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A Literature Review of Disruptive Innovation Theory

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Abstract

This study aims to provide a comprehensive overview of the existing research on the "disruptive innovation" theory proposed by Clayton Christensen, with the objective of clarifying both its theoretical contributions and its remaining challenges. Disruptive innovation theory offers a powerful explanation for why established, high-performing firms lose market share to emerging firms despite making rational and appropriate decisions. The theory posits that managerial actions that are "economically rational" and "correct" can, over the long term, cause established firms to lag in their responses and risk being displaced from the market. This theory has influenced a wide range of fields, including innovation management, business strategy, organizational theory, marketing, economics, sociology, healthcare management, educational management, and tourism management, and has also been widely accepted in business practice, particularly in the business strategy and startups context. However, the theory has also been subject to academic criticism because of its conceptual ambiguity, misuse and overuse, the difficulty of empirical investigation, and its limited predictive power. Against this background, this study collected relevant literature through a review of major prior studies and database searches, and closely examined 149 documents. Building on this, we systematically organize the definitions, mechanisms, and logic of disruptive innovation, as well as the perspective of the underlying process and challenges facing current research. Therefore, clarify the current state of the literature and the issues that remain unresolved while also presenting our own definition and analytical framework.

1. Introduction

Since its introduction by Clayton Christensen, a professor at Harvard Business School in the mid-1990s, the theory of disruptive innovation (hereafter, "disruptive innovation theory") has had a profound impact on both academic research and business practices. Upon publication in 1997, his seminal work *The Innovator's Dilemma* attracted widespread scholarly and managerial attention. Not only did the book become an unprecedented bestseller in the field of management, but it also became a widely cited reference in various fields of management

[1] This paper is a revised and translated version of the supplementary chapter, "A Literature Review of Disruptive Innovation Research," originally published in *The Process of Disruptive Innovation: The Rise and Fall of the PC-98 Empire* (Hakuto Shobo, 2026).

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studies, including innovation and business strategy. Christensen subsequently published a series of works with his co-researchers, including *The Innovator's Solution* and *Seeing What's Next*, consolidating his position in innovation studies and business strategies.

The fundamental question underlying this theory is " why established, high-performing firms sometimes lose markets to emerging companies despite making rational and appropriate decisions?" (e.g., Christensen, 2006). According to Christensen (1997), established firms lag in responding to disruptive innovation and are ultimately forced out of the market because they engage in rational and appropriate management. These activities include prioritizing the voices of primary customers, making rational investment decisions, and concentrating on the development of the latest and most advanced technologies. This argument has had a profound impact on both academia and business.

Disruptive innovation theory provides a new analytical perspective on phenomena that traditional innovation research cannot adequately explain. This theory substantially advances our understanding of the mechanisms underlying changes in corporate competitiveness and market dynamics triggered by innovation. Moreover, the theory has been widely cited not only in innovation management and business strategy but also across a broad range of disciplines, including organizational theory, marketing, economics, sociology, healthcare management, educational administration, and tourism management, thereby giving rise to an extensive body of subsequent research in these fields (e.g., Christensen, McDonald, Altman, & Palmer, 2018).

Furthermore, this theory has significantly impacted businesses. Fearing the possibility of falling into the "innovator's dilemma," many executives have begun incorporating the concept of disruptive innovation into their business strategies. Furthermore, since the 2000s, a succession of business models, such as e-commerce, streaming services, sharing services, and various communication services, have fundamentally transformed existing modes of service delivery. As a result, "disruption" became a buzzword in the startup industry, and many emerging firms positioned themselves as "disruptors" to appeal to investors and the market. Additionally, in the management practices of established companies, disruptive innovation has been used as a synonym for "transformation" or "innovation," often functioning as a keyword to justify strategies and investments. Thus, disruptive innovation theory has served as a bridge linking academia and the business field.

Despite its substantial influence, this theory has been subject to considerable criticism in academic research because of its conceptual ambiguity, misuse, overuse, difficulty of empirical investigation, and limited predictive power. Accordingly, this study aims to comprehensively clarify how existing studies have addressed the definition, mechanisms, and logic of disruptive innovation, identify issues that remain unresolved, and propose a definition and analytical

framework for disruptive innovation.

Several comprehensive literature reviews have been published on disruptive innovation theory. In this study, we draw on prior review studies to identify the key contributions of existing literature. Specifically, we relied on six studies: Yu and Hang (2010), Nagy, Schuessler, and Dubinsky (2016), Christensen, McDonald, Altman, and Palmer (2018), Petzold, Landinez, and Thomas (2019), Si and Chen (2020), and Martínez-Vergara and Valls-Pasola (2021). We then compiled a list of all the papers published since 1990 that appeared in the reference lists of the six studies. Additionally, for the period from 2021 through the end of 2023, we conducted a database search using EBSCO's *Business Source Elite*, combining keywords such as "disrupt," "disruption," "disruptive," "innovation," and "technology," together with logical operators such as "AND" and "OR," to compile a comprehensive list of journal articles on disruptive innovation.

We read the abstracts of all the papers listed through this process and extracted those directly related to disruptive innovation. We then read the full texts of all the selected papers, took notes on their contents, and used them as the foundational materials for this study. During this process, we excluded papers judged to be weakly related to disruptive innovation in terms of content. We read the full texts of 149 documents, all of which are listed in the bibliography.

In the following sections, based on the results of this literature review, we systematically examine the definition of disruptive innovation, the mechanisms and logic of disruption, the underlying "process perspective," and the challenges facing disruptive innovation research. On this basis, we present the definition of disruptive innovation and the analytical framework adopted in this study.

2. Definition of disruptive innovation

Christensen, the pioneer of disruptive innovation theory, published numerous articles and books throughout his career, but consistently avoided offering a clear definition of this concept. For example, Christensen and Rosenbloom (1995), published in *Research Policy*, and Christensen, Suarez, and Utterback (1998), published in *Management Science*, the terms "disruptive innovation" and "disruptive technology" do not appear. Similarly, Christensen (1993), published in *Business History Review*, and Christensen and Bower (1996), published in *Strategic Management Journal*, provide only illustrative descriptions of the characteristics of disruptive innovation in the hard disk drive (HDD) industry without presenting a rigorous definition. Similarly, in his first book, Christensen (1997) offers no clear definition of disruptive innovation. Instead, only a broad concept is outlined, and its characteristics are

illustrated in a fragmentary manner through multiple case studies, including those of the HDD, drilling equipment, and steel industries. The absence of a clear definition has been the subject of considerable criticism since early on, and Christensen responded repeatedly through rebuttals and refinements. Nevertheless, as noted above, he never provided a rigorous definition of disruptive innovation throughout his career.

For example, the 2006 special issue of the *Journal of Product Innovation Management*, titled 'Dialogue on the Effects of Disruptive Technology on Firms and Industries,' contributed six papers, including one by Christensen. In that issue, the authors reviewed each other's drafts and examined the validity of disruptive innovation theory from multiple perspectives. Yet even there, Christensen did not provide a rigorous definition of disruptive innovation, instead referring to "the ongoing process of building a theory of disruption."[3]

Furthermore, although Christensen consistently criticized, both at the time and thereafter, the tendency for the term "disruptive innovation" to be used loosely to refer to "any new threat" rather than as a rigorous theoretical concept, he nevertheless persistently avoided providing a clear definition even in the very papers in which he raised such criticisms (e.g., Christensen, Raynor, and McDonald, 2015; Christensen, McDonald, Altman, and Palmer, 2018). Consequently, various definitions of disruptive innovation—including "misuses" that depart from the original claims of Christensen and his colleagues—have proliferated, and the debate has yet to reach a consensus (e.g., Si and Chen, 2020; Martínez-Vergara and Valls-Pasola, 2021). Given these circumstances, we first introduce Christensen's conceptual explanation of disruptive innovation, and then examine how other researchers have interpreted the concept.

It should be noted that, as discussed later, the terms "sustaining innovation" and "disruptive innovation" were first used in Christensen and Overdorf (2000), whereas prior studies primarily used the terms "sustaining technology" and "disruptive technology." However, to avoid confusion and facilitate the reader's understanding, this paper uses the terms "sustaining innovation" and "disruptive innovation" consistently, even when referring to literature published before 2000.

Furthermore, although sustaining and disruptive innovations may take the form of technologies, products, services, or business models, these will hereafter be referred to collectively as "products" for the sake of convenience. Additionally, firms that held leading positions in an industry prior to the emergence of disruptive innovation will be referred to as "incumbent firms," whereas firms seeking growth through disruptive innovation will be referred to as "new entrants" or "disruptors". The latter category includes not only firms that have literally entered the market for the first time, but also incumbent firms that previously did

[3] "The ongoing process of building a theory of disruption" is the title of Christensen's contribution to this special issue of the *Journal of Product Innovation Management*.

not occupy a central position within the industry, namely “lower-tier firms.”

2.1. Christensen’s original conceptual definition

(1) Early conceptualization

The concept of disruptive innovation was first introduced by Christensen (1993). This paper presents a historical study of technological transitions and shifts in leadership in the HDD industry. It uses terms such as “disruptive technological change,” “disruptive architecture,” and “disruptive new architectural technology,” in contrast to “sustaining technological change” and “trajectory-sustaining improvements.” In this context, the latter can be understood as referring to innovations in the HDD industry that follow a normal technological trajectory, that is, the performance improvement curve, with performance improving over time. By contrast, the former refers to innovations that disrupt the normal technological trajectory and give rise to a new and different trajectory, namely, a new HDD architecture. However, rigorous definitions of these terms have yet to be provided .

Furthermore, drawing on detailed empirical data, this study demonstrates that new entrants lead to both technological development and market introduction in the case of disruptive innovation, whereas established firms assume these roles in the case of incremental innovation. These new entrants achieved success in new application markets that established firms overlooked and eventually dominated existing markets.

Christensen and Bower (1996) were the first to articulate an explicit definition of disruptive innovation. They distinguished between sustaining innovation, which improves product performance along the existing performance trajectory within an industry, and disruptive innovation, which disrupts or redefines that trajectory. They further argued that technologies capable of disrupting or redefining the conventional performance improvement trajectory should be understood as disruptive (ibid., pp. 201–202).

In the article, the authors examine technological shifts and leadership transitions in the HDD industry. They argue that the phenomenon whereby incumbent firms tend to have an advantage in incremental innovation, whereas new entrants tend to have an advantage in disruptive innovation, can be explained by differences in the technological characteristics of the two types of innovation and the resulting differences in firms’ internal resource allocation processes. In this context, sustaining and disruptive innovation are employed merely as operational distinctions to develop this argument rather than as conceptual definitions within a general theory.

In any case, in its early formulation, the concept of disruptive innovation referred to a type of innovation in the HDD industry that departed from the conventional trajectory of

technological progress (i.e., the technological trajectory or performance improvement curve) and initiated a new and distinct trajectory. In other words, the concept was initially confined to the HDD industry and was based on the assumption that technology advances steadily over time, emphasizing a break from the existing technological trajectory and the establishment of a new one.

(2) The conceptual definition by Christensen (1997)

Thus, the concept of disruptive innovation, as presented in Christensen's studies from 1993 to 1996, is grounded in empirical analyses of the HDD industry. However, as the discussion progressed, the scope of the concept expanded to a wider range of industries and its content transformed.

Christensen (1997) was the first to provide a general conceptual definition of disruptive innovation, not limited to the HDD industry. While contrasting sustaining innovation with disruptive innovation, he argued the following[4]:

According to Christensen (1997), sustaining innovation is a type of innovation that improves the performance of existing products along dimensions of performance traditionally valued by customers in mainstream markets. Thus, most new technologies can be understood as sustaining innovation, because they improve the performance of existing products. Christensen also suggests that even highly radical and technically challenging forms of sustaining innovation seldom cause established firms to fail.

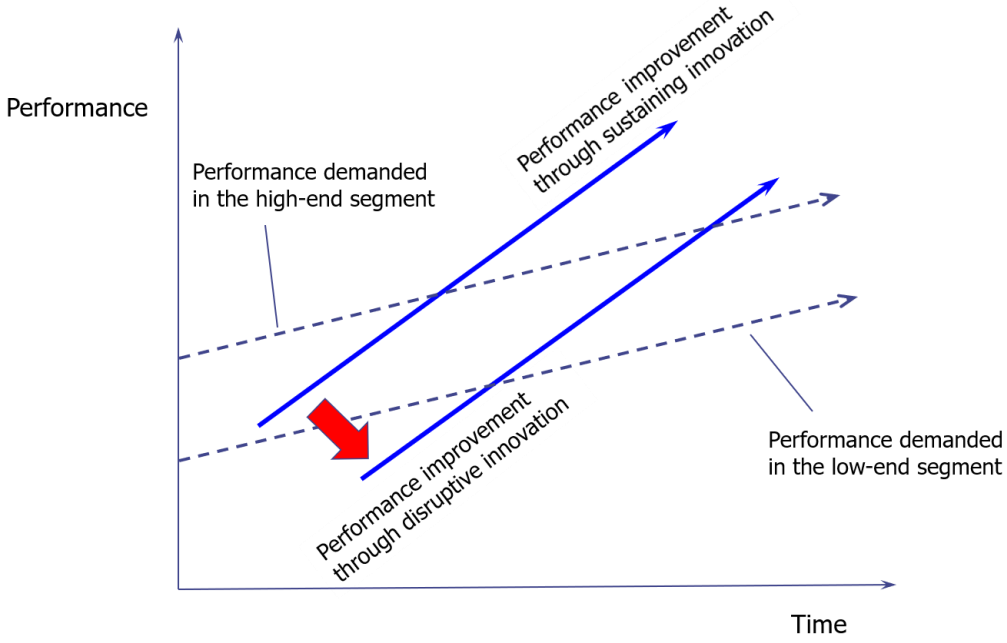
By contrast, Christensen (1997) characterizes disruptive innovation as a type of innovation that, at least initially, offers a lower level of performance than existing products in terms of the criteria valued in mainstream markets. At the same time, however, it possesses attributes that are valued by a limited group of non-mainstream customers, often including new customers. Products based on disruptive innovation are typically less expensive, simpler, smaller, and more convenient to use. Although they are initially inferior to existing products in mainstream markets, they introduce new value standards that differ from those that previously prevailed. Christensen further argues that, while the performance of disruptive innovations initially falls short of market demand, it eventually improves to a level sufficient to meet market requirements. The case studies examined in the book also suggest that these disruptive innovations led to a decline in established firms.

To explain this process, Christensen presents a conceptual diagram contrasting the trajectories of technological progress, namely the technology trajectories or performance

[4] The following discussion is based primarily on Christensen (1997), but also draws in part on Christensen (2000), the expanded and revised edition of Christensen (1997), as well as Christensen and Raynor (2003).

improvement curves of sustaining and disruptive innovation (ibid., Figure 0.1). In this diagram, product performance is plotted on the vertical axis, and time on the horizontal axis, illustrating the technological trajectories of the two types of innovation alongside the changing levels of customer demand in the existing market. While the trajectory of sustaining innovation tends to advance beyond the prevailing levels of customer demnd, the trajectory of disruptive innovation initially remains below the requirements of mainstream customers and begins near the minimum level of performance demanded at the low end of the market. However, its performance improves over time and eventually reaches, and even surpasses, a level sufficient to satisfy mainstream customers. This diagram provides a basis for understanding the basic mechanisms underlying disruptive innovation [Figure 1].

