DISRUPTIVE INNOVATION IN BUSINESS AND FINANCE IN THE DIGITAL WORLD

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PART I

DISRUPTIVE INNOVATION AND FINTECH FIRMS

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CHAPTER 1

INNOVATION AND DISRUPTION: INDUSTRY PRACTICES AND CONCEPTUAL BASES

Jongmoo Jay Choi and Bora Ozkan

ABSTRACT

Disruptive digital technological innovation has the potential to dramatically alter the corporate landscape as we know it. The authors explore this premise by examining both industry practices and their conceptual bases in the digital age. The authors then describe cases and trends in the three main mediums of digital innovation – artificial intelligence, fintech, and blockchain. The authors focus on how these innovative technologies can impact the firms by creating values as part of corporate strategy, and by changing the way employees work. However, the impacts will likely go well beyond business and finance, and are likely to be adopted by healthcare, non-government organizations, and governments as well.

Keywords: Disruptive innovation; platform firm; artificial intelligence; Fintech; blockchain; cryptocurrency; cloud or digital technology; competitive advantage

JEL classifications: O31, O32, O34, D26, M15

1. INTRODUCTION

Digital disruption is ubiquitous and has changed both the way businesses operate and the way people live. Disruption caused by innovation affects firms across multiple industries, from financial services to industrial firms, business processes

to payment systems, manufacturing to supply chains. Further, scholars hear more and more about artificial intelligence (AI), big data, machine-learning, block-chain, financial technology (fintech), and so forth as examples of contemporary manifestations of disruptive technology that will profoundly influence disciplines beyond business and finance, such as law, healthcare, and government. Global extensions of these technologies and innovations challenge the efficacy and boundaries of law. Indeed, disruptive innovations potentially change the way we consider the future as humans versus some super AI.

Not all innovations are disruptive. Innovations can happen as a part of evolutionary progression based on existing ideas or processes rather than as a result of a revolutionary overhaul of existing systems. In ordinary communicative usage, either type of innovation can be disruptive if it leads to a rapid change in business that can dramatically alter the market. However, this is at odds with Bower and Christensen (1995), who defined a disruptive innovation in a particular fashion as an innovation that creates *new* market and eventually disrupts an *existing* market.

In the next section, we examine the role and implications of innovation models. In the subsequent section, we describe the advancements that we observe in three specific areas – AI, fintech, and blockchain – that are transforming the corporate landscape. We then close with concluding remarks.

2. CONCEPTUAL BASES

Considering disruptive innovation from a specific viewpoint, Bower and Christensen (1995) argue that disruptive innovation must create new markets before challenging the mainstream market. Christensen, Raynor, and McDonald (2015) further specify that *disruptive innovation* originates in low-end or new market footholds before challenging established incumbents in the mainstream market, and that disruptors are often regarded as inferior by incumbents. Thus, Uber may not be a disruptive innovator according to this theory as it challenged the mainstream taxi market from the beginning. While statistics may show revenue growth for the industry at large, it is not obvious that the creation of a new market was its objective, and Uber's growth may have come at the expense of traditional taxi firms.

Instead, Uber is a good example of *platform-based innovation* that challenges the traditional taxi industry in the mainstream market. Compared to traditional taxis, Uber provides a service that is more flexible, more customizable, lower cost, and features immediate feedback. This is made possible by platform technology combined with a network of freelance drivers. The competitive advantage of Uber is not easily understood by existing industrial organization theory such as transaction cost economics (Williamson, 1983) or resource-based theory (Barney, 1991; Peteraf, 1993) as the underlying technology can be imitated without a great deal of capital investment – see the rather long list of competitors already emerged: Lyft, Curb, Ola, Grab, Didi Chuxing, Lift Hero, Turo, etc.

The question, then, is what are the sources of competitive advantage for disruptive innovators? Mihet and Philippon (2019) in this volume examine the economics of big data and AI. They argue that big data technology can be understood as an intangible asset that acts as the source of competitive advantage to innovating firms. The creation of an intangible asset requires high fixed costs and low marginal costs. As such, large firms with technological or financial resources or firms with the ability to generate startup capital have competitive advantage vis-á-vis small firms or firms without access to venture capital. However, the human capital investment – an indispensable ingredient for the creation of intangible asset – does not have to be as large upfront as it occurs over a period of time.

In addition to low marginal cost advantage, the aggregation of big data aided by AI can provide an important informational advantage to an innovative data-based firm such as Google, which uses customized consumer data for advertisement and search. These data can be used across many different business lines. In addition, big data firms produce information good (e.g., Google search) which is not consumed, hence the marginal cost of one more search is close to zero.

