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INSIGHTS

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COMPLETE AND INCOMPLETE FINTECH PLATFORMS

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A major consequence of the Internet era is the emergence of complex "platforms" that combine technology and process in new ways that often disrupt existing industry structures and blur industry boundaries. These platforms allow easy participation that often strengthens and extends network effects, while at the same time the vast amounts of data captured through such participation can increase the value of the platform to its participants, creating a virtuous cycle. While initially slow to penetrate the financial services sector, such platforms are now beginning to emerge. We provide a taxonomy of platforms in finance and identify the feasible strategies that are available to incumbents in the industry, innovators, and the major Internet giants.

1 Introduction

As a broad notion, *FinTech* has attracted intense interest among both popular and industry observers. Harbingers of change seem apparent in the financial services industry, but there remains considerable confusion about where various forms of "disruption" might occur (or if they will occur at all), or whether we should simply expect to see continued steady, measured efficiency improvements as in the last few decades.

In this paper, we examine the potential trajectories and impacts of FinTech innovation on incumbent and new business models in the finance industry. We provide a framework for understanding the value created through various types of platforms in financial services. This framework provides a natural mechanism for thinking about FinTech winners and losers and for predicting the trajectory of changes in the industry. It also provides a description of the possible strategies that innovators, incumbents, and the currently dominant Internet players can pursue.

We define FinTech as:

financial sector innovations involving technology-enabled business models that can facilitate disintermediation, revolutionize how existing firms create and deliver products and services, address privacy, regulatory and

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law-enforcement challenges, provide new gateways for entrepreneurship, and seed opportunities for inclusive growth.[1]

By way of context, for most of its history the financial services industry has been a leader in technological innovation along a number of dimensions involving telecommunication, computation, and data management.[2] Historically, barriers to entry were also high, so most sectors of the industry were in a position to resist structural change and thereby defend entrenched business models. Banks invested heavily in scalable systems for facilitating and processing transactions which increased efficiency in various markets (such as lending, trading, and market making). Exchanges and early payment networks were also among the first technology adopters, along with a number of other businesses in the financial ecosystem such as "post-trade" processing entities (depositories and clearinghouses), for which technology investment yielded economic benefits from improved operational efficiency or client services.

As this innovation progressed, and as increasingly complex business processes were integrated into technology infrastructures, automation generally occurred in a patchwork fashion. This was due in no small part to the paucity of accepted technology standards. Even today, for example, it is not uncommon to find multiple definitions for fundamental building blocks such as the constituents of a corporate sector or the identifier for an instrument or organization. This path of evolution was also due to gaps in technological capabilities that prevented more general integration and allowed only some components of key business process to benefit from innovation.

Technology infrastructure emerged in this inchoate fashion because, for the most part, technology was used to enhance efficiency in operations and was often simply *layered on top* of the core business processes. However, little changed *structurally* as incumbents invested in IT; while essential to their capability, IT remained peripheral to their business models. Margins remained relatively healthy, growing in some cases due to efficiency improvements. The threat of new entrants was muted in these years because the financial industry still operated in a largely moated ecosystem that required significant capital investments, regulatory remits and operational infrastructure to enter a market, and much more to establish brand.

Arguably, the widespread availability and use of Internet connectivity was the first major disruptor of business models in finance, enabling new players to address "white spaces": or new capabilities that incumbents had ignored but for which there was client demand. PayPal can be seen as one of the first of these in the retail "consumer to consumer" payments market, integrating technologies and business processes to provide a fundamentally different payment model that was easy to access and use, and that made use of innovative data analysis methods for estimating transaction risk, which allowed the firm to settle low-risk transactions before clearing them. At the time, such a practice was anathema in the payments industry where transactions typically followed a standard, well-established process of clearing and settlement that was largely insensitive to transaction size.

The larger lesson from early Internet businesses like PayPal and others such as Amazon was that value could be created, both for customers and owners, through the introduction of *platforms*, which have now become commonplace in almost all areas of commerce.