Figure 1. Technology trajectories of sustaining innovation and disruptive innovation



Source: Christensen (1997), partially modified

Furthermore, this book offers a more detailed account of the characteristics of disruptive innovation through an in-depth case study of the HDD industry[5]. Christensen argues that there are two types of innovation in this industry, each of which has a fundamentally different impact

[5] The case study of the HDD industry in this book is essentially a reprint of Christensen (1993), Christensen and Rosenbloom (1995), and Christensen and Bower (1996). Although the book also presents case studies of several other industries, including excavators, steel, and machine tools, these cases do not appear to contribute substantially to refining the definition of disruptive innovation and therefore will not be discussed here.

on incumbent firms. The first is sustaining innovation, which continuously improves conventional dimensions of performance, particularly storage capacity and recording density. According to Christensen, most innovations in the history of the HDD industry have followed and advanced this established trajectory of performance improvement, and leading firms have consistently led the development and adoption of such technologies, thereby achieving success.

The second is disruptive innovation, which disrupts and redefines conventional performance improvement trajectories. According to Christensen, such innovations are seldom adopted in established markets because they do not satisfy customer demand. By contrast, they are valued in small and new peripheral markets, far removed from the mainstream market, because they offer a different package of attributes, including advantages in size, weight, power consumption, and shock resistance. Although only a limited number of disruptive innovations have appeared in the history of the industry, Christensen argues that these innovations have led incumbent industry leaders to fail. He further notes that new entrants, rather than established firms, consistently took the lead in the development and adoption of disruptive innovations.

According to Christensen (2000), the first HDD was developed at IBM's San Jose Research Laboratory in the 1950s, and 116 new technologies emerged in this field by the 1990s. Of these, 111 were classified as sustaining innovations because they contributed to improving HDD performance along conventional performance dimensions, whereas the remaining five were classified as disruptive innovations because they gave rise to smaller HDDs with lower speeds and capacities than existing products, thereby reducing performance along these conventional dimensions. Christensen further argues that all firms that developed and introduced the 111 sustaining innovations were established firms that were established industry leaders, and that the probability of successful development and adoption of such innovations by leading incumbents was 100 percent. By contrast, the five disruptive innovations were introduced by new entrants with no prior track record in the market, and no incumbent leader was able to retain its or top market position after the emergence of those innovations, implying a success rate of zero for established firms.

Christensen (1997) made the first attempt to define the general concept of disruptive innovation beyond the specific context of the HDD industry, supplementing this effort with a detailed case study of that industry. The book suggests that the definition of disruptive innovation consists of four key elements: (1) initially inferior performance relative to existing products; (2) superior attributes in other respects, such as low price, simplicity, compactness, and ease of use; (3) the creation of new application markets by offering a value proposition that differs from the conventional one; and (4) performance improvement over time in existing markets until a sufficient level is eventually reached.

However, the description cited above was not presented consistently or systematically, but rather appeared in a fragmentary form; thus, it remained more of an illustrative explanation than a rigorous definition (e.g., Danneels, 2004). Furthermore, although a detailed case study of the HDD industry was offered to supplement this account by presenting the specific characteristics of disruptive innovation, the concept still contained many ambiguous elements, and its definition could not be considered sufficient at that time[6].

(3) The definition in Christensen and Overdorf (2000)

Christensen and Overdorf (2000), published in the *Harvard Business Review*, appear to be the first to use the term "disruptive innovation" rather than "disruptive technology"[7,8].

In the paper, the authors characterize disruptive innovation in the following terms (numbering added by the present author): (1) it creates entirely new markets through the introduction of new types of products or services; (2) at the outset, such products or services are inferior when assessed according to the performance criteria valued by mainstream customers; (3) they are considered disruptive because they do not meet the next-generation needs of mainstream customers in existing markets; (4) at the same time, however, they possess other characteristics that make them applicable to new markets; and (5) they evolve rapidly and eventually become capable of satisfying the needs of mainstream customers in existing markets as well.

It should be noted that Christensen and Overdorf (2000) were the first to present the analytical framework for organizational capabilities that was later termed the "RPV framework" in Christensen, Anthony, and Roth (2004). The framework is discussed in detail in Section 4 of the present paper.

Furthermore, in the same year, Christensen (2000), an expanded and revised edition of Christensen (1997), appeared with a newly added Chapter 8, which used the RPV framework to explain why established firms fail to respond to disruptive innovation. Although there are

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[6] According to Christensen (2006), disruptive innovation theory had, at that stage, only just begun to evolve from a descriptive theory into a normative one, and the phenomenon in question had not yet been theorized in a sufficiently accurate manner.

[7] This paper does not explicitly explain why the term "disruptive technology" was replaced by "disruptive innovation." Instead, although Christensen (1997) primarily used the terms "sustaining technology" and "disruptive technology", Christensen and Overdorf (2000) refer to that work as if the terms "sustaining innovation" and "disruptive innovation" had already been used.

[8] According to Christensen (2006), a conversation with Andy Grove, then CEO of Intel, shortly after the publication of Christensen (1997), led him to recognize that the difficulty established firms faced in adapting to technological change did not arise from the technology itself, but from the incompatibility between the new technology and their existing business models. Based on this recognition, he subsequently came to use the term "disruptive innovation" rather than "disruptive technology".

minor differences in wording, the definitions and mechanisms presented are essentially the same as those in Christensen (1997). Therefore, they are not discussed further here.

(4) Conceptual extension 1 in Christensen and Raynor (2003): scope and relativity

Christensen and Raynor (2003), in their second major work published in 2003, introduced three notable conceptual extensions to the theory of disruptive innovation.

First, the scope of the theory was expanded to encompass not only products and technologies but also services and business models more broadly. Although this tendency was already apparent in Christensen (1997) and Christensen and Overdorf (2000), Christensen and Raynor (2003) articulated this position more explicitly by presenting a variety of services as examples of disruptive innovation, including discount department stores, point-to-point low-cost airlines, and online businesses in book retailing, education, securities, and travel services[9].

Second, it was explicitly stated that disruptive innovation should be understood as a relative concept. In Christensen (1997), it remained unclear whether a given technology or product was inherently disruptive, or if disruptiveness was a relational property defined from the perspective of firms dealing with that technology or product (Danneels, 2004). In response to this ambiguity, Christensen and Raynor (2003) clarified that disruptive innovation is best understood as a relative phenomenon.

Christensen (2006) argues that disruptiveness is not an absolute but a relative property, the significance of which can be assessed only in relation to the business models of particular firms. From this perspective, an innovation that is disruptive to one firm's business model may function as a sustaining innovation for another. Christensen further makes the following points:

For example, Christensen and Raynor (2003) note that Dell Computers began selling computers through mail orders and telephone channels. From this perspective, the shift to direct sales over the Internet represented an extension of Dell's existing business model and therefore constituted a sustaining innovation for the company. By contrast, for firms such as Compaq and IBM, direct online sales were disruptive because they conflicted with relationships with retail channel partners. Likewise, Christensen (2006) points out that online stock brokerage represents an extension of the traditional business model of discount brokers such as Schwab and Ameritrade and thus functions as a sustaining innovation for those firms. However, the same innovation was incompatible with Merrill Lynch's traditional business model and therefore constituted a disruptive innovation in that context.

[9] Christensen (1997) cited discount retailing as an example of disruptive innovation, and Christensen and Overdorf (2000) cited Charles Schwab's discount brokerage business. By contrast, all of the other examples they discussed were drawn from the manufacturing sector. However, in Table 2-2 of Christensen and Raynor (2003), 22 of the 75 cases listed, or approximately 30 percent, were drawn from the non-manufacturing sector.

Thus, Christensen argued that whether a given technology or product is disruptive is determined not by properties inherent in the technology or product itself but rather by the perspective of the firms that adopt or do not adopt it.

(5) Conceptual Extension 2 of Christensen and Raynor (2003): Introduction to the Two Categories

The third and most significant conceptual extension is the introduction of two distinct categories of disruptive innovation. Christensen and Raynor (2003) proposed a new analytical framework that classifies disruptive innovation into two types: low-end and new market disruptions. The book explains this distinction as follows.

The first is a low-end disruptive innovation. This type of disruptive innovation targets the least profitable customer segment at the low end of an existing market, namely customers whose needs are overserved by existing products and who therefore seek lower-priced offerings with inferior but sufficiently acceptable performance. Christensen and Raynor (2003) identify mini-mills in the steel industry and discount retailers as typical examples of this type of disruptive innovation.

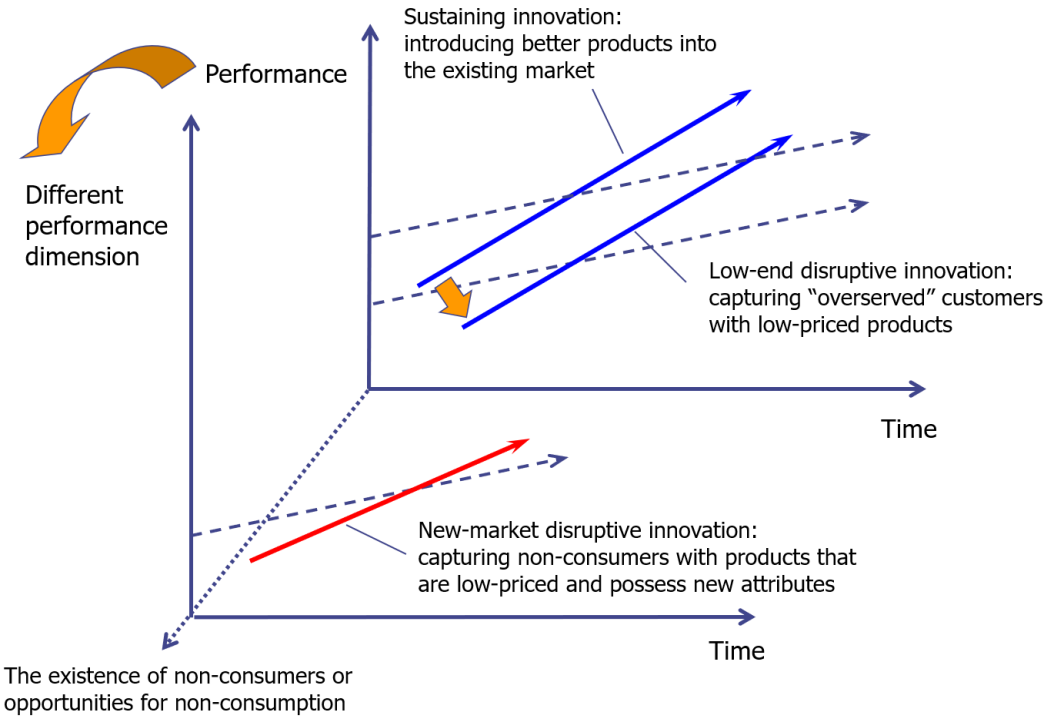
The second type is new, market-disruptive innovation. This form of disruption targets non-consumers, that is, potential customers who have not previously participated in the market because existing products or services are too expensive, inconvenient to use, or complex and skill-intensive to operate. Products associated with new-market disruptive innovations are offered at prices far lower than those of conventional products and are easier to use; as a result, individuals who had not previously been consumers begin to adopt them. Christensen and Raynor (2003) identify personal computers, Sony's battery-powered compact transistor radio, and Canon's desktop copier as examples of this type of disruptive innovation.

This new market-disruptive innovation initially competes against non-consumption within newly created application markets of its own. However, as their performance improves, they gradually draw customers away from the existing market, beginning with the least demanding segment and eventually reaching mainstream customers. Christensen and Raynor (2003) argue that this type of disruptive innovation does not directly invade the existing market; rather, it draws customers out of that market and into a new one by offering products that are perceived as less expensive and more convenient.

To explain these two types of disruptive innovation, Christensen and Raynor (2003) introduced a diagram that extends the technology trajectory or performance improvement curve into three dimensions. In this figure, in addition to conventional performance on the vertical axis and time on the horizontal axis, a third axis representing different performance dimensions

is introduced. This additional axis makes it possible to visualize the differences in application markets. For a given performance dimension, the plane formed by performance and time corresponds to a specific application market in which customers use products or services. The authors further explain that customer consumption and competition among firms occur on this plane and that a corresponding value network is formed.

Figure 2. A three-dimensionally extended model of disruptive innovation



Source: Christensen and Raynor(2003), partially modified

In this figure, the plane located farthest back along the third axis represents the existing market, whereas the plane positioned closer to the front represents a market with a different application based on a performance dimension that is distinct from that of the existing market. A value network different from that of the existing market is formed within this plane. In this framework, new market-disruptive innovation refers to the process by which a market or plane serving a different purpose is created at a distance from an existing market. By contrast, low-end disruptive innovation begins by capturing the least profitable customers in the existing market, namely those at the low end whose needs are overserved, or in other words, in a state of over-satisfaction.

It is important to note that the distinction between new-market and low-end disruptive

innovation primarily concerns the market segment that new entrants, or disruptors, initially enter to survive. In both cases, the first customers targeted in the existing market are those at the lower end, that is, the segment with the lowest performance requirements and highest price sensitivity. Furthermore, the two types share a common pattern in that once this initial foothold is established, substitution proceeds from the lower to the upper end of the existing market as performance improves along the traditional performance dimension.

Another point to note is that Christensen did not regard the distinction between these two types as strictly fixed. Christensen and Raynor (2003) suggest that disruptive innovations should be understood as lying along a continuum, with new market and low-end disruptive innovation representing its two extremes, and many cases containing elements of both. Although new and low-end disruptive innovations occur on different planes in the figure, it is unclear how such hybrid forms should be graphically represented, this discussion suggests that many, if not most, disruptive innovations combine the features of both types. In practice, it is often difficult to distinguish between new and low-end disruptive innovations.

(6) The definition in Christensen and Raynor (2003)

Considering these points, we now review Christensen and Raynor's (2003) conceptual definition of disruptive innovation. The authors characterize sustaining and disruptive innovation, together with their respective effects on firm competitiveness, as follows:

According to Christensen and Raynor (2003), sustaining innovation refers to a type of innovation that targets high-end customers by offering superior performance relative to existing products and seeks to provide better products to existing customers within an established market. They further argue that established firms are generally well positioned to succeed in competition over sustaining innovation. Such competition focuses on developing superior products that can be sold to the most attractive customers at higher profit margins, thereby providing established firms with strong incentives to participate and the resources necessary for success.

On the other hand, Christensen and Raynor (2003) describe disruptive innovation as a type of innovation that overturns and redefines the existing trajectory of technological progress by introducing products that are initially inferior to existing ones in terms of mainstream performance criteria. At the same time, however, such products offer different forms of value to customers. Specifically, disruptive innovation typically provides products that are simpler, easier to use, and less expensive, thereby appealing to new customers or those with less demanding performance requirements. Once disruptive products gain a foothold in new or low-end markets, they enter a process of progressive improvement. As the pace of technological progress exceeds the rate at which customer demand increases, technologies that were initially

inadequate eventually improve to a level sufficient for satisfying more demanding customers. At that point, new entrants advancing disruptive innovation are placed on a trajectory that may undermine established firms. Thus, while incumbent industry leaders tend to prevail in competition over sustaining innovation, new entrants are more likely to succeed in competition through disruptive innovation.

Whereas the discussion of disruptive innovation in Christensen (1997) was dispersed across a wide range of sections, Christensen and Raynor (2003) present it in a more integrated form as the "Model of disruptive innovation," together with a revised version of Figure 0.1. Consequently, the argument becomes considerably more coherent, and its readability and comprehensibility are substantially improved[10].

However, it cannot be said that the concept of disruptive innovation is rigorously defined, even in Christensen and Raynor (2003). Although the book presents a "Model of disruptive innovation" and explains disruptive innovation through that model, the descriptions remain ambiguous, making it difficult to determine whether they constitute a proper definition or merely descriptions of characteristics and examples. Moreover, it remains unclear whether the presented elements should be regarded as necessary conditions or as merely contingent attributes. In other words, even in Christensen and Raynor (2003), disruptive innovation is not strictly defined; rather, the discussion remains at the level of illustrating its characteristics through a model.

