DIGITAL PLATFORMS IN A DIGITAL ECONOMY

Jointly developed between IMDA and Platformation Labs (Sangeet Paul Choudary)

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INFOCOMM MEDIA DEVELOPMENT AUTHORITY

CONTENTS

1 Overview of the Services and Digital Economy in Singapore 3

1.1 Realising Services 4.0 4

1.2 Global National Efforts in Encouraging Platform Strategies 5

1.3 Approach for Digital Platforms in Singapore 6

2 The Platform Business Model 7

2.1 Key Success Factors for Platform Business Model 8

2.2 Three Platform Archetypes 10

2.3 Four Business Model Positions 12

3 Platform Opportunities in Traditional Industries 14

3.1 Platform Opportunities in Information-Intensive Industries 15

3.1.1 Telecommunications and Messaging 16

3.1.2 Media and Entertainment 19

3.1.3 Technology, Data and AI 23

3.2 Platform Opportunities in Services-Intensive Industries and B2C 27

3.2.1 Banking and Financial Services 28

3.2.2 Healthcare 37

3.2.3 Retail, Lifestyle and Consumer Brands 45

3.3 Platform Opportunities in Asset-Intensive Industries and B2B 50

3.3.1 Construction and Real Estate 51

3.3.2 Logistics, Trade and Maritime 58

3.3.3 Manufacturing and Supply Chain Management 64

4 Platform Opportunities for Small Companies 71

5 Challenges for the Platform Business 74

5.1 Challenges of Building Platforms 74

5.2 Challenges of Being a Producer or Consumer of Platforms 81

5.3 Challenges of Being a Capability Provider 85

6 Implications of Blockchain for Platform Businesses 86

6.1 Model 1: Permissioned Blockchains to Manage Industry Ecosystems 87

6.2 Model 2: Permissionless Blockchains to Create Alternate Platform Governance Models 89

6.3 Model 3: Shared Identity, Reputation Management and Trust for Platform Businesses 89

6.4 Model 4: Digital Infrastructure that Supports Platforms Moving to the Blockchain 90

7 Conclusion 91

1 OVERVIEW OF THE SERVICES AND DIGITAL ECONOMY IN SINGAPORE

The world is seeing a confluence of emerging technologies that are fundamentally transforming entire industries and business models. These shifts open up new possibilities for small countries like Singapore, to transcend conventional economic constraints, such as its small domestic market and geography. To seize these opportunities, Singapore needs to have a better grasp of major technology trends, understand their implications, and respond boldly and nimbly.

To this end, IMDA launched the Services and Digital Economy Technology Roadmap (SDE TRM)[1] in November 2018. This roadmap is intended to guide IMDA's industry development plans and regulatory approaches for the Infocomm and Media (ICM) sector. The document will also inform the next tranche of investments in digital technologies under the Research, Innovation and Enterprise (RIE) programme and identify new areas to digitally transform industries under the work of the Future Economy Committee.

The roadmap paints an exciting vision of the future of services – Services 4.0 – where technology lies at the heart of how services are designed and delivered. This, in turn, gives our enterprises and workforce the competitive edge in a digital economy.

Services 4.0 envisions Singapore delivering next-generation services that are end-to-end, frictionless, empathetic, and anticipatory to customer needs. Services 4.0 puts people at the centre – harnessing technology for workers to have more fulfilling work, enabling businesses to innovate nimbly to capture opportunities in a digital marketplace, and delivering superior experience to customers. The journey to Services 4.0 can be best explained below:

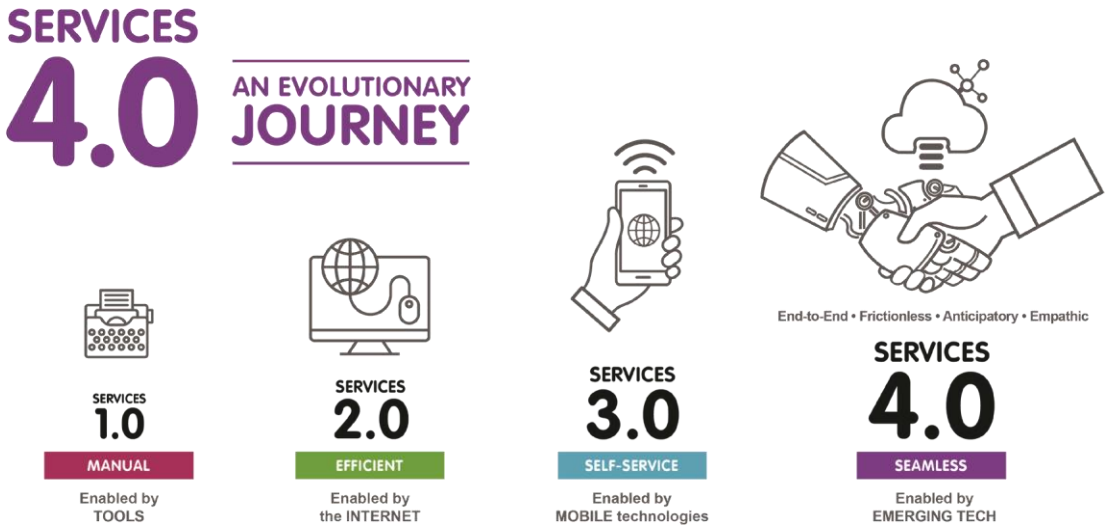

Figure 1 : Evolutionary Journey of Services

[1] "The Future of Services", IMDA, Nov 2018

1.1 Realising Services 4.0

Step 1 – Embracing Cloud Native Architecture

In order to reap the benefits from Services 4.0, companies should embrace a Cloud Native Architecture. This will provide easier access to emerging technologies that will make it more cost-effective and scalable for companies to help meet customers' or users' demands in an agile manner. Such an architecture also enables companies to embrace the "as-a-service" paradigm by offering services, software or complementary products along with the original product via microservices and Application Programming Interfaces (APIs).

Step 2 – Identifying New Business Models

The ability to deliver products as services opens up opportunities for companies to identity new business models to create that competitive edge over players that fail to make this transition. As an example, Rolls-Royce's traditional business model involved selling jet engines to airlines, and offering post-sales maintenance and parts to its customers, accounting for the bulk of its profitability. As independent servicing firms and competing jet engine manufacturers began targeting its lucrative aftermarket business, Rolls-Royce transformed its business model dramatically. Instead of selling the physical equipment, it sold the utility of the equipment in the form of flight uptime. The engine is provided to the customer, and charges are based on hourly use; the cost of services and parts to keep the engine up and running are included in the charges. Such a business model creates value for its customers, whilst keeping competitors at bay.

A services mindset can also help augment product usage. Consumer brands like Nike and Sephora augment their product offerings with connected services, which enhance the experience of product consumption. Nike's Runkeeper helps fitness enthusiasts quantify and track their activities, while Sephora's BeautyTalk and BeautyBoard help customers engage on beauty tips and share different makeup styles. These brands create a larger portfolio of connected services that enhance the usage of their core products. In both cases, the respective brands have moved from selling products only, to serving users in the context of product usage.

Step 3 – Creating Value through Digital Platforms and Ecosystems

Finally, firms that successfully migrate to the services economy will participate in an increasingly open and connected environment. Firms will open out resources for external innovation, as Google did by opening Android to partners like Samsung and to external developers. Firms will also collaborate with other firms using open APIs. Passengers on Uber can connect their Spotify account and listen to their favourite music during the ride, because of the power of APIs in this increasingly connected world, platform business models emerge as the most powerful business model.

> "Firms that want to gain competitive advantage in a services economy will need to embrace platform business models."

Today, platform businesses have become some of the most powerful businesses in the digital world. Seven of the top ten most valuable companies globally are now based on a platform business model.[2] Some of the largest platforms today – Facebook, Google, Uber, WeChat, Airbnb and Alibaba – have transformed multiple industries. A McKinsey survey in May 2019 indicated that digital platforms have become an essential part of the business landscape, and no longer the domain solely of digital natives. The survey also suggested that a successful platform play by incumbent companies can yield significant performance gains. However, incumbents are only about half as likely as digital natives to embrace platform business models.[3]

The reason why platform business models are powerful lies in positive network effects from its ecosystem of connected services, over others building single services. When competitors have achieved step 2 described above, the key differentiator for businesses would lie in step 3, where companies build a position of advantage, either by being a platform player, or by owning critical capabilities that other platforms need.

1.2 Global National Efforts in Encouraging Platform Strategies

At the national level, countries are also examining the role of digital platforms in their respective digital transformation strategies. In March 2017, the German Federal Ministry for Economic Affairs and Energy launched a white paper on digital platforms[4], acknowledging platforms as a driver of economic development. The paper also suggested the shift of the German and European economy towards a digital production and platform economy can become a driver of growth, innovation, productivity and employment. In October 2017, Finland published the national roadmap for digital platform economy, articulating the vision and roadmap for Finland.[5] In Asia, the Korean government has also indicated an expansion of investments into the platform economy, as part of efforts to attain innovative growth[6]. In Singapore, there have also been discussions about the need for Singapore to think like a platform to thrive as a digital hub.[7]

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[2] "The Platform Economy", Innovator News, Jan 2019
[3] "The Right Digital-Platform Strategy", McKinsey, May 2019
[4] "White Paper – Digital Platforms", German Federal Ministry for Economic Affairs and Energy, Mar 2017
[5] "Finland's Master Plan for Platform Economy", Platform Value Now, Nov 2017
[6] "Korea to Nurture 'Platform Economy'", Korea Times, Aug 2018
[7] "Singapore Must Think Like a Platform to Thrive as a Digital Hub", Straits Times, Feb 2018

1.3 Approach for Digital Platforms in Singapore

Acknowledging the importance of digital platforms and ecosystems in catalysing economic development, in March 2017, IMDA launched the Digital Platforms programme to catalyse the growth of digital platforms in Singapore. The technology roadmap published by IMDA also highlights digital platforms and "as-a-service" architectures as one of nine key technology trends that are making the greatest impact on the digital economy.

Digital platforms are enablers to digital transformation, and offer new ways for organisations to collaborate with their business partners and ecosystems for ideas, technologies and knowledge.

This white paper outlines the platform opportunity for Singapore, and is intended to guide business leaders in understanding how the industries they operate in are being affected by platforms. Business leaders can also learn about the opportunities enabled by adoption a platform business model and/or ecosystems strategy.

2 THE PLATFORM BUSINESS MODEL

The platform business model facilitates value-creating interactions between external producers and consumers. Companies like Facebook, Google, Amazon and Alibaba provide such platforms that mediate social and economic activity between participating parties. All parties — both producers and consumers of value — that participate on these platforms or are impacted directly or indirectly by the activity on these platforms, are part of the platform's ecosystem[8].

As an example, Facebook mediates activity between its users but also between brands and consumers, between political outfits and their followers, and between advertising firms and consumers. Alibaba mediates economic activity between buyers and sellers, with the Alibaba B2B marketplace, the TMall B2C marketplace and the Taobao C2C marketplace.

All platforms constitute three key elements:

1) A mechanism to pull producers and consumers;
2) An infrastructure and governance model that facilitates their interactions; and
3) A matchmaking facility and learning capability that matches producers and consumers in value-creating interactions and learns from their activity on the platform[9].

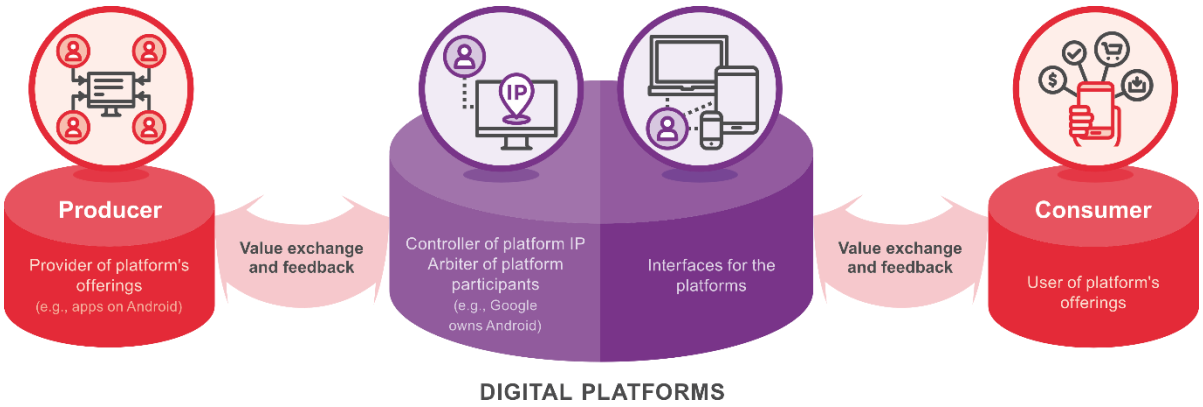

Figure 2 : Digital Platform Business Model

The goal of the platform is to facilitate these value-creating interactions and constantly scale its ability to perform all three functions described above.

In an increasingly connected world, digital platforms have established themselves as the most powerful business models. There are three factors, in particular that have driven the rise of digital platforms — connectivity, data, and the cloud. First, the rise of the mobile Internet and the

8 "Platform Revolution: How Networked Markets Are Transforming the Economy - and How to Make Them Work for You" (Chapter 1), Geoffrey G. Parker & Marshall W. Van Alstyne & Sangeet Paul Choudary, Mar 2016
9 "Three Elements of a Successful Platform Strategy", Harvard Business Review, Jan 2013

smartphone enabled a global user base to be connected to the Internet, which allows them to participate in platform ecosystems. Second, this globally connected user base creates massive quantities of content and data that help the platforms learn and improve their matchmaking ability. Finally, the rise of the cloud, both in consumer and business contexts, has allowed many workflows and business processes to be moved online, while also creating cost efficiencies that allow a greater number of businesses to come online and participate on these platforms. These three factors have worked together to strengthen platform activity.

2.1 Key Success Factors for Platform Business Model[10]

Many consumer platforms boast large user bases with hundreds of millions of users and many of them have scaled faster than any company in the industrial economy. Platforms scale rapidly because of the following four key scaling factors.

Scaling Factor 1 – Minimal Marginal Costs of Production and Distribution

Unlike traditional industrial firms that relied on supply side expansion, platforms benefit from near-zero marginal costs of production and most of these costs are often borne by ecosystem participants. For example, a traditional hotel incurs costs of construction and property management, but Airbnb passes these costs out to the hosts in its ecosystem and charges a transaction fee on all bookings made in its ecosystem of hosts and travellers without having to incur any construction and property management costs. The marginal cost of scaling production and distribution is minimal on platforms when compared to traditional industrial businesses.