In our context, we use the term "platform" to describe an entity that

"*facilitates exchange between two or more interdependent groups, usually consumers and producers,*[3] *using a*

combination of channel access, functionality embedded in an IT system, and associated key business processes (sometimes augmented with physical assets)."[4]

Platforms have a number of important properties. They allow easy participation, exhibit *network effects* that increase in value as participation increases, and typically capture and generate huge amounts of data that enhance the value of the platform to all.[5]

Internet businesses are increasingly structured as platforms, and, in most markets, a few such platforms tend to dominate. Facebook has dominated social networking; Google controls search; Amazons is the retailing behemoth; LinkedIn is the leader in professional networking; AirB&B represents a significant number of the total rooms available for rent in the cities in which it operates. And so on. As network effects accrue, these platforms become increasing difficult to dislodge.

What platform equivalents can we observe in the financial services industry?

Arguably, exchanges are examples of the earliest platforms, even though they have traditionally been built on proprietary technology and were accessible only to members. Clearinghouses and payments systems are also instances of platforms with limited access.

As interest in FinTech increases, and questions about its future impact arise, it is natural to think of technological disruption and innovation in the financial services industry through the lens of platform formation and extension. This perspective is useful for both understanding the *historical* trajectory of progress in the industry and identifying *future* areas where new platforms may create value.

The remainder of this paper proceeds as follows: in the next section we present the characteristics of platforms in the financial industry and introduce the notion of *complete* and *incomplete platforms*. Section 3 examines the implications of platform completeness for incumbents and the potential for FinTech disruption in different sectors. Section 4 examines which business models are likely to be most attractive to potential disruptors; and the last section concludes with some open questions for future exploration.

2 FinTech platforms

We begin by revisiting our definition of a FinTech platform and unpacking its components. Prior innovation in the financial services industry tended to occur as industry participants addressed individual of these components in a bespoke manner, at a time when IT capability was relatively primitive and rapidly changing and during which clear standards had not emerged.

However, we are now at a point of technological advancement where the increasing sophistication of key technologies, enabled by software modularity, massive data processing capacity, and network connectivity, has led to the emergence of a new generation of increasingly complexity platforms. These next-generation platforms are well positioned for disruptive change.

The most durable platforms are "complete." Ignoring the physical assets of these new platforms, *complete* platforms provide *all* of the following three essential components:

- Open access,
- Functionality embedded in an IT system, and
- Implementation of standardized domain-specific business processes.

For example, Amazon provides open channel access to anyone with a networked device through Internet connectivity; has the technology required for customers to search for, analyze, and purchase products; and has embedded business processes

for payments and fulfillment. Likewise, PayPal provides open access through the Internet and its API; IT functionality for ascertaining risk and completing the transaction securely; and processing workflow for clearance and settlement. As another example, AirB&B provides open access to standardized mechanisms for people to (a) list or find rooms and pricing information, (b) book rooms and make payments, and (c) manage processes associated with their stay or rental.

Because of historical factors and regulation, platforms in finance have tended to be "incomplete" in that they lack one of more of the three essential components. Exchanges are examples of some of the earliest "members only" incomplete platforms—the Royal Exchange of London (opened in 1571),[6] and the Osaka Rice Exchange *(Dōjima kome ichiba,* 堂島米会所, established in 1697) are early instances of these.[7] Modern exchanges have replaced manual processes with machines and added process sophistication, but are still generally accessible only to members in order to minimize risk to the platform. Similarly, clearinghouses and payment platforms with limited access are incomplete.