Furthermore, although Christensen and Raynor's (2003) concept of disruptive innovation does not at first glance appear to differ substantially from earlier formulations, several modifications were introduced in conjunction with the classification of disruptive innovation into two types, thereby giving rise to a degree of conceptual ambiguity. This issue is examined in detail in Section 7.1.

As discussed above, Christensen and Raynor (2003) expanded the concept of disruptive innovation and enhanced its general applicability. Moreover, their account is considerably more integrated and clearer than that of Christensen (1997). However, it is difficult to conclude that a rigorous definition was provided. Indeed, in some respects, the expansion of the concept appears to have increased its ambiguity. Although the book also includes practical guidance on applying the theory to new product and business development as well as strategic planning, these discussions do not resolve the underlying conceptual ambiguity, and the definition

[10] Rather, it seems reasonable to assume that existing studies, including this paper, have understood the fragmented and insufficiently systematized descriptions in Christensen (1997) by reconstructing them based on the account provided in Christensen and Raynor (2003).

remains insufficient.

Since then, Christensen, Anthony, and Roth (2004), among others, have published numerous books and articles on disruptive innovation. However, as their discussions on its definition and mechanisms largely follow the framework presented by Christensen and Raynor (2003), they were not examined further in the present study.

2.2. Interpretations by other researchers

Since Christensen himself did not provide a rigorous definition, various researchers have attempted to formulate more precise definitions based on the passages cited above from Christensen (1997) and Christensen and Raynor (2003), as well as other relevant discussions in those works and related descriptions found in other books, articles, and case studies by Christensen and his colleagues. We will now examine several representative interpretations.

In the latter four cases, the descriptions correspond to the two categories of disruptive innovation: new market-disruptive innovation and low-end disruptive innovation, whereas this is not the case in the first two. Additionally, for the sake of simplicity, we standardize the terminology throughout this discussion by using “sustaining innovation” and “disruptive innovation,” even where the original texts employ the terms “sustaining technology” and “disruptive technology.”

First, Adner (2002) defines disruptive innovation as one that introduces a performance package that is distinct from that of mainstream products and inferior along the performance dimensions most valued by mainstream customers. Consequently, such innovations are initially accepted only by niche segments that value non-mainstream performance attributes. However, over time, further development increases the performance of the key attributes of disruptive innovation to a level sufficient to satisfy mainstream customers (Adner, 2002, p. 668).

Based on this definition, Adner (2002) employs a computer simulation-based model analysis to demonstrate that the process through which disruptive innovations replace existing products is shaped not only by these supply-side factors but also by the structure of demand.

Danneels (2004) characterizes disruptive innovation as an innovation that changes the basis of competition by altering the performance dimensions on which firms compete. Disruptive innovation-based products have attributes that differ from those of existing products. Initially, such products exhibit low performance on dimensions relevant to mainstream market segments but high performance on dimensions valued by non-mainstream segments, such as peripheral segments distant from the mainstream or newly emerging market segments. However, over time, the performance of disruptive innovations improves, and their performance levels eventually meet or exceed the minimum threshold required in the mainstream market (Danneels, 2004, p.

249).

Husig, Hipp, and Dowling (2005) likewise distinguish between sustaining innovation and disruptive innovation. Sustaining innovation is defined as a type of innovation that continuously improves performance along an established trajectory of performance improvement. By contrast, disruptive innovation is understood as a type of innovation that either disrupts the established trajectory of performance improvement or redefines the meaning of performance itself. In their early stages, disruptive innovation-based products are inferior to existing products in terms of the performance dimensions valued in the mainstream market. Therefore, they are accepted only in niche or emerging markets outside the mainstream market. Although major existing customers initially reject such products, customers in new markets or those at the low end of the incumbent market value their non-standard performance attributes. These customers who are often few, newly emerging, or initially unattractive to established firms tend to prefer disruptive innovation-based products because they are simpler, less expensive, and more convenient. Eventually, as the performance of disruptive innovation improves to a level that meets the standards of the mainstream market, the disruption of the incumbent market accelerates rapidly (Husig, Hipp, and Dowling, 2005).

Furthermore,Schmidt and Druehl (2008) characterize disruptive innovation-based products as performing poorly relative to conventional products in the key performance dimensions most highly valued by mainstream customers. At the same time, however, such products exhibit superior performance on other dimensions, such as ease of use or low cost, thereby opening up new markets. Over time, disruptive innovations improve along key performance dimensions and eventually reach a quality level acceptable to the mainstream customer base that initially rejects them (Schmidt and Druehl, 2008).

Drawing on Christensen (1997), Christensen and Raynor (2003), and Schmidt and Druehl (2008) point out the ambiguities inherent in the concept of disruptive innovation. On this basis, they attempt to refine the theory by reconceptualizing it from the perspective of where the erosion or replacement of existing products by new products begins in the market.

Additionally, Tellis (2006) summarizes the disruptive innovation theory in terms of five key assumptions.

(1) A disruptive innovation-based product is initially inferior to a dominant existing product in terms of the attributes traditionally valued by mainstream customers in the primary market.

(2) However, disruptive innovations possess other characteristics valued by a minority of customers who are often new to the market. Disruptive innovation-based products are generally less expensive, simpler, smaller, and easier to use than products based on dominant technologies.

(3) (a) The most profitable customers of leading incumbent firms generally do not desire disruptive innovation-based products and initially refuse to adopt them. Consequently, (b) disruptive innovations are first commercialized in new or less important markets. Consequently, (c) established firms conclude that investing in disruptive innovations is not a rational financial decision.

(4) Disruptive innovations (a) steadily improve performance over time, and (b) this improvement continues until they reach the performance standards required by the mainstream market.

(5) At this point, (a) disruptive innovations replace existing products and (b) new entrants displace incumbent market leaders from the mainstream market.

As point (5) concerns the outcome of disruptive innovation, it is not appropriate to include it in the definition. Accordingly, disruptive innovation is defined here in terms of the characteristics identified in points (1) to (4).

Similarly, drawing on prior research, Govindarajan and Kopalle (2006b) define disruptive innovation as an innovation possessing the following characteristics.

(1) Disruptive innovations possess functional and performance characteristics that differ from those of existing products, and are offered at lower prices.

(2) At the time of product introduction, disruptive innovations are unattractive to mainstream customers because they perform poorly in terms of the attributes they value.

(3) However, new customer segments, or price-sensitive customers in the mainstream market, perceive value in the new attributes and lower prices associated with disruptive innovations.

(4) Through subsequent development, the product attributes resulting from disruptive innovation improve over time to a level that satisfies mainstream customers, thereby making it possible to penetrate the mainstream market more fully.

Govindarajan and Kopalle (2006b) translated this definition of disruptive innovation into a five-item scale, examined its reliability and validity through a questionnaire survey, and obtained results supporting their arguments.

As we have seen, although there are slight differences in detail and wording, existing studies are broadly consistent in their characterization of disruptive innovation. Taken together with the description provided by Christensen and his colleagues' model, disruptive innovation may be understood as possessing the following characteristics:

(1) Disruptive innovation initially decreases performance along the traditional dimensions valued by mainstream customers in the existing market. In doing so, it establishes a new technological trajectory or performance improvement curve that is distinct from

conventional trajectories. Disruptive innovation temporarily interrupts the conventional technological trajectories.

(2) Disruptive innovations are accepted either in the low-profit, low-end segments of existing markets, or in new peripheral markets, where they offer a new value proposition characterized by features superior in dimensions to those traditionally valued.

(3) Over time, their performance improves, even along traditional performance dimensions, eventually reaching a level that fully satisfies mainstream customers in the existing market.

Once Stage (3) is reached, the substitution of existing products with those based on disruptive innovation is likely to accelerate rapidly within the existing market, ultimately enabling new entrants or disruptors to displace established firms from market dominance.

3. The mechanism of disruption through disruptive innovation

How, then, does disruptive innovation place established firms at a disadvantage while giving new entrants an advantage? This issue will be addressed in the following sections.

3.1. The occurrence of overshoot

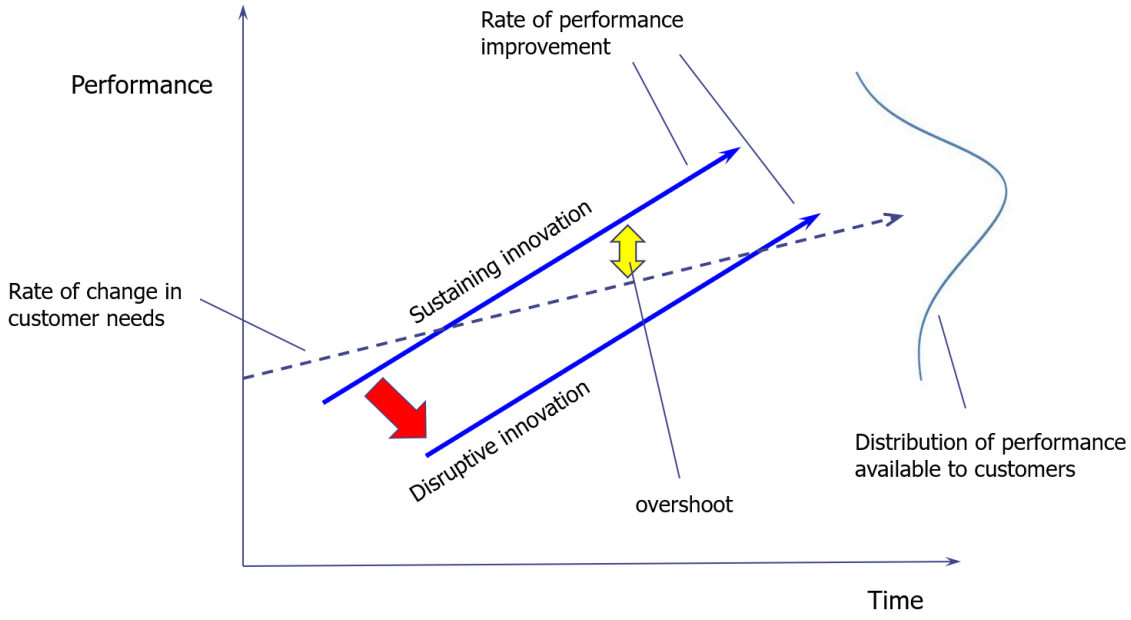
Overshoot is a prerequisite for disruptive innovation. Overshoot refers to the condition under which the functionality of a product exceeds the level of performance demanded by customers; that is, the level at which customers are willing to pay (Christensen, 1997; Christensen and Raynor, 2003).

Figure 3 illustrates this phenomenon. This figure superimposes the trajectories of technological progress or performance improvement curves for sustaining and disruptive innovations on the changing levels of performance demanded by customers (Christensen and Raynor, 2003, Figure 2-1). Up to this point, the figure is essentially the same as Figure 1 (Christensen, 1997, Figure 0.1). However, it differs in one respect: for simplification, the level of performance demanded by customers is not represented by two straight lines corresponding to the low and high ends of the market, as in Figure 1, but by a single straight line, shown as the dashed line in Figure 3, representing the average or mainstream level. This line generally indicates a “good enough” level of performance that satisfies the needs of mainstream customers in the existing market .

The key point here is the assumption that the rate of technological progress, represented by the slope of the technological trajectory, consistently exceeds the rate at which customer expectations increase, as represented by the slope of the customer demand trajectory. According to Christensen, this is a common phenomenon observed across many products and services (Christensen and Raynor, 2003). Consequently, beyond a certain point, the product performance

continuously exceeds the level of performance demanded by customers on a continuing basis. Christensen refers to this persistent condition, in which product performance exceeds customer-demanded performance, as an overshoot.

Figure 3. The emergence of overshoot



Source: Christensen (1997), partially modified

From the customer's perspective, an overshoot signifies a state in which the performance exceeds what is actually needed, that is, a condition of being overserved. Christensen argues that once a certain number of such overserved customers emerge within the existing market, the destruction mechanism driven by disruptive innovation begins to take effect (Christensen, 1997). For these customers, further performance improvements are unnecessary. Instead, they prefer products that provide an adequate level of performance, while being simple, easy to use, and affordable. Christensen further suggests that this customer segment constitutes the initial foothold from which disruptive innovation penetrates the existing market and is a crucial prerequisite for the success of disruptive innovation.

3.2. The emergence of disruptive innovation, securing a foothold, and neglect by established firms

Subsequently, disruptive innovations have emerged. When they first appear, they perform poorly in traditional performance dimensions valued by mainstream customers in the existing market. Consequently, in their early stages, mainstream customers in the existing market do not

readily accept such innovations. By contrast, established firms prioritize the demands of mainstream customers and tend to concentrate their resources on sustaining innovation, that is, improving the performance of existing products in ways that respond to those demands. As a result, they find it difficult to commit substantial resources to disruptive innovation and therefore tend to underestimate its significance (Christensen, 1997).

By contrast, although disruptive innovations are inferior to existing products along conventional performance dimensions, they outperform them on other dimensions. Because they are often less expensive, simpler, more compact, and easier to use, new entrants or disruptors offering such innovations attempt to identify customers who value these attributes through trial and error. If they succeed in identifying and attracting this small non-mainstream group of customers, disruptive innovation can gain an initial foothold in the market and survive.

(1) low-end disruptive innovation

There are two types of disruptive innovation. The first targets low-end customers in the existing market who believe that further performance improvements are unnecessary and would prefer lower prices; this type is referred to as a low-end disruptive innovation (Christensen and Raynor, 2003). Low-end disruptive innovations initially enter low-end segments of the existing market to establish a foothold.

Because low-end disruptive innovations are inferior to existing products along conventional performance dimensions and offer fewer advantages than lower prices, established firms often dismiss them as low-cost, low-quality alternatives. Additionally, low-end customers initially targeted by such innovations have the lowest performance requirements and are highly price sensitive, making the low-end segment the least profitable part of the existing market. Therefore, the cost of withdrawing from this segment is relatively low for the incumbent firms. Indeed, because such a withdrawal may improve profitability, at least in the short term, established firms often choose to shift their focus toward higher-end segments rather than engage in direct competition with new entrants offering low-end disruptive innovations (Christensen and Raynor, 2003).

Thus, new entrants can continue developing their technologies while capturing the demand from low-end customers for a certain period without being drawn into direct head-to-head competition with established firms.

(2) new-market disruptive innovation

On the other hand, the second type is new-market disruption. This disruption attracts non-consumers who have not used existing products because they are too expensive, inconvenient to use, or too complex and skill-intensive to operate, thereby opening new application markets

(Christensen and Raynor, 2003). This type of disruptive innovation initially enters a new peripheral market composed of non-consumers to establish a foothold.

Established firms often overlook new-market-disruptive innovations because they are inferior to existing products in conventional performance dimensions. However, because they are characterized by low prices, simplicity, ease of use, and the absence of any need for advanced skills, they create new application markets in peripheral areas that are distinct from the existing market. As their performance improves, even along conventional performance dimensions, they begin to attract customers from the existing market, starting with low-end customers, whose performance requirements are the lowest[11].

In the case of a new market disruption, the initial objective is not to enter the existing market directly but rather to carve out a new market serving novel uses on the periphery of the existing market. Therefore, established firms initially experience little pain and perceive almost no threat from such innovations (Christensen and Raynor, 2003). This remains the case even as substitution progresses gradually and customers begin to be drawn away from the existing market. As initial low-end customers constitute the least profitable segment, the loss of this customer base imposes only a limited burden on established firms and may even improve profitability in the short term. Consequently, incumbent firms often avoid direct confrontation with new entrants, offer disruptive innovations to new markets, and shift their attention to higher-end segments (Christensen and Raynor, 2003).

Thus, for a certain period, new entrants can continue advancing their technological development while capturing demand from customers in new peripheral markets and from low-end customers in existing markets without being drawn into direct head-to-head competition with established firms.