Scaling Factor 2 – Network Effects

Platforms benefit from network effects where more producers coming on board attract more consumers, who, in turn, attract even more producers. This creates a virtuous cycle. Producers value access to more consumers and consumers find greater value in the platform when they have more choices in the products and services they wish to consume on the platform, which is created by a larger number of producers.

As an example, more hosts on Airbnb attract more travellers who in turn attract more hosts. More videos created on YouTube attract more viewers, which attracts even more video creators. More freelancers on a freelancing platform like UpWork attract more client activity, which in turn attracts even more freelancer participation.

[10] "Platform Scale: How an Emerging Business Model Helps Startups Build Large Empires with Minimum Investment" (Chapter 1.5), Sangeet Paul Choudary, Sep 2015

This mutually reinforcing cycle is driven both by quantity and by quality. Hence, more hosts with higher quality properties attract travellers on Airbnb, and more trustworthy travellers attract the best hosts on Airbnb.

Scaling Factor 3 – Machine Learning

A third factor that scales a platform is its ability to process massive amounts of data created by its ecosystem and learn from it. The platform gathers data from activity in its ecosystem and learns from this data, thereby improving its ability to facilitate future interactions.

As the platform gathers data, it is better able to train its learning models. These improved learning models provide more value back to the platform users, who then increase their usage, leading to the capture of even more data.

The Facebook newsfeed is one such example where the platform constantly learns from user interactions and is able to serve more relevant content to users, who in turn increase their usage of the platform.

Similarly, many fintech platforms, particularly peer-to-peer lending platforms learn from the interactions in the ecosystem of borrowers and lenders to identify the credit-worthiness of borrowers and dynamically price the loan.

Both these technologies — a social media news feed and a peer-to-peer marketplace — can be easily replicated by a competitor but the competitor would never have access to such strong learning models. This acts as a barrier to entry for new players entering the market and concentrates even more power with the platform.

Scaling Factor 4 – Virality

A fourth factor that drives rapid adoption of platforms is virality. Virality is observed when platform users attract non-platform users onto the platform. Platform users share content and messages from the platform onto external networks. As more users share content from the platform onto an external network, more non-platform users are exposed to this content and come on board the platform. These new users in turn start sharing content from the platform and the cycle scales further.

Users taking pictures on Instagram would share those pictures on Facebook and attract other users from Facebook back to Instagram. YouTube users share videos on Twitter and Facebook, which in turn attracts other users to YouTube.

Virality allows the platform to leverage its user base to acquire even more users. This reduces the user acquisition costs as the platform scales.

2.2 Three Platform Archetypes[11]

There are many different types of platforms, but all of them perform the three core functions mentioned above and consist of three key value layers:

1) A network of participating actors;
2) A plug-and-play infrastructure to enable these parties to connect and interact with each other; and
3) A data layer that helps the platform learn from the ecosystem activity and facilitate these interactions.

These three layers are represented through a visual framework - the platform stack:

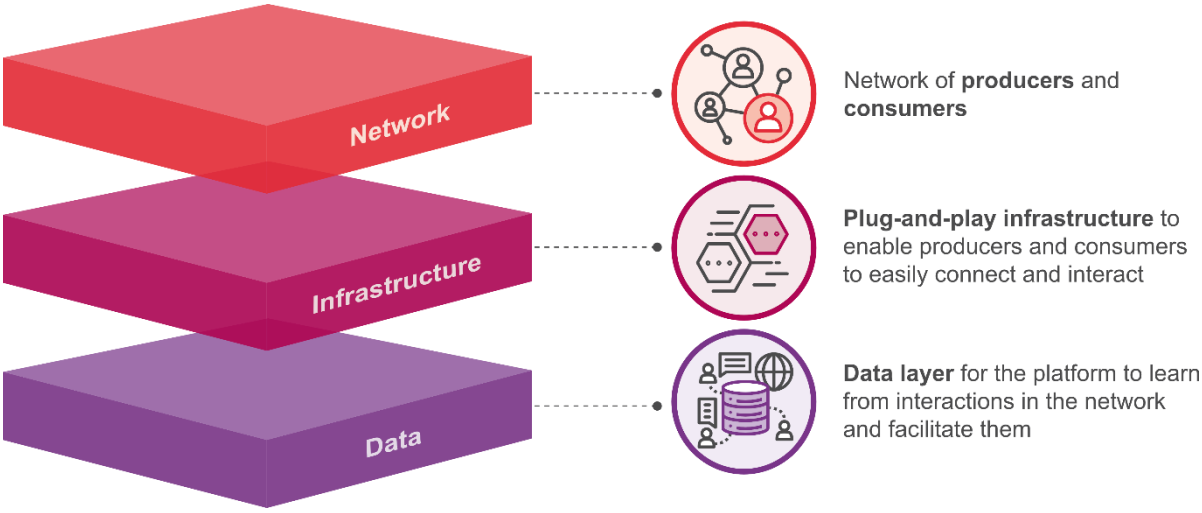

Figure 3 : Three Key Value Layers of the Platform Stack

Network Layer

The network layer comprises the various actors — producers and consumers — who participate on the platform, as well as the resources they bring to the platform. Hence, for a platform like Airbnb, the hosts and travellers are part of the network layer, as also the actual rooms provisioned by hosts to travellers through the platform. Some platforms may have a network layer that is less obvious. For example, a wearables company may allow its users to benchmark their health statistics versus other users. Even though these users are not explicitly interacting with each other, they benefit from each other's participation on the platform.

[11] "Platform Scale: How an Emerging Business Model Helps Startups Build Large Empires with Minimum Investment" (Chapter 1.4), Sangeet Paul Choudary, Sep 2015

Infrastructure Layer

The infrastructure layer comprises the tools and services and the rules of governance that the platform puts in place to facilitate and standardise interactions in its ecosystem. The infrastructure layer typically comprises a value hosting infrastructure, a value exchange infrastructure, and a payment exchange infrastructure. For example, YouTube's hosting capabilities provide the value hosting infrastructure, while UpWork's escrow capability provides a payments exchange infrastructure.

Data Layer

The data layer comprises the data captured by the platform from ecosystem activity and the learning models created using this data. Every platform uses data to learn from ecosystem activity and scale its ability to manage the ecosystem. Data is a core asset for platform businesses and a key driver of value. For example, MySpace was a social network which did not effectively use data to engage users, but Facebook's news feed leverages all the data captured by the platform to engage users further.

Any platform can be described as a combination of these various platform layers. Some platforms are more dominant on one layer versus the other. For example, marketplaces like Airbnb and Uber, as well as social media platforms like Instagram and Snapchat are dominant at the network layer. App development platforms like Android provide several tools and services to handset manufacturers and developers and are dominant at the infrastructure layer. Finally, several industrial Internet platforms like GE Predix and healthcare platforms like Philips HealthSuite are dominant at the data layer.

Platform Stack Case Study: Alibaba Group

The platform stack can also be used to understand the various components of a larger platform ecosystem comprising multiple components. For example, the Alibaba Group's platform ecosystem involves multiple initiatives at different levels. Alibaba, TMall and Taobao are network-dominant components which organise different networks of actors and their transactions. Alibaba Cloud, the digital backend infrastructure, and Cainiao, the Alibaba Group's logistics backbone, are infrastructure-dominant initiatives that extend across Alibaba, TMall, and Taobao. Finally, Alimama manages all of the Alibaba Group's data assets. We do not mention Ant Financial or Alibaba's media properties here and focus only on Alibaba's e-commerce businesses but similar platform stacks can be drawn for these other businesses as well. This example illustrates how the various components of a complex platform ecosystem work across the three layers of the platform stack.

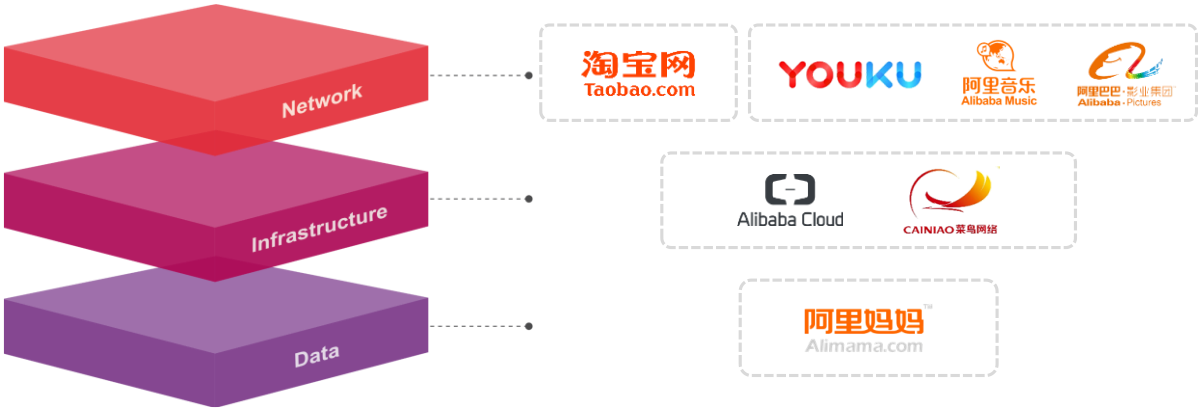

Figure 4 : Alibaba Group's Platform Stack

2.3 Four Business Model Positions

As we move towards a world of platforms, every company will need to have a strategy for the economy. Every company may not choose to be a platform but every firm will have to strategically evaluate its participation in other platforms' ecosystems and its relationship with other platforms.

Companies can take up one or more of four positions to stay competitive in this new economy.

Position 1 – Build a Platform

The strongest position is that of the platform itself. The platform's position at the centre of the ecosystem as an intermediary and orchestrator of other ecosystem participants provides it a position of leadership within that ecosystem. Companies like Facebook, Alibaba, and Airbnb have all created a position of platform leadership in their respective ecosystems.

Position 2 – Provide a Critical Capability to Other Platforms

Some companies may choose not to build platforms. Instead, they may provide critical capabilities to other platform businesses. This ensures that as these platform businesses grow, the business of the underlying capability provider also grows. If platforms represent the gold rush, these companies provide the picks and shovels for this gold rush.

Twilio is a cloud communications platform as a service company that allows applications to perform communication functions by calling its API, including making and receiving phone calls as well as sending and receiving text messages. Platforms like Airbnb, Uber, Doordash, and Ebay use Twilio to manage their programmatic communication needs.

Similarly, Plaid provides a unified banking API capability that enables consumers and businesses to authorise communications between their bank accounts and other fintech applications.

Even platform firms can provide capabilities to other platforms. Facebook Connect, Facebook's identity management capability, allows other platforms like Airbnb and UpWork to manage the sign-on experience for their users. In this way, Facebook Connect provides a critical capability to other platforms. These participating platforms benefit from the 'single sign on' value proposition and can provide easier access to Facebook users, while Facebook benefits from the additional data that these third party platforms provide.

Position 3 – Provide Supply to Other Platforms

Most companies that continue to build products and services will have to work with other platforms in order to expand the distribution of their products and services. These 'producer' companies can build a position of strength if they differentiate themselves and are able to gain reputation and influence in the platform's ecosystem. For example, a media house producing non-differentiated content on YouTube uses the platform as a distribution mechanism but does not gain scale or influence. In contrast, YouTube producers with unique content gain a huge following on the platform and are able to successfully monetise their following through brand promotions, e-commerce, and other mechanisms.

Position 4 – Consume APIs from Other Platforms and Create New Value

Finally, some companies may also consume the data flow from other platforms (through an API integration) and create new value in the form of analytics, decision support systems, or a new user experience, using this data. Social media analytics firms consume data from social media platforms and provide analytics to users.

Firms that do not actively pursue a strong position as a platform or in another platform's ecosystem may risk commoditisation in the long run. In the media industry, Facebook and Google's control over user data and engagement, and hence advertising dollars, already demonstrates how companies get commoditised in a platform's ecosystem. The telecom industry also provides examples of telcos that have ceded power to platform companies like Apple and Google which now own the key user relationships through their platform ownership.

3 PLATFORM OPPORTUNITIES IN TRADITIONAL INDUSTRIES

Platform business models are emerging across industries and their relevance is not restricted to the big tech firms only. Beyond Google, Apple, Facebook, Amazon, in the US and Alibaba and Tencent in China, every traditional company will need to have a platform strategy as well. While every company may not become a platform, every company will need to have a strategy for the economy and choose business model positions that accord it competitive advantage over its competitors.

Platform business models are becoming increasingly important across every industry[12]. Two factors primarily determine the extent to which an industry will be impacted by platform business models:

1) **Extent of digitalisation** – This refers to the extent to which the core assets, processes and user behaviours have already been digitalised in that industry. Every industry needs an initial business case for digitalisation. Platform business models can be implemented at scale only after this initial digitalisation.
2) **Degree of resistance arising from regulation** – This refers to the degree of resistance created because of regulation. Regulated industries are more resistant to the shift to platforms and often need to be deregulated before platform business models can be implemented at scale.

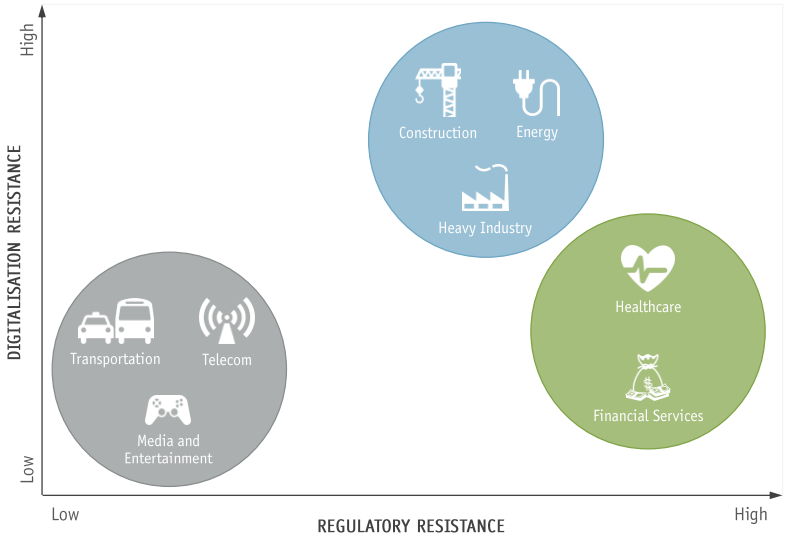

Figure 5 : Extent to Which Industry Will Be Impacted by Platform Business Models

For the purposes of this paper, we look at three (3) categories of industries that have been impacted to varying degrees by digitisation:

[12] "The Platform Business Model: Why It Works and How to Get There: An Interview with Sangeet Paul Choudary", Forbes, Nov 2016

1) **Information-intensive industries** – These industries were the earliest to be impacted by digitalisation, from the early days of the Internet, largely because the core output of the industry is information-based.
2) **Services-intensive industries and B2C** – These industries have been impacted by large-scale digitalisation since the mid-2000s, particularly driven by the rise of new reputation systems and by the digitalisation of labour through cloud-hosted workflow management. Traditionally regulated services industries, like banking and healthcare, are also moving towards platforms with deregulation.
3) **Asset-intensive industries and B2B** – These industries have been least impacted by digitalisation. However, since the early 2010s, the proliferation of sensors has led to the digitalisation of asset performance, coupled with the rise of new standards for data exchange in these industries.