However, barriers to entry can still be set by incumbents and institutional environments rather than economic fundamentals. Ozalp, Cennamo, and Gawer (2018) extend disruptive innovation theory to platform technology transitions in the US videogame industry and conclude that incumbents tend to steepen complementors' learning curves, causing their defection to less challenging rival platforms rather than the superior technology. Nevertheless, the platform can act as a signaling device, which reduces information asymmetry. Lehdonvirta et al. (2019) indicate that such platform signaling benefits are larger for emerging economy providers (e.g., Alibaba, JD) given the large *ex ante* information asymmetry caused by institutional devoids due to underdeveloped infrastructure (Khanna & Palepu, 1997).

As another example, Amazon is a content-based platform firm in retail industry. It has large technology startup costs but the marginal cost for scaling is comparatively small (although not as small as pure service-based IT firms due to warehousing cost). This enables the firm to offer highly competitive prices, disrupting traditional retail firms like Barnes & Noble or Borders. Once the technology is set up, it can extend the same crowd-based technology to other retailing business lines and expand into the entire retailing industry beyond books, pharmaceuticals, and traditional items. It now competes with diverse retail firms such as WalMart, Alibaba, eBay, Priceline, JD, and others. It is unclear whether Amazon qualifies as disruptive innovation as defined by Christensen and his collaborators, since it aimed to disrupt existing mainstream retail markets. Regardless, platform-based firms such as Amazon can still be disruptive in the broad sense to retails firms across different types of retail industry.

In sum, the particulars of business models differ from firms to firms, depending on the menu of disrupting technological advantages adopted as well as different business models firms pursue. Theory that helps to understand disruption and innovation is at its infancy. In the next section, we will examine three mediums of innovation that are expected to alter and disrupt corporate landscape going forward – AI, fintech, and blockchain.

3. THREE MEDIUMS OF INNOVATION

3.1 Artificial Intelligence

The term AI is said to come from a 1956 Dartmouth College summer workshop where researchers from various fields gathered to work on "thinking machines." More recently, Merriam-Webster defines AI as a branch of computer science dealing with the simulation of intelligent behavior in computers; or the capability of a machine to imitate intelligent human behavior.[1] *MIT Sloan Management Review*'s Global Executive Study and Research Report on AI (2018) documents that firms were investing heavily in AI for the purpose of mimicking human reasoning through machines.

We can see the impacts of these investments throughout the corporate landscape. Not only consumers see Roomba sweep the floor, but AI-based systems analyzing consumer behaviors and guide them for purchase according to personal preferences revealed in consumer data. Several music and video streaming services such as Hulu or Netflix recommend videos to their users based on their streaming history aimed at creating better user experience. Amazon uses a subset of AI, machine-learning to grow its business by enhancing customer experience including logistic quality and speed.[2] According to Reuters (2019), Amazon is also piloting new automated packing machines at its warehouses, which can pack much faster than a human.

International businesses have often been early adopters of new technological advancements. Modern supply-chain technology is used by numerous global firms as their sourcing strategy. An example of this, as noted in *Wall Street Journal* (2019a), is that Absolut Vodka recently changed the way they manage their supply chains by adopting a demand-planning software that uses machine-learning. This technology was developed by an Amsterdam-based company, and via its use, Absolut intends to reduce its inventory and to improve its complicated supply-chain process.

Healthcare systems have also begun to implement AI technologies to better understand and control their processes and facilities to improve patient care. New York Presbyterian Hospital in Manhattan, according to *Wall Street Journal* (2019b), is using AI-powered command center to monitor its key metrics including patient vital signs, bed availability, staffing levels, and medical supplies. With the use of AI, healthcare systems are trying to better understand their overall operations and create efficiencies that ultimately benefit patients. The *Financial Times* (2019) recently reported that Chinese firm, Tencent, along with UK startup Medopad, is using AI for clinical trials to diagnose Parkinson's disease.[3]

Financial services firms typically operate on legacy systems due to the large number of mergers and acquisitions that many of them have undergone. Financial firms with the most complex systems have difficulty in managing their data for customized customer service. Salesforce recently announced a cloud-based data analytics tool, Einstein, which can be used as a comprehensive predictive tool by banks, insurance firms, and wealth managers as well as by customers directly on its platform.[4]

A 2018 report by Gartner Inc. states that more than 75% of business organizations will use AI techniques by 2022.[5] They expect AI to generate $1.2 trillion in

business value in 2019 alone and to triple that amount by 2022. McKinsey Global Institute surveys that 47% of companies adopted AI in 2018, a double that of the previous year.[6] Additionally, it is not just corporations that are adopting AI. According to *Wall Street Journal* Pro Artificial Intelligence (2019), the US Food and Drug Administration is working on an AI application to analyze antecedents to hazardous food shipments in order to help select imported goods for inspection.