3.3. Substitution of the main segment in the existing market

If disruptive innovations are accepted only by a limited customer segment, established firms are unlikely to face serious problems even if that segment expands. This is because the segment in question and the main segment of the existing market can coexist, with disruptive innovation-based products and existing ones occupying distinct niches. However, once disruptive innovation-based products begin to expand into new peripheral markets or low-end segments of the existing market, and once their performance along traditional performance dimensions

[11] Whereas low-end disruptive innovations grow within existing markets by replacing established products, new-market disruptive innovations, at least in their early stages, grow within newly created markets while gradually drawing customers away from existing products. On this issue, Christensen and Raynor (2003) argue that new-market disruptive innovations do not directly enter existing markets; rather, they attract into new markets those customers in existing markets who perceive the new product as more convenient.

improves to a level sufficient to satisfy mainstream customers' expectations in the existing market, they begin to replace the main segment that constitutes the volume zone of the existing market (Christensen and Raynor, 2003). At this point, it is difficult for established firms to devise effective countermeasures against new entrants for two reasons.

(a) Concerns about cannibalization

Even after disruptive innovation begins to replace the main segment of the existing market, the principal reason established firms find it difficult to implement effective countermeasures against new entrants is concern about cannibalization.

Cannibalization refers to the replacement of a firm's existing products, which generate high sales and profit margins, with new products that yield lower sales and profit margins. When concerns about cannibalization are strong, incumbent firms tend to restrain investments in new products because the sales and profitability of their existing products will decline (Kamien and Schwartz, 1982). A rigorous empirical analysis of the HDD industry from 1981 to 1998, conducted using methodologies from industrial organization theory, estimated that the primary factor leading established firms to restrain investment in disruptive innovation was fear of cannibalization (Ikami, 2018).

Disruptive innovations typically begin on a small scale, with low sales volumes and profit margins because they initially target either the low-end segments of existing markets or emerging niche markets outside the mainstream. In other words, if established firms were to fully commit to such innovations, they would face the substantial risk of eroding their own profitable existing product lines, thereby undermining their overall performance. Thus, established firms face a dilemma: the more they commit to disruptive innovation, the more they risk accelerating the decline of their existing product lines, making them reluctant to enter the market. Moreover, attempting to respond by lowering the prices of existing products results in a more direct decline in sales and profit margins, making this option difficult to pursue. Consequently, established firms tend to avoid direct head-to-head competition with new entrants, allowing them to accumulate the resources and capabilities necessary for growth (e.g., Danneels, 2004; Druehl and Schmidt, 2008).

(b) Asymmetric motivation and the "escape route" for incumbent firms

In the early stages of market entry, new entrants are compelled to focus on building a lean cost structure that enables them to generate profits while handling low-priced, small-scale products. This allows them to capture the demand from new peripheral markets or low-end customers in existing markets. As a result, once the performance of the new technology improves to a "good enough" level even along conventional performance dimensions, and

reaches the point at which it can substitute for products in the main segments of the existing market, the new entrant is able to use the lean cost structure it has developed as a competitive edge in challenging incumbent firms from a position of strength.

However, at this stage, established firms are unlikely to confront new entrants. This is because asymmetric motivation, the second reason established firms hesitate to launch effective counterattacks against new entrants, comes into play (Christensen and Raynor, 2003).

For new entrants, the higher segments, relative to the low-end segments they currently occupy, represent "fertile ground" with the potential for greater profitability, and therefore provide a strong incentive for upward movement. By contrast, for established firms, the lower subsegments of the main segment, namely, those closest to the lower end and most vulnerable to entry by new firms, constitute relatively "barren grounds" in profitability terms; accordingly, their motivation to defend these areas is weak (Christensen, 1997). Rather, established firms may find it more attractive to abandon the lower subsegments eroded by new entrants, concentrate on higher-level subsegments, and introduce higher value-added products that further improve performance along conventional performance dimensions by leveraging their advanced technological capabilities. In other words, an "escape route" is available to them (Christensen, 1997). Consequently, even when the main segment is attacked, established firms, at least in the early stages, tend to avoid the painful path of thoroughly streamlining their cost structure to engage in cutthroat competition with advancing new entrants and instead choose the easier course of retreating to higher segments.

If there is no room to retreat, established firms would have little choice but to mount a determined counterattack. In such a case, even a new entrant with a lean cost structure is unlikely to secure an overwhelming advantage over an established firm with abundant resources and capabilities. However, because established firms often have an incentive to withdraw rather than fight, new entrants can advance their challenges far more easily than would otherwise be the case. Therefore, Christensen and Raynor (2003) suggest that an opponent who tries to escape without fighting is far easier to defeat than an opponent who does not.

3.4. Further advancement into higher segments

If established firms hesitate to counterattack new entrants and instead retreat to higher subsegments, this strategy will eventually prove self-defeating. Once a disruptive innovation improves along traditional performance dimensions to a level sufficient to satisfy mainstream customers in the existing market, it rapidly replaces existing products because it is superior to other performance dimensions. By this stage, the sales and profitability of established firms deteriorate sharply, and they lose the capacity to mount an effective counterattack. If they choose to retreat further into higher-end segments, the size of the market they can secure shrinks

further, making eventual withdrawal highly likely. In short, once substitution begins in the main segment, any counterattack launched thereafter is likely to occur too late, placing the firm at serious risk of losing its position.

4. The logic of disruptive innovation (1): An explanation based on economic rationality

Next, we examine the causes and logic underlying the loss of competitiveness experienced by established firms in the face of disruptive innovation, distinguishing between explanations based on (1) economic rationality and (2) explanations grounded in the new institutional and social cognitive theories. This section focuses on the first case.

Christensen explains why established firms lose competitiveness when confronted with disruptive innovation in terms of the firm's dual embeddedness in its value network and its resource dependence on primary customers, which in turn gives rise to a resource allocation process shaped by the value standards of the value network and the demands of primary customers[12]. Within the framework of economic rationality, this explanation seeks to account for why established firms facing disruptive innovation tend to underestimate its significance and instead choose to pursue sustaining innovation.

Although some of these points have already been highlighted in the previous section, the following discussion examines this logic primarily based on the arguments advanced by Christensen and his colleagues, while drawing on other research findings where necessary.

4.1. The RPV framework

Christensen and his colleagues proposed a framework in which a firm's organizational capabilities are defined in terms of resources, processes, and values. They argue that precisely because leading incumbent firms possess organizational capabilities that enable them to respond accurately and efficiently to the value standards of their value networks and the needs of their primary customers, they are paradoxically less able to respond effectively to disruptive innovation (Christensen, 2000; Christensen and Raynor, 2003).

This concept was first introduced by Christensen and Overdorf (2000) in a Harvard Business

[12] This interpretation is advanced by the present author and is not explicitly stated by Christensen. In fact, in Christensen (1997), value networks and resource dependence on primary customers are discussed separately in different sections, and the relationship between them is not necessarily made clear. The same is true of Christensen (2000) and Christensen and Raynor (2003). However, within the RPV framework discussed below, a schema is presented in which the value network defines value standards, which in turn guide internal organizational processes. Furthermore, these internal processes may reasonably be interpreted as including the resource allocation process, which is significantly influenced by resource dependence on primary customers. On this basis, it becomes possible to conceive of a schema of "dual embeddedness," in which the organization is embedded both in the value network and in its resource dependence on primary customers.

Review article. It subsequently reappeared in Chapter 8 of Christensen (2000), the revised edition of Christensen (1997), and in Chapter 7 of Christensen and Raynor (2003), before being designated as the “RPV framework” by Christensen, Anthony, and Roth (2004). Although there are some differences in terminology, there are no substantial differences in the content. The following discussion generally follows Christensen (2000).

In the RPV framework, the first factor that defines an organization’s capabilities is its resources. These include human resources, facilities, technology, product design, brands, information, capital, and relationships with suppliers, distributors, and customers. Many resources are tangible or intangible assets that can be bought, sold, hired, or dismissed, and their value can increase or diminish. Moreover, many of them can be easily transferred across organizations. To the extent that an organization can acquire and utilize an abundance of appropriate and high-quality resources, its capacity to adapt to change is enhanced (Christensen, 2000).

The second factor defining an organization’s capabilities in the RPV framework is the process. Firms create value by investing resources and producing higher-valued products and services. The processes referred to here are the patterns of interaction, coordination, communication, and decision-making through which such inputs are transformed into outputs. Organizational processes encompass not only those related to product development, manufacturing, and sales but also those associated with procurement, market research, budgeting, business planning, human resource development, compensation decisions, and methods of resource allocation. Furthermore, while some processes are formal, in the sense that they are clearly defined, documented, and consciously followed, others are informal and operate through habits and unspoken conventions (Christensen, 2000).

Processes developed and refined for a specific task tend to operate efficiently when applied to that task. However, when applied to a fundamentally different task, they often cause delays or inefficiencies and may even fail to function. For example, even when similar products are sold, a process designed for marketing very high-priced products will generally not function effectively if applied unchanged to the sale of very low-priced products. Thus, processes that generate strong organizational capabilities within a firm may also give rise to organizational incompetence when circumstances change.

Furthermore, because processes require consistency in the repeated execution of recurring tasks, they are inherently less flexible than resources and cannot be easily modified even when a fundamental change is required. The more successful a firm becomes, the more likely it is to develop sophisticated processes for activities, such as conducting market research, incorporating the results of such analyses into financial forecasts, discussing business plans

and budgets, and allocating resources. However, the processes are typically inflexible. Consequently, even when the environment changes and a shift from existing processes becomes inevitable, many firms are unable to adapt appropriately and, as a result, encounter serious difficulties (Christensen, 2000).

The third factor defining an organization's capabilities within the RPV framework is its value standards. Value standards refer to the criteria used by a firm to prioritize tasks. For example, they include criteria used to judge whether a customer is important, whether a new product idea is promising, and whether an order is attractive.

Employees at every organizational level make priority decisions daily. At the executive level, such decisions concern investment priorities, including which products, services, or business proposals should receive investment, and which should be rejected. Among sales representatives, sales priorities involve decisions regarding which products should be recommended to customers, which should not, and which customers should be visited more or less frequently. Similarly, the design engineers decide which design proposals to adopt, whereas the production managers determine which orders should be processed first. It is precisely those firms in which clear and consistent value standards permeate the entire organization and guide day-to-day prioritization decisions from top to bottom that are regarded as excellent.

As a firm matures, its value standards gradually reflect its business model and cost structure. This is because a firm must prioritize activities that contribute to revenue generation to survive. However, once employees accept value standards as core values, many firms face serious difficulties when environmental change makes a shift in existing value standards unavoidable, because they are unable to modify them appropriately (Christensen, 2000).

Thus, the quality, quantity, and portfolio of a firm's resources are shaped by the processes through which operational priorities are set and resources are allocated, which in turn are shaped by the value standards used to determine such priorities. Together, these elements define a firm's organizational capabilities. Moreover, in the order of resources, processes, and value standards, these elements become progressively less visible, more deeply embedded within the organization, and increasingly difficult to change. As will be discussed later, these resources, processes, and value standards, together with the organizational capabilities they constitute, lie at the root of the "inability" incumbent firms face when confronted with disruptive innovation and become the primary obstacles to change (Christensen and Raynor, 2003).

4.2. Embedding in value networks

By contrast, the value network surrounding a firm shapes its value standards and, in turn, influences its processes, resources, and, ultimately, its organizational capabilities.

A value network is a loosely structured network composed of a firm, its customers,

competitors, and the complementary actors surrounding them, such as suppliers and distributors. It provides the context within which value creation and capture through specific business activities take place (e.g., Christensen, 1997; Chesbrough and Rosenbloom, 2002)[13]. Within this value network, firms identify and respond to customer needs, solve problems, procure resources, compete with rivals, and pursue profits.

The cost structure that emerges within a given value network and the expected profit level are shaped by customers' past choices and the competitive strategies of the firms involved. Consequently, these factors also influence the perception of the economic value of new innovations (Christensen, 1997). For example, an innovation expected to yield only a low profit margin may be highly valued by firms embedded in a value network characterized by low expected margins and a low-cost structure, whereas it is likely to be assigned a much lower value by firms embedded in a value network characterized by high expected margins and a high-cost structure. Thus, whether an innovation is considered attractive or difficult for a firm to pursue depends on the type of value network embedded within the firm.

In sum, firms are embedded in value networks, and those value networks shape the firm's value standards, which in turn influence its processes, resources, and organizational capabilities. Consequently, as discussed later, it becomes difficult for established firms to allocate resources to disruptive innovations that do not conform to the value standards of their value networks, causing them to fall behind and experience a substantial loss of competitiveness.

4.3. The interaction between resource dependence on primary customers and the resource allocation process

Christensen argues that firms are not only embedded in specific value networks but are also doubly constrained by their resource dependence on primary customers. Consequently, internal resource allocation processes tend to be biased toward reflecting customer preferences, ultimately leading firms to fail to adapt to disruptive innovations.

According to the resource dependence theory, firms are not wholly autonomous and unconstrained entities; rather, to survive and grow, they must acquire resources from external actors and are therefore susceptible to the influence and control of organizations on which they

[13] This definition was reconstructed by the present author based on Christensen's (1997) description, supplemented where necessary by insights from other studies. In fact, neither Christensen nor Rosenbloom provides a rigorous definition of the value network. For example, Christensen (1997) describes it as the context within which a firm identifies and responds to customer needs, procures resources, competes with rivals, and pursues profits. While this description refers to the functional aspects of the value network, it does not explicitly specify its constituent elements. Consequently, it remains unclear whether stakeholders such as shareholders, investors, creditors, including banks, and even government actors are included within the value network. Furthermore, its relationship to adjacent concepts such as "business ecosystems" and "organizational fields" also remains unclear.

are highly dependent (Pfeffer and Salancik, 1978). Customers, particularly primary customers, are among the most important providers of resources, and their influence is substantial. For established firms, mainstream customers who occupy the volume zone of existing markets constitute important resource providers and are among the most influential actors in the value network. Accordingly, it is economically rational for firms to improve the performance of existing products or add new features in response to demand. Thus, a strong resource dependence on primary customers leads firms to prioritize resource allocation for product improvements that satisfy customer demands, thereby reinforcing the tendency to emphasize sustaining innovation.

Furthermore, research on internal resource allocation processes indicates that such processes are deeply embedded within organizations, that many investment proposals are formulated at lower levels of the organizational hierarchy, and that their approval or rejection is strongly influenced by the extent to which they are supported and promoted by middle managers (Bower, 1970; Burgelman, 1983a, 1983b, 1991). In other words, decisions regarding the allocation of resources to numerous individual projects are made daily at the lower and middle levels of the hierarchy, and the accumulation of these decisions ultimately shapes an organization's overall pattern of resource allocation.

In this context, the performance evaluations and career trajectories of lower-level employees and middle managers are heavily influenced by the success of investment projects they support. Consequently, they tend to become involved in profitable projects for which customer demand is relatively certain, while avoiding projects for which market demand is uncertain and the expected profitability is low.

As previously noted, disruptive innovation is typically not welcomed by existing customers. Although it may appeal to new customers, these customers are often difficult to identify, at least during the early stages of development. In other words, the extent of the expected customer demand remains uncertain. Moreover, as disruptive innovation must initially penetrate new peripheral markets outside the mainstream or low-end segments of existing markets, neither large markets nor high profitability can be expected at the outset. Under such circumstances, even when top management decides to invest in disruptive innovations, such initiatives often fail to secure support at the operational level, are frequently neglected, and are, therefore, not adequately reflected in resource allocation. Thus, disruptive innovations that do not conform to the demands of primary customers are excluded from the resource allocation process and fail to gain sufficient momentum within the organization.