3.1 Platform Opportunities in Information-Intensive Industries

Information-intensive industries create value through information-based products. These industries have been most significantly impacted by digitalisation. Digitalisation first changed the economics of distribution in this industry as digital distribution obviated the need for bundling and allowed individual information products to be transported at near-zero marginal costs. For example, the music industry moved from album sales to the sales of individual songs, starting with iTunes. Digitalisation also changed business models. Traditional software businesses commercialised their software by charging the user. However, with near-free distribution and with the ability to gather data on the cloud, cloud-hosted software businesses have embraced freemium business models where they give away software for free, something that would not have been possible in pre-digital software distribution.

In addition to restructuring the economic models for the industry, information-intensive industries have also witnessed the democratisation of production. Adobe's creative suite enables anyone to access design tools, while a host of blogging, wiki, and other publishing technologies have democratised web publishing. New software frameworks and the rise of cloud-hosted infrastructure like Amazon Web Services reduce the barriers to building technology firms. As a result, information-intensive industries have also seen widespread democratisation of production.

This two-pronged increase in both production and distribution — leading to new sources of both supply and demand — has led to the increase in importance of platform business models. Platforms effectively organise new sources of supply and create network effects leveraging low-cost distribution on the demand side. The largest platforms today – Apple, Facebook, and Google gained scale on the back of building dominant platforms in information-intensive industries. Even Amazon, which gained

scale in retail, eventually moved into technology services with Amazon Web Services and is now moving into a host of information-intensive industries including media and entertainment.

In this section, we look at three information-intensive industry groups in detail: telecommunications and messaging, media and entertainment, and technology, data and Artificial Intelligence (AI).

3.1.1 Telecommunications and Messaging

The telecommunications industry has been impacted by two waves of platform businesses.

In the early 2000s, the user relationship in the telecom value chain was largely controlled by the telco in a product distribution model. With the rise of Symbian and Java ME the control of user relationship and applications moved to handset OEMs, allowing applications to be hosted on the handset rather than in the operator/telco's network. The economics of both these models took the lion's share of revenues away from the developers.

Starting in 2007, platforms like Apple's iOS and app store and Google's Android and Play Store took over app billing and user relationship away from the telcos and handset manufacturers and moved it to the platform. Because of network effects, app stores scaled through a virtuous cycle where more applications attracted more users and more users attracted more app developers. This also improved revenue sharing in favour of developers.

Telcos were impacted by a second wave of platforms which eroded further power away from them in the value chain. Historically, telcos have invested in communications infrastructure with the hope of monetising that with the SMS and voice traffic that they subsequently facilitate. However, a range of 'over-the-top' communication platforms, in particular WhatsApp, WeChat and Skype, gained rapid adoption between 2010 and 2015 and have eroded these revenue streams by offering competing communication models for free. Most of these players have revenue models that do not charge for communication (e.g. WeChat) or are subsidised by other profitable businesses (e.g. WhatsApp by Facebook and Skype by Microsoft).

Traditional operators/telcos have been increasingly commoditised with the rise of platforms. The application platforms control the billing and user relationship while the communication platforms erode their primary revenue model.

The history so far notwithstanding, telcos can still choose profitable positions in a world of platforms, particularly as new waves of platforms come in.

3.1.1.1 Opportunities in the Platform Business Model – Platform Owners

Telecom industry insiders and observers often erroneously conclude that a telco's vast access to users positions it well to act as a marketplace for third party service providers. These arguments often miss the fact that telcos do not necessarily have deep engagement from their users, which could provide them a rich user data profile that helps them target users consistently. Like media companies, telcos may also erroneously believe that a platform merely needs access to a large user base in order to succeed. Instead, deep engagement and a rich data profile are critical to the success of a consumer platform.

Instead of looking to build platforms, telcos are better positioned to play as capability providers to other platforms.

3.1.1.2 Opportunities in the Platform Business Model – Capability Providers

The dominant opportunity for the telecom industry is to be a capability provider:

Opportunity 1 – Video Compression and Management

A first key driver for telco opportunity is the rise of video with proliferation of 4G, and possibly 5G. Data traffic for video is much higher and an important source of revenue for telcos. As the demand for video increases, technologies that allow telcos to launch video services and reduce the time to market, are likely to find greater adoption among fast moving telcos. Huawei's video-as-a-service solution is one such example of a capability for telcos to power video services.[13]

Opportunity 2 – Internet of Things and Industrial Internet

A second more important driver for the telco opportunity is the rise of the Internet of Things and the industrial Internet, and the machine-to-machine communication needs that they have. Telcos will increasingly be required to provide the sensor-network infrastructure to acquire and transfer data from connected machines and objects. Hence, telcos would be well-positioned to shift focus towards opportunities in the industrial Internet.

The industrial Internet does pose one challenge. Consumer Internet applications generate heavy data traffic and, hence, traditional telecom processes and thinking is geared towards monetising heavy data traffic originating from calls and video. The industrial Internet and machine-to-machine communication, on the other hand, creates much lower data traffic. Merely providing the sensor-network and communications infrastructure is unlikely to be a profitable position and will also be increasingly commoditised. Hence, telcos that want to succeed as capability providers will have to

[13] "Huawei Announces New Video-as-a-Service Solution", Huawei, Apr 2016

expand beyond their position as infrastructure providers and move to providing data analytics, processing, decision support and automation capabilities. This is likely to be the most attractive position for telcos.

There are several use cases for telcos to play in this space:

1) Digitalisation of Heavy Industry

   The digitisation of heavy industry is a significant opportunity. Companies like GE, Siemens, and Bosch have already invested heavily in creating the tools for the industrial Internet. With increasing digitisation, heavy industry players are moving towards creating ecosystems of connected machines and objects. These ecosystems involve heavy data traffic, better analytics and measurement of outcomes, as well as an opportunity to move towards new business models. But this shift requires an underlying sensor-network infrastructure. A telco could provide robust implementations for this infrastructure, coupled with advanced analytics capabilities.

2) Smart City Infrastructure, Services and Analytics

   Governments have historically been big customers of technology infrastructure. As more cities and governments invest towards smart cities, telcos are well-positioned to provide not just the enabling infrastructure, but in partnership with other city services, own the end to end stack across infrastructure, user-facing services and analytics.

3) Supply Chain Digitisation and Automation

   Supply chain digitisation and automation is on the rise and requires industrial communication capabilities. Unlike consumer communication, industrial communication requires higher security, privacy, uptime, and performance; all of which telcos are well-positioned to serve. To stay competitive, telcos will also have to complement this infrastructural value with data analytics and processing capabilities that power supply chain decision making.

4) Consumer Ecosystems with High M2M Communication

   While communication, e-commerce and social networking are dominated by large platforms, many other consumer ecosystems remain to be fully tapped. Physical retail provides one such opportunity. Short range networks, that power in-store and around-the-store tracking of consumers, allow retailers better information on targeting these consumers at the point of purchase. GPS tracking is not accurate enough for these use cases and this will present an opportunity for telcos not just to manage the near field communication, but also to create value from the machine data they collect and transfer.

Opportunity 3 – Identity and Access Management

Telecom firms are also well-positioned to leverage their existing strengths in consumer KYC compliance and enterprise IoT enablement to build identity and access management capabilities. These identity and access management capabilities would apply to both humans and machines, managing their authentication and access rights in smart systems like an enterprise, a smart building or a smart city, allowing administrators of such systems to make informed, risk-based decisions. In the enterprise, telcos could manage workforce identity to enforce access controls as well as machine identity, especially as machines increasingly augment the workforce.

In a world of platforms, firms will also get more customer-centric, which require them to manage customer identities in their ecosystems. This will present a significant opportunity for telcos as well as other custodians of identity, like banks, to create value-added services around identity management and extend their value proposition beyond basic compliance.

3.1.2 Media and Entertainment

The media industry was one of the first industries to be impacted by the platform business model. The Internet democratised publishing tools and allowed anybody to be a publisher. This led to an explosion of content. Ever since, content discovery has been an ever-increasing challenge for consumers.

Every generation of technology has provided its own unique solution to this challenge. In the first generation of such solutions, Yahoo built a successful business, solving this problem using human editors. Google powered the second generation of such solutions by solving this problem using indexing algorithms and introducing search behaviour. Facebook's news feed pioneered a third generation of solutions that leveraged social recommendation.

Since content discovery was the main challenge for the industry, each of these solutions attracted huge user engagement, thereby moving users and eyeballs away from the traditional media companies and the content creators to the content aggregation and discovery platforms. As a result, each of the above platforms also pulled advertising dollars away from media companies and made them increasingly dependent on these content discovery platforms. As a result, the majority of media companies have faced commoditisation and declining revenues with the rise of platforms.

3.1.2.1 Opportunities in the Platform Business Model – Platform Owners

Even as Facebook and Google have already cornered most of the advertising revenues, the media industry can still innovate in the ever-changing economy by building platforms for content publishing, discovery and monetisation.

Opportunity 1 – Divest Unprofitable Assets and Invest in Creating a Federated User Identity and Common Data Layer across the Ecosystem of Assets

Incumbent media firms need to follow a two-pronged strategy. First, they need to divest unprofitable assets that are increasingly commoditised as other platforms control distribution. Second, they need to integrate their assets and user touch points around a federated user identity and a common data layer. This integration allows the firm to deepen user engagement and insight and connect users with a range of third party solutions.

The Schibsted Media Group is one of the most successful examples of a traditional media business gaining a position of power with platform business models. As advertising revenues increasingly moved away from media companies to Facebook and Google, Schibsted consciously moved towards creating a differentiated position. While other media companies continued to prioritise content and monetisation of eyeballs, Schibsted moved away from content and increased its focus on classifieds. The two-sided nature of classifieds, connecting buyers and sellers, was Schibsted's bet in the platform business model and it grew its classifieds business through international acquisitions and joint ventures.[14][15] Meanwhile, it is regularly focused on divesting off non-performing traditional media assets.[16]

Schibsted's bigger move into platforms started around 2012, when it started investing in creating a federated user identity, linked to the user's payment information, called the SPID (Schibsted's payment ID). The SPID acquires credit card data for logged in users, allows them to make frictionless payments, and most importantly serves as the bedrock of their overall data strategy.[17] The company has increasingly integrated its overall ecosystem of services and consumer touch points using the SPID as the central digital identifier for all user actions and to uniquely identify user flows across all Schibsted digital services.

Opportunity 2 – Create a Platform to Provide Tools that Power Operations for Other Media Companies

A second opportunity for media companies is to look internally and identify the problems that are unique to the digital transformation of a media firm. If these challenges are experienced across the industry, the company can provide the tools to power operations for other media companies. As the number of other media firms using this platform increases, it can be further strengthened through

[14] "Naspers and Schibsted Call a Truce in Five Countries", AIM Group, Nov 2014
[15] "Schibsted to Spin Off International Online Classifieds in IPO", Reuters, Sep 2018
[16] "Why Schibsted, Axel Springer Are Selling, While Jeff Bezos Is Buying", INMA, Oct 2013
[17] "Data as the Foundation of Ecosystems", Schibsted Media Group

network effects by bringing on third-party providers that can create value for participating media firms. This strategy is best exemplified by the Washington Post's Arc platform.

The Arc platform contains three key components targeted at media firms: technology to improve the publishing process, digital advertising optimisation and digital subscription development.[18] The Washington Post started out by first creating this technology as a backbone for its own operations. Realising that this technology was horizontal enough to be desired by other media companies, it then opened it out as a platform that now powers the publishing, advertising, and subscription business of other media companies, while also creating an ad network across them.

In addition to providing content management and advertising optimisation tools, the platform is also moving towards creating an ad network across the range of properties that are managed with the platform. The platform also offers paywall-tech that enables media companies to run their digital subscription business.

Vox Media's Chorus[19] and Gawker's Kinja[20] are other examples of media companies that have employed a similar strategy of building technology to solve their internal problems, and subsequently licensing it out as a platform for other media companies to leverage.

Opportunity 3 – Leverage Improving AI to build a Content Aggregation and Recommendation Platform

Content aggregation and discovery platforms have historically held a position of power in the media industry, as mentioned in the opening section. With improving AI, the media and content industry is well-positioned for a new range of such platforms. China's Toutiao is one such example. Toutiao is a content aggregation and recommendation platform that provides a push solution, pushing relevant content users, based on rich data profiles created about these users, using sophisticated AI algorithms. The platform connects publishers with consumers and closely tracks consumer behaviour on the platform to curate content and serve the most relevant content to consumers.

With improvements in AI, the media industry is likely to see a new range of recommendation platforms.

3.1.2.2 Opportunities in the Platform Business Model – Capability Providers

The media industry will also need new capability providers:

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[18] "How The Washington Post is Building Its Tech Platform, Arc", Digiday, May 2018
[19] "Chorus" by Vox Media
[20] "Kinja, the Publishing System at the Heart of Gawker, Lives on Under Univision", Poynter, Jun 2017

Opportunity 1 – Media Storage and Transfer Technologies

With improving cellular connectivity, video creation and distribution is on the rise across the Internet. That rise of video drives the importance of video compression and storage technologies.

Industry players should actively scout for such technologies and offer them as a capability for other media firms. Amazon's acquisition of Elemental Technologies is one such example.[21] Elemental provides high-speed video encoding and transcoding software which powers multiscreen content delivery across different devices, and acts as a capability provider for several media firms including ESPN, Comcast, ABC and BBC.

3.1.2.3 Opportunities in the Platform Business Model – Producers

Finally, media companies can differentiate as producers in the platform economy. There are two ways in which content creators and producers create a position of strength on third party platforms.