As AI becomes mainstream, there are certain concerns that remain shared by consumer advocates and regulators. The chief concern is about an ethical implication of big data collection and analysis by advanced technologies. Uber is known to capture large quantities of personal data, up to and including the battery levels of customers' cell phones. When it was reported that Uber was using surge pricing for users with low battery, it created a consumer backlash that lead Apple to stop sharing such data with Uber.[7] Another concern is whether AI will lead to corporate decision-making that is biased toward certain customer groups. Amazon is reported to have scrapped a recruitment tool based on AI that was found to be biased against women.[8] Since machines are run by code and humans write those codes, the concern is whether there is sufficient safeguard to prevent biases at the algorithm level. Apple was working on the project for several years before executives realized they could not resolve this type of bias behind the programing. According to Roll Call, the US Food and Drug Administration is looking into regulating certain AI-powered medical devices for similar reasons.[9]

The idea of a possible bias in an algorithm at the hand of government is particularly alarming. There are several reports of China using AI to predict whether someone is likely to commit a crime, which may lead the authorities to preemptively intervene. According to the *Financial Times* (2019), the US and Europe may also use similar tools but less invasive ones, and some counter-measures reducing bias have been suggested.[10] France, for example, is allowing its policies to be checked for biases by making its algorithms publicly available prior to their implementation. This attests to thorny issues related to the governance of AI, and suggests that a broad set of stakeholders including companies, consumer advocates, and regulators, as well as people with philosophical and programing expertise, should start a dialogue around ethics and data rights pertaining to AI.

3.2 Financial Technology (Fintech)

The global fintech industry has seen major changes since the 2008 financial crisis. Further, starting in 2012, funding has poured into technology startups. Industry analysts and experts have been talking about digital disruption in their reports for the past several years; however, it was more recent when established companies started re-evaluating their IT strategies and started collaborating with startup firms. This not only allowed startups to raise large sums of money to enter the industry, but also allowed incumbent fintech firms to start expanding their services, enabling them to offer more products to their customers.

One of the most active segments in fintech industry is insurance technology (insurtech). According to the Standard & Poors Global Market Intelligence (2018a), digital lenders actively sought partners, and partnerships became

widespread in digital investment management. According to the report, "incumbent insurers are avid investors in insurtech companies, and the digital agency model relies heavily, for now at least, on partnerships with established underwriters." More than $1.8 billion of capital was raised in 2018 by insurtech startup companies. For example, Root Inc., an Ohio-based auto insurance company that uses telematics data relying on insurers' cell phones, was able to raise $100 million in just one round in 2018. Overall, new funding of US insurtech firms reached $8.64 billion in 2018. Other financial segments that received significant startup funding are in payment systems, investment management, digital lending, and banking technology.

Robo-advisories that provide financial advice based on algorithms have captured much attention since 2008 when Wealthfront and Betterment were founded as automated investment firms. Since then, large investment firms like Vanguard and Charles Schwab have also started offering robo-advisory services to their customers. The Standard & Poors (S&P) Global Market Intelligence (2018b) expects this industry to grow from roughly $181 billion assets under management in 2017 to $608 billion in 2022.

The digital lending industry has also seen a solid demand for their services since 2016 and leading players in the industry saw 30% growth in loan originations in 2017. The S&P Global Market Intelligence expects the industry to have over $73 billion in annual originations by 2022. Companies started to offer multiple services like student loan refinancing, personal loans, mortgages, and small business loans.

Financial institutions and startups have also introduced significant innovations in the payments industry. PayPal has aggressively grown peer-to-peer (P2P) payments with its Venmo service; the company posted an 80% increase in transaction volume to $19 billion in the fourth quarter of 2018. Twenty-nine financial institutions, including Bank of America and JP Morgan Chase, launched the Zelle platform in 2017, which offers member banks and their consumers real-time P2P services. Working with businesses is the key to the long-term success of payment apps according to Bloomberg (2018a). Zelle network handled 100 million transactions for a total of $28 billion in the second quarter of 2018, larger than Venmo's $14 billion volume. In a survey conducted by the S&P Global Market Intelligence in February 2018, consumers expressed concerns about mobile apps specifically with regard to perceptions of security and convenience, which are two valued but potentially conflicting sides of the product.

3.3 Blockchain

Blockchain is a much talked-about technology, but not many people know how it works. Historically, businesses have stored their data in centralized database systems. Blockchain technology, outlined initially in Satoshi Nakamoto's (2008) whitepaper, is designed to change this procedure by offering a decentralized autonomous ledger system that makes hacking almost impossible. Blockchain received increased attention in 2017 when the price of bitcoin, a cryptocurrency and one of the foremost applications of blockchain technology, skyrocketed to