Consequently, because of firms' resource dependence on primary customers and the corresponding internal resource allocation processes that emerge from them, established firms are likely to devote substantial efforts to developing existing technologies when their primary

customers explicitly demand improvement, thereby increasing the likelihood of successful execution. Conversely, when the target is not the primary customers in the existing market but rather the needs of low-end customer segments or non-consumers, such initiatives are less likely to gain sufficient internal momentum, thereby increasing the risk of failure due to insufficient resource commitment. In other words, because established firms act based on economically rational judgments, they tend to overlook disruptive innovations and ultimately lose competitiveness when existing products are replaced.

4.4. Embedding in the value network and concerns about cannibalization, asymmetric motivation

The above discussion pertains to the early stages, when a new technology has just entered the market. However, once a disruptive innovation-based product captures low-end customers in the existing market and begins to replace the main segment, the number of mainstream customers willing to accept the product gradually increases. Consequently, the constraints imposed on established firms by primary customers are likely to weaken over time. At the same time, however, such firms are expected to remain constrained by the value network in which they are embedded[14].

As noted earlier, as firms solve customer problems and compete within a particular value network, a shared understanding gradually emerges among the actors in that network regarding the appropriate firm size, growth rate, and cost structure associated with their respective roles. Consequently, investment proposals that do not conform to these standards are unlikely to pass through the internal resource allocation process (Christensen, 1997).

In this regard, disruptive innovations initially replace existing products in the low-end segment of the market, where revenue per customer is low; accordingly, the expected return on investment appears extremely limited for established firms. Moreover, if a firm commits heavily to disruptive innovation, cannibalization may occur, eroding sales and profits from its existing products, and potentially leading to deterioration in overall business performance. Under such circumstances, it is unlikely that investments in disruptive innovations will receive sufficient support from management or investors.

Additionally, when concerns about cannibalization are strong, complementary actors surrounding the firm, such as existing suppliers of components, materials, and distribution channels, are likely to resist efforts directed toward disruptive innovation. For example,

[14] This argument represents the present author's interpretation and is not explicitly stated by Christensen. In fact, works such as Christensen (1997), Christensen (2000), and Christensen and Raynor (2003) do not provide a clear account of how long the influence derived from value networks or resource dependence on primary customers continues to operate within established firms.

suppliers of existing components and materials are likely to anticipate that new disruptive innovative products will, at least initially, be low-priced, low-margin, and associated with only a small market. Accordingly, even if they succeed in securing a share of the parts and components business for a new product, replacing existing products with new products is likely to reduce sales and profits from their existing business. A similar logic applies to existing distribution channels; even if they are entrusted with handling new products, the replacement of existing products with new disruptive innovation products is likely to erode their distribution margins. Because the costs of engaging in disruptive innovation are assumed to outweigh the benefits for nearly all complementary actors in an existing value network, it is unlikely that they will support such efforts. Moreover, because avoiding disruptive innovation is consistent with short-term economic rationality, it is also likely to receive support from investors. Consequently, investment proposals for disruptive innovation tend to appear highly irrational for lower-and middle-level managers responsible for resource allocation.

Furthermore, the same logic gives rise to asymmetric motivation. Established firms operating in mature markets, constrained by the value networks in which they are embedded, tend to take large market sizes and high profit margins for granted, and accordingly develop high-cost structures. Consequently, their internal resource allocation processes for new product development tend to prioritize projects that promise large market sizes and high profit margins.

By contrast, the low-end segments of existing markets and new peripheral markets into which disruptive innovations initially enter are characterized by low prices, small volumes, and immature demand. Consequently, such markets appear unattractive to established firms, and related projects are likely to be rejected in the internal resource allocation process. Consequently, the motivation to fight new entrants advancing through disruptive innovation tends to wane. Indeed, when such firms are attacked, the incentive to abandon a threatened segment and retreat to a higher segment may increase.

However, new entrants that enter the low-end segments of existing markets or new peripheral markets through disruptive innovation are compelled to build low-cost structures to survive, despite their small market size and low profit margins. From their perspective, a higher-end market dominated by established firms appears to be far more attractive than the segment they currently occupy. Consequently, their motivation to move up markets becomes increasingly strong, and investment proposals related to disruptive innovation are more likely to be approved through the firm's internal resource allocation process.

Thus, a state of asymmetric motivation in which established firms refrain from investing in disruptive innovation, while new entrants actively pursue it, tends to become the norm. This fundamental difference in motivational intensity gives rise to a pattern of asymmetric competitive response: new entrants aggressively seek to expand their market share, whereas

established firms do not take proactive defensive action, but instead attempt to retreat to higher-value market segments (Christensen, 1997).

Therefore, firms' embeddedness in their value networks and resource dependence on primary customers strongly constrain incumbent firms' resource allocation processes and decision-making, thereby reinforcing their tendency to disregard disruptive innovation. Consequently, even when the threat of disruptive innovation is partially recognized, or when top management directs the firm to prioritize disruptive innovation, the organization often fails to move in that direction or hesitantly does so, thereby accelerating the process of decline.

5. The logic of disruptive innovation (2): Explanations based on new institutional theory and social cognition theory

The foregoing discussion provides an explanation, grounded in economic rationality, of the causes and logic underlying the loss of competitiveness among firms facing disruptive innovation. Christensen's argument relied almost exclusively on this line of reasoning. Because he sought to answer the question of why excellent firms fail even when they employ "correct" management practices, he appears to have remained consistently committed to an explanatory framework based on economic rationality.

By contrast, from around the mid-2000s onward, explanations of the logic underlying disruptive innovation increasingly drew on new institutional and social cognitive theories, neither of which necessarily assumes economic rationality. The core concepts of these perspectives are organizational identity and legitimacy. These concepts are examined in detail in the following sections.

5.1. What is organizational identity?

Organizational identity refers to the shared understanding among organizational members of what the organization is. It is expressed through its central characteristics, which exhibit a certain degree of continuity over time and distinguish it from similar organizations (e.g., Albert and Whetten, 1985; Dutton and Dukerich, 1991; Gioia, Schultz, and Corley, 2000).

Such organizational identity is generally expressed in terms of the industry to which the organization belongs, the products it offers, and the processes through which those products are delivered (e.g., Glynn and Abzug, 2002; Livengood and Reger, 2010). Additionally, it is often expressed through distinctive characteristics that differentiate the organization from similar firms, or through characteristics that the organization seeks to acquire in the future (e.g., Kammerlander, König, and Richards, 2018). Examples of the former include labels based on industrial classification, such as "railroad company" or "oil company," and labels based on

product category, such as “photographic film company” or “automobile company.” Examples of the latter include attributes related to functional orientation, such as “technology-oriented” or “marketing-oriented”; attributes related to value orientation, such as “ethical,” “altruistic,” or “moral”; and attributes related to competitive position in the market, such as “leading company,” “young and agile challenger,” or “industry veteran” (e.g., Altman and Tripsas, 2015).

Organizational identity can be divided into two forms: the identity perceived by members within the organization (hereafter, “internal identity”) and the identity perceived by external actors, including customers and suppliers (hereafter, “external identity”) (Tripsas, 2009). Internal identity refers to shared expectations and self-understanding among organizational members regarding various aspects of an organization’s identity (e.g., Dutton and Dukerich, 1991). Initiatives within an organization are more likely to secure resources when they are consistent with this internal identity; by contrast, when they deviate substantially from it, resources tend to be withdrawn, rendering such initiatives difficult to sustain (e.g., Gioia, Patvardhan, Hamilton, and Corley, 2013).

By contrast, external identity refers to the socially shared expectations, evaluations, and collective understandings held by external actors regarding various aspects of an organization’s identity (e.g., Pólos, Hannan, and Carroll, 2002; Hsu and Hannan, 2005; Navis and Glynn, 2011)[15]. When an organization operates in ways that align with this external identity, it can more easily obtain resources from external sources; however, when it deviates substantially from such expectations, securing those resources becomes more difficult, potentially threatening the organization’s survival (e.g., Benner, 2007; Zuckerman, 1999; Gioia, Schultz, and Corley, 2000).

Executives and managers attempt to interpret issues through the lens of internal and external identities, as they perceive them, and arrive at what they regard as desirable decisions, not only in day-to-day operational decision-making, but also in critical strategic decision-making (e.g., Dutton and Dukerich, 1991; Gioia and Thomas, 1996). In this way, organizational identity provides both organizational members and external actors with a shared understanding, that is, a set of values regarding what is desirable and what is not, thereby serving as a source of legitimacy.

Legitimacy refers to the generalized perception or assumption that the actions of a given actor are desirable, proper, or appropriate within a socially constructed system of norms, values, beliefs, and definitions (e.g., DiMaggio and Powell, 1983; Suchman, 1995). Put simply, it

[15] External identity is also referred to as “organizational image” (e.g., Dutton and Dukerich, 1991). However, because the term “organizational image” is overly broad and does not readily convey the more specific meaning of outsiders’ perceptions of an organization’s identity, this paper follows the terminology adopted by Tripsas (2009).

means being recognized by society as legitimate or "correct." In other words, the establishment of an organizational identity creates a standard by which both organizational members and external actors can judge whether a firm is making appropriate decisions and actions.

In this way, the establishment of organizational identity gives rise to legitimacy and promotes consistency in the firm's decision-making and actions (e.g., Dutton and Dukerich, 1991). Furthermore, such consistency in decision-making and behavior enhances the organization's reliability and accountability, thereby facilitating the acquisition of resources and ultimately contributing to improved long-term survival prospects (Hannan and Freeman, 1984; Hannan, Baron, Hsu, and Kocak, 2006).

5.2. The rigidity of organizational identity and innovation

By contrast, although organizational identity can change over the long term, it is deeply embedded within the organization and exhibits a high degree of rigidity; consequently, it is difficult to alter rapidly or flexibly in response to sudden environmental changes (e.g., Reger, Gustafson, Demarie, and Mullane, 1994; Fiol, 2002). In this respect, serious problems may arise when changes brought about by innovation require established firms to alter their identities.

One reason for the rigidity of organizational identity is that identity itself, together with its legitimacy, has become established as a normative framework for decision-making and behavior. Consequently, organizational members take for granted and accept natural patterns of thought and behavior that conform to this framework, making it difficult for initiatives aimed at change to emerge.

In fact, day-to-day decisions and actions tend to be regarded as legitimate insofar as they conform to the organization's identity and are therefore more likely to gain approval and recognition within the organization. Conversely, actions that contradict organizational identity are often perceived as illegitimate deviations and are therefore likely to invite resistance or criticism (e.g., Elsbach and Kramer, 1996). In this context, efforts aimed at transforming organizational identity tend to be excluded as unjustified and potentially dangerous, thereby giving rise to internal conflict or dysfunction. In other words, organizational identity is prone to self-protective dynamics. This tendency becomes even stronger when internal and external identities overlap, as the two reinforce each other (e.g., Ashforth and Mael, 1996; Dhalla, 2007).

Thus, because organizational identity is governed by self-protective dynamics, it may become an impediment to adaptation when innovation requires transformation (e.g., Anthony and Tripsas, 2016). Innovation generally requires the mobilization of diverse and substantial resources for technology development (e.g., Takeishi, Aoshima, and Karube, 2012). However, when such efforts are perceived as threatening organizational identity, it becomes difficult to

secure the necessary resources, thereby reducing the likelihood of innovation success (e.g., Anthony and Tripsas, 2016).

The second source of organizational identity rigidity lies in the emergence of organizational inertia, as identity becomes embedded in routines and strategies. Various activities occur within a firm, many of which are repeatedly performed and thereby form recurring patterns of action. Among these repetitive and ongoing activities, those that yield desirable results, including manuals, computer programs, stable communication patterns, and various forms of knowledge, are gradually selected and accumulated as routine (Nelson and Winter, 1982). Similarly, firms learn from past experiences in which strategies have led to success or failure, and gradually select and reinforce only particular strategies (Noda and Bower, 1996).

This implies that routines and strategies are formed in accordance with the legitimacy and value standards of the firm in question and, therefore, with its organizational identity (Kogut and Zander, 1996). Given this, movements aimed at negating or transforming existing legitimacy, value standards, or organizational identity are unlikely to emerge. Moreover, even when such movements occur, it is not easy to transform the entire system of established routines and strategies (e.g., Leonard-Barton, 1995).

Furthermore, when confronted with situations that threaten existing organizational identity, organizational members tend to cling to well-established routines and strategies to protect their own understanding of that identity (e.g., Brown and Starkey, 2000). Therefore, when organizations are compelled to transform their existing routines and strategies in response to innovation-induced change, they are likely to encounter extremely strong resistance arising from organizational inertia and ultimately fail.

A third source of the entrenchment of organizational identity lies in the emergence of socio-cognitive bias resulting from the incorporation of organizational identity into the “schemas” of executives and managers. A schema refers to a cognitive framework through which an external environment is understood. As a framework for selecting, interpreting, and assigning meaning to information received from the external environment and for integrating that information with existing knowledge, it serves to simplify a complex world and render it more comprehensible (e.g., Barr and Huff, 1992; Walsh, 1995).

Simultaneously, organizational identity functions as a shared cognitive schema among organizational members, acting as a filter that shapes which information from the external environment members attend to, as well as how they interpret and assign meaning to it (e.g., Ashforth and Mael, 1996; Kogut and Zander, 1996). Of the vast amount of information available in the external environment, only a very limited portion that passes through this filter is incorporated into the organization, interpreted, and used as a basis for decision-making (e.g., Altman and Tripsas, 2015). Thus, information is filtered in the process of selection and, in

general, priority is given to information that maintains or reinforces organizational identity (e.g., Ashforth and Mael, 1996; Dutton, Dukerich, and Harquail, 1994).

For these reasons, executives and managers often fail to recognize innovations that do not align with their organizational identity, and even when they recognize them, they find it difficult to take them seriously (e.g., Fiol, 2002; Tripsas and Gavetti, 2000). Consequently, organizational responses to innovation-induced change are often significantly delayed (Tripsas, 2009).

5.3. Disruptive innovation and organizational identity

Whereas organizational identity fundamentally provides stability, consistency, and continuity, innovation inherently brings about change because the two embody opposing vectors; a fundamental tension exists between them. However, whether organizational identity promotes or hinders an organization's adaptive response to innovation depends on whether the change brought about by innovation is perceived as reinforcing or expanding the existing organizational identity or threatening it.

In the former case, that is, "identity-reinforcing" or "identity-expanding" innovation, the existing organizational identity works to support the organization's adaptive response to innovation. By contrast, in the latter case, that is, "identity-challenging" innovation, the existing organizational identity functions as a barrier to such adaptation (Anthony and Tripsas, 2016).

Then, which category do sustaining innovation and disruptive innovation fall into: identity-reinforcing or identity-expanding innovation, on the one hand, or identity-challenging innovation, on the other?

Sustaining innovation delivers performance improvements along dimensions that have traditionally been prioritized, and thus remains aligned with the value sought by mainstream customers in existing markets. Moreover, because it tends to improve profit margins, it is more likely to be recognized by executives, managers, suppliers, distribution channels, and shareholders as consistent with their expectations, and therefore more readily accepted. Furthermore, as established firms often construct their organizational identity as industry leaders or possess superior technological capabilities, the pursuit of sustaining innovation is likely to reaffirm and strengthen such self-understanding. In other words, sustaining innovation is highly likely to be perceived as a form of innovation that reinforces and expands the organizational identity of established firms.

By contrast, disruptive innovation exhibits superiority in dimensions that have not traditionally been prioritized, such as low price, simplicity, and ease of use, and offers a new value proposition. However, because it emerges as an inferior product in terms of existing

performance metrics, it is highly likely to be fundamentally incompatible with the organizational identity that established firms have developed over time. Consequently, disruptive innovation is likely to be perceived as a form of identity-challenging innovation that threatens a firm's organizational identity. Additionally, resistance to its pursuit, both inside and outside the organization, is likely to be extremely strong (Anthony and Tripsas, 2016).