Opportunity 1 – Create Unique and Differentiated Content

Media companies that create unique and differentiated content will continue to attract a following. However, since platforms enable distribution of the long tail of content, the most successful media companies are likely to be the ones that focus on creating niche and differentiated content. Independent journalists who create a large following by specialising in niche content also become more powerful in a world of platforms. Ezra Klein, a journalist with the Washington Post, gained a huge following by editing a niche technology blog at the media firm, called Wonkblog. By building reputation and following on third-party platforms like Twitter, Ezra Klein was able to move on and start his own media house, Vox Media.[22]

Opportunity 2 – Create a Content Distribution Model that is Custom-Built to Leverage Existing Platform Distribution

A second opportunity is the rise of media companies that will create content custom-built for distribution leveraging an existing platform.

In the early days of search engine optimisation, Demand Media created a 'content farm' that was focused on mass-producing articles and videos, based on analysis of the most popular Internet search queries.[23] The company built content based on what would be most successfully distributed through

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21 "Amazon Acquires Elemental Technologies For a Reported $500 Million in Cash", TechCrunch, Sept 2015
22 "Ezra Klein Is Officially Leaving the Washington Post", The Atlantic Monthly Group, Jan 2014
23 "Epic Fail: The Rise and Fall of Demand Media", Variety Media, Dec 2013

Google. However, Google's Panda update to its search algorithm made several changes that de-prioritised results from sites that produced a lot of 'junk' content.

Companies like Buzzfeed and Upworthy similarly create content that is likely to spread on social networks like Facebook. Similar to Google's response to Demand Media, Facebook updated its algorithm to de-prioritise content from sites like Buzzfeed.[24]

Both these examples demonstrate that while content creators can arbitrage a platform's distribution, such opportunities, even if they lead to rapid growth, are unlikely to be sustainable and make the company heavily dependent on the underlying platform for distribution, and hence susceptible to any policy changes by the platform.

3.1.3 Technology, Data and AI

In the platform business model, every industry will need to use digital technologies. With that acknowledged, we still view the technology industry in its own right as an industry whose principal output is technology. A fintech may use technology, but its principal output is a financial service. Similarly, a healthtech firm may use technology, but its principal output is a healthcare service.

The technology, data and intelligence industry is an information-intensive industry as well. In the platform business model, this industry takes on a whole new role of providing capabilities for all other industries to participate in the economy. As a result, we specifically focus on the roles that technology companies – with a particular emphasis on data analytics, machine learning, and artificial intelligence – can play as capability providers in the platform business model. With the rapid pace of innovation in these industries, we specifically focus on capabilities that are likely to be increasingly important going forward rather than those that have played an important role in the past.

3.1.3.1 Opportunities in the Platform Business Model – Capability Providers

In the future, every industry will need to use digital technologies. With that acknowledged, we still view the technology industry in its own right as an industry whose principal output is technology. A fintech may use technology, but its principal output is a financial service. Similarly, a healthtech firm may use technology, but its principal output is a healthcare service.

The technology, data and intelligence industry is an information-intensive industry as well. We specifically focus on the roles that technology companies — with a particular emphasis on data analytics, machine learning, and artificial intelligence — can play as capability providers to other firms that are looking to build platforms. With the rapid pace of innovation in these industries, we

[24] "Facebook is Trying to Prove It's Not a Media Company by Dropping the Guillotine on a Bunch of Media Companies", Insider, Jan 2018

specifically focus on capabilities that are likely to be increasingly important going forward rather than those that have played an important role in the past.

Opportunity 1 – Analytics and Data Processing Capabilities

Firms that build platforms or even partner with platforms will amass massive amounts of data either directly from users or through data partnerships.

As traditional firms move to platforms, they need to improve their ability to acquire, process and leverage data into their business models. Several technology firms provide key capabilities to manage this data lifecycle and enable these firms to better transform towards platform business models.

There are three key challenges that enterprises looking to build or participate on platforms face from a data-readiness perspective.

First, they need help with digitising data that may currently exist in analogue form. A whole range of solutions, ranging from optical character recognition (OCR) to manual data entry have been used to address this challenge. With improvements in deep learning as well as the ability to leverage crowds to train data, new solutions are being developed that may serve as critical capabilities to scale such digitalisation. For instance, Captricity uses crowd-guided deep learning to digitise paper documents, faxes, emails and web forms, eliminating the need for manual data entry.

Second, most firms have digitised data sets that are not analysis-ready. Trifacta is a key capability provider for many large firms looking to process and analyse their data. It processes raw, complex data into clean and structured data sets, ready for analysis. Moreover, it tracks how data sets are being used by users and learns from these inputs to scale data management across large data sets.

Finally, traditional firms struggle with managing data across their organisational silos. Maana provides advanced analytics capabilities that organise data across an enterprise into a knowledge graph, data analysis across multiple silos simultaneously. It enables internal experts across the organisation to model and digitalise their knowledge and enriches and trains these models with data from across organisational silos, to better manage the entire knowledge and IP of the organisation.

Tamr is another key capability provider that integrates and processes data across an enterprise and its environment, allowing firms to better move towards internal collaboration and eventual ecosystem management. It combines machine learning algorithms with human insight to model key relationships across silo-ed data.

Similarly, Insight Engines leverages natural language processing to process unstructured data and communications across organisational silos. Its natural language search assistant enables analysts to rapidly query data and gain insights to identify enterprise security risks.

Opportunity 2 – Providers of Training Data

Moving beyond the data life-cycle, firms that look to apply AI and machine learning in their business models will need additional training data sets beyond the ones they directly acquire. Training data providers will play a critical role as capability providers.

Mighty AI provides training data to companies looking to build computer vision models for autonomous vehicles. Similarly, Figure Eight helps firms create high quality customised training data for their machine learning projects and helps digitalise workflows to support use cases ranging from self-driving vehicles to medical image labelling and CRM data enhancement.

Training data providers that leverage deep learning to learn from their data sets and improve over time will have a competitive edge and avoid the risks of commoditisation of the data sets in the long run.

Opportunity 3 – Natural Language Processing and Generation

Many interactions on platform-enabled ecosystems do not involve structured data. More likely, they involve conversations and exchanges in natural language. Natural language and text processing capabilities will play an important role for platforms to process these data sets and generate insights.

Kyndi structures natural language for computer processing at scale. It tokenises text and identifies sentence construction and syntax as well as name-entity relationships. Its solution also calculates semantic distances between words to determine correlation between entities. It then leverages domain-specific ontologies to determine the meaning of a document.

Natural language processing will also involve the generation of natural language. Narrative Science is one of the leading firms providing such capabilities using Quill, its Advanced natural language generation capability that learns and writes like a human and converts data into narratives and conversations.

Opportunity 4 – Vision and Associated Capabilities

Vision will be an important data acquisition interface for platforms. As an interface, vision powers a whole range of use cases from autonomous driving, a key component of future logistics platforms, to facial recognition, an important mechanism for identity verification.

China-based SenseTime is one of the leading players globally in developing computer vision capabilities. SenseTime is one of the five national AI platforms in China (along with Baidu, Alibaba Cloud, Tencent, and iFLYTEK) is appointed by the Ministry of Science and Technology. The company provides text, vehicle, and face recognition for industries ranging from mobility to financial services

and security. In 2018, SenseTime signed an MoU with three leading Singaporean organisations – NTU Singapore, National Supercomputing Centre of Singapore (NSCC), and Singtel – to collaborate on advancing AI research in the region.

Megvii,[25] another China-based AI firm, is the creator of Face++ that provides a suite of cloud-hosted vision APIs, allowing developers to incorporate these vision capabilities in their applications. Much like SenseTime, Megvii also started expanding into South-East Asia in 2018[26] and is likely to play an important role as a vision capability provider in the region.

Alongside China, the US also boasts several leading computer vision firms. AEYE provides vision hardware, software and algorithms which power vision for autonomous vehicles.

Most computer vision currently relies on supervised learning, which require image tagging, a human-intensive process. Vision firms are working on moving away from this bottleneck associated with supervised learning. Tractable is one such company working on automating visual recognition tasks and removing the dependence on manual tagging.

Computer vision also helps to power autonomy, a capability that will play a significant role in the shift of logistics and mobility to platform-based models. Autonomy, however, is multi-sensory and requires more complex modelling of the environment. Drive.ai, a US-based start-up that counts Grab among its key investors, creates the capabilities required for self-driving mobility solutions.

Identity management and verification will be a critical capability for platforms and many technology firms are working on being the capability provider for such use cases. Vision firms like SenseTime and Megvii are already making important strides in this direction with their facial recognition technology. Firms like Onfido and Socure validate identity information with facial biometrics and apply machine learning to process data across multiple sources to verify identities in real-time.

Opportunity 5 – Voice and Intelligent Assistants

Voice is rapidly emerging as an important interface. Some of the most significant steps in consumer deployment of this technology have been taken by the giant platform firms Google, Amazon, Apple, and Microsoft. But there are a host of other capability providers seeking to play a bigger role across platforms.

AI-powered assistants will play an increasingly important role, not just as a new engaging customer interface, but as an alternate workflow management tool that learns from the conversations and

[25] "Inside the Creepy and Impressive Startup Funded by the Chinese Government that is Developing AI that Can Recognize Anyone, Anywhere", Business Insider, Jul 2018
[26] "Chinese Facial Recognition Start-up Megvii Makes Push into Southeast Asia", South China Morning Post, Jun 2018

workflows to create learning models for key workflows in an industry. For example, in B2B sales, Conversica's AI-powered sales assistant manages the sales pipeline by engaging, qualifying and scheduling follow-ups in human-like conversations.

AI-powered assistants that take over a workflow will create an important control point with their learning models based on intermediating that workflow across organisations and contexts.

Opportunity 6 – AI-Enablement of Machines and Assets

With the deployment of sensors and machine-to-machine communication, connected assets and machines have emerged as an important component of any platform business model in more asset-intensive industries. Even in services industries, connected machines be AI-enabled, thereby augmenting skills of the service providers who interface with these machines.

Brain Corp creates algorithms that model the nervous system's sensory and motor capabilities to create AI-powered solutions for visual sensing, motor control, and autonomy. Brain Corp's BrainOS transforms existing machines into intelligent self-driving robots.

Similarly, Neurala creates capabilities for machines and devices to be more intelligent and autonomous. The technology can be deployed across a fleet of robots, drones, consumer electronics and self-driving cars to create alternate mobility and logistics solutions. Like the BrainOS, the Neurala Intelligence Engine (NIE) models the human brain and uses a variety of sensory interfaces to capture and process data, and make intelligent decisions.

3.2 Platform Opportunities in Services-Intensive Industries and B2C

As consumers spend more time online, they create a data trail, which has served as the core for many consumer industries moving towards platform business models. B2C and services-intensive industries follow a common template in transitioning to platform business models. They start by gathering consumer data and providing some value back to the consumer in exchange for that data. Once they have enough data and sufficiently engage a large consumer base, they bring third party producers on board looking to serve these consumers.

Among services-intensive industries, banking and healthcare have been particularly resistant to platform models because of regulation. However, since the mid-2010s, deregulation of these two industries is driving the rise of platform business models across these industries as well.

In these two industries, in particular, we also see the rise of mega-platforms that span multiple use cases and sectors, much like the rise of Facebook and Google in information-intensive industries.

Services-intensive industries also rely on reputation systems to ensure the provisioning of high quality services to end consumers. Most of these industries leverage a combination of explicit consumer feedback in the form of ratings, as well as implicit signals derived from usage data to determine the quality of services in the ecosystem.

In this section, we look at three services-intensive industry groups in detail: healthcare, banking and financial services, and retail, consumer brands, and lifestyle.

3.2.1 Banking and Financial Services

The banking industry has been heavily regulated traditionally. However, the financial services value chain is increasingly being impacted by platform business models, owing to three key shifts underway:

1) Shift to Open Banking

   While traditionally heavily regulated, the banking industry is going through massive regulatory shifts. In a bid to increase competition and reduce the traditional opacity in the industry, regulators have been working since 2008 to restrict product bundling. However, the most important regulatory shift is the shift towards open banking, most notably with PSD2 in Europe and with similar open banking directives in the UK and in Australia. Open banking is also taking hold more organically in the US as the heavily fragmented industry in the US works towards greater interoperability. Closer home in Singapore, the Monetary Authority of Singapore (MAS) has been actively encouraging banks to adopt APIs to enable greater innovation and interoperability. These shifts towards open banking require that banking services be consumable and distributable as APIs, and that banking data be accessible to third parties. This shift towards open banking is the single biggest driver moving financial services towards a platform business model. However, this central driver is also complemented by two other shifts.

2) Unbundling of Financial Services Distribution from Manufacturing

   Traditional financial services institutions managed both the manufacturing and distribution of financial services. However, customer loyalty to financial institutions has been gradually decreasing since the rise of the Internet, first with the rise of direct banks and direct insurance, and then with the rise of aggregators that reduced search costs for consumers by providing them all competing services in one place. These aggregators were not exactly platform business models as they did not retain the consumer or the consumer's data to power the ecosystem. But starting with these aggregators, the distribution of financial services has been increasingly decoupled from the manufacturing of these services. While banks continue to own the balance sheet and power financial products, profit pools have shifted to the players that manage distribution and particularly the ones that own the customer relationship

and customer data. E-commerce players like Amazon as well as social networks like Facebook have the primacy of customer relationship. Banks are increasingly losing access to customers as people switch to non-banking channels to access financial products in other contexts. As banking services move to APIs and become increasingly distributable, this trend is expected to accelerate further. As a result, banks risk losing brand awareness and becoming invisible as consumers' access financial services on other channels without necessarily interacting with the bank's brand.

3) Shift from Serving Secondary Demand to Serving Primary Demand

   With the unbundling of distribution from manufacturing, companies that capture user data and control user engagement are the ones best placed to recommend banking services to users, even if they are not banks themselves. In general, these companies participate in the primary demand while banks serve the secondary demand. For example, the purchase of a home is a user's primary demand that drives the secondary demand for a mortgage. Banks often classify this shift as a shift from banking to 'beyond banking' activities. However, the shift is more strategic than merely an expansion in the activities of the bank. Companies that understand the user's primary demand will be better placed to recommend related banking products that arise as secondary demand. More importantly, these companies will also be best positioned to build larger platform-enabled ecosystems that serve the user across both the primary and the secondary demand.

