies for each targeted market segment (Alexiev et al., 2016).

Insert Table 2 about here

However, there is growing recognition that viewing CH through a resource lens can complement the traditional complexity-based viewpoint (Bonner and Walker, 2004). Xie and Li (2015) note that the information acquired from diverse customers can generate the novel insights that are critical to innovation success. As noted earlier, the diversity of knowledge gained from heterogenous customers facilitates significant leaps in technical performance, quality, and advanced features (Bonner and Walker, 2004). In other words, CH should be regarded as an opportunity to create value rather than as a problem to be minimized (Alexiev et al., 2016). Firms that subscribe to this resource-based perspective adopt proactive responses to CH that reflect a strategic innovation-driven approach.

Representative of such responses are deliberate efforts to involve customers in the innovation process (Cui and Wu, 2016). von Hippel's (1986) findings on lead users motivated firms to start seeking information on needs as well as solutions from knowledgeable customers (Cui and Wu, 2016). However, customer related information can be "sticky," i.e., difficult to transfer, and therefore expensive to acquire (Franke and Piller, 2004). Therefore, allowing customers to innovate on their own via innovation toolkits is preferred for knowledgeable customers who are less motivated to collaborate (Franke and von Hippel, 2003). In contrast, collaborative innovation development is recommended with customers who have the ability as well as the motivation to participate in information sharing (Cui and Wu, 2016). Collectively, the

different forms that customer involvement can take points to the relevance of CKH and CRH as two additional CH dimensions that are relevant to the resource-based perspective.

Alexiev et al. (2016, p. 982) note that "… managers frame facts about the organizational environment both as a competitive threat and as an enabling opportunity." We subscribe to this integrative approach and propose a reconceptualization of CH that incorporates this multidimensional viewpoint. Specifically, we regard CH as a multidimensional construct that encompasses CNH, CKH, and CRH. Customer need heterogeneity refers to the extent to which customers' needs/preferences for a product offering differ from each other, customer knowledge heterogeneity indicates the degree to which customers have different knowledge levels regarding how their needs can be satisfied, and customer relationship heterogeneity indicates the extent to which customers have different preferences toward engaging in relationships with the firm. Thus, we define CH as the degree to which customers' (a) needs for a product offering, (b) knowledge levels regarding how these needs can be satisfied, and (c) preferences toward engaging in relationships with a firm differ from each other.

This reconceptualization can facilitate the implementation of effective CH management strategies. Specifically, a multidimensional view of CH provides a finer perspective of the links between CH and its antecedents/outcomes. Because this refined view is particularly useful to understanding and managing the strategic contradictions associated with each dimension, we turn our attention to synthesizing these linkages next.

Antecedents and Outcomes of Customer Heterogeneity

Antecedents

The 99 reviewed articles helped identify antecedents relevant to each of the three CH dimensions. As can be seen from Table 3, customer characteristics, social comparison behavior, and customer value dynamism are noted antecedents of CNH. Datta (1996) proposed that customer characteristics such as demographics (like age and gender), psychographics (like attitudes and values) and socioeconomic characteristics (like income) influence CNH. Pannhorst and Dost (2019) found evidence that socioeconomic variables like income and social class affect the needs of older customers. Further, Yankelovich and Meer (2006) note that psychographic variables are particularly relevant to CNH because they can reveal needs that are not being met. Besides the above customer characteristics, Baudisch (2007) and Iyer and Soberman (2016) found that social comparison behavior leads to increased CNH. Customers tend to compare their

consumption decisions with others in their reference group. This social comparison process alerts customers to differences between their consumption decisions and those of the reference group. This can lead to the selection of new reference standards and consequently the emergence of new reference groups and market segments. Over time, CNH increases because these new market segments will stabilize thanks to the assimilation of the social comparison processes among their members. Blocker and Flint (2007) propose that customer value dynamism can also impact CNH. They note that what is valued by customers in any particular market segment can change over time. This induces segment instability, accentuates CNH, and can result in new market segments with different needs. Thus, to sum, customer characteristics, social comparison behavior and customer value dynamism have been noted as antecedents of CNH.

Insert Table 3 about here

With respect to CKH, Adner and Levinthal (2001) state that such heterogeneity results from differences in resources and capabilities. While examining the dynamics of product and process innovations, they found that CKH influenced customers' perceptions of the benefits offered by product innovations and their willingness to pay for such benefits. In turn, these value perceptions affected the relative emphasis on and evolution of product and process innovations. Adner (2002) also notes that CKH stems from customers' internal resources, capabilities, and human capital. While examining the success of disruptive technologies, he observed that customers' knowledge heterogeneity influences value perceptions and consequent acceptance of such technologies.

The antecedents of CKH have also received attention in the firm-customer interaction context. von Hippel (1986) indicated that real-world experiences enable lead users to articulate solutions as well as needs. Bellos and Kavadias (2019) state that higher capabilities lead to enhanced knowledge levels which facilitates increased participation in the innovation process. In a study of customer contributions to innovation contests, Fuller et al. (2014) posit that customers' skills, experiences, and backgrounds contribute to their knowledge levels and enhance their contributions. Nahuis et al. (2012) observe that knowledge influences users' interaction with firms during the innovation process; they argue that users have different knowledge bases based on their education, skills, and experiences. However, they did not empirically test this

proposition; in fact, there were no studies that empirically investigated the links between CKH and its antecedents.

With regard to CRH, an extensive prior relationship between a firm and its customers has been noted as an important antecedent (Bonner and Walker, 2004; Seiders et al., 2005). Such a prior relationship facilitates joint goal setting and close coordination. It also motivates the exchange of rich and complex information because there are fewer concerns about trust and the loss of proprietary information (Bonner and Walker, 2004). Eriksson and Mattsson (2002) propose that customer characteristics such as size and type (i.e., business vs individual) also influence CRH. A customer's attitudes and personality traits can also affect CRH; for example, Reynolds and Beatty (1999) argue that beyond functional (e.g., product related) and social (e.g., information related) benefits, customers also seek "special treatment" as a precursor to forming relationships while Bonner and Walker (2004) observed that customers desire relationships with firms who enjoy industry prestige.