Competition among platforms often arises from differentiation of some component. For example, electronic exchanges, the evolutionary successors to the Royal Exchange of London and the Osaka Rice Exchange, are complete platforms, allowing a much broader set of investors to trade assets such as currencies, equities, or bonds directly with each other and without human brokers. Dozens of e-exchanges have arisen in the last two decades, each designed to meet some kind of specialized need, such as the ability to transact large sizes or to provide incentives to specific types of liquidity takers or makers, and so on. Liquidnet is an example of a complete platform, well suited for institutional trading involving execution of large blocks of assets that are often illiquid. Historically these were handled through brokers to minimize market impact. Now, robots match market participants wishing to transact, without third-party intermediation. In so doing they increase liquidity at a much larger scale and with more efficiency.

Lack of open access, however, is not the only way in which a finance platform may be incomplete. Yahoo Finance, for example, is incomplete because it lacks key business processes to complete transactions. Ratings agencies are incomplete because most of their key value-adding business processes require human expertise and are not amenable to codification in IT systems.

In fact, this time, few current platforms in finance can be considered complete, in the sense that they feature all three components. Table 1 enumerates a taxonomy of business models in FinTech that achieve varying degrees of "platform-completeness." It provides examples of different combinations of the three major dimensions of complete platforms.[8]

In the table, a • indicates that a key component of the business model relies on that specific dimension, while a ✖ indicates that dimension is relatively less central to the business model.[9]

Along with each combination, we have provided a mnemonic label for the implied business model associated with that platform as well as some examples of current industry participants that use it.

The first row of the table denotes *complete platforms*, namely, those that provide some form of each of the components: open channel, IT capability, and business processes. Peer-to-peer lending, marketplaces, and robo-advisors are examples of existing platforms that do this. Lending Tree, for example, is "open," and provides the technology infrastructure and required processing for bringing together lenders and borrowers. Robo-advisors are openly accessible to

Table 1 Taxonomy of platforms and partial platforms in finance.

	Openness	Technological enablers	Special business processes/ position	Examples
Complete platforms	•	•	•	*P2P lending, electronic exchanges, Robo-advisors (e.g., Lending Tree, Liquidnet, Betterment)*
Utility partial platforms	•	•	✖	*Information aggregation platforms (e.g., Yahoo Finance, Google Finance)*
Proprietary partial platforms	✖	•	•	*Prop trading, specialized information providers, custodial services (e.g., Bridgewater, MSCI, BONY)*
Standards providers	•	✖	•	*Rating agencies (e.g., FICO, Moody's, S&P)*
Open air platforms	•	✖	✖	*Auction houses (e.g., Sotheby's)*
Proprietary technology providers	✖	•	✖	*Software vendors (e.g., SAS Institute, Numerix)*
Process providers	✖	✖	•	*Consulting firms (e.g., McKinsey, Mercer-Oliver Wyman)*

retail investors and aim to do much of what human advisors have traditionally done for—screening various classes of investments—plus more, in the form of standard analytics like portfolio optimization.

Competition among platforms often arises from differentiation of some component. For example, electronic exchanges are complete platforms. Dozens of exchanges have arisen in the last two decades, differentiating themselves by focusing on meeting some kind of specialized need, such as the ability to transact large sizes, providing incentives to specific types of liquidity takers or makers, and so on. Liquidnet's platform, for example, specializes in institutional trading involving execution of large blocks of assets. Historically these were handled through brokers to minimize market impact. Now, robots facilitate it and in so doing increase liquidity at a much larger scale and with more efficiency.

The remaining rows of Table 1 denote *incomplete platforms*. The three *simple incomplete platforms* shown are open outcry markets such as auctions, software, and IT vendors such as SAS that provide pure technology solutions, and high expertise process providers such as consulting companies.