These three shifts are working together to move the banking industry towards the platform business model. It is also important to bear in mind that the financial services industry has always been an information intensive industry, building their business around the strength of their risk scoring models. To continue to protect their traditional business in the economy, banks will have to innovate on data acquisition and processing in order to build the most accurate risk models. Banks that actively explore platform opportunities will also benefit from creating new data flows from their users, which help them understand their user base better and help them improve their core competency around risk scoring.

As open banking gains greater ground across geographies, the traditionally regulated financial services value chain will open up to allow new business model positions allowing platform firms to capture greater profits without even needing to own a banking license. Banks that do not actively pursue these opportunities through a platform strategy or through building capabilities will either need to differentiate themselves as producers or risk commoditisation and dependence on a few large platforms.

3.2.1.1 Opportunities in the Platform Business Model – Platform Owners

As financial services get distributed as APIs and manufacturing gets unbundled from distribution, a host of platform opportunities emerge for both traditional and non-traditional players in the banking and financial services industry:

Opportunity 1 – Primary Demand Ecosystems around Insurance

Traditionally, insurance firms capture data as a one-time event, using it to determine customers' risk profiles and premiums. Moving forward, insurance firms are adopting connected technologies to offer personalised and dynamic insurance premiums. More importantly, the data flow from these connected devices and services serves as the core around which these insurance firms can create larger platform enabled ecosystems.

The starting point for building these platform opportunities is to create a dynamic data flow from the insured user to the platform. For example, insurers, like Progressive and Insure The Box retrofit cars with data-capturing sensors. Other insurers are looking to partner with auto manufacturers. These data flows from users allow insurance firms to offer personalised premiums but can also inform product innovation. In the UK, Bought By Many, an insurtech firm brings on board users with special insurance needs – e.g. a rare illness – and informs insurers on creating new insurance products for these segments where these users can be served at scale.

Starting with personalised premiums as an initial incentive to get users on board, insurance firms can now create larger ecosystems by bringing third parties on board to serve these users. With real-time data captured on a user's behaviour, for example, on their wellness or driving habits, insurance firms can build platforms that serve value-added services from third parties to these users. An auto insurer could build a platform that provides value added services from driving schools, auto repair centres, auto parts manufacturers, and so on, In the U.K., Marmalade Insurance targets young drivers by setting up a black box behind the car dashboard, and using the data captured to provide personalised feedback to improve their driving habits. Similarly, health insurer could build a platform that connects patients with wellness and care services. Ping An Good Doctor is one of the most successful insurance ecosystems which mediates doctor-patient interactions, and also uses AI to augment doctors who consult patients on the platform.

As with all consumer platforms, ownership of consumer data creates the competitive edge. Insurers moving down this path will also need new organisational skills and will have to shift focus from risk assessment and claims management to service innovation.

Opportunity 2 – Primary Demand Ecosystems around Lending and Payments (Beyond Banking Ecosystems)

In a similar vein to the platform opportunity for insurance firms, banks can also move from serving the secondary demand around a loan or mortgage or payments provisioning to serving the primary demand.

Strategically, the shift to focus on primary ecosystems is important from the bank's perspective. The bank's traditional lending business is increasingly commoditised and with distribution getting unbundled from manufacturing, the players that can best distribute loans by serving the user's primary home buying or car buying will have greater negotiation and differentiation power than the banks that provision these loans. Hence, banks will need to move closer to the primary demand to protect and strengthen their lending business. But in doing so, they can also unlock new revenue streams by monetising interactions in the home buying or car buying journey.

In Singapore, this shift to participating in the primary demand is further encouraged from a regulatory perspective as the Monetary Authority of Singapore (MAS) allows banks to participate in the operation of digital platforms that serve primary demand, as long as such activities are related to the bank's core financial business.

Some banks choose to participate directly in these primary demand ecosystems by building their own platforms. For example, Danske Bank[27] allows users to find houses and also check what they can afford. In Singapore, DBS has launched a similar platform[28] connecting sellers and buyers, and providing a home financial planner for first-time home buyers who can determine which homes they can afford based on their monthly cash flow. The platform also manages end-to-end paperless transactions. Beyond the home-buying phase itself, the platform also aims to serve the user once they move into the home by bringing together service providers who can serve the homeowner's needs. Capital One, in the US, has similarly created a digital platform[29] to facilitate the user's car buying journey, while also providing a car loan to users who are ready to transact.

Ownership of consumer data and understanding primary demand patterns will again serve as the key competitive advantage for banks moving in this direction.

Opportunity 3 – Alternate Financial Ecosystems

The platform business model allows the creation of entirely new market interactions. In financial services, traditional banks do not support market interactions between high risk participants. But

[27] "Sunday" by Danske Bank
[28] "DBS Marketplace" by DBS Bank
[29] "Auto Navigator" by Capital One

with greater data available, emerging platform businesses can facilitate entirely new financial ecosystems which banks have traditionally been unable to serve. These platforms achieve this by using alternate sources of data.

Peer lending platforms, like CreditEase in China and LendingClub in the US, are examples of such platforms. In addition to analysing traditional sources of data while determining a borrower's ability to repay a loan, they also look at data sources that a bank may never look at, including the online rating of a restaurant that is borrowing or the length of time a borrower has used the same email address, as signals for potentially fraudulent requests. Additionally, these platforms can also determine correlation patterns gathered from actual usage data to determine the ability of a borrower to repay loans. For example, some peer lending platforms have a slider allowing the borrower to decide what loan amount they would like to take. A whitepaper[30] by Foundation Capital on the state of peer lending states that the longer a borrower spends moving the slider up and down (and hence, potentially, debating their ability to return the loan), the more likely they are to return the loan. Such correlations help platforms improve their ability to better manage risk and serve clients that would be deemed high-risk using traditional risk scoring models.

As traditional banks seek to pursue a platform strategy, they need to actively identify such data sources to strengthen their risk models. With lending platforms gathering more data, the manual effort required to underwrite loans falls as algorithms scale the underwriting process. Also, with better data, the platform improves its ability to predict high quality borrowers, and hence, reduces risk. With lower risk, the platform is also able to offer loans at lower rates, thereby attracting even more users and more data. This creates a virtuous cycle that strengthens the platform's business model over time.

Opportunity 4 – Banking-as-a-Service (BaaS) Platform

The future banking landscape will see banks increasingly supplying their financial products and capabilities as banking-as-a-service (BAAS) APIs and non-banking players provisioning these services to customers. As more banks provision APIs and more of these APIs get served to customers in non-banking contexts, platforms will be required to manage the aggregation and provisioning of banking-as-a-service (BAAS) APIs from multiple banks. A BAAS platform aggregates BAAS APIs from various financial institutions, provides the core banking system and the KYC/AML capabilities required to consume these services, and gets the demand side on board to access these services.

In the US, The Bancorp and CBW were the first to pursue this strategy while BBVA in Spain is a traditional bank creating a BAAS platform. SolarisBank provides a BAAS platform and supplements its

[30] "A Trillion Dollar Market by the People, for the People", Foundation Capital, Aug 2016

API aggregation capabilities with credit scoring capabilities to create more attractive IP for other companies to access. It has also partnered with Mastercard to use its payments infrastructure to develop new IP that can be licensed as services. In Singapore, BAAS is following a similar strategy to provision its platform across countries.

Opportunity 5 – Financial Profile Aggregators

Another platform opportunity that banks could consider pursuing is that of a financial profile aggregator, which aggregates data from a user's different financial accounts and creates a single financial profile for the user. In addition to providing analytics for the user, the platform also serves offers from third parties — both financial and non-financial — that are targeted to the user based on their specific data profile. This model was pioneered by mint.com in the US, but has since been implemented in many other geographies. The more fragmented the banking landscape and the more financial relationships the average user has, the more likely is this model to create value for the user.

It is important to bear in mind, however, that one of the key competitive advantages for such businesses lay in the proprietary screen-scraping technologies and the investment required to gather data from multiple financial services accounts. With the shift to open banking, the barriers to entry to such businesses may fall. In order to continue being differentiable and competitive, these businesses will have to move to gathering additional sources of data beyond merely that available from the financial accounts.

Opportunity 6 – Trade Platforms

Banks with a strong trade finance practice should also seek to improve their capabilities to finance trade. In order to participate more effectively in trade finance, several leading banks have formed consortia to collaborate around the usage of a common blockchain or DLT (distributed ledger technology) enabled trade infrastructure. These collaborative initiatives serve to digitalise the events and documents along the shipment lifecycle, which in turn, provides the data needed by the bank to create superior risk models to finance trade activity. As trade becomes increasingly digitalised, banks will need to move from providing only the trade finance to moving into the primary ecosystem and participating in actual trade facilitation.

3.2.1.2 Opportunities in the Platform Business Model – Banking Mega-Platforms

Many large platforms in the financial services space follow not just one but a combination of the above opportunities to create a larger platform strategy.

Ping An operates in several primary ecosystems including healthcare — as Ping An Good Doctor, auto and real estate. It also manages LuFax, the largest marketplace for financial products in China. It

supplements these platform opportunities with Total One Account, its identity management capability, and Ping An Cloud, the financial cloud that it serves to partner banks.

Ant Financial, similarly, started with Alipay, its payments service, as an entry point into the financial services ecosystem but has used the volume of payments activity in Alipay to branch into other platform opportunities. Its reputation scoring capability, Sesame Credit, derived from the payments data from Alipay, provides a reputation scoring capability to other ecosystems, even beyond financial services. Ant Financial also uses its access to data to create new capabilities, including an AI-enabled loss adjusting assessment for car insurance, based on claim data and computer vision. It also uses biometrics-enabled identity management to authenticate policy holders. Similar to Ping An, Ant also powers the financial cloud or provides specific technology capabilities for traditional players like Bank of Nanjing and Huaxia Bank. Additionally, using the cash in Alipay wallets, Ant moved into creating a digital money market fund, which rapidly became the largest money market fund in the world. Finally, Ant also provides micro-credit loans (Ant micro-loan) to small businesses in China, which traditional banks find difficult to underwrite, and uses Sesame Credit to similarly provide a consumer credit loan service (JieBei).

3.2.1.3 Opportunities in the Platform Business Model – Capability Providers

Opportunity 1 – API-Enablement and Financial Cloud Capabilities

As banks move to digitalise their operations, some companies — both technology firms and other financial services firms — are actively creating the necessary digital financial infrastructure capabilities that will help these banks provision their services as APIs.

Plaid is a technology firm that powers the connectivity between banks and third party applications in the US. Tink, another European start-up, creates similar capabilities for banks looking to move towards platforms.

Some players move beyond providing individual capabilities to powering the entire digital operations of a bank by provisioning a 'financial cloud'. Ping An's Ping An Cloud aims to transform banking operations by providing the technological capabilities to digitalise banking operations while allowing partner banks to focus on balance sheet management.[31]

Opportunity 2 – Balance Sheet Management Capabilities

While banks acting as financial cloud providers allow partner banks to manage their own balance sheet while powering digitalisation of banking operations, some banks can choose to provide the

[31] "Chinese Insurance Giant Ping An Launches Cloud Service Aimed at Banks, Hospitals", South China Morning Post, Oct 2018

complementary capability by focusing on managing the balance sheet and allowing partners to serve customers. These backend balance sheet managers will lend to other banks and companies that own the customer relationship. China Industrial Bank, for example, helps smaller banks in China manage their balance sheet. These smaller banks do not have the balance sheet scale to competitively price their products. By aggregating capital across partner banks, the backend balance sheet operator creates scale advantages that enable it to price products most competitively.

Opportunity 3 – Identity Management

Regulation has required banks to traditionally be the custodians of consumer identity. Banks can extend their KYC capabilities to create identity management capabilities.

Identity management is a key capability in the platform business model, as evidenced by the proliferation of Facebook Connect. A whole range of sharing economy start-ups mushroomed around the opening of Facebook Connect.

Banks can play a similar role by providing identity management capabilities for high-risk transactions on third party platforms. In China, Ping An has invested in creating identity management capabilities which it now uses not only to manage interactions in its own ecosystem but also provisions at a service to other platforms.

Opportunity 4 – Risk Modelling and Reputation Scoring

In their traditional business, banks have invested in creating risk-scoring models that allow them to manage their lending business. These risk models can now serve as a starting point to creating larger reputation scoring models that can be used by other platforms.

Reputation scoring is a key driver of value, as evidenced by the rise of companies like TripAdvisor and Yelp, that use consumer feedback to create reputation scores for businesses. Banks can similarly manage reputation scoring for both consumers and businesses by leveraging diverse data sets.

Ant Financial's Sesame Credit provides such reputation scoring capability, leveraging data from Alipay and from activities in the Alibaba ecosystem, which is now used by third parties across a range of ecosystems,[32] including immigration systems of foreign countries.[33]

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[32] "The Complicated Truth About China's Social Credit System", WIRED, Jan 2019

[33] "Ottawa Opens Door to China's Sesame Credit for Visa Seekers' Credit Scores", The Globe and Mail, Dec 2018

3.2.1.4 Opportunities in the Platform Business Model – Producers

Opportunity 1 – New Banking Bundles

As banking services become more distributable as APIs, some firms are working on creating alternate banking experiences powered by traditional banking products. Simple is one such example of an alternate banking experience which bundles traditional banking products into a new user experience. To enable this, Simple bundles the payments capability of Visa and Venmo, with the ATM network of Allpoint, and deposit savings products from Bankcorp and CBW to create a new banking bundle. These players, while not platforms themselves, create competitive advantage by building a superior user experience and service without having to manage the cost of balance sheet management.

Opportunity 2 – Partner to Target a New User Base

Traditional banks can also look to partner with platforms to access a new user base that may not directly interact with the bank. For example, the insurance firm CIC partnered with M-Pesa to launch micro-insurance products to target the unbanked population. The partnership allows the insurer to accept payments and manage claims payout using the user's M-Pesa balance. Similarly, Citibank has partnered with PayPal to any believer in deductibility between the usage of Citibank cards and PayPal's payment system. PayPal customers can use PayPal for in-store purchases across the bank's merchant network, while Citi customers can redeem their credit card rewards points with PayPal merchants.

Opportunity 3 – Better Balance Sheet Management

Traditional banks can also work with emerging fintech platforms to improve their balance sheet management. As an example, Union Club, a U.S. regional bank partnered with Lending Club, a P2P lending platform, to buy personal loans through the platform and to co-create new credit products. This allows Union Bank to better serve its high-risk customer segments while also benefiting from higher interest.