Finally, an empirical study by Guo et al. (2017) found that reciprocity (i.e., self-interest vs mutual-interest), social exchange (i.e., intangible obligations), and economic exchange (i.e., specified, tangible obligations) are antecedents to CRH. The authors note that these three components constitute the building blocks of psychological contracts which in turn underlie variations in how customers respond to firms' relationship overtures. Their study of customers in B2C service settings revealed four types of relationships labeled as standard, captive, transitional, and relational. While the standard group merely sought a transactional exchange, the captive group "felt stuck" in a relationship they did not desire. And, while the transitional group was receptive to a closer relationship, the relational group was most interested in maintaining a close relationship with the firm.

Outcomes

As can be seen from Table 3, our literature review revealed that CH is associated with three types of innovation related outcomes: product-related, firm-level, and customer-related. We discuss each of them next.

Product-related outcomes. The literature showed that three product-related outcomes are associated with CH: new product, new technology, and marketing mix related outcomes. In relation to new product-related outcomes, Cui and Wu (2016) posited that customer involvement mediates the effect of CNH on new product performance. Their survey of 245 firms in a variety

of industries showed that customer involvement partially mediates the impact of CNH on new product performance. Bonner and Walker (2004) found empirical support for their hypothesis that there is a positive relationship between CKH and new product advantage for highly innovative products. In their study, new product advantage was defined as the degree of superiority of the new product's quality, features, technical performance, and ability to meet customer needs relative to competitor's products. Voss et al. (2006) found that CRH affects the diffusion of innovations. In a study of innovation acceptance in the professional theater industry, their results showed that transactional customers were more receptive to innovations compared to relational customers. As explanation, they note that transactional customers include a higher proportion of product category innovators and early adopters whereas relational markets are comprised largely of the early and late majority segments. In terms of new technology outcomes, there is evidence that CNH is positively associated with the development of disruptive technologies (Adner and Levinthal, 2001; Adner, 2002; Windrum, 2005) and with the diffusion of new technologies (Windrum et al., 2009a; Windrum, Ciarli, and Birchenhall, 2009b).

Finally, Bahadir, Bharadwaj, and Srivastava (2015) found that firms confronting market heterogeneity adapt elements of the marketing mix to increase brand sales. Sheth (2011) studied the marketing strategies of U.S. based multinational firms in emerging markets where market heterogeneity is an important characteristic. Their findings revealed that success in such markets is related to making appropriate adaptations to product, promotion, pricing, and distribution strategies.

Firm-level outcomes. The literature related three firm-level outcomes to CH: firm innovativeness, firm performance, and new market identification and development. Alexiev et al. (2016) note that CNH can increase firm innovativeness, i.e., the capacity to introduce new products and services, which is a key source of competitive advantage. But improving innovativeness is difficult for firms confronting heterogeneous markets because they need to gather and process more information in order to develop appropriate innovations for each targeted market segment. Alexiev et al. (2016) argue that this challenge motivates firms to collaborate with different stakeholders rather than attempt to understand a particular market segment alone. Accordingly, they hypothesized that "interorganizational collaboration partially mediates the positive relationship between market heterogeneity and firm innovativeness" (p. 976). But their survey of 391 firms in multiple industries (e.g., manufacturing, construction,

transportation, business services) showed that the relationship between market heterogeneity and firm innovativeness is *fully* mediated by interorganizational collaboration.

Besides firm innovativeness, research has investigated other indirect relationships between CH and firm performance. Zhou et al. (2009) studied CNH in the hotel industry setting and found that customer need heterogeneity positively influences firms' customer orientation and subsequent competitive advantage and financial performance. Zahra and Bogner (1999) show that in heterogeneous high-technology settings, firms can enhance their financial and market performance via appropriate innovation strategies. In an empirical study of 116 firms in the U.S. software industry they found that product upgrades had a significant positive impact on profits and market share growth. In contrast, developing radical new products had a positive but nonsignificant impact on profits and market share growth. Finally, Ba et al. (2010) used a simulation-based game theoretic model to study the impact of heterogeneous customer preferences for different service delivery channels (electronic-service delivery vs human-service delivery) on firms' profits. Because electronic-service delivery requires considerable investments in IT-based customer service systems, not striking the right balance between the two delivery systems adversely affects profits.

Regarding new market outcomes, Adner and Snow (2010) and Corrocher and Zirulia (2010) observed that demand heterogeneity presents opportunities for new market identification and development. In studying firms' responses to the emergence of new technologies, Adner and Snow (2010) noted that newer technologies help surface latent heterogeneous needs that were not satisfied by the old technology. Therefore, a viable strategy for incumbent firms is to actively identify these hitherto unserved market segments and seek to satisfy their needs with the old technology. Corrocher and Zirulia (2010) found that firms in the mobile communications industry addressed demand heterogeneity in a similar fashion by developing such unserved market segments.

Customer-related outcomes. The literature notes that increased satisfaction and higher purchase intent/willingness to pay (WTP) are two customer related outcomes associated with CH. Customers with heterogeneous needs are typically displeased with standardized solutions (Franke and Piller, 2004). Therefore, product enhancements that meet their preferences more precisely lead to greater satisfaction (Franke and von Hippel, 2003; Zhang and Xiao, 2020), higher purchase intent (Franke, Keinz, and Steger, 2009; Habicht and Thallmaier, 2017), and

willingness to pay (Adner, 2002; Adner and Levinthal, 2001). But understanding and transferring market related information to tailor products is particularly difficult when customer needs are heterogeneous (Cui and Wu, 2016). To remedy this challenge, Cui and Wu (2016) found that firms facing heterogeneous needs actively involve their customers in the innovation process. Toolkits, i.e., design interfaces that facilitate self-design and development, are recommended for customers that have the skills (CKH) to modify standardized product options (Franke and Piller, 2004). Besides offering a cost-effective approach to involving customers in innovation development, toolkits also enhance satisfaction and purchase intent (Habicht and Thallmaier, 2017). Codeveloping innovations with customers is another approach to developing customized solutions. As noted earlier, such cooperation is preferred with customers who have the ability (CKH) as well as the motivation (CRH) to collaborate (Cui and Wu, 2016).