We refer to the remaining three *compound incomplete platforms* that combine two of the three

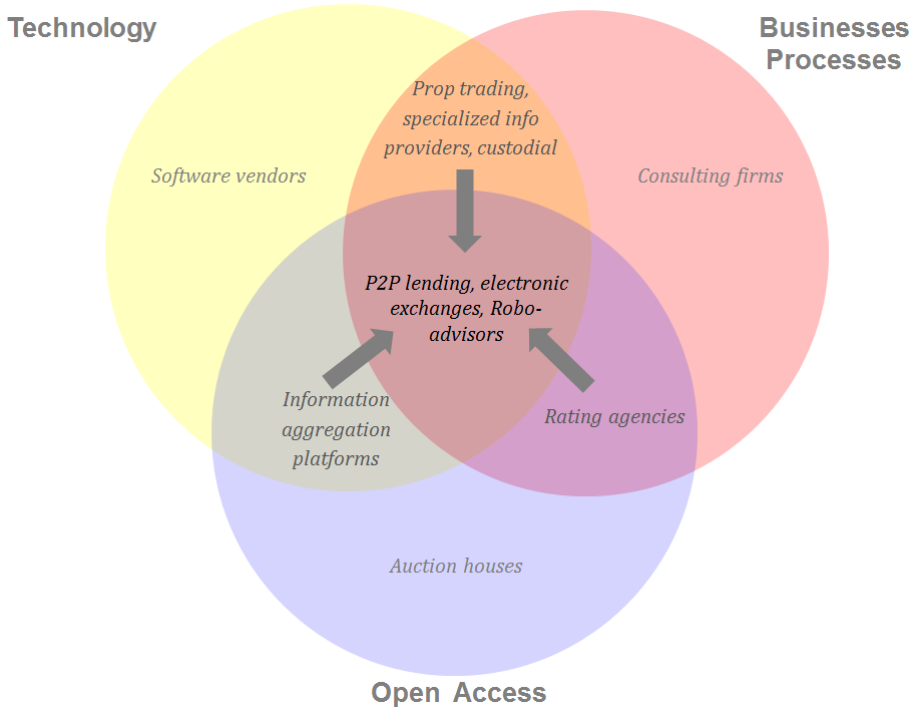

Figure 1 The three core components of a complete platform with examples of platform businesses exhibiting various levels of completeness.

dimensions as *Utility, Proprietary*, and *Standards* platforms, respectively.

- Utility platforms typically rely on key technologies and are open but do not provide a domain-specific client-facing business processes. Yahoo Finance is an example of a dominant Utility platform. It is open, and a rich information source with some analytics, but users cannot transact on the platform itself.
- Proprietary platforms rely on key technologies and business processes but access to these platforms is limited, for example, to specific types of customers. This may arise either intentionally or due to regulation. For example, investments in hedge funds and other systematic asset managers generally remain closed to retail investors, primarily because of regulation. The same applies to custodial services.
- Standards providers, such as rating agencies, rely on extensive business processes and provide open access to unconflicted advice, but tend to use technology only in the periphery, delivering much of their value through the ability to integrate consistent analytic processes across geographies and to do so in an unconflicted manner.

Figure 1 presents a visual representation of the platform components and their interactions, showing examples of where various players fall into the various intersections of IT functionality, business process, and open access.

The Venn diagram in Figure 1 provides a graphical view of our framework, which combines the three platform components. Figure 1 also provides some examples. The intersection at center defines complete platforms. All of the other regions denote incomplete ones.

The Venn diagram representation is intuitive. The businesses on the periphery of the diagram tend

to be those that play supporting roles, rather than central ones, in the lifecycle of financial transactions. The platform framework can be useful for analyzing incumbent and new entrant business models in a number of ways. To start, the framework identifies which capabilities are required for each type of platform to attain completeness.

The diagram is useful in considering the various vectors through which FinTech may affect the structure of business models in the finance industry. In the next section we describe strategies associated with the various intersections of the Venn diagram that correspond to the seven platform types in it. We also discuss possible extensions or transitions that are feasible among them.

3 FinTech strategy

The platform framework can be useful for analyzing incumbent and new entrant business models in a number of ways. For example, the framework identifies which capabilities are required for each type of platform. Conversely, it suggests which business functions are vulnerable to different types of disruptions due to their incompleteness. It also provides a way to think about transitions from partial- to complete-platforms, the implications of these, and the opportunities that would motivate such transitions. Finally, the frameworks permit us to examine new technologies in terms of the businesses they are likely to impact.