Indeed, because disruptive innovations perform poorly in traditionally valued performance dimensions, existing customers tend to reject them as inexpensive, low-quality products. Even when such explicit rejection does not occur, customers accustomed to conventional products are likely to perceive the new product as inappropriate or out of place. Furthermore, many internal members are likely to feel that such a cheap and low-quality product is inconsistent with the company's identity and, therefore, may be unwilling to support it. For example, members of the engineering department may resist the initiative or participate reluctantly without strong commitment. Even if development proceeds, the product enters the market, and new customers emerge who value its superiority along different dimensions, the scale of that market is likely to remain limited, at least in the early stages, and sales are likely to be negligible. Given the burden of development investment, the project is also likely to operate at an initial loss.

Thus, at least in its early stages, disruptive innovation is unlikely to gain support from existing customers or internal organizational members while generating neither substantial revenue nor profit. However, these are among the most important sources of legitimacy; without them, disruptive innovation is likely to begin as an initiative with minimal legitimacy.

Furthermore, because disruptive innovation typically enters new peripheral markets or low-end segments of existing markets, firms must establish a low-cost structure to survive despite small market size and low profit margins. Naturally, relationships with complementary actors, such as suppliers and distribution channels, must also be organized in ways consistent with this low-cost structure. Consequently, even when an established firm attempts to pursue disruptive innovation, existing suppliers and distribution channels are likely to resist, because they fear a decline in sales and profit margins. In other words, efforts directed toward disruptive innovation are unlikely to receive support from most existing complementary actors, making it difficult to secure legitimacy from this perspective.

Thus, by its very nature, disruptive innovation tends to create a mismatch with the organizational identity of established firms, making it highly likely that it will fail to attain legitimacy. Consequently, the following forms of resistance to promotion can be anticipated.

First, even when an established firm attempts to pursue disruptive innovation, it may fail to secure the legitimacy necessary to mobilize the resources for its development, thereby reducing the likelihood of success.

Second, even when an established firm attempts to pursue disruptive innovation, it is likely to encounter extremely strong resistance arising from organizational inertia, making an effort to shift from existing routines and strategies that are highly likely to fail.

Third, because such innovation does not align with organizational identity, executives and managers may fail to recognize signs of disruptive innovation under the influence of socio-cognitive bias. Even when they recognize them, they may find it difficult to consider them seriously.

Fourth, executives may avoid the difficulty of transitioning to a new organizational identity and instead choose to retreat to higher segments.

For established firms, retreating to higher segments is more likely to gain internal consensus than transitioning to a new organizational identity and engaging in head-to-head competition with new entrants armed with disruptive innovation. This is because such markets demand higher performance along traditional performance dimensions and, therefore, a higher level of technical capability, making it easier to secure support from mainstream customers in the existing market while simultaneously allowing the firm to preserve its existing organizational identity and sense of pride. Furthermore, a shift to higher segments may improve profit margins even if sales decline, thereby making it easier to obtain investor support. Consequently, executives in established firms tend to choose a path of strategic retreat that preserves the existing organizational identity, rather than enduring the pain of transforming that identity and engaging in cutting-edge competition with aggressive new entrants.

For the reasons outlined above, executives in established firms often find it difficult to implement proposals to allocate resources to disruptive innovation, distinct from improvements to existing technologies, because such proposals lack legitimacy. In other words, they are not recognized by either internal or external stakeholders as the appropriate course of action.

6. The “process view” of disruptive innovation

Most existing research on disruptive innovation, including the studies discussed thus far, has focused on elucidating the characteristics and outcomes of disruptive innovation and the causal relationships between them, largely based on what may be broadly described as a “variance approach” (Mohr, 1982), that is, an “X → Y” model. In other words, researchers have concentrated on identifying linear causal relationships of the following kind: when a disruptive innovation possessing characteristic X emerges, it leads to outcome Y, such as the loss of competitiveness among established firms or the growth of competitiveness among new entrants (e.g., Kumaraswamy, Garud, and Ansari, 2018).

Although time is incorporated into this model in the form of phase transitions, it effectively

assumes a linear progression from one phase to the next, such as a transition from Phase 1 to Phase 2 or from Phase 2 to Phase 3. Therefore, it does not adequately capture the dynamic aspects of the process, including interruptions, path divergence, backtracking, and variations in the pace of development. Consequently, this approach has not sufficiently deepened our understanding of how actual phenomena emerge, unfold, change, persist, and eventually come to an end (e.g., Langley, Smallman, Tsoukas, and Van de Ven, 2013; Cozzolino, Verona, and Rothaermel, 2018).

In response to these shortcomings, increasing attention has been paid to a perspective that treats disruptive innovation as a process rather than merely an outcome. This perspective is referred to as the "process view."

The process view is a general term for research that conceptualizes disruptive innovation as a sequence of events and actions unfolding over time (e.g., Petzold, Landinez, and Thomas, 2019). Rather than regarding the emergence of disruptive innovation as a linear process that, despite passing through several phases, inevitably leads to the loss of competitiveness among established firms and the growth of competitiveness among new entrants, this perspective offers a different interpretation. This emphasizes that the process of disruption unfolds through nonlinear and complex dynamics with the possibility of interruption, stagnation, branching into multiple paths, or even returning to earlier phases.

As clarified in Section 2.1 of this paper, Christensen, the founder of the theory, explains the mechanism through which disruptive innovation leads to the loss of competitiveness among established firms by dividing it into several phases. Moreover, he does not portray this progression as a linear stage model of the form "if X, then Y" or "if Y, then Z." In this sense, his perspective may be regarded as fundamentally grounded in a process view.

In a footnote, Christensen and Raynor (2003) explicitly describe disruption as an ongoing process rather than a one-off event. They emphasize that the force of disruptive innovation is continually at work in every industry, although the speed at which it permeates an industry may vary considerably. They emphasized the importance of understanding the types of forces operating at each stage of the process. Furthermore, in another passage, they point out that established firms tend to "squeeze" technologies and products that might otherwise become disruptive innovations, that is, potentially disruptive innovations, into existing markets, thereby halting the process of disruption (Christensen and Raynor, 2003; Christensen, McDonald, Altman, and Palmer, 2018).

He further argues that the force of disruptive innovation should be understood in the same way as gravity; the fact that some firms succeed in overcoming disruptive innovation does not mean that the underlying force ceases to operate; rather, it indicates that managers have learned

how to deal with it and harness it for success (Christensen and Raynor, 2003). This description suggests that although certain dynamics are always at work for established firms facing disruptive innovation, it is nevertheless possible to avoid a loss of competitiveness by properly understanding these forces and strategically leveraging them. In other words, Christensen appears to have rejected a linear stage model of "the emergence of disruptive innovation → the decline of established firms" and instead emphasized that disruptive innovation should be understood as a dynamic process involving multiple pathways and patterns of progression that do not necessarily culminate in failure.

Not only has the linear stage model been questioned in this way, but a growing body of research has also argued that it is necessary to consider a broader range of factors, including the chain of decisions and actions of key actors (e.g., Si and Chen, 2020).

For example, Petzold, Landinez, and Thomas (2019) conducted a systematic literature review from the perspective of the process view and concluded that disruptive innovation should be understood as a dynamic process constituted by a chain of interactions among the actions of new entrants, the responses of established firms, and events in the external environment. They further show that diverse pathways may emerge, such as the timing of entry, timing of related events and actions, availability of complementary technologies and resources, and adaptability of each actor's strategic behavior, which shape the trajectory and pattern of the process.

Thus, research informed by the process view divides the process of disruption caused by disruptive innovation into several phases and examines, in each phase, the strategies of new entrants, responses of established firms, changes in customer purchasing behavior, pace of technological evolution, and interactions with the external environment, such as the availability of complementary technologies and suppliers. Thus, it seeks to elucidate the dynamic process of disruption, specifically the sequence, timing, and pace of these changes, as well as the resulting pathways and patterns of progression. Although the body of research in this area remains limited, this approach is regarded as an important direction for deepening disruptive innovation theory (e.g., Ansari, Garud, and Kumaraswamy, 2016).

Furthermore, recent research has begun to argue that the process of disruptive innovation should also be understood from the performative approach perspective, which incorporates elements of social constructivism and holds that phenomena are constructed, deconstructed, and reconstructed through the actions of multiple actors (e.g., Garud and Karunakaran, 2018; Kumaraswamy, Garud, and Ansari, 2018). Although such research remains at an early stage, it represents a noteworthy new trend, and further developments in this area are expected to attract considerable interest.

Thus, the process view of disruptive innovation has significantly deepened our understanding

of this phenomenon by capturing aspects that traditional linear stage models have overlooked. However, research from this perspective remains in its early stages. Studies in this area are still relatively limited and have been conducted largely in isolation, and a systematically integrated and comprehensive model has yet to be established.

Accordingly, Section 8 of this paper proposes an analytical framework based on the process view to trace the disruptive innovation process in detail.

7. Challenges in disruptive innovation research

Considering the foregoing discussion, this section examines the remaining challenges in the disruptive innovation theory.

7.1. Remaining challenges regarding the definition of disruptive innovation

(1) Absence of a definition

We begin by examining the unresolved issues concerning the definition of disruptive innovation. The first and most fundamental problem is the lack of a widely accepted definition.

As discussed in Section 2, Christensen never provided a rigorous definition of disruptive innovation over the course of his career. For example, although Christensen and Raynor (2003) and Christensen, Anthony, and Roth (2004) presented a “model of disruptive innovation” and explained the concept within that framework, their discussions remained limited to illustrating its characteristics through the model. Consequently, it was difficult to clearly determine whether all the characteristics described constituted essential elements of the definition or were merely incidental features. Furthermore, classifying disruptive innovation into these two types introduces an additional degree of ambiguity into its conceptual definition. Consequently, a proliferation of definitions, including “misuses” that depart from the original arguments of Christensen and his colleagues, has emerged, and the debate remains unresolved (e.g., Si and Chen, 2020; Martínez-Vergara and Valls-Pasola, 2021). This definitional confusion has serious implications for both theoretical development and empirical research; it not only hinders academic progress but also reduces predictive power and impedes practical application.

(2) Is achieving a sufficient level of performance in traditional performance dimensions a necessary condition?

The second unresolved issue concerning the definition of disruptive innovation relates to the pace of technological progress.

Christensen’s disruptive innovation theory assumes that the pace of technological progress exceeds the rate at which the customer requirements increase. According to Christensen, this is

a common phenomenon observed in many products and services (e.g., Christensen, 1997; Christensen and Raynor, 2003). As disruptive innovations are inferior to conventional performance metrics, they can initially satisfy only low-end customers in the existing market. However, under these conditions, their performance improves faster than the rate at which the customers need to increase. Consequently, over time, they may reach a performance level sufficient to satisfy mainstream customers in the existing market. Consequently, substitution progresses even within the main segments of the existing market, and existing products are eventually driven out.

Conversely, if this premise does not hold, disruptive innovation is limited to replacing only low-end segments of the existing market. This is because if the pace of technological progress is slower than the rate at which customer expectations increase, the product in question cannot continue to expand while capturing demand in the existing market. This premise can be regarded as a critical condition for the successful replacement of existing products through disruptive innovation.

On the other hand, Christensen, McDonald, Altman, and Palmer (2018) later qualified this premise. As clarification is important, this study explains it in the relevant sections below:

The original diagram of disruptive innovation (Figure 1 in this paper) depicts technology trajectories as having similar rates of technological progress, that is, similar slopes. However, prior studies such as Christensen, Raynor, and McDonald (2015) have pointed out that the pace of technological progress varies significantly across industries. For example, in the HDD industry, which Christensen (1997) refers to as the "fruit fly" of the business world, technological progress has been rapid, resulting in a steep technological trajectory. In this industry, disruptions occur quickly, with new entrants challenging established firms every few years and eventually replacing them. By contrast, in industries with less steep technology trajectories, such as steel and discount retailing, substitution has unfolded over several decades. Still, in other industries, where the technology trajectory appears to be nearly flat, substitution does not occur. For example, in the hotel industry, it has been pointed out that although low-end entrants have attempted to move into the high-end market and compete with luxury hotel chains such as Four Seasons, such attempts have historically struggled. Such cases suggest that disruptive substitution does not occur universally or proceed at the same pace across industries.

Thus, Christensen, McDonald, Altman, and Palmer (2018) appear to argue that the pace of technological progress varies considerably across industries and is not necessarily faster than the rate at which customer expectations increase. Furthermore, even when the overall technological progress tends to outpace the growth of customer expectations holds in a given industry, products generally possess multiple attributes. Thus, there is no guarantee that performance on a particular attribute, especially one belonging to traditional performance

dimensions, can be improved at a pace that exceeds the rate at which customer expectations increase. Therefore, it is conceivable that, although a new product may rapidly improve performance along a new dimension that has not traditionally been emphasized, the pace of improvement along traditional performance dimensions may remain slow because of technological constraints. Under such conditions, new entrants may abandon efforts to improve traditional performance dimensions, redirect technological development toward performance improvement along other dimensions, and seek to establish a niche market that is fully differentiated from existing products (e.g., Adner, 2002).

However, if the condition is not met that the performance level of a new product eventually becomes sufficient to satisfy the major customers of the existing market along conventional performance dimensions, the process by which disruptive innovation replaces existing products is likely to lose momentum before reaching the main segment of the existing market. Therefore, it is appropriate to include as a necessary condition in the definition of disruptive innovation, rather than merely as a precondition, the element that performance improves over time, even along conventional performance dimensions, and eventually reaches a level sufficient to satisfy mainstream customers of the existing market.

(3) Is a low price a necessary condition?

The third unresolved issue concerning the definition of disruptive innovation is whether low prices should be regarded as a necessary condition for disruptive innovation or merely an incidental attribute (e.g., Adner, 2002; Govindarajan and Kopalle, 2006a; Druehl and Schmidt, 2008). Christensen (1997) states that products based on disruptive innovation are typically lower in price, simpler, smaller, and often more user-friendly (Christensen, 1997). In other words, characteristics such as low price, simplicity, compactness, and ease of use are presented merely as features that disruptive innovations generally tend to possess and are not treated as indispensable elements of the definition itself. This implies that even products lacking these incidental characteristics could still qualify as disruptive innovations, provided they satisfy all other conditions; however, it remains open to question whether this is sufficient. Low price is a critically important factor in triggering the mechanism of disruption through disruptive innovation. However, even an in-depth reading of Christensen's work does not clarify whether it is appropriate to exclude this element from the necessary requirements of the definition.

This issue has come to the fore in debates on high-end disruptive innovation. Govindarajan and Kopalle (2006a) argued that displacement through disruptive innovation does not necessarily begin at the low end of an existing market but may also originate at the high end. Drawing on the early history of mobile phones, they pointed out that although early mobile phones were inferior to landlines with respect to traditionally valued performance dimensions

such as call quality and reliability, they were expensive and were nevertheless adopted by executives in large firms because of their convenience and portability. They further argued that as technological progress subsequently reduced prices, improved call quality and reliability, and expanded coverage areas, mobile phones became more widely accepted by mainstream customers, ultimately resulting in technological shifts.

In response, Christensen (2006), while expressing appreciation for the proposal of the "high-end disruptive innovation" model, argued that it was inaccurate to characterize this phenomenon as disruptive innovation. He explained that mobile phone operators were able from the outset to set prices above those of landline telephones and build their networks by targeting the least price-sensitive segment of landline users, namely, high-end customers. He further noted that, as the mobile phone market expanded, landline telephone companies could incorporate mobile phone operations through acquisitions without substantial internal resistance. This was because, in terms of customer base, profit margins, and expected market size, the mobile phone business was more attractive than the traditional landline business model. In other words, although mobile phones have largely replaced landline telephones, Christensen argued that the underlying business model was not disruptive. Rather, mobile phones constituted a sustaining innovation relative to landline telephone companies' business models. For this reason, major landline firms did not follow the path of being driven out of the market by mobile phone operators.