Opportunity 4 – Differentiated Niche Banking

As customers move to digital channels and engage less with traditional banking channels, banks can continue to differentiate themselves even as producers by focusing on a specific product category or a new service delivery model. These banks will consciously stay away from building platforms and may lose out on the upside but will protect their margins by focusing on specific business lines. Banks like DBS and Airbank have experimented with a digital bank while others are working on differentiating the user experience by experimenting with virtual assistants and chatbots to serve customers.

3.2.2 Healthcare

The healthcare industry has been highly regulated traditionally. However, three key forces are driving the rise of platforms in healthcare:

1) Digitised Patient Data

   While traditionally heavily regulated, the banking industry is going through massive regulatory shifts. In a bid to increase competition and reduce the traditional opacity in the industry, regulators have been working since 2008 to restrict product bundling. However, the most important regulatory shift is the shift towards open banking, most notably with PSD2 in Europe and with similar open banking directives in the UK and in Australia. Open banking is also taking hold more organically in the US as the heavily fragmented industry in the US works towards greater interoperability. Closer home in Singapore, the Monetary Authority of Singapore (MAS) has been actively encouraging banks to adopt APIs to enable greater innovation and interoperability. These shifts towards open banking require that banking services be consumable and distributable as APIs and that banking data be accessible to third parties. This shift towards open banking is the single biggest driver moving financial services towards a platform business model. However, this central driver is also complemented by two other shifts.

2) Digitalise Provider Workflows

   Firms across the healthcare value chain have invested in moving their workflows to the cloud. This move, initially driven by cost savings, has served to digitalise processes and workflows of healthcare firms. As more processes move to the cloud, API-enabled connectivity between these services allows greater end-to-end coordination. This enables the healthcare workflows to be part of a connected platform ecosystem.

3) Rise of Informal Wellness and Care Ecosystems

   With changing demographics and an aging population, as well as with greater awareness on wellness, the healthcare value chain has extended, beyond the traditional healthcare providers, to include informal wellness and care players. This informal economy of wellness and care providers is increasingly being organised on platforms that connect those who need care and wellness services with those who provide such services.

The increasing breadth of potential services available across the continuum of care will move the industry to coalesce around a few platforms in the long run, which will best orchestrate these services. Digitalisation of patient data and provider workflows will allow these platforms to own the central intelligence required for matching relevant healthcare services to patients.

Additionally, healthcare regulation globally is shifting towards value-based healthcare. Even though Asia lags in this shift, Singapore ranks high on its focus on value-based healthcare, placed second in a 2014 EIU study across 166 countries, in terms of outcomes achieved per unit cost.[34] Value-based healthcare emphasises outcomes, which further drives the importance of platform business models and healthcare which can track interactions across the entire ecosystem of care and accurately measure outcomes achieved per unit cost.

3.2.2.1 Opportunities in the Platform Business Model – Platform Owners

Healthcare platforms can take up various positions across the value chain. Further up the value chain, firms are building platforms that coordinate clinical research and drug development. Closer to the patient, several firms are working on building patient-centred platforms that allow providers to serve the patient across the continuum of care, by leveraging and coordinating formal and informal care ecosystems. All ecosystem players are coordinated around the patient's data profile and the firm(s) that control this unique understanding of the patient based on their data profile, are the best placed to own the recommendation engine and intelligence required to inform and manage the patient's care. Accordingly, these firms are best positioned to be in a position of ecosystem leadership, managing the matching and coordination of services across the ecosystem.

We look at platform opportunities in healthcare from two perspectives: firms that are targeting specific platform opportunities and firms that seek to take multiple platform positions across the continuum of care, building what we call healthcare mega-platforms.

We lay out the specific platform opportunities first.

Opportunity 1 – Telehealth and Remote Care Platforms

Telehealth and remote delivery of healthcare services are one of the core services offered by any platform-based ecosystems. Some platforms create their own marketplaces by connecting certified doctors with patients. Others work within existing care provider ecosystems, allowing them to connect their doctors with their patients over new channels. Spruce, for example, is an omni-channel, telehealth platform that enables healthcare providers to deliver real-time care by connecting board-certified dermatologists to patients via the patient's smartphone. SnapMD is another such example, which powers the backend for many care providers as a white label solution.[35]

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34 "Health Outcomes and Cost: A 166-Country Comparison", The Economist Intelligence Unit, 2014
35 "Spruce" by Spruce Health

In Southeast Asia, Doctor2U, in partnership with Microsoft, connects doctors with patients, both over live chat, and in person, and also manages a medication delivery service.[36]

Opportunity 2 – Healthcare Workflow Platforms

Another platform opportunity in healthcare involves connecting patients to doctors over one single booking and appointment management interface. These platforms provide patient records management and workflow management capabilities to doctors and healthcare institutions. These workflow management capabilities ensure greater integration of the patient into the healthcare provider's workflow, thereby increasing their switching costs and preventing other platforms from taking over as would be the case if the platform only managed matchmaking and appointment scheduling. These platforms also gather consumer feedback to create a reputation score for doctors.

Practo, an Indian start-up started out as a booking management and workflow platform before expanding into other adjacent healthcare use cases around this core. In addition to the booking interface, Practo provides a workflow management platform, Practo Ray, that helps organise doctor schedules, patient information and payments into one integrated workflow.

Workflow platforms form a component of many larger healthcare mega-platforms, as we note shortly. Tencent's WeChat Intelligent Healthcare, for example, manages appointment booking and management for users on WeChat.

Opportunity 3 – Eldercare Platforms for Coordinating Informal Care Ecosystems

With an aging demographic globally, especially in developed countries, the demand for in-home care is increasing rapidly. The demand far outstrips the supply that traditional care agencies provide. In this case, the supply for care also exists in the form of informal care providers. Eldercare marketplaces provide a solution to manage this informal care ecosystem by bringing together families and older adults, care agencies, and individual care workers. Platforms like Honor orchestrate these three sides of the ecosystem by matching families with care workers and also providing the tools to manage and monitor the provisioning of care. Some platforms are even going a step further, and matching care agencies and care workers with available real estate that allows them to set up new care locations. With a long-term trend towards an aging demographic, the informal care ecosystem is likely to grow even further to serve the growing demand, and the platforms that best manage these ecosystems will have strong growth potential.

[36] "When Microsoft & Doctor2U Collab, Expect Tech Upgrades—Like Uber for Ambulances", Vulcan Post, May 2017

Opportunity 4 – Personalised Treatment and Device-Driven Healthcare IoT Platforms

Many personalised treatment platforms gather patient data through connected sensor-enabled devices. This data then serves as the basis for providing personalised recommendations as well as serving services from third parties to patients.

Livongo Health is an example of such a platform which helps patients manage diabetes by providing them a connected glucose meter that captures data in real time and provides personalised insights. This serves as a starting point to understand the patient condition and eventually connect them to a larger ecosystem of services providers.

Firms like Philips and Medtronic are using their strength as medical device manufacturers to create larger platform-enabled ecosystems around the data gathered from their devices.

Opportunity 5 – Healthcare Supply Chain Coordination Platforms

Further up the healthcare supply chain, platform initiatives are working to create greater transparency in interactions across the healthcare supply chain. For instance, the traditional clinical testing value chain has very low transparency into the capabilities of individual test centres. Firms like Forte Research Systems are working on creating a supply chain coordination platform for clinical testing. Forte's OnCore software is used by research and testing centres to manage research operations and clinical testing data. This integrates with Forte EDC, their electronic data capture platform, that allows greater collaboration across participating academic research centres, clinical testing centres, pharmaceutical firms, and other healthcare systems. The operational data captured also helps the platform determine the effectiveness and operational capabilities of different test centres.

Other platforms like EHR4CR and FIND also provide similar supply chain coordination capabilities. The EHR4CR platform extends further downstream to leverage data from Electronic Health Records to improve clinical research, by coordinating the interactions between research sponsors and researchers. Owing to greater integration further downstream with hospitals, the platform makes the clinical trial protocol design faster and more efficient and also helps with patient recruitment.

Opportunity 6 – Healthcare Data Management and Analytics Platforms, including AI-Enabled Diagnostics Capabilities

Owing to the fragmentation of patient data and the low interoperability between healthcare systems, the most powerful platform opportunity lies in integrating clinical data from multiple sources and integrating the analysis of this data. Several platforms are working on pursuing this opportunity and the few that succeed will be best placed to lead healthcare ecosystems in the future.

Philips HealthSuite provides such a data platform that integrates data from all Philips devices and services but also integrates data from other partners like Samsung. The platform integrates the data to create a single comprehensive view of the patient. The more the participating data sources, the richer the data profile, and the better the analytics and diagnostics that each participating party can benefit from. Alibaba Health's partnership with Carestream Health[37] is aimed at creating a similar medical imaging data management platform to integrate all forms of imaging data and enable AI-powered diagnostics on the basis of this linked data.

In Singapore, the Health Cloud (H-Cloud) powered by Integrated Health Information Systems (IHIS) and Schneider Electric aims at providing a single platform to integrate all patient electronic medical records (EMRs).

Platforms that centralise, aggregate and integrate data from multiple sources to create a comprehensive view of the patient are likely to be the most powerful players in healthcare in the future.

3.2.2.2 Opportunities in the Platform Business Model – Healthcare Mega-Platforms

While each of the six opportunities laid out above are compelling in their own right, many large healthcare platforms today are pursuing a combination of these different platform positions instead of focusing on only one position. Owing to the fragmentation of patient data across the continuum of care and the relatively low interoperability between systems, no single healthcare player has a complete view of the patient. As a result, firms that seek to serve the patient across the continuum of care need to pursue multiple platform positions.

Several firms in different industries are working towards capturing that patient data around which they aim to orchestrate a platform ecosystem:

1) Device manufacturers like Philips are working on building a data analytics platform (HealthSuite) around the core data captured by their devices;
2) Pharmacies like Walgreens are digitising sales receipts to create a patient data profile around sales data;
3) Technology companies like Google and Amazon are using their data troves captured from non-health services to move into healthcare;
4) Care providers are using EHR data as the core of their platform efforts; and

[37] "Carestream Health and Alibaba Health Sign Agreement to Create Medical Image Management Cloud Platform in China", Carestream Health, Feb 2016

5) Insurance firms are working towards moving from servicing claims to creating an ecosystem of value-added services around a continuous patient data stream created using sensors and connected services.

As these examples demonstrate, firms are converging towards building a patient-centric ecosystem, while starting from several different directions. As a result, we also see the rise of healthcare mega-platforms – firms that play in multiple platform positions.

Tencent is one such example of a healthcare mega-platform[38] orchestrating a range of healthcare services and players. Tencent's WeChat Intelligent Healthcare platform allows appointment booking and payments using WeChat public accounts. Tencent also provides WeSure, a medical insurance co-underwritten with insurer Taikang, which connects with WeChat's step count function and uses that data to offer cash back to users. Tencent's mega-platform also includes the AI Medical Innovation System (AIMIS), a medical imaging service used across hospitals for AI-powered diagnostics. In November 2017, AIMIS was endorsed by the Chinese government as the national AI diagnostic medical imaging platform.

Alibaba, the other giant platform firm in China, is building its own platform-enabled ecosystem through a range of strategic partnerships. At its core is Alibaba Health's partnership with Carestream Health to create a Medical Image Management Cloud Platform, aimed at standardising storage, analytics and collaboration around clinical imaging data. In this partnership, Carestream provides critical enterprise image management capabilities to the Alibaba Health platform.[39] Alibaba Health has also partnered with pharmaceutical firm GSK to enable appointment booking and telemedicine services and book appointments for GSK's Cervarix drug administration.[40] The platform has similar partnerships with other pharmaceutical firms like Merck.[41] Alibaba's healthcare partner ecosystem also includes Allergan and Bayer, to provide services in medical aesthetics and consumer self-care products respectively.

Ping An, China's largest insurance company, has built out one of the largest telehealth platforms in the world, Ping An Good Doctor, with more than 200 million registered users. The platform enables provider-patient interactions, which it also uses to train its AI, which increasingly augments and supports decision making for doctors. Other ecosystem participants include insurance firms and

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38 "How Tencent's Medical Ecosystem is Shaping the Future of China's Healthcare", TechNode, Feb 2018
39 "Carestream Health and Alibaba Health Sign Agreement to Create Medical Image Management Cloud Platform in China", Carestream Health, Feb 2016
40 "Alibaba Ties Up with GlaxoSmithKline for Online HPV Vaccine Appointment Service", South China Morning Post, Nov 2017
41 "Merck and Alibaba Health Announce Collaboration to Develop Patient-Centric Digital Services in China", AsiaOne, Jun 2018

healthcare administrators. The platform helps insurance firms co-underwrite the risk using data analytics. Ping An has also invested in TytoCare, which allows remote patients to measure their vitals using a smartphone. This allows a doctor to perform tests remotely on the patient. Ping An Good Doctor has also formed a joint venture with Grab to bring the platform to South-East Asia.[42] The JV will leverage GrabPay, Grab's digital wallet, as the payment provider for these services. In this manner, Grab, while a platform itself, is acting as a capability provider and distribution channel to the Ping An Good Doctor platform.

Medical device manufacturers like Philips and Medtronics are working towards creating a platform enabled ecosystem leveraging the data generated from their devices. Both companies are transitioning from device-driven value creation to data-driven value creation, using a suite of connected devices and applications with a common data platform. The platform also interoperates with other cloud-based services and technology layers.

Philips HealthSuite is a digital platform integrating services and tools from Philips and its partner ecosystem, across the continuum of care. The tools and services that integrate into this platform include the Philips Avent Smart Baby Monitor and uGrow App, targeted at young parents, Philips Sonicare, a connected toothbrush with real-time feedback, Philips Lumify, an app-based ultrasound medical imaging system, the Philips Health Watch, which captures fitness data, the Philips Diabetes Support Solution, a diabetes self-management app with a peer support community, the Philips eCareCoordinator, providing patient analytics to clinicians, and the Philips CareSage, a suite of connected devices and an analytics engine that monitor elderly patients.[43]

Closer home, Medtronic, with significant R&D and operations based in Singapore, is building a platform-enabled ecosystem as well, bringing together a suite of connected products and services for monitoring patient well-being and enabling provider-patient interactions. Medtronic's acquisition of Cardiocom, a firm working on telehealth technologies for patient-monitoring firm, provides it with the capabilities to create a platform for provider-patient interactions. The company is also working on developing a glucose monitor for type 2 diabetes patients. This involves a wearable monitoring device which gathers patient data into the platform, allowing for data aggregation, analytics and decision support for doctors.