Synthesis

As noted earlier, a multidimensional conceptualization of CH facilitates a more refined understanding of the links between CH and its antecedents/outcomes. But, as described later, future research can enhance this understanding even further by addressing several current gaps. For example, empirical research relating CKH and CRH to their antecedents is relatively limited. Also, the current literature has not investigated how the linkages between CH and its antecedents differ across customer type (e.g., B2C versus B2B), product type (e.g., goods versus services) and country type (international versus domestic markets).

With respect to outcomes, extant research places greatest emphasis on the link between CNH and product-related outcomes. While several studies investigate how CNH affects product-related outcomes, there is very limited research on firm-level and customer-related outcomes. Further, the relatively few studies that do investigate the CKH/CRH-outcomes link also limit their focus to product-related outcomes. Thus, we know very little about the links between CKH/CRH and firm-level/customer-related outcomes. Also, extant research has not sought to clarify hitherto mixed empirical results. For example, while Bonner and Walker (2004) found that developing radically new products is positively linked to new product success in heterogenous environments, Zahra and Bogner (1999) did not find support for this link.

Besides addressing these gaps, there is a need for greater research attention on how CH can be managed effectively. The preceding discussion on CH related innovation outcomes highlights product customization and customer involvement as important CH management

strategies. But effective implementation of these strategies requires firms to resolve strategic contradictions and tensions associated with each CH dimension. For example, CNH alerts firms to new market segment opportunities that can be pursued via customized offerings. However, as Zhang and Xiao (2020) caution, these new segments may place conflicting requirements on a firm's underlying technologies. In such situations, the costs of customization can outweigh the benefits. Similarly, while CKH points to the benefits of actively involving knowledgeable customers in product development, the "persistent contradictions between different alternatives in the co-development content" (Oinonen et al., 2018, p. 102) present considerable challenges. Likewise, with CRH, while close collaboration and intense interactions through strong ties with existing customers can lead to disruptive opportunities and successful innovation, these ties can also be detrimental to innovation as close customer relationships can lead to lock-in and a narrow understanding of customer needs (Fredberg and Piller, 2011). Collectively, these insights suggest that a deeper understanding of the tensions associated with CH is critical to its effective management. Building upon the literature on strategic contradictions (c.f., Poole and Van de Ven, 1989; Smith and Tushman, 2005), we next use the paradox lens to explore how managers embrace CH based contradictory agendas related to customer involvement strategies and outline propositions for future research.

Managing CH for Competitive Advantage: A Paradox-Based Perspective

Persistent competing demands comprise the greatest challenges for most organizations. Yet, effective management of these challenges spur greater learning, agility, creativity, efficiency, future innovations, performance, and competitive advantage within organizations (Miron-Spektor et al., 2018). As noted, managing CH effectively is challenging because it requires firms to recognize and resolve several strategic tensions that arise due to contradictory demands and resource constraints. But we argue that firms can leverage these tensions to increase their knowledge resources and improve innovation-based performance. Against this background, insights from the paradox literature are particularly relevant to understanding how firms can effectively manage CH to achieve sustainable competitive advantage.

The paradox perspective is rooted in the ambidexterity literature and emphasizes the managerial need to balance the forces of *exploration* and *exploitation* (March, 1991). His work illustrates the contradictory and competing logics that firms encounter in seeking competitive advantage. For instance, D'Aveni (1994) notes that firms compete effectively by building upon

existing products (exploitation) while at the same time creating new products (exploration) that cannibalize existing products. Exploitation builds on an organization's past and emphasizes variance decreasing activities namely, economies of scale, efficiency, and disciplined problem-solving enabling short-term efficiency; exploration focuses on a path to the future and emphasizes innovation, learning by doing, and trial and error to achieve long term outcomes (Smith and Tushman, 2005). The need to manage these inconsistent and contradictory strategic contradictions *simultaneously* by embracing them is a fundamental premise of the paradox perspective.

Smith and Tushman (2005) assign a central role to managerial agency in balancing strategic contradictions. As a starting point, they highlight the cognitive mechanism of 'paradoxical frames' or mental templates, that act as a lens for managers to recognize and accept the co-existence of contradictory agendas, to think about and respond to information, and to serve as a basis for organizational initiative and action. In response to external events, these *cognitive frames* create a context and enable the behavioral responses or routines that follow (which we discuss in the subsequent sections). Developing a paradox mindset (i.e., paradoxical frames) is the first step towards recognizing external disequilibrating events and effectively managing the potential of the tensions (Miron-Spektor et al., 2018). Building upon this understanding, we next discuss the tensions associated with each CH dimension. We align with the emerging perspective of CH as a disequilibrating influence (see Table 2) that provides the 'external raw material' or impetus and the contradictory context for organizational action.

CNH: Recognizing the contradictory context

As noted earlier, knowledge of the extent to which customer needs and preferences are fragmented or unique (Cui and Wu, 2016) is an important resource associated with CNH. Traditionally, firms downplayed CNH and relied on *standardization strategies* to identify and service homogenous groups of customers with relatively similar needs, preferences, and behaviors via an emphasis on volumes and economies of scale (Palmatier and Crecelius, 2019). Although recent trends acknowledge CNH and recognize that heterogenous customer needs, preferences and behaviors are potentially an important resource to tap into through *customization strategies,* extant empirical findings reveal mixed results regarding the benefits of customization. For example, while Franke and Piller (2004) and Schreier (2006) found a higher willingness to pay (WTP) for customized products, Schoder et al., (2006) did not find the same. Kramer,

Spolter-Weisfeld, and Thakkar (2007) found that some customers prefer products derived from the aggregated preferences of other customers to products derived from their own preferences. It is understandable therefore that firms weigh using the 'logic of standardization' to service the homogenous needs of existing market segments (exploitation) alongside introducing the 'logic of customization' to explore the potential that need heterogeneity offers. This creates "learning" or "knowledge" tensions related to ensuring current as well as future success (Smith and Lewis, 2011). CNH thus creates paradoxical tensions involving standardization and customization approaches. We propose that managers evaluate these tensions using two CNH-related attributes, namely, 1) *scope of needs* and 2) *degree of customer input* (see Figure 1a).