We consider two types of (non-mutually exclusive) transition strategies that new entrants and incumbents may pursue:

(1) *Platform completion strategies* in which technology enables the introduction of a missing component into a an existing incomplete platform where the missing component is of interest not only to new users but also entrenched ones, not dissimilar to the phenomenon described by Christenson as the innovator's dilemma[10]; and
(2) *Component replacement strategies* in which one or more components of a complete or incomplete platform are supplanted by a cheaper, faster, or better solution, sometimes opening up new markets and sometimes attracting new clients in existing markets through the desirability of the new solution.

3.1 Platform completion strategies

Given the potential competitive advantages that complete platforms enjoy, *platform completion* provides an intuitive path to market entry or growth. Key to this strategy, for both incumbents and innovators, is to address a missing platform component. Visually, FinTech platform completion strategies can potentially disrupt any of the incomplete platform models and can be visualized in terms of vectors from the six partial platforms to the center of Figure 1.

Consider the transition that might be achieved by completion of a Utility platform such as Yahoo Finance or Google Finance. Ignoring regulation, such platform completion could involve introducing capabilities to move these offerings toward providing investment advice, managing assets, or even acting as exchanges. Utility platforms already have both the infrastructure for data aggregation and the network externalities that accrue from being widely used and accessible. These capabilities can support new business models that complete the platform. Adding trading capability, for example, would open up new business through integration with online brokerage services or analytic models developed in collaboration with organizations that specialize in these areas. Such "one-stop-shopping" could result in more adoption of key businesses and standards and thus extend the client networks that these businesses enjoy to a broad range of

additional services supported by the complete platform. These activities, in turn, would act to extend these providers' networks.

3.2 Component replacement strategies

An equally viable strategy for innovators and incumbents is to provide cheaper, faster, or safer alternatives to legacy components in existing platforms. Consider for example, the case of custodian banks, such as BONY, that provide valuable back-office services comprising combinations of detailed business processes along with meticulous security and confidentiality. Historically, these services have required large organizations and infrastructure. However, the advent of Blockchain technologies could introduce alternative means to satisfying both of these needs, and potentially do so at much lower cost. Emerging Blockchain technology could be highly disruptive to the existing combination of manual business processes and traditional IT systems that form that backbone of clearance, settlement, and payment. Indeed, properly implemented, Blockchain could significantly reduce the need for specialized custodial institutions, as market participants would be able to exchange and record transactions themselves.

This does not necessarily mean that existing custodial or clearing incumbents will be displaced (since they may in fact themselves adopt and use the new technology and bolster their positions by leveraging other useful core processes). Indeed, if only one or a few platforms were to dominate this space, as has become the norm in other platform businesses, these incumbents could become the dominant Blockchain platform providers.

Other verification and trust-based businesses could be similarly disrupted. For example, credit bureaus such as Dun and Bradstreet may find their business models under pressure as it becomes easier for individual businesses to provide their data to business counterparties bilaterally, in a verifiable and secure fashion without the need for a trusted third party. With the advent of more widespread machine learning technology, credit scoring of these data may also become cheaper and more competitive.

Finally, some technologies may result in much lower-cost execution of expertise- or business-process-based operations. For example, businesses that rely on the curation of textual information or the distillation and interpretation of legal documents may see those business processes eroded as natural-language processing and highly contextualized search technology becomes more well developed, more widely available, and powerful enough to perform large portions of these tasks at low marginal cost.

Complete platforms may also be created, by design, *de novo*. Amazon and Paypal are early examples in retail and payments. Peer-to-peer lending and robo-advisor platforms are recent instances of complete platforms in finance. Lending Tree, for example, is "open," and provides the technology infrastructure and processing required to connect lenders and borrowers directly. Robo-advisors are openly accessible to retail investors and aim to do much of what human advisors have traditionally done—screening investments and providing standard analytics like portfolio optimization—through technology.