Further, Medtronic is building out its partner ecosystem to add key capabilities and scale the adoption of its monitoring platform. In addition to the Cardiocom acquisition,[44] Medtronic has also partnered

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[42] "Grab, Ping An Form JV to Deliver Online Healthcare Services in South-east Asia", The Business Times, Aug 2018

[43] "Philips Unveils HealthSuite Digital Platform", HIT Consultant Media, May 2016

[44] "Medtronic Buys Cardiocom: Are Medical Product Companies Finally Serious About Business Model Evolution?", Forbes, Aug 2013

with Qualcomm[45] for wireless technology for data transfer and with the LHC Group,[46] a home health services company, to roll out the home monitoring platform.

As these examples demonstrate, the quest to serve the patient across the continuum of care will drive greater consolidation and partnerships among healthcare platforms and we are likely to see more such mega-platforms emerge to serve patients.

3.2.2.3 Opportunities in the Platform Business Model – Capability Providers

Opportunity 1 – Intelligent Interfaces for Delivery of Healthcare

With the shift to telemedicine, the interfaces that offer the most intuitive and effective patient experience will be best positioned to attract patient engagement. Hence, intelligent interfaces to healthcare platforms will be a key capability. While many platforms may seek to own the interfaces themselves, firms with proprietary interface technologies could play an important role as a capability provider to other platforms.

Voice and chat are two such interfaces, especially attractive to the elderly to access services in care ecosystems. In Singapore, Talentgrid Ventures' Aunty Sal[47] is a chatbot that targets Singapore's elderly population and their caregivers, allowing them to access all aged-care related services through a single interface, including finding daily meal caterers, getting financial assistance, and making clinic appointments.

Beyond voice and chatbots, improvements in computer vision and gesture recognition could further enhance the delivery of telehealth, and capability providers that specialise in such interfaces will occupy an important position in platform ecosystems. Microsoft's 'TEKI' project[48] in Spain is one such example. It allows patients with chronic conditions to connect with their doctors via an Internet-connected Microsoft Kinect unit. Patients receive a Kinect box with a wireless heart rate monitor that measures their pulse and a spirometer capturing respiratory levels. In addition to video communication, patients can also complete questionnaires by gesture control and the interface guides them through rehabilitative exercises using the Kinect's 3D depth-sensing technology.

Opportunity 2 – Data Analytics and AI-Enabled Diagnostics

As data management platforms form the core of healthcare platforms, players that provide critical data analytics and AI-enabled diagnostics capabilities will play an important role. This is particularly

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45 "Qualcomm, Medtronic Tackle Type 2 Diabetes", San Diego Business Journal, Jun 2016
46 "Cardiocom, Medtronic's Patient Monitoring Services Business, Announces Partnerships with Home Health Care Companies", Medtronic, Feb 2015
47 "Every Caregiver Needs an Aunty Sal", TalentGrid Ventures, Sep 2017 (YouTube video)
48 "Teki System Lets Patients Visit the Doctor via Kinect", New Atlas, Nov 2013

important because AI-enabled diagnostics is the initial incentive used by many platforms to encourage users to share data and providers to upload patient data.

RenalytixAI is one such startup working on creating AI-enabled diagnostics for early detection of kidney disease. While the AI trains on many data sets which the company integrates itself, the trained AI can also be provided as a capability to other platform-enabled ecosystems.

Opportunity 3 – Data Management Capabilities

As data management platforms form the core of healthcare platforms, players that provide critical data management capabilities will also play an important role in healthcare.

As an example, the Alibaba Health platform partnered with capability provider Carestream Health. Carestream provides critical enterprise image management capabilities to Alibaba Health's medical imaging data management platform.

3.2.2.4 Opportunities in the Platform Business Model – Producers

Opportunity 1 – Co-Created Data Products

Traditional firms can partner with platforms to create co-created data products. In healthcare, one such example involves insurance firms working with platforms to co-underwrite insurance, using the data captured by the platform. For instance, insurance provider Taikang partners with Tencent to co-underwrite insurance products using data from the WeChat platform.

3.2.3 Retail, Lifestyle and Consumer Brands

Ever since the rise of the Internet, the economics of retail and consumer industries has changed. There are three factors, in particular, that have changed these industries.

First, even before the rise of digital platforms, the near-zero marginal costs of distribution on the Internet made e-commerce much more efficient than traditional commerce, leading to the disruption of many businesses, like bookstore Borders, which failed to compete with Amazon, and the DVD rental business Blockbuster, which could not compete with the superior economics of Netflix.

Second, the ability to gain consumer data allows consumer brands and e-commerce players to create greater value through personalisation. As brands personalise the consumer experience, they also engage consumers better. This is especially true for high engagement and fad-driven categories like fashion and beauty.

Finally, as brands engage users across multiple channels, they realise the need for a single view of the customer across multiple channels. As a result, since the early 2010s, many consumer-focused

brands have worked on unifying their internal systems and processes in order to track the user across multiple channels and have a single view of the user.

These three factors, together, have led to the rise of the platform business model in consumer industries. The companies that identify the customer across all touchpoints, and constantly gather consumer data, are the best positioned to serve as platforms. Other brands move towards partnering with platforms that have primacy of customer relationship and engagement.

Brands and merchants — whether online-only, offline-only, or online-offline — are increasingly participating on platforms, either by creating platforms themselves or by partnering with other platforms.

3.2.3.1 Opportunities in the Platform Business Model – Platform Owners

Opportunity 1 – E-commerce Marketplaces and Lifestyle Super-Apps

The most powerful platforms in retail and consumer industries are the horizontal marketplaces that span multiple categories and aggregate buyers and sellers across these categories. Leading e-commerce marketplaces include Amazon Marketplace and Ebay, as well as Alibaba's Taobao and TMall, Flipkart, Tokopedia and Lazada in Asia. C2C marketplaces like Carousell allow secondary transactions and resale between consumers.

In recent times, single use case apps have been transitioning into super-apps that support commerce across a wide range of consumer categories. Most of these super-apps start by supporting a single use case. Once they gain widespread adoption with that initial use case, they focus on creating a payments capability. With widespread adoption and payments integration, these apps then open up as a platform allowing other services to integrate in. WeChat started as a messaging application only, moved on to supporting payments, and is now one of the largest platforms supporting multiple third party applications. Similarly, in South-East Asia, Grab started as a ride hailing app with payments integration. It then strengthened its payments integration with a partnership with Mastercard where the two companies issue a payments card that can be used across Mastercard's network. With greater control of the payments layer, much like WeChat, Grab has transitioned into a super-app inviting other applications and services, like online grocer HappyFresh, to come on board.

Opportunity 2 – Offline to Online Retail Aggregators

Many e-commerce marketplaces aggregate online-only merchants or serve as one of many channels to offline merchants. In contrast, offline to online (O2O) aggregators aggregate offline stores, which do not have a dedicated online presence and provide them with a dedicated online presence. Shoptiques is one such platform that aggregates small local boutiques and gives them an online

presence. Shoptiques also provides them the necessary services for digitalising their inventory, managing shipping, and marketing their business online.

Opportunity 3 – Loyalty Platforms

Even as e-commerce marketplaces manage commercial activity online, loyalty platforms seek to manage commercial activity offline. Loyalty platforms increase customer stickiness and retention but also provide additional analytics to merchants by capturing greater data about offline consumer activity. Most loyalty platforms create an incentive for the customer to digitalise their offline transaction, in exchange for reward points. The loyalty platforms then provide customer relationship management and analytics tools to participating merchants.

Shopkick, a US-based loyalty platform owner by South Korea's SK Telecom, rewards consumers for a variety of activities, including walking into stores, scanning items, purchasing items and scanning receipts. In Singapore, Chope has created a loyalty platform for the food and beverages industry, where consumers can earn and redeem rewards across participating merchants.

Opportunity 4 – Social Commerce

Social commerce platforms have gained prominence in categories where consumers engage with content before making a purchase decision. Most social commerce platforms differentiate themselves in the mechanism with which they engage users. These platforms are particularly relevant to fashion and luxury goods.

Wanelo is a social commerce platform that allows users to post pictures of products from brands and independent retailers who can then monetise actual purchases that ensue on the back of this social sharing. Wanelo users post links to items from any online store by using the Wanelo Google Chrome extension or the browser bookmarklet. As a platform, Wanelo combines a community of users who generate and consume content as well as a marketplace of stores that sell the products tagged in the content.

Chictopia is another social commerce platform that allows fashion influencers to grow a following and gain monetary rewards for purchases made by their followers. Even general purpose social media platforms like Instagram and YouTube encourage social commerce as brands pay influencers to promote products, but these platforms do not monetise this commercial activity, which takes place off-platform.

Opportunity 5 – Brand-as-a-Platform

The most important opportunity for consumer brands is to move towards a brand-as-a-platform business model. In this model, the brand captures consumer data by engaging them across multiple

touchpoints. As the data profile of the consumer improves, other third parties come on board to target the consumer and the overall ecosystem of consumer-oriented services is created around the brand.

The beauty brand and retailer Sephora has created a brand-as-a-platform, integrating its online and offline touchpoints around a single view of the customer. At Sephora stores, sales assistants scan a customer's face to capture the exact skin tone, which is then digitalise as a four-digit code called the Color IQ. The data profile for the customer is built around the Color IQ. The customer can then combine the Color IQ with her Sephora Beauty Insider Account, which is Sephora's loyalty program. This data profile is enhanced by integrating data from other online and offline customer touchpoints, including in-store behaviour, in-app purchases, and the user's actions on Sephora's online social networks Beauty Talk and Beauty Board. By creating this consolidated data profile, Sephora understands the customer better than most other beauty brands and is not bringing third parties on board to create a larger ecosystem of services targeted at the customer.

Much like Sephora, the food ingredients company McCormick Foods is also transitioning to brand-as-a-platform business model. McCormick launched an online service called FlavorPrint which gathers data about users' eating preferences and taste. Based on consumer responses, the service creates a data profile of the consumer's taste. Consumers are served personalised recipe recommendations on the basis of their data profile. As the platform gained adoption, McCormick spun off this business as a separate company, Vivanda, to keep it independent and alleviate concerns around competitors joining the platform. The company has now opened up its APIs to other food companies to consume this data. API consumers get analytics to see what flavours are trending. Companies can access the platform to market to different food and eating profiles.

Opportunity 6 – Shop-in-a-Box

A 'shop-in-a-box' is a platform position that involves an infrastructural play. Unlike other platform positions that involve market creation or market mediation, 'shop-in-a-box' platforms provide all the tools and services required for a merchant or brand to set up an online shop, but without necessarily creating a marketplace for participating merchants.

Shopify and Blueport Commerce provide a platform-as-a-service allowing any consumer brand or retailer to set up an online store. Shopify's app store also integrates third party applications allowing participating merchants and brands to benefit from the functionalities of many different application partners.

Opportunity 7 – Marketplace-in-a-Box

Similar to the shop-in-a-box model, companies like Mirakl and ShareTribe provide a marketplace-in-a-box, which allows any brand or merchant to easily set up an e-commerce marketplace. Several prominent retailers, including Galeries Lafayette and Best Buy Canada have used Mirakl's marketplace-in-a-box to launch their own marketplaces.

3.2.3.2 Opportunities in the Platform Business Model – Capability Providers

Opportunity 1 – Payment Providers

On consumer e-commerce platforms, payment providers provide a critical capability. PayPal and Stripe have created massive businesses as capability providers to other platforms. In Asia, Ant Financial has taken equity stakes in the leading payment platforms in multiple countries, while also owning Alipay. Across these investments, the company is poised to grow as a capability provider on the back of e-commerce growth across Asia.

Opportunity 2 – Omnichannel Capabilities

As brands and merchants seek to engage the customer across multiple touchpoints, providers of omnichannel capabilities will play a critical role. OneView Commerce provides brands the capabilities to engage customers across multiple channels and have a single integrated view of the customer.

3.2.3.3 Opportunities in the Platform Business Model – Producers

Consumer brands face the risk of commoditisation on third party platforms, as consumers make more of their engagement and purchase decisions on these platforms. Conversely, consumer brands can also benefit from partnerships with platforms.

Opportunity 1 – Engage Consumers Seamlessly Across Platforms

As platforms mediate more of consumer commerce, brands and merchants will need to engage consumers on third party platforms. In doing so, they should seek to not get overtly dependant on any particular platform. Also, to effectively serve users across multiple e-commerce and social media platforms, brands and merchants need to invest in omnichannel capabilities to ensure that they have a single view of the customer and can serve them seamlessly across multiple platforms.

Opportunity 2 – Be a Niche Producer

Brands and merchants will increasingly have to participate on third party platforms. While participating on platforms, most producers risk getting commoditised as platforms create price transparency and intensify competition among producers.

When selling through platforms, producers should seek to provide niche products and services, to avoid getting commodified because of the increased competition in their category. Producers that provide niche products and services can use the platform to effectively scale and potentially build a brand that can be leveraged to eventually strengthen their owned online destination as well.

Opportunity 3 – Co-Create Products with Platforms using their Wealth of Data

While brands risk being commoditised as producers on platforms, they can also strengthen their business model through partnerships with platforms. Platforms capture rich consumer data across a wide range of categories which can help brands better craft product propositions catered to market data.

Alibaba's TMall Innovation Centre (TMIC)[49] employs consumer insights gathered from across the Alibaba ecosystem to help brands develop and market new products. Brands as diverse as Snickers, Johnson and Johnson and L'Oreal have worked with TMIC to co-develop products for the Chinese market.

3.3 Platform Opportunities in Asset-Intensive Industries and B2B

Consumer industries have witnessed the rise of large, global platforms built on information discovery, communication, commerce, and exchange of labour. The industrial economy, however, has not yet witnessed the large scale impact of platform business models.

However, since the mid-2010s, a range of technologies have come together to move business-to-business (B2B) interactions and asset-intensive industries towards platforms.

In particular, there are four key drivers driving the shift of asset-intensive industries towards platforms:

1) Proliferation of sensors has driven the initial digitalisation of asset-intensive industries;
2) Shift from on-premise software to cloud-based solutions – Many business workflows have moved to the cloud, which in effect, digitalises these workflows and makes them interoperable with other cloud-hosted workflows;
3) Technologies like additive manufacturing are decentralising many industrial processes that historically operated only at factory-scale. This increasing decentralisation in manufacturing needs to be managed as platform-enabled ecosystems; and

[49] "Alibaba's 'Innovation Centre' Gives Brands Edge in China", Alizila, Nov 2018

4) The creation of new standards that drive interoperability is critical for the widespread adoption of platform business models. In industries as varied as construction, logistics, and manufacturing, we are seeing the rise of new standards.