Insert Figure 1a about here

When faced with unique customer needs (i.e., ↑CNH), firms are likely to use customization strategies with greater input from customers about their needs and preferences. Conversely, when faced with common needs ((i.e., ↓CNH), firms are likely to use standardization strategies with lesser reliance on customer input about their needs and preferences. Accordingly, we propose:

P1: Heterogeneity in customer needs is associated with paradoxical tensions between customization and standardization strategies.

CKH: Recognizing the Contradictory Context

Traditional perspectives on NPD hold that customers play a relatively passive role in the NPD process typically during the concept testing and market testing phases (Athaide and Stump, 1999). These viewpoints emphasize the role of customers as providers of information regarding their needs while a firm's role is to develop new product solutions to address these needs (Cui and Wu, 2016). However, a growing body of research notes that quite often customers are not only able to express their needs, but they can also contribute by actively proposing solutions. These "user innovation" studies highlight several advantages of letting customers/users design their own solutions via firm-defined toolkits and platforms: addressing heterogenous user needs, higher user satisfaction, superior solutions in terms of value, cost, and speed (c.f., Franke and von Hippel, 2003; Franke and Piller, 2004). In other instances, users pro-actively develop innovations to meet their needs with minimal firm involvement (Bogers, Afuah, and Bastian, 2010). These insights highlight the fact that beyond needs, some customers possess the

knowledge, competences, and skills (i.e., customer resources) to identify and develop solutions. To take advantage of such proficiencies, Cui and Wu (2016) call for a more active role for such knowledgeable customers in the NPD process. Specifically, they suggest incorporating information on customer solutions as well as needs.

Although, there are several benefits to co-creating new value with customers, namely, actively involving customers in a firm's innovation efforts (c.f., Cui and Wu, 2016), a growing stream of research also highlights associated challenges: selection of appropriate customers in potential innovation projects (Bonner and Walker, 2004); the inability to capture customer motivations to contribute to innovation (Bellos and Kavadias, 2019); customer-perceived barriers to involvement, including appropriate organizational mechanisms (Cui and Wu, 2016); asymmetry in knowledge flows (Athaide and Stump, 1999). These challenges paralyze action by introducing uncertainty, hesitancy, and defensive managerial responses (Vince and Broussine, 1996). Given these challenges, it is conceivable that firms manage customer (involvement) resources across a spectrum ranging from 'customer as an information source' to 'customer as an innovator' (c.f., Cui and Wu, 2016). Thus, with CKH, firms face a contribution paradox where they have to concurrently manage the exploitation-based 'logic of passive contribution' alongside the exploration-based 'logic of active contribution' to tap into the potential that customer knowledge heterogeneity offers. This is analogous to "organizing tensions" (Smith and Lewis, 2011), where firms create competing organizational structures to achieve desired customer-related outcomes (c.f., Cui and Wu, 2016; Foss, Laursen, and Pedersen, 2011). We propose that managers evaluate these tensions using two CKH-related attributes, namely, 1) *scope of input* and 2) *degree of customer input* (see Figure 1b).

Insert Figure 1b about here

In situations where customers' ability to actively contribute is higher (i.e., ↑CKH), firms are likely to use *solutions focused customer input strategies* by relying on greater input from customers about their needs, preferences, and solutions. Conversely, when faced with passive customer input ((i.e., ↓CKH), firms are likely to use needs focused customer input strategies with lesser reliance on customer input about their needs, preferences, and solutions. Accordingly, we propose:

P2: Heterogeneity in customer knowledge is associated with the paradoxical tensions between needs focused and solutions focused customer input strategies.

CRH: Recognizing the contradictory context

Customer relationship heterogeneity refers to the different propensities customers have towards building relationships with firms (Berry et al., 2010; Eriksson and Mattsson, 2002; Rust and Huang, 2014). Extant literature suggests that engaging in relationships with customers provides access to "sticky" customer preference information, i.e., information that is difficult to obtain, transfer and use (Sánchez-González, González-Álvarez, and Nieto, 2009) which leads to several firm related benefits including innovations of higher quality (Sethi, 2000) and higher customer value (Kristensson, Gustafsson, and Archer, 2004). Customers benefit by gaining access to new technologies ahead of competitors (Udwadia and Kumar, 1991) and by being able to influence the innovation's performance attributes (von Hippel, 2001).

Yet collaborating with customers to achieve these benefits can be challenging. Thomke and von Hippel (2002) note that obtaining precise and meaningful information from customers is costly and challenging. Building trust, communication, and commitment is foundational to collaboration, but is resource intensive (Coviello et al., 2002). Successful management of customer collaboration requires a deep understanding of the roles of customers, the timing, frequency, and intensity of their involvement, as well as the number and types of customers to involve (Lynch, O'Toole, and Biemans, 2015). Indeed, collaborative relationships increase the complexity of NPD management (Cui and Wu, 2016). It is not surprising therefore that despite the emphasis on a relational approach in the marketing literature, managerial practice has adopted integrative and pluralistic approaches that range across the transactional and relational endpoints (c.f., Coviello et al., 2002; Day and Montgomery, 1999).