4 Business models in the cross-hairs

While FinTech is, by definition, a technology-driven phenomenon, it is important to note that for many incomplete but successful business models, IT is *not* critical. Many businesses that do not currently rely heavily on technology, such as consulting companies or unconflicted "standard" providers, are the *least* likely to be experience the full brunt of displacement in the near term,

since their business models are robust to a lack of technology.[11]

For example, rating agencies (a form of Standards provider) have generally relied on technology only on the periphery of their business, which is largely driven by both their market position and the extensive network of analysts and business processes they maintain across industries and geographies. But it is the broader context within which these organizations develop and deliver their credit opinions that permit them to generate the value that clients require. Repeated attempts to displace or replace rating agencies with new technologies (e.g., statistical models, market-based measures, expert systems) have generally not succeeded, both because of the complexity of the products that rating agencies provide—in the form of their ratings and rating rationale—and due to the business processes that rating agencies follow in their analysis which are designed to provide market participants with specific benefits in the form of unbiased, unconflicted analysis.

However, such business models would appear to be much more the exceptions than the rule in finance. There is a much larger set of financial services business models in which process and scope form the essential drivers of value, and thus where automation, aggregation, integration, and facilitation may provide opportunities for disruption via a combination of platform completion or component replacement.

For example, consider again the case of robo-advisors. This business model is potentially disruptive on all three fronts—platform completion through the introduction of end-to-end automated business processes, component replacement that keeps these processes compliant, low-cost and efficient, and democratization as devices and access to information become increasingly widespread. This innovation, which combines open access with low-cost analytics and front-office functionality, opens up the possibility of providing scalable advice at near constant cost. These platforms are designed to provide regulatory compliant processes and technology that brings basic portfolio management concepts and tools to an investor base that previously could not access them, and it does so at a low price point that human advisors cannot match. The IT functionality of robo-advisors is designed to manage the increasing complexity of the portfolio selection and risk management requirements of a retail marketplace that is itself offering an increasing selection of financial instruments that must be screened and assembled into more customized portfolios and managed in response to market conditions.

The robo-advisor business model appears positioned to displace segments of the wealth management marketplace where human advisors still charge substantial fees. In the current environment of fee compression for managing assets, such approaches are cheaper to administer and have much lower marginal costs than traditional human-based advisors. What makes the retail investment advisory space particularly vulnerable (or attractive depending on whether we are discussing incumbents or new entrants) is that long-only asset managers for the most part have underperformed the standard indices while continuing to charge healthy fees. Robo-advisors are able to track the indexes at lower cost. Whether such vehicles are ultimately able to deliver better performance to investors remains to be seen, but even if they do no better than the market, but do so at much lower fees than human advisors, they could gain traction.

It is also important to consider that there is tremendous scope in FinTech for process improvements in general. For example, asset managers spend considerable resources ensuring that they are compliant with changing regulatory requirements

using traditional approaches. They must confirm that any trade is allocated fairly among customers and settled correctly, a process that is still largely human. One can envision compliant software components that can be easily plugged into existing trading processes to replace humans or outdated parts, in much the same way that PayPal can be plugged into any web-based business, large or small. This would not only create a much more efficient and cost-effective function, but would also allow businesses to participate in markets without maintaining a proprietary compliance and back-office functionality. This transformation would be an example of component replacement.

As another example, consider the case of exchanges for trading financial assets. While these platforms are amongst the oldest institutions and business models in finance,[12] they have also been among the earliest to experience FinTech disruption.[13] Today's modern exchanges differentiate themselves on criteria such as liquidity for specific asset classes, execution speed, size, fees, rebates, quality, and more. Given the maturity of exchanges, innovation in this space will likely continue in the area of execution efficiency. This implies that it is reasonable to expect to see platform component replacement strategies pursed in this domain, along with the introduction of electronic exchanges for new asset classes, where demand warrants.