Based on the foregoing discussion, it may be inferred that Christensen regarded the essence of disruptive innovation as lying either in products, services, or business models that begin to replace existing markets from the low-end segment, or in the process through which such replacement, once triggered by the emergence of those offerings, progresses from the lower to the upper tiers of an existing market. However, if this interpretation is correct, it becomes necessary to offer prices that are sufficiently attractive to low-end customers. In other words, low prices constitute an indispensable element. In short, low price should be included as a definitive requirement for disruptive innovation.

(4) The impact of new markets and low-end categories.

The fourth unresolved issue relates to the implications of introducing two new categories: new market-disruptive innovation and low-end disruptive innovation. As discussed in Section 2, the conceptual definitions of disruptive innovation presented by Christensen (1997) and Christensen and Raynor (2003) do not appear to differ substantially at first glance. A closer examination, however, suggests that several modifications were introduced and that these changes may, at least in part, lead to greater conceptual ambiguity.

The most apparent difference between the two is that a characteristic included in

Christensen's (1997) conceptual definition, namely the development of new application markets through the introduction of a new value proposition that is different from the conventional one, is no longer explicitly articulated in works published by Christensen and Raynor (2003) onward. Although the reason for the omission of this characteristic is not explicitly stated, it is reasonable to assume that the introduction of these two categories influenced this change.

The characteristics described above are consistent with new market-disruptive innovation. In other words, the combination of inferior performance along conventional performance dimensions and superior performance along different dimensions, together with the opening of new application markets through a new value proposition, closely corresponds to the characteristics of a new market type. By contrast, in the case of low-end disruptive innovation, although performance is inferior to conventional performance dimensions, there is no corresponding improvement along the different dimensions; rather, the principal benefit offered is a lower price. Consequently, low-end disruptive innovations do not open up new application markets. Instead, it enters the low-end segment of the existing market from the outset and grows by progressively replacing existing products within that market. In other words, the aforementioned characteristics are inconsistent with those of the low-end type. Therefore, it may be inferred that these characteristics were excluded to broaden the concept of disruptive innovation so that it would also encompass a low-end type that does not conform to the earlier conceptual definition.

However, even in the case of low-end disruptive innovation, a new value proposition is presented in conjunction with a price reduction, such as offering a product at 50 percent of the conventional price in exchange for a 30 percent reduction in functionality. Therefore, we argue that the condition of providing a new value proposition different from the conventional one should be retained within the conceptual definition of disruptive innovation.

Furthermore, new market-disruptive innovation and low-end disruptive innovation clearly differ in terms of the initial market they enter and the process through which they expand. Specifically, while new market-disruptive innovation creates a new application market and grows by drawing customers from the existing market into that new market, low-end disruptive innovation begins by eroding the low-end segment of the existing market and grows through substitution within the existing market. Although these two types differ, attempts to construct a comprehensive definition by extracting only their common elements ultimately appear to obscure the overall picture of disruptive innovation (Nagy, Schuessler, and Dubinsky, 2016).

More importantly, the introduction of the two categories, new-market disruptive innovation and low-end disruptive innovation, shifted attention toward distinguishing between them, with the result that ambiguity in the definition of disruptive innovation receded into the background.

As Christensen and Raynor (2003) note, most actual cases appear to combine elements of both types, and there seems to be limited practical benefit in drawing a strict distinction between them. Although incorporating the low-end type, which previously occupied an ambiguous position, into the scope of disruptive innovation has helped clarify the conceptual definition to some extent, it is difficult to deny that this has made the concept as more difficult to understand.

Considering the foregoing, one effective way to define disruptive innovation more rigorously is to clearly identify the elements common to both types while comparatively describing their differences.

(5) Is the concern about cannibalization an indispensable element in this mechanism?

The fifth unresolved issue concerning the definition of disruptive innovation is whether concerns about cannibalization play an essential role (e.g., Danneels, 2004). On this point, Danneels (2004), Tellis (2006), Govindarajan and Kopalle (2006a), and Druehl and Schmidt (2008) appear to regard cannibalization as playing an essential role. Furthermore, as noted earlier, a study that conducted a rigorous empirical analysis of the HDD industry from 1981 to 1998 using methods from industrial organization estimated that the primary factor restraining established firms from investing in disruptive innovation was fear of cannibalization (Ikami, 2018).

By contrast, Christensen does not, at first glance, appear to regard concerns about cannibalization as playing an essential role. In fact, works such as Christensen (1997), Christensen and Raynor (2003), Christensen, Anthony, and Roth (2004), as well as review articles such as Christensen (2006) and Christensen, McDonald, Altman, and Palmer (2018), contain very little discussion of cannibalization.

However, Christensen (1997) includes a passage that is a rare exception. There, he suggests that established firms often delay the adoption of new technologies out of concern that the sales of their existing products will be eroded. At the same time, he notes that when a new technology creates a market for new uses, adopting it does not necessarily imply the erosion of existing products. By contrast, if established firms wait until the new applications of the technology–that is, disruptive innovation) have reached commercial maturity and adopt the technology only to defend their own market, concerns about the erosion of existing product sales may become a reality (Christensen, 1997).

This passage is somewhat difficult to interpret because it contains a series of negative constructions. However, if the main point is summarized, it may be understood as suggesting that if a firm delays its response to disruptive innovation, concerns about cannibalization may ultimately become a reality. Accordingly, Christensen (1997) does not appear to deny that concerns about cannibalization can play a role in the mechanism of disruptive innovation; rather,

he appears to acknowledge this possibility.

Why, then, is cannibalization discussed so little despite this? The reason for this is unclear. However, one possible interpretation is that Christensen may have regarded concerns about cannibalization as reflecting a judgment not grounded in economic rationality. As he was strongly committed to explaining why good firms failed through logic based on economic rationality, it may be inferred that he deliberately excluded concerns about cannibalization, which could be viewed as inconsistent with such rationality, from the factors explaining the mechanism of failure.

However, concerns about cannibalization exert a substantial influence on the decision-making of established firms in practice and therefore should not be disregarded. Moreover, there is no need to confine the analysis exclusively to the logic grounded in economic rationality. Accordingly, concerns about cannibalization should be incorporated as an indispensable element in the mechanisms associated with disruptive innovation.

7.2. Lack of consistent theoretical and empirical research

Although the disruptive innovation theory has stimulated many academic studies, these studies have not necessarily accumulated consistently. This lack of cumulative theoretical and empirical development constitutes the second problem in the disruptive innovation theory.

First, because its definition remains ambiguous, no clear criteria have been established to determine what constitutes disruptive innovation. Consequently, the verifiability and falsifiability of the theory are significantly undermined.

In fact, it is not uncommon for a product regarded as “disruptive” in one study to be interpreted as non-disruptive in another. For example, whenever a product, service, or business model emerges with the potential to significantly transform an industry, debates often arise over whether it should be classified as a disruptive innovation, as in the case of the iPhone or sharing services such as Uber. Because such debates stem not only from differences in interpretation but also from ambiguity in the definition itself, they frequently reach an impasse and remain unresolved.

Christensen himself states that he devoted considerable effort to identifying anomalies, that is, phenomena that do not fit the theory, and refined the theory based on those findings, thereby continuously developing disruptive innovation theory (Christensen, 2006). However, unless clear definitions are provided, it is difficult for researchers to verify the validity of these claims, even if provisional definitions are provided. Consequently, it becomes difficult to identify the errors and limitations of the theory, which, in turn, impede its academic refinement.

Second, because the definition remains ambiguous, the selection and comparison of case studies tend to appear arbitrary or, at the very least, difficult to demonstrate as nonarbitrary.

Critics of disruptive innovation theory have often questioned whether the concept is being used arbitrarily as an ex post facto explanation and whether it has degenerated into a convenient label to explain success or failure after the fact (e.g., Danneels, 2004; Tellis, 2006). This situation undermines the validity of empirical research and the credibility of the theory itself, thereby hindering academic progress.

Third, there is also the problem that the criteria for determining outcomes, that is, what counts as being "disrupted" or as constituting "completed substitution," remain unclear. For example, Markides (2006), referring to the table in Christensen and Raynor (2003) that presents examples of disruptive innovation, discusses the case of low-cost airlines and points out that although they have experienced remarkable growth since 1995, they still have not reached 20 percent of the total market share. Therefore, Markides suggests that disruption may not have occurred in that industry, or that, unlike in the case of products where the previous generation is often eliminated through substitution, a concept other than disruptive innovation may be more appropriate when analyzing business model innovation (Markides, 2006, p. 21).

By contrast, Christensen argues that, although the seven major U.S.-based airlines (the "Majors") have indeed survived, the market capitalization of Southwest Airlines (the "Disruptor") exceeds the combined market capitalization of the seven Majors, and that this may therefore be taken as evidence that the industry has been disrupted (e.g., Christensen, 2006). Regardless of which interpretation is more persuasive, when the criteria for evaluating outcomes remain unclear, it becomes impossible to conclusively determine whether an industry has been disrupted. This, in turn, raises serious questions about the rigor of the research.

Fourth, there is the problem of a limited number of quantitative studies because many rely on case analyses specific to individual industries. Thus, it is difficult to compare and integrate findings across industries (e.g., Si and Chen, 2020). As the definition of disruptive innovation remains unclear, it cannot be translated into a unified measurement scale; consequently, it is impossible to accurately determine whether the selected samples genuinely represent disruptive innovation. Furthermore, because the criteria for evaluating the outcomes are unclear, it is difficult to accurately determine whether a disruption has occurred within a given industry. Ultimately, because neither the explanatory nor dependent variables can be definitively specified, substantial obstacles remain in conducting a quantitative analysis.

In this context, a fifth criticism sometimes raised is that the body of academic research in this area is not especially substantial. Christensen and his co-researchers have argued that the usefulness of the theory has been supported by numerous studies (e.g., Christensen, McDonald, Altman, and Palmer, 2018). However, critics have often pointed out that much of the research by Christensen and his colleagues has been published not in academic journals but in business journals, such as the Harvard Business Review, and has therefore not undergone peer review

by other researchers, raising concerns about its reliability (e.g., Lepore, 2014; King and Baatartogtokh, 2015). In other words, empirical research with robust "academic validation" is scarce.

Therefore, although a large body of research on disruptive innovation has accumulated, refinement of both theoretical and empirical research has lagged behind the accumulated work. This can impede academic progress.

7.3. Limits of predictability

The third problem with the disruptive innovation theory is its limited predictive power. Managers must determine in advance whether a newly introduced product will undermine the competitiveness of the market, industry, or firm. This is because, if managers can identify disruptive innovations before the process of disruption begins, they may be able either to prevent damage to their firm's competitiveness or to transform a potential threat of market disruption into a new opportunity (Nagy, Schuessler, and Dubinsky, 2016). However, existing research suggests that although disruptive innovations can be explained retrospectively, their predictive power remains weak (e.g., Yu and Hang, 2010; Si and Chen, 2020).

The first reason for this, as discussed repeatedly above, is the ambiguity of the definition of disruptive innovation. Since no established criteria exist to determine what qualifies as a disruptive innovation, it is difficult to identify in advance whether a given product should be regarded as disruptive (Tellis, 2006).

Second, the relativity of disruptive innovation is another reason. Innovation may be disruptive for some firms in the sense that it threatens their existing businesses, whereas for others it may be sustaining, reinforcing their existing strengths. Consequently, predicting future disruptions using a single unified standard is difficult (e.g., Nagy, Schuessler, and Dubinsky, 2016).

Another reason is the lack of data required to construct predictive models of practical value. In many cases, data relevant to disruptive innovation become available only after a disruption occurs. Consequently, efforts to identify the kinds of data that would enable the detection of early signs of disruption and the prediction of future changes, and to collect such data systematically, have not yet advanced sufficiently (e.g., Nagy, Schuessler, and Dubinsky, 2016).

Researchers have proposed theoretical predictive frameworks that define disruptive innovation and identify its key characteristics. However, for the reasons discussed above, clear criteria for identifying disruptions in advance have yet to be established. Consequently, it is difficult for managers to rely on this theory as a basis for investment and strategic decision-making.

By contrast, from a process perspective, an excessive preoccupation with predictability does not necessarily appear productive. Attempting to raise the predictive accuracy to something close to 100 percent is almost equivalent to adopting a technological determinism premise, namely, the view that if technology A emerges, outcome B will inevitably follow a linear causal relationship. However, as many previous studies have pointed out, the innovation process cannot be adequately explained by such a linear causal model (e.g., Pinch and Bijker, 1987; Van de Ven, Polley, Garud, and Venkataraman, 1999; Numagami, 2000). In reality, innovation processes are shaped by contingencies and serendipity, and setbacks and direction changes are common. They often follow complex and dynamic trajectories accompanied by unintended consequences within which events may unfold in unexpected ways.

Therefore, rather than strongly criticizing disruptive innovation theory for its insufficient predictive accuracy, it would be preferable to recognize its value as a guide for managers and corporate practice.

7.4. Lack of understanding of multifactorial causes and multilevel analysis

The fourth issue with the disruptive innovation theory is the insufficient understanding of multilayered factors and the lack of multilevel analysis. Discussions on the success or failure of disruptive innovation have largely proceeded by separating the phenomenon into distinct levels such as individuals, firms, industries, nations, and ecosystems. For example, a substantial body of analysis focuses on factors at particular levels, including entrepreneurs' cognition and decision-making, organizational culture and resource allocation processes of established firms, industrial structures, national and regional policies, and legal systems, as well as the influence of ecosystems such as platforms and networks.

However, such research has often failed to fully capture the interactions among elements across multiple levels and has attempted to understand disruptive innovation within a complex, multilayered network of relationships, which has remained insufficient (e.g., Ansari, Garud, and Kumaraswamy, 2016; Si and Chen, 2020).

In recent years, studies that consider the processes through which these multilevel factors are interconnected and interact dynamically have emerged. Thus, the importance of a comprehensive multilevel understanding is increasingly being emphasized. However, such studies remain sporadic, and a systematically integrated theoretical framework has yet to be presented (Kumaraswamy, Garud, and Ansari, 2018). This has been identified as an important challenge for future research.

7.5. Lack of research on how existing firms adapt to disruptive innovation

The fifth issue with disruptive innovation theory is limited research on how established firms

adapt to disruptive innovation. While disruptive innovation poses a serious threat to established firms, it is well known that not all such firms necessarily fail. Cases such as Charles Schwab's success in online trading and Fujifilm's partial success in digitalizing film photography suggest that adaptation by established firms is possible (e.g., Danneels, 2004).

Existing research has identified several conditions that may facilitate such an adaptation. The first is the establishment of an independent organization that is not constrained by the evaluation criteria of existing businesses or the demands of primary customers. The second is the adoption of new technologies through external partnerships, such as alliances or startup acquisitions. Third, prior studies point to the importance of a shift in framing, through which disruptive innovation is reinterpreted not as a threat but as a new opportunity. Fourth, they emphasize corporate transformation initiatives aimed at overcoming organizational inertia rooted in long-standing success and organizational culture.

Although the research on the adaptation of established firms has progressed, a theoretical framework that systematically explains the factors underlying successful cases remains underdeveloped. Although various strategies have been proposed, our understanding of the conditions under which these strategies are effective remains limited. This has been identified as an important challenge for future research.

Although disruptive innovation theory provides powerful insights into the dilemmas faced by established firms, it faces several challenges, including definitional ambiguity and misuse, a lack of cumulative theoretical and empirical development, limited predictive power, the need for a multilevel analysis of complex factors, and the question of how established firms can adapt to disruptive innovation. The next section presents a new definition and model of disruptive innovation with the aim of addressing the challenges identified above.