Within the CRH context, when more customers are able and willing to engage relationally (↑CRH), active collaboration with customers would require a firm to cede control of the innovation process and give customers more autonomy over the new product design and development functions (von Hippel, 2005). Alexy et al., (2018) note that collaborative relationships require the sharing and potential surrender of firm control to gain competitive advantage. In contrast, when firms encounter customers who prefer transactional interactions during NPD (↓CRH) (Berry et al., 2010; Garbarino and Johnson, 1999), firms engage in unilateral knowledge acquisition efforts aimed at developing products that meet customer needs

(Cui and Wu, 2016). Restricting relational engagement with a customer enables the firm to retain control over the NPD process and reduces the risk that exclusivity clauses or joint patent ownership may delay or even preclude innovation diffusion to the larger marketplace (Ness and Skjelnes, 1994). In other words, there are benefits when firms gain or maintain unilateral control over the locus and responsibility of innovation. Concurrently managing the transactional-relational endpoints means that firms deal with the tensions of belonging (Smith and Lewis, 2011) abilities to deliver on their own (an inward focus on self) when needed and also abilities to deliver in collaboration (an outward focus on customers) (c.f., Miron-Spektor et al. 2018). Similar, to CNH and CKH, we argue that within the CRH context firms are confronted with the relationship/control paradoxical tension, i.e., balancing a collaborative approach (and ceding control) with a unilateral approach (and retaining control). As depicted in Figure 1c, we argue that this would depend upon the attributes of 1) scope of engagement and 2) the level of customer input needed. We therefore present the following proposition:

P3: Heterogeneity in customer relationships is associated with the paradoxical tensions between unilateral strategies and collaborative strategies of relational engagement.

Insert Figure 1c about here

Paradoxes, Dynamic Capabilities and Performance Outcomes

As noted above, the paradox literature suggests that firms can achieve sustained competitive advantage by attending to tensions simultaneously. Miron-Spektor et al. (2018) observe that tensions, if managed effectively, can stimulate creativity, enable resilience and long-term sustainability. In order to do so, firms need to first *accept* and then *resolve* the paradoxes they confront (Smith and Lewis, 2011). While acceptance refers to recognizing and embracing tensions as opportunities for creativity and innovation (Beech et al., 2004), resolution entails confronting tensions via complex resource iteration strategies such as *differentiation* and *integration* (Smith and Lewis, 2011). Smith and Lewis (2011) also note that acceptance and resolution represent a "virtuous cycle" and posit that organizational dynamic capabilities can spur this cycle. We, therefore, turn our attention to understanding the role of dynamic capabilities in effectively managing paradoxical tensions.

Dynamic capabilities refer to a firm's "ability to integrate, build, and reconfigure internal and external competences to address rapidly changing environments" (Teece, Pisano, and Shuen, 1997, p. 516). In other words, dynamic capabilities denote the ability to change and quickly develop new capabilities (Helfat and Peteraf, 2003). The dynamic capabilities approach is rooted in the resource-based view (RBV) of the firm which holds that firms can be viewed as bundles of resources and that firms are heterogeneous with respect to their resource endowments (Eisenhardt and Martin, 2000). Achieving sustainable advantage requires unique dynamic capabilities (Teece, 2007). Dynamic capabilities spotlight how organizations acquire and deploy resources to better match environmental characteristics and derive competitive advantage (Day, 2011). Teece (2009) notes that two important functions of dynamic capabilities include (1) sensing environmental changes that present opportunities or threats, and (2) responding to these changes by combining and transforming available resources as well as adding new resources. Makadok (2001) argues that the causal mechanisms of *resource picking* and *capability building*, respectively, underlie these functions; both are particularly relevant to addressing the paradoxical tensions generated by CH.

Recall that the effective management of paradoxical tensions requires a virtuous cycle of acceptance and resolution. As noted earlier, acceptance refers to embracing tensions for their innovation potential. Smith and Tushman (2005) point out that *recognizing* tensions is an important precursor to embracing them. The notion of *resource picking or selection* within a dynamic capability is particularly relevant to recognizing resource potential from CH related tensions. It emphasizes a firm's ability to scan its customers to recognize needs and capabilities to gather superior information and knowledge resources, that can lead to current and future growth opportunities. The emerging perspective of CH as a resource suggests that dynamic capabilities help alert firms to such opportunities with respect to customization (CNH), customer solutions (CKH), and customer collaboration (CRH). A corollary is that dynamic capabilities enable firms to recognize and to embrace the tensions related to each of the three CH dimensions. Such acceptance can help firms overcome the organizational rigidities that result from inertia or a tendency to rely on extant capabilities that have outlived their usefulness (Leonard-Barton, 1992). As Cameron and Quinn (1988) and Poole and Van de Ven (1989) point out, firms need to build capabilities to resolve contradictions. In particular, resolution requires *capability building* that incorporates distributive/differentiating and integrative competences

(Smith and Tushman, 2005). Distributive competences entail clarifying differences in strategy and organization architectures to facilitate appropriate resource allocations to the competing tensions (existing v/s new). In contrast, integrative competences involve finding synergies that accommodate opposing tensions (Smith and Lewis, 2011) Thus, concurrent engagement in both processes is important to manage paradoxes and enhance performance. Cui and Wu (2016) note the relevance of *strategic flexibility* as a dynamic capability that ensures suitable reallocation and reconfiguration or organizational resources to pursue alternative tensions to enhance new product performance. *Knowledge integration capability*, which denotes a firm's capacity to develop novel knowledge configurations by integrating acquired and existing knowledge to achieve innovation and sustainable competitive advantage, also seems relevant given CH's import as a knowledge resource (Salunke, Weerawardena, and McColl-Kennedy, 2019). Based on the foregoing discussion, we propose:

P4: Firms with dynamic capabilities will foster greater acceptance and resolution of paradoxical tensions arising from CH.

P5: Greater acceptance and resolution of CH paradoxes will enhance sustainable (long term) performance.

Directions for Future Research

Besides testing the above propositions, this article offers additional directions for future research (See Table 4). For example, insights from this article can be validated with those from a field study to provide a more holistic conceptualization of CH. Future research should also clarify the relationship between the three CH dimensions, for example, do the three dimensions complement each other? Likewise, the associations between CH and other customer related constructs, e.g., customer dynamism, are worth investigating. Similarly, future research should address the CH measurement issues outlined in Table 4. Given its definitional inconsistency, it is not surprising that several different measures have been used to operationalize CH (see Table 1). While Franke and von Hippel (2003) use cluster analysis as the basis for deriving a coefficient of heterogeneity, Bonner and Walker (2004) use similarities between customer pairs as the starting point to derive a heterogeneity score. When measurement scales are used to operationalize CH, some researchers prefer a Likert Scale (e.g., Cui and Wu, 2016) while others use a Semantic Differential (e.g., Zahra and Bogner, 1999). And, as with its conceptualization, current operationalizations treat CH as a unidimensional variable.