Platforms in these industries are more focused on coordinating B2B industry ecosystems and less on creating marketplaces and networks with global network effects. Hence, the platform archetype for these industries is quite different from those for information-intensive industries. Data-dominant platforms are a common archetype in these industries. Network-dominant platforms are less focused on counterparts' discovery and matchmaking and create value by providing coordination complex network coordination capabilities. Many common templates that apply to B2C services industries do not apply to B2B asset-intensive industrial ecosystems.

In this section, we look at three asset-intensive industry groups in detail: construction (including real estate), logistics, and manufacturing.

3.3.1 Construction and Real Estate

The construction industry has resisted digitalisation owing to its asset-intensity and complex manual processes. However, four key forces are driving the rise of platforms in construction:

1) Standards and digitalisation in the construction industry
   As we have noted before, the creation of common standards drives greater interoperability across an industry ecosystem. In the construction industry, building information models (BIM)[50] now serve as an industry standard for digitised building performance, and can hence enable greater interoperability between different players who interface with each other using the standard.
2) Digitalisation across the life-cycle
   The rise of platforms in the construction industry is also driven by greater digitalisation across the entire construction lifecycle. The construction lifecycle consists of three phases: design, construction, and operations. In the design phase, AI enabled design tools are increasingly being used to design building models. These design tools create the digitised design of the building and create the starting point for greater interoperability with the other two phases. In the construction phase, an increasing number of processes are being coordinated through cloud-hosted software tools. Construction processes are themselves leveraging robotics and 3D printing to a larger extent. These factors, together, are driving an increasing degree of digitalisation in the asset-intensive construction phase. Finally, in the operations phase, sensors and, more specifically, building management systems digitalises many aspects of

[50] "6 Ways the Construction Industry Can Build for the Future", World Economic Forum, Mar 2018

building performance as data flows. Through a combination of digitalisation across all three phases, the construction lifecycle is well-positioned to be mediated and managed by a platform.

3) Value creation from data flows in the construction industry

   The data generated by buildings can power new services and decision-support for all stakeholders involved in using and managing the buildings. The services and decision support systems can be integrated as part of a common platform. There are four types of data, in particular, that help to create value:

   a) Building operations data is valuable for monitoring energy and operations across the facility and provides inputs to decision support for building administrators and operators.
   b) Enterprise resource planning data ties building operations data with other data sources like Enterprise Resource Planning (ERP) systems, to provide business metrics for executives.
   c) Usage data tracks the navigation, usage and engagement of building occupants. Based on the occupants' specific persona, and their usage data, targeted services can be provided around building navigation, comfort management, and occupant collaboration to enhance their experience in the building. Usage data can also serve as inputs for emission calculations.
   d) Finally, some buildings may also track energy data from Distributed Energy Resources (DER) to manage onsite energy generation and storage.

4) New construction models

   Finally, emerging technologies like additive manufacturing and prefabrication can now allow more distributed models of construction, where several construction activities can be performed off-site and later assembled on-site. Such distributed construction models will also require centralised platform-based orchestration.

3.3.1.1 Opportunities in the Platform Business Model – Platform Owners

Opportunity 1 – Platforms to Coordinate the Construction Life-Cycle across CAPEX and OPEX

The most significant platform opportunity in the construction industry lies in the integration of activities across the design, construction, and operations phases.

The construction industry is characterised by a disintegrated and highly fragmented value chain. A platform that coordinates all processes and actors because these three phases can unlock efficiency gains, capture coherent data across the lifecycle, and even build on-demand marketplaces of service providers whose reputation can be assessed based on the data captured by the platform. As more

activities are coordinated through the platform, the platform gathers data about the various actors performing these activities, and can create reputation scores for these actors.

Firms that seek to lead intermediate the construction lifecycle can start at any of these three phases.

1) Design Phase

   In the design phase, building designers would create the overall building information model, which can serve as the centrepiece for coordination of activities in the construction phase. Autodesk[51] is working on creating a platform for the building construction ecosystem, centred on its building information model (BIM360). BIM360, as part of Autodesk's larger Forge platform, provides the coordination mechanism for multiple players to collaborate around the building information model built using Autodesk's design tools. Forge also brings together a larger developer ecosystem who create applications that interface with the data on the Forge platform. In this manner, Autodesk is putting together the pieces for a platform to coordinate the overall construction ecosystem.

2) Construction Phase

   In the construction phase, building contractors manage the end-to-end construction process. In this phase, construction process management can serve as the entry point towards creating a platform.

   Spot-r by Triax Technologies[52] is taking the first steps towards creating such a platform by integrating multiple data streams across a jobsite providing visibility into worker efficiency and equipment utilisation. This has the potential to be a larger platform business if it uses data collected from every individual jobsite to calculate reputation scores for service providers, and if it can uncover under-utilised equipment from job sites as part of a larger on-demand marketplace.

3) Operations Phase

   Further downstream, in the building operations phase, companies like Siemens and Honeywell, which provide building management systems and other tools to building operators, are also working on creating larger platforms around the data generated from these tools.

As the industry consolidates, the emergent winning platform is more likely to be a partnership between players in the design phase, players in the construction phase, and players in the operations phase rather than one single player that manages the end to end platform. We have already seen this

[51] "Demystifying the BIM 360 and Forge APIs", Autodesk, Nov 2017
[52] "Sport-r" by Triax

with companies like Autodesk and Siemens signing interoperability agreements[53] in the manufacturing industry, and could expect similar moves in the construction industry as well.

Opportunity 2 – Platforms in Real Estate Management

Further downstream from the asset-intensive construction industry, real estate management has long benefited from platform-based business models.

1) Listing Aggregators

   In the early 2000's, the first generation of real estate platforms served as listing aggregators, aggregating supply across a fragmented market, and allowing buyers to access the supply of listings in one place. The prevailing wisdom at that time suggested that brokers would be displaced by these supply aggregators. Instead, traditional brokers continued to prosper but the platform created a level playing field by providing the same information to all brokers. These listing aggregators continue to flourish in every market. PropertyGuru, the leading real estate marketplace in Singapore, continues to operate on this model.

   Over time, these platforms have evolved to incorporate new forms of decision support, including home valuation capabilities, first pioneered by Zillow in the US, real estate heat maps, made popular by RedFin in the US, and map-based navigation and filtering of listings.

2) End-to-End Real Estate Management

   The home-buying journey is much more complex than merely surveying listing information. Homebuyers need help with valuation, viewings, mortgages, and eventually home renovation and home management. Increasingly, platforms are moving into these adjacencies to serve the homebuyer across their entire home buying journey.

   Zoopla, A UK-based real estate platform. Zoopla started as a listing aggregator but has moved into several adjacencies through acquisitions and partnerships. Zoopla's acquisition of uSwitch, a price-comparison service for utilities, personal finance, insurance and communications services, allows it to re-intermediate these transactions for homeowners.[54] Through the acquisition of VizziHome, Zoopla owns greater market intelligence data while its acquisition of Trinity Mirror Digital Property helped it acquire a real estate agents' directory.[55][56]

   To create an integrated platform across all these acquisitions, Zoopla still needs to integrate these various assets at the data and network layers. But its market moves clearly demonstrate

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[53] "Autodesk and Siemens Sign Agreement to Increase Software Interoperability", Gardner Business Media, Mar 2016

[54] "Zoopla to buy price comparison site uSwitch for £160m", IBTimes, Apr 2015

[55] "Venture Capital-backed Zoopla Closes Latest Acquisition", Bonhill Group, Jun 2013

[56] "Zoopla Property Group Acquires Trinity Mirror Digital Property", Zoopla Property Group, Sep 2013

that platforms will move beyond merely aggregating listings to serve users across other parts of the purchase lifecycle.

Finally, to serve brokers better, real estate platforms will also need to provide workflow management tools to help brokers manage their business better. Platforms that effectively provide these tools will lock-in the workflow of the brokers, gaining an advantage over current listing aggregators that have very low switching costs for brokers.

3) Home Renovation and Home Management Platforms

Home renovation and home management platforms assist the home owner in managing their homes, by coordinating activities across a range of service providers. Most of these platforms acquire users by assisting them in the home renovation phase.

In China, Tubatu[57] aggregates interior designers and interior decoration firms on an integrated platform. Platform users can initiate home renovation or interior design requests and obtain fee proposals. The platform's reputation system provides users with the necessary decision support required to choose service providers. The platform further creates trust through its escrow service as well as a quality inspection service to guarantee quality of the renovation work.

To hook in service providers, the platform provides a software suite that digitalises their operations and creations and assists with customer acquisition and management. The platform also provides supply chain financing services to service providers.

From the homeowner's perspective, the platform provides an insurance and centralised project management capabilities through the platform to guarantee the quality and completion of the project.

The platform is now moving further upstream into the construction industry by onboarding upstream suppliers of construction materials, furniture and household items onto its marketplace. The company manages the backend logistics across all suppliers and stores them in a central warehouse, before delivering to the customer.

Houzz, a US-based home renovation platform, and likely the one to pioneer this model, brings together a community of interior designers and homeowners and layers on a home products marketplace as well. Additionally, the platform provides several other tools. Houzz's Real Cost Finder helps homeowners plan renovations and calculate costs, based on data from the Houzz community.[58] Houzz's Visual Match uses deep learning to recommend designs to users. Houzz's Sketch feature allows homeowners to create and collaborate on home design projects

[57] "The Disruptor: Tubatu – An O2O Disruptor in the Home Décor Market", Coresight Research, Jan 2017

[58] "Houzz's Real Cost Finder Helps You Figure Out How Much That Renovation Will Set You Back", Huffpost, Aug 2013

while View in My Room 3D enables them to virtually view products from the Houzz Marketplace in their home setting before buying.[59]

3.3.1.2 Opportunities in the Platform Business Model – Capability Providers

Opportunity 1 – Data and AI Capabilities for the Construction Industry

Building data analytics, building AI, and construction workflow software providers will provide key capabilities in the construction industry. Smartvid.io is an AI provider that uses AI to identify jobsite risks and analyses data streams from jobsites. Such AI providers can serve as critical capability providers in construction platforms.

Workflow software providers also provide important capabilities. SmartBid is a leading construction bidding management software, which digitalises the bidding workflow. These examples demonstrate how a variety of construction industry software providers could play a critical role in the platform economy even if they do not build the end platforms themselves.

Opportunity 2 – Building Design Tool Providers

Building design tools will also serve as critical capabilities on construction platforms. Towards that end, Autodesk, in addition to providing a larger platform around its billing information model, could also drive the proliferation of the building information modelling across other third-party platforms by providing design tools as a capability to these third-party platforms. In fact, the firm could very well pursue a strategy that combines the positions of a platform owner and a capability provider to drive large-scale adoption of the building information model, while also capturing larger profits through a platform-based model.

Opportunity 3 – Real Estate Workflow Management Tools

Further downstream, providers of real estate workflow management tools will provide a critical capability. The workflow for most real estate transactions are still primary paper-based. To move to a platform-based model, these workflows need to be digitalise. Providers of cloud-based workflow tools will play an important role in digitalising this workflow. Qualia Labs and Amitree are examples of such workflow tool providers, but have not yet gained widespread scale as of 2018.

[59] "You Can Now *Virtually* Try Out Furniture Before You Buy", Brit + Co, Feb 2016

3.3.1.3 Opportunities in the Platform Business Model – Producers

Opportunity 1 – Construction Supplies and Materials Management

Construction materials firms are increasingly creating a more seamless experience for their clients by integrating all the customer touch points, even if they do not eventually expand to becoming a multisided platform.

CEMEX Go,[60] offered by the construction materials supplier Cemex is an offering that combines order placement, live tracking of shipments, and invoices and payments management for Cemex's main products, allowing construction companies to manage all their interactions with Cemex in one place. While Cemex is the only producer and it is not yet a fully-fledged multisided platform, the company could very well open out to other complementary materials providers, e.g. glass manufacturers, once there is enough platform adoption with customers.

These initiatives start by integrating all customer and supplier touch points with the manufacturer and creating a coordinated their journey across all these touch points. Once the firm's immediate customer and supplier ecosystems come on board, the offering can migrate to a multi-sided platform by opening up to other complementary and non-competing construction materials manufacturers, allowing them to come on board and serve the customers.

Opportunity 2 – New Brokerage Models

The traditional real estate brokerage and selling model itself is being impacted by digital technologies. There are two models, in particular, that compete directly with the traditional broker.

First, tech-enabled estate agents, like eMoov and Purplebricks, use automated workflows to reduce the various transaction costs involved across the house buying process. This allows them to pass the savings back to the seller and/or the buyer in the form of lower brokerage fees, thereby attracting more buyers and sellers away from the traditional real estate agent model.

Second, tech-enabled resellers, like Opendoor and Offerpad, purchase actual housing inventory, using debt, and resell the inventory. In doing so, they take on inventory risk but manage it using comprehensive market data analysis. As of December 2018, with real estate markets in the US and UK constantly on the upswing, these reselling models have not been tested yet over a downturn.

As these examples demonstrate, automation of workflows and access to greater data can enable even producers on third party platforms, to migrate towards more digitally enabled business models.

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[60] "CEMEX delivers the future: CEMEX Go", Cemex, Nov 2017

3.3.2 Logistics, Trade and Maritime

Logistics, trade and maritime involve materials flows at a global scale. These industries have historically operated like physical networks which orchestrate materials flows across multiple stakeholders. As these materials flows get digitalise, these industries will move towards platforms that bring multiple stakeholders on board and coordinate materials flows across these stakeholders.

There are three driving forces that are driving the digitalisation of materials flows in these industries:

1) Trade life-cycle increasingly being digitalised leading to greater interoperability

   Digitalisation of the end-to-end trade life-cycle lies at the heart of platforms in these industries. Historically, this has posed a challenge as every stakeholder across the trade life-cycle uses different workflows, processes and systems which do not interoperate with each other. However, recent technologies, particularly distributed ledger technologies like the blockchain, are creating new layers of interoperability that allow these stakeholders to interoperate with each other.

   Several banks, logistics firms, and supply chain management companies have set up DLT-based trading consortia which create a new infrastructure for managing trade. This has been a significant driving force towards greater interoperability.

   Another factor driving interoperability is the adoption of the enterprise cloud across the supply chain. As more companies move to the cloud, their processes get digitalised and can interact through APIs. This further allows interoperability between different players.

   Finally, sensor-generated data and digitalisation