In the current regulatory landscape, platform completion and component replacement in FinTech seem likely to occur mostly through platform partnerships, driven by the forces of regulation and economics. Customer acquisition and regulatory compliance activities in finance can be very expensive for newcomers, making it difficult to dislodge incumbents. At the same time, incumbents tend to resist ceding access to their customers, and this aversion will likely induce them to pursue strategies centered on acquiring innovators for platform completion or component replacement while exploiting the existing levels of trust embodied in their brands.

Finally, and perhaps most significantly, even though they are not natural participants today, once market participants begin to trust the data handling and AI capabilities of the large *Internet* platforms, they could become core components of *FinTech* platforms for the same reasons that they are trusted in the social, retail, and device domains.

Indeed, partnerships between technology platforms and financial services franchises are already emerging. H&R Block's partnership with IBM's Watson in the tax arena is a recent case in retail finance. Just as H&R Block chose not to build its own version of Watson from scratch, other financial players are unlikely to choose to build Google's or Amazon's Artificial Intelligence and machine learning capabilities from scratch.

5 Concluding remarks

A core capability that cuts across the many opportunities in FinTech is the ability to collect and analyze vast amounts of data to extract actionable intelligence.[14] Robo-advising relies on data. So do peer-to-peer lending and payment systems. The intelligence that develops across these areas derives from the large swaths of data collected by these systems.

An intriguing question that follows is whether over the long run, currently dominant non-financial Internet platforms will evolve to dominate the FinTech space as they do in their current markets, due to the capabilities they have developed as Internet and online markets have matured. Internet giants such as Google, Facebook, Amazon, and Apple have tremendous market power, but more importantly, ever increasing data on people, markets, events, and social interactions from which to learn and expand. This combined with their prodigious capabilities in optimization,

machine learning, and data science create opportunities for them that could be hard for others to match.[15]

Could such business adopt one or more of the strategies we have been discussing (e.g., platform completion or component replacement) by virtue of their existing capabilities? Will centuries-old financial institutions continue in their current form, shedding less lucrative businesses due to margin compression while fortifying and expanding others? Or will companies with small or no current footprints in the financial industry, but deep expertise in building robust technology platforms, overtake them?

Regulatory constraints notwithstanding, for example, it is not difficult to imagine that many customers would be just as happy to purchase stocks and other investment instruments through Amazon as they are to purchase clothing and computers. Indeed, as of this writing, Amazon has begun offering services, in addition to its traditional retail products, through its website. Similarly, could firms such as Google, Amazon, or Facebook apply their formidable data science and operations research capabilities to portfolio search, selection, and optimization, thereby allowing users to choose a portfolio in the same manner that they choose products with the features they desire or in which they use automated mapping to find the best route home? Would access to data about purchase and search histories enable such institutions to better assess customers' investment preferences? These companies often know more about their clients than many financial institutions; might not they be able to price risk better for individual customers than traditional institutions, in the same way that PayPal did in the payments space?

While such scenarios are clearly not viable today, in part due to regulatory constraints, one can foresee a state of the world in which such services are not only viable, but also become the norm. Furthermore, were such services to evolve, they would likely not be confined only to retail consumers. Given the infrastructure and access that such firms might acquire, they could conceivably provide similar, industrial strength services to institutional investors as well, in much the same way that Amazon's powerful cloud-computing platform has now been opened up to both consumer and commercial enterprises in need of on-demand computing and storage. Clearly, in an environment in which technology is increasingly able to augment and replace activities that have traditionally been the domain of humans and institutions, and where every individual, firm, and government is effectively on the same connected network, the lines between various consumer and commercial clients and their respective service provider become more blurred.