Insert Table 4 about here

As noted earlier, additional research on the antecedents of CKH and CRH would provide useful added insights. Delving into the co-creation and service-dominant logic literature can facilitate the identification of additional CKH antecedents. Similarly, the customer relationship marketing (CRM) and customer experience management (CXM) literatures may yield other antecedents of CRH. Finally, as stated previously, research regarding how the antecedents vary across customer types (business vs individuals), product types (good vs services) and country types (domestic vs international markets) is worth pursuing.

Future research should also investigate the CH-Outcomes links in greater detail. As noted earlier, extant research focuses primarily on the link between CNH and product-related outcomes. Greater investigations are needed regarding additional links between each CH dimension and each outcome type. As noted earlier, research is also needed to clarify hitherto mixed empirical results relating CH to its outcomes. Studying the relationships between the three outcome types would be useful as would the identification of additional (if any) outcomes.

As is evident from the propositions, extant literature identifies product customization and customer involvement as important mediators of the CH-Outcomes link. The tension related challenges associated with customization and customer involvement suggests that further research is needed regarding the potential negative consequences of these mediators. Future research should also identify additional mediators and their effects on CH outcomes. Finally, given the importance of dynamic capabilities for managing the paradoxical tensions associated with CH, additional research should focus on the specific capabilities needed to manage the paradoxical tensions.

Conclusion

To facilitate understanding of how firms can better manage the innovation related opportunities and challenges provided by CH, we reviewed and synthesized the extant literature on CH. This synthesis reveals the lack of a commonly agreed upon definition and measure for the construct and highlights the inconsistencies, fragmentation, and potentially contradictory scholarly viewpoints which stymie coherent understanding of the construct. To address this limitation, we offer an integrative conceptualization of the CH construct that comprises three dimensions, i.e.,

CNH, CKH, and CRH. This proposed conceptualization of CH as a multidimensional construct can transform CH from an intuitively appealing concept to a scientifically viable construct. Juxtaposed with insights relating each CH dimension to its antecedents/outcomes, the decision-making tensions associated with each dimension, and the relevance of dynamic capabilities to address them, this article offers a useful starting point to advance a nomological network of CH theory as well as a guide to managerial decision making.

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Table 1. Conceptualizations and Operationalizations of Customer Heterogeneity (CH)

CNH	Conceptualization	Operationalization	Journal
Alexiev et al. (2016)	Differences in consumer preferences	1. Our organization operates in distinctive customer segments 2. We can observe significant differences in customer needs 3. The nature of competition varies widely in different market segments	*Journal of Business Research*
Cui and Wu (2016)	The degree to which customers' needs for a product are different from each other, i.e., each customer has unique preferences for product features and specifications	1. Our customer needs for this project were very diverse. 2. Our customer needs could not be fully satisfied with a standardized design. 3. Our customers had expressed a widely varying set of preferences for the final product design.	*Journal of the Academy of Marketing Science*
Franke and von Hippel (2003)	The degree to which the needs of i individuals can be satisfied with j standard products which optimally meet their needs	Coefficient of heterogeneity	*Research Policy*
Miller and Friesen (1983)	Complexity which encompasses variations among the firm's markets that require diversity in production and marketing orientations	1. Needed diversity in your production methods and marketing tactics to cater to your different customers	*Strategic Management Journal*
Zahra and	Diversity of the market	1. Must use different marketing	*Journal of*

Bogner (1999)	segments within an industry	approaches in its operations 2. Is diversified in its business operations 3. Targets many customer groups with different buying habits 4. Must use many different production systems	*Business Venturing*
Zhang and Xiao (2020)	The scope and breadth of customer product preferences	1. Our customers' needs were very diverse. 2. Our customers had a broad range of preferences for product features. 3. Our customers' needs could not be fully satisfied with standardized design.	*Industrial Marketing Management*
CKH	**Conceptualization**	**Operationalization**	**Journal**
Bonner and Walker (2004)	The degree of diversity of product-related information and competencies among the most influential customers on technical, market, strategy, and social dimensions	A pair of influential customers are assessed on similarities: 1. Possess similar technical competencies 2. Compete in similar product markets 3. Attend common industry events 4. Have similar competitive strategies (finally, calculate a concentration index of similarity scores)	*The Journal of Product Innovation Management*
CRH	**Conceptualization**	**Operationalization**	**Journal**
Eriksson and Mattsson (2002)	Different customer contributions to relationship building	1. Is there little or much variation by type of customer relation in the customer's contribution to	*Industrial Marketing Management*

		establish and develop bank–customer relations? 2. Is there little or much variation by type of customer relation in the bank's contribution to establish and develop bank–customer relations? 3. Is there little or much variation by type of customer relation in the mutual adaptation between customer and bank?	