8. Definition and model of disruptive innovation in this paper

In the preceding sections, we reviewed the existing literature on the definition of disruptive innovation, the mechanisms and logic of disruption, process views, and challenges facing disruptive innovation research. Building on this discussion, this section presents the definition and the model of disruptive innovation adopted in this study.

8.1. Definition of disruptive innovation

This section defines disruptive innovation. We begin with a low-end disruptive innovation defined by the following characteristics:

(1) Low-end disruptive innovation results in a decline in performance, at least initially, along

with the traditional performance metrics valued by mainstream customers in the existing market.

(2-A) By contrast, low-end disruptive innovation is characterized by low prices.

(3-A) As a result, it is accepted in the low-end segment of the existing market as a product offering a new value proposition, namely, inferior performance relative to existing products, in exchange for a lower price.

(4) Over time, performance improves along with conventional performance metrics, eventually reaching a level sufficient to satisfy mainstream customers in the existing market.

Next, we define new market disruptive innovation in terms of the following characteristics:

(1) New-market disruptive innovation results in a decline in performance, at least initially, along with the traditional performance metrics valued by mainstream customers in the existing market.

(2-B) By contrast, new-market disruptive innovation improves performance along metrics that mainstream customers do not value in the existing market. It is also characterized by low price and is typically simple, compact, and easy to use.

(3-B) As a result, it creates a new peripheral application market separate from the existing market by offering a new value proposition characterized by superiority along metrics different from those traditionally valued.

(4) Over time, performance improves along with traditional performance metrics, eventually reaching a level sufficient to satisfy mainstream customers in the existing market.

The foregoing constitutes the definition of disruptive innovation. However, because (1) and (4) are common characteristics to both types, whereas (2) and (3) differ, the latter are presented separately as A and B.

Point (1) implies that disruptive innovation is a form of “spec-down” innovation. As indicated by (1), (2-A) and (2-B), and (3-A) and (3-B), disruptive innovation refers to a product that, while involving a decline in performance along conventional performance metrics, offers benefits such as new attributes or lower prices; in other words, it provides a new value proposition. However, to those deeply embedded in existing value standards, such products are likely to appear merely “inferior” or “cheap and shoddy.” Disruptive innovation can be understood as a type of innovation that fundamentally transforms perceptions by prompting actors to recognize that what was previously regarded as inferior may be valuable. Put differently, it can be seen as a form of “value-disruptive” innovation (e.g., Kusunoki, 2013; Shibata, 2015), and the disruptive process may be interpreted as a phase in which understandings of the product become fluid and are reconfigured among both firms and customers (e.g., Kato, 1999, 2011).

Furthermore, once Stage (4) is reached, disruptive innovation begins to rapidly replace existing products within the volume segment composed of mainstream customers in the existing market. This is because disruptive innovations, in addition to offering inherent advantages such as new attributes or lower prices, improve performance along traditional metrics to a level sufficient to satisfy mainstream customers in the existing market. Consequently, once this stage is reached, virtually no rational grounds exist for choosing existing products except for a limited segment of high-end customers. Consequently, new entrants or disruptors offering disruptive innovations can seize established firms' market dominance.

8.2. The model of disruptive innovation

Christensen (1997) identified the logic through which established firms lose their competitiveness when confronted with disruptive innovation, as firms being doubly embedded in value networks and resource dependencies on primary customers. He argued that a firm's organizational capabilities are defined by its resources, processes, and value standards. In his view, firms are embedded in specific value networks, and the value standards of these networks shape the firm's own value standards, which, in turn, influence their resource allocation processes and organizational capabilities. Furthermore, firms are also embedded in a dependence on resources provided by primary customers, with the result that resource allocation processes tend to be biased toward the preferences of those customers. On this basis, Christensen presented the logic that because of this dual embeddedness, firms develop resource allocation processes shaped by the value standards of the value network and the demands of primary customers. Consequently, they find it difficult to respond organizationally to disruptive innovations that do not conform to these standards, causing established firms to fall behind and ultimately face irreversible decline.

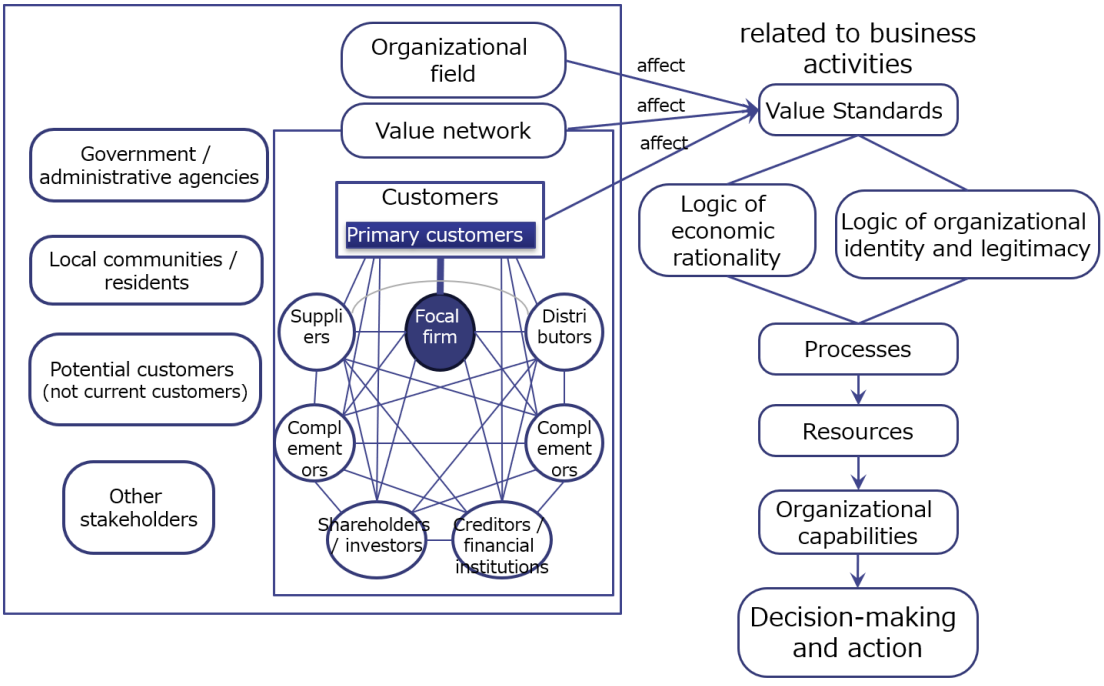
By contrast, a broadly similar framework is assumed in explanations grounded in the new institutional theory and social cognitive theory. In new institutional theory, the concept corresponding to the value network is the "organizational field." DiMaggio and Powell (1983) define the organizational field as a set of organizations that together constitute a recognized domain within institutional life and are structured through interactions among relevant actors. Although this concept may appear somewhat abstract, it refers to a broader configuration of stakeholders involved in a given industry, including firms, customers, competitors, suppliers, regulatory agencies, and professional associations. Within such an organizational field, firms are subject not only to pressure for efficiency but also to pressure to adopt structures and practices similar to those of other organizations to gain legitimacy.

Whereas value networks primarily emphasize the economic dimensions of value creation and distribution, organizational fields differ in that they capture a broader context, namely, the

influence of social and cultural norms on organizational behavior, and encompass a wider range of actors. Nevertheless, when analyzing the economic activities associated with the innovation process, it is reasonable to treat the two as broadly analogous. Accordingly, this study treats the organizational field as functionally equivalent to a value network and adopts a framework in which the value standards of the value network constrain the focal firm's decision-making and actions through pressures arising from the pursuit of organizational identity and legitimacy.

Based on the foregoing discussion, the disruptive innovation model proposed in this paper can be summarized as follows. The first pathway involves the constraint of resource allocation by the value standards of the value network and the demands of primary customers arising from firms' dual embeddedness in the value network and their relationships with primary customers; this pathway is explained through the logic of economic rationality. Second, the pressure exerted through organizational identity and legitimacy within the value network constrains corporate decision-making and behavior; this pathway is explained through the logic of new institutional theory and social cognitive theory. These two pathways interact synergistically to generate the structural reasons why incumbent firms are unable to adapt to disruptive innovation.

Figure 4. Conceptual diagram of the logic of disruptive innovation



Source: Author

Furthermore, this theoretical framework is also used to explain, in a stage-based manner, the process through which disruptive innovation erodes the competitiveness of established firms and ultimately leads to a shift in market leadership. Specifically, by applying this model to the three phases that follow the occurrence of overshoot: (1) the emergence of disruptive innovation and the establishment of an initial foothold, (2) the onset of substitution in the low-end and main segments, and (3) entry into the high-end segment, it is possible to understand why established firms are gradually pushed into a disadvantageous position by illuminating the dynamics operating at each stage.

First, a key precondition of disruptive innovation is the occurrence of overshoot. Established firms continuously improve their existing products in accordance with the value standards of the value network and the demands of their primary customers. However, overshoot eventually occurs, that is, the point at which product performance exceeds the requirements of the average customer. Once this state of performance oversupply emerges, some customers begin to perceive existing products as offering more features than necessary, entailing disadvantages such as high cost and complexity. This customer segment provides the initial foothold through which disruptive innovation begins to penetrate the existing markets.

In Stage (1), a new entrant introduces a disruptive innovation into the market. Although the new product generated by this innovation may initially offer lower performance along with conventional performance metrics, it compensates for this by offering a lower price and superior performance compared with other metrics. Consequently, it succeeds in establishing a foothold in either the low-end segment of the existing market or a new peripheral market.

At this stage, established firms that have been shaped by the value standards of their value networks and possess resource allocation processes that strongly depend on the demands of their primary customers tend to evaluate new products as inferior. Such products fail to meet the performance levels required by existing customers; therefore, customers show little inclination to proactively pursue them. From the perspective of organizational identity, these products are also often regarded as incompatible with a firm's pride in its advanced technological capabilities. Furthermore, because the low-end segments of existing and new peripheral markets are limited in scale and have low profitability, asymmetric motivation comes into play, leading established firms to conclude that it is economically rational to abandon these segments rather than engage in head-to-head competition. Consequently, established firms tend to delay their response to disruptive innovations.

Next, in Stage (2), disruptive innovation gradually improves its performance along with conventional performance metrics, captures nearly all demand in the low-end segment of the existing market, and eventually becomes capable of replacing demand in the main segment.

Even at this stage, however, established firms tend to refrain from full-scale attacking new entrants because of concerns about cannibalization. Furthermore, they continue to prioritize resource allocation in accordance with the demands of primary customers and the value standards of their value networks and, therefore, hesitate to respond fully to new products. Additionally, under conditions of asymmetric motivation, they tend to judge shifting toward higher-margin upper segments as representing the most rational course of action. Consequently, established firms often avoid head-to-head competition with new entrants and instead retreat to the upper end of the market.

At the same time, organizational identity tends to function defensively at this stage, perceiving new products as a threat to the organization's identity and seeking to exclude them. Additionally, organizational inertia intensifies, strengthening the tendency to cling to established routines and strategies. Furthermore, socio-cognitive biases become more pronounced, leading to the exclusion of information that conflicts with the organization's self-understanding and distortions in interpretation. Consequently, established firms often fail to recognize disruptive innovation as a serious threat. Even when the situation becomes critical, they are reluctant to endure the pain of transforming their organizational identity and instead tend to choose the path of retreating to higher-end markets while preserving their existing identity.

Once a disruptive innovation reaches a level sufficient to satisfy mainstream customers in the existing market along with conventional performance metrics, rapid substitution begins to occur within the volume segment. At this point, existing products suddenly lose their competitiveness, and established firms are no longer able to maintain their market dominance.

As the process advances further into Stage (3), established firms that have already retreated to the high-end segment find that even their final stronghold has been eroded and are ultimately forced to exit the competitive arena. In other words, the cumulative consequences of their failure to adapt to disruptive innovation, which began in Stages (1) and (2), led them to exit the market in the final stage.

However, this process does not occur in an ordered or linear manner. Firms are often constrained by socio-cognitive biases in their interpretation of the environment, leading them to misread the intentions of customers and competitors, struggle with unforeseen events, and suffer unintended consequences of their actions. Moreover, as interactions among the actions of multiple actors, including unintended consequences, accumulate over time, it is common for situations to develop in unexpected directions.

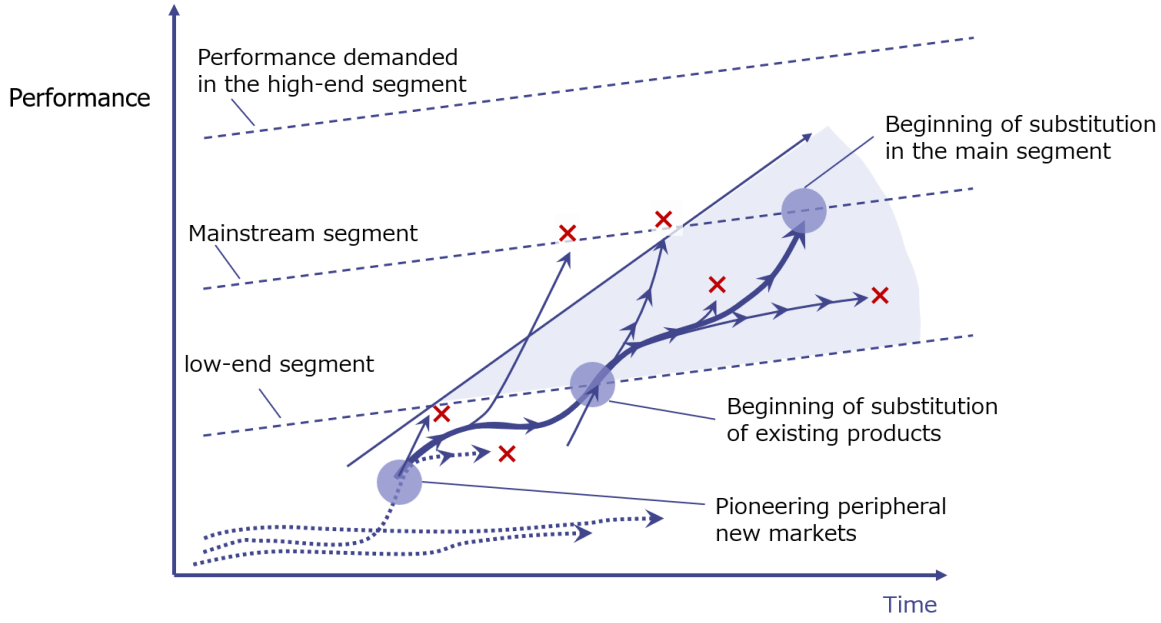
Furthermore, the sequence of events and actions associated with disruptive innovation unfolds amid complex interactions with the external environment, including the chain of actions

among key actors, such as the strategic moves of new entrants, competitive responses of established firms, pace of technological evolution, shifts in market demand, and availability of complementary technologies and suppliers. Consequently, the process may stall, branch into multiple paths in each phase, stagnate, or revert to an earlier phase.

In this context, the aforementioned factors function as determinants that increase the likelihood of particular actions being selected in each phase. In other words, they serve to clarify the strength, direction, and timing of these forces, specifically, at what point, under what conditions, a particular action becomes likely, and what patterns tend to emerge as a result. However, this does not imply that a linear causal relationship of the form "X→Y" occurs with 100 percent probability; naturally, situations may arise in which different outcomes occur despite the presence of such forces.

Figure 5 presents a conceptual illustration of the disruption process caused by disruptive innovation.

Figure 5. A process-view model of disruptive innovation



Source: Petzold, Landinez, and Thomas, B. (2019), partially modified

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