A counter-argument to such a future unfolding is that Internet giants such as Google may have other, more central, and therefore more attractive, non-FinTech objectives to pursue. It is worth noting that to date technology platform companies have tended to focus less on building applications *within* areas such as FinTech and more on *providing platform* tools to enable third parties to build domain-specific applications. In building such tools and services on top of specific technology platforms, participating third parties join the growing and increasingly interconnected ecosystem, thus increasing its value and potential. This potential may be mitigated if such platform providers begin to ramp up fees for their services and technology (for services and data) to further monetize their platform status.[16]

The development of foundational platforms designed to potentially support all aspects of commerce and civil life can also be planned by governments.

India, for example, established the world's largest biometric-based identity system with roughly 1.1 billion individuals registered and growing as of 2016. The platform, known as Aadhaar, has rapidly become the primary method for establishing an individual's identity in real time, and it does so at virtually no cost. This capability enables other services, including financial transactions, as part of a secure set of services that are provided by a global network of providers.

Globally, the market for FinTech is huge. Hundreds of millions of people will enter the digital era in the coming decades in developing countries and will require a wide array of financial services. What we are witnessing at the moment is the emergence of platforms for providing these services. Developing economies have the opportunity to leapfrog more established industrial powers by creating a well-designed modular "technology stack" with platforms for authentication, document sharing, and access to financial services in an on-demand manner.[17] As these developing economies come online and enter the FinTech domain, they are less burdened by legacy regulation and industry structures and can thus be more agile. Not unlike other technologies such as cellular networks in emerging economies, where laggards were able to leapfrog layers of obsolete technology to achieve widespread cell phone penetration that displaced traditional land lines, these newer platforms—designed with openness and security as inherent features—could allow for processes and additional enabling technologies to be easily grafted onto them to provide complete platforms across the range of financial services.

Notes

[1] See: http://www.stern.nyu.edu/programs-admissions/full-time-mba/academics/specializations/fintech. We thank Arun Sundararajan for contributing to an earlier version of this definition.

[2] Steiner, T. D. and D. B. Teixeira (1991), *Technology and Business: Creating Value and Destroying Profits*, Dow Jones Irwin, Homewood, IL.

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[6] http://www.geekwire.com/2016/report-uber-claims-87-u-s-market-share-losses-mount-1-27b/.

[7] Moss, D. and Kintgen, E. (2010). "The Dojima Rice Market and the Origins of Futures Trading," HBR Case 9-709-044. Harvard Business School.

[8] We ignore physical assets since these are peripheral to our focus and not always present or required.

[9] We show the cells in the table in binary form (● or ✖). Of course in practice, the presence or absence of these dimensions is not generally strictly discrete in nature, but tends to vary along a continuum.

[10] Christenson, C. (1997). *The Innovator's Dilemma*, Harvard Business Review Press.

[11] Note that this does not imply that they cannot be disrupted. For example, consulting firms currently face competition for certain services as cheaper, off-shore providers are able to offer services at lower prices remotely from regions with lower cost bases.

[12] The first formally organized commodities exchange, which had regular hours and rules of trade, etc., is thought to be the Osaka rice exchange (*Dōjima kome ichiba,* 堂島米会所), which was established in 1697 and quickly evolved to include futures trading and other modern conventions. See, Moss, D. and Kintgen, E. (2010). "The Dojima Rice Market and the Origins of Futures Trading," HBR Case 9-709-044. Harvard Business School.

[13] For example, for an account of the impact on the LSE of the "Big Bang" see R. Schwartz, R. Frandoni and B. Weber (2006). *Equity Trader Course*, John Wiley & Sons.

[14] See For example, Dhar, V. and Stein, R. (1998). *Seven Methods for Transforming Corporate Data Into Business Intelligence*, Prentice Hall.

[15] This is also true for China, which has pursued a policy of shutting out the major US players from Chinese markets and creating their own versions of the Internet Giants such as Baidu, Alibaba, and others.

[16] This would be analogous to the manner in which exchanges and payment processors have increased their fees for ancillary data and services over the past 10–15 years.

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