Table 2. Perspectives on Customer Heterogeneity (CH)

	Traditional perspective on CH	**Emerging perspective on CH**
Strategic Lens	Environmental complexity	Organizational resource
Firm Viewpoint	CH poses a challenge	CH provides an opportunity
Firm Response	Reactive	Proactive
Strategic Management Approach	Market segmentation, targeting, positioning	Innovation-driven
Emphasized CH Dimension(s)	CNH	CNH, CKH, and CRH
Representative Literature	Alexiev et al. (2016); Giloni, Seshadri, and Tucci (2008); Miller and Friesen (1983); Zahra and Bogner (1999)	Bellos and Kavadias (2019); Bonner and Walker (2004); Franke and von Hippel (2003); Habicht and Thallmaier (2017); Xie and Li (2015)

Table 3. Research on Antecedents and Consequences of CH

Topic	Author(s)	Nature of evidence	Findings
Antecedents → CNH	Datta (1996); Pannhorst and Dost (2019); Yankelovich and Meer (2006)	Empirical	Customer characteristics (demographic, psychographic, and socioeconomic) influence CNH
	Baudisch (2007); Iyer and Soberman (2016)	Empirical and theoretical	Social comparison behavior leads to increased CNH
	Blocker and Flint (2007)	Theoretical	Customer value dynamism leads to increased CNH
Antecedents → CKH	Adner (2002); Adner and Levinthal (2001)	Theoretical	Customers' knowledge bases are a function of their resources, capabilities, and human capital
	Bellos and Kavadias (2019); Fuller et al. (2014); Nahuis et al. (2012); von Hippel (1986)	Theoretical	Customers' knowledge bases are a function of their education, skills / capabilities, and experience
Antecedents → CRH	Bonner and Walker (2004); Seiders et al. (2005)	Theoretical	Prior relationship between firm and its customers is an antecedent to CRH
	Bonner and Walker (2004); Eriksson and Mattsson (2002); Reynolds and Beatty (1999)	Theoretical	Customer characteristics (e.g., size, type, attitudes, personality, etc.) are antecedents to CRH
	Guo et al. (2017)	Empirical	Reciprocity, social exchange, and economic exchange are antecedents

			to CRH
CNH → Product-related outcomes	Cui and Wu (2016)	Empirical	CNH has a significant direct effect on new product performance; also, customer involvement partially mediates this relationship
	Adner (2002); Adner and Levinthal (2001); Windrum (2005); Windrum et al. (2009a); Windrum et al. (2009b)	Empirical and theoretical	CNH positively contributes to development and diffusion of new technologies
	Bahadir et al. (2015); Sheth (2011)	Empirical and theoretical	Firms confronting market heterogeneity adapt their marketing mix to enhance sales
CKH → Product-related outcomes	Bonner and Walker (2004)	Empirical	There is a positive relationship between CKH and new product advantage
CRH → Product-related outcomes	Sood and Kumar (2017); Voss et al. (2006)	Empirical	CRH affects the diffusion of innovations
CNH → Firm-level outcomes	Alexiev et al. (2016)	Empirical	CNH increases firm innovativeness; this relationship is fully mediated by inter-firm collaboration
	Zahra (1996); Zahra and Bogner (1999); Zhou et al. (2009)	Empirical	CNH enhances financial and market performance when firms are market oriented and adopt appropriate product and market entry strategies
	Ba et al., (2010)	Theoretical	Optimal investment decisions regarding IT-based customer service systems are influenced by CNH

	Adner and Snow (2010); Corrocher and Guerzoni (2015)	Empirical and theoretical	CNH enables firms to identify and develop new markets
CNH → Customer-related outcomes	Cui and Wu (2016); Franke and Piller (2004); von Hippel (1998); von Hippel and Katz (2002)	Empirical and theoretical	Firms facing CNH seek greater customer involvement in new product design and development
	Franke and von Hippel (2003); Zhang and Xiao (2020)	Empirical	Customer satisfaction increases when customers' heterogeneous needs are met
	Adner (2002); Adner and Levinthal (2001); Franke et al., (2009); Habicht and Thallmaier (2017)	Empirical	When heterogeneous customers are given the opportunity to develop/modify products to suit their needs, their purchase intention and willingness to pay for the product increases

Table 4. Future Research Directions Related to CH

Topic	Future Research Directions
Conceptualization and Measurement of Customer Heterogeneity (CH)	How can field study insights be integrated with the literature-based insights from this article to provide a more holistic conceptualization of CH? How do CNH, CKH, and CRH relate to each other (i.e., do they complement each other?)? How does CH relate to other customer related constructs (e.g., customer dynamism)? What is the appropriate unit of analysis to measure CH (e.g., individual customers vs market segments)? How should CH be measured (e.g., coefficient vs measurement scales)? If measurement scales are used to operationalize CH (a 2nd order construct), should the three dimensions (1st order constructs) be regarded as formative or reflective dimensions? What types of item indicators are appropriate for CNH, CKH and CRH (formative vs reflective)?
Antecedents of CH	Can insights from other literature streams (e.g., co-creation, service-dominant logic, CRM, CXM) help identify additional antecedents of CKH and CRH? How do the antecedents vary across customer types (e.g., B2B vs B2C), product types (e.g., goods vs services), and country types (e.g., international vs domestic markets)?
Outcomes of CH	Can additional links be identified between each CH dimension and each outcome type? Are there additional outcomes associated with effective CH management? Do the three CH dimensions have varying levels of impact on product, firm, and customer outcomes?

	What (if any) are the relationships between the three outcome types?
Mediating effects on achieving CH outcomes	Under what situations do customization and customer involvement have a negative impact on CH-related outcomes? Besides product customization and customer involvement, what are some other important CH management strategies? What are the tensions associated with these strategies?
Paradoxical tensions and CH	How should CH related tensions be measured? What specific dynamic capabilities should firms develop to accept tensions arising from CH? What specific dynamic capabilities should firms develop to resolve tensions arising from CH?

Figure 1a. CNH: The Need Paradox

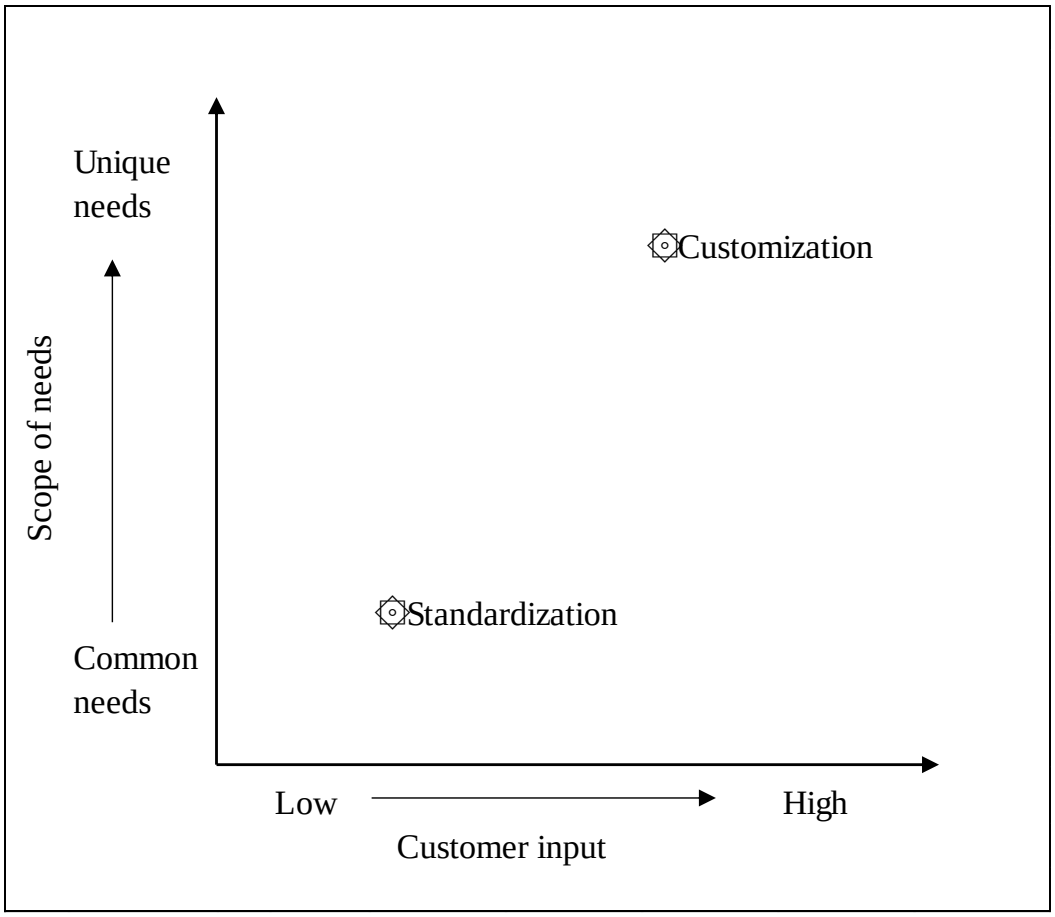

Figure 1b. CKH: The Contribution Paradox

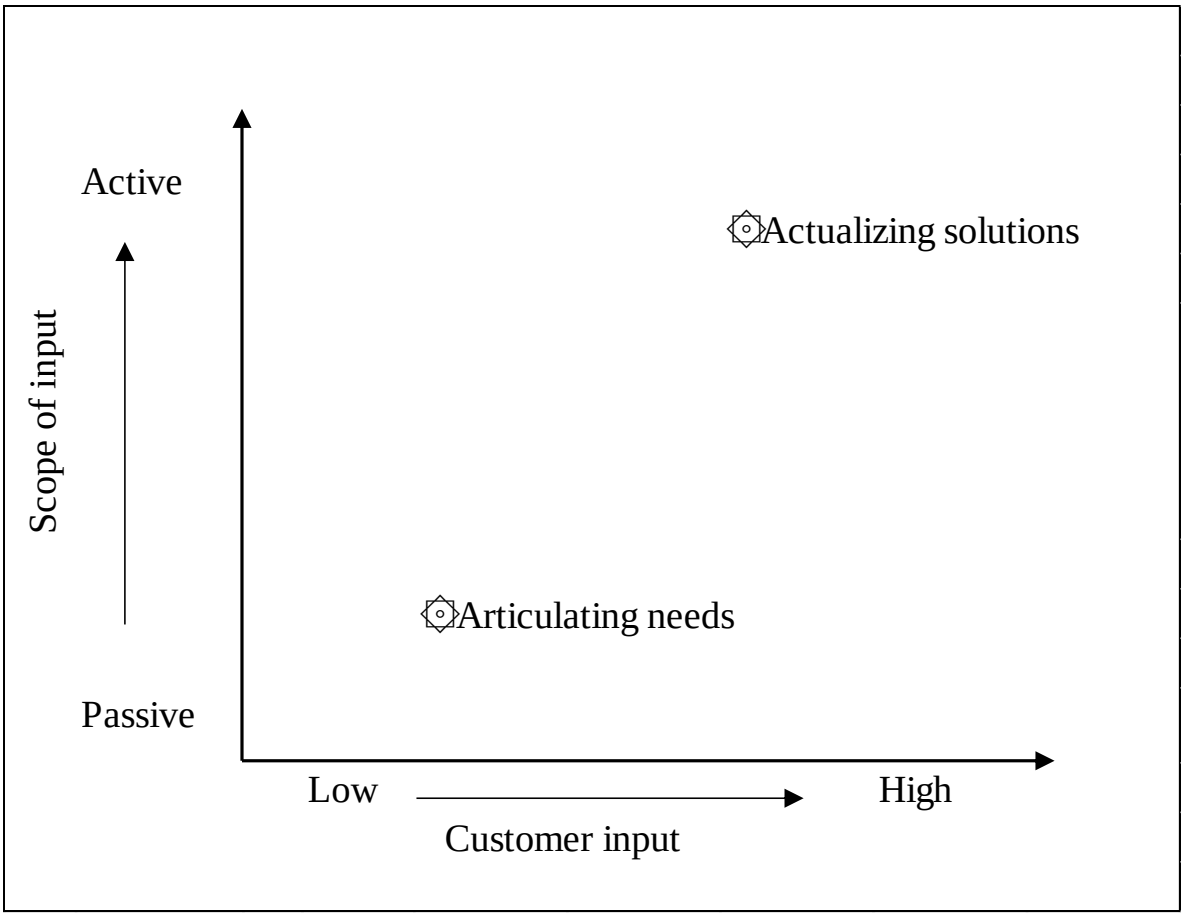

Figure 1c. CRH: The Relationship/Control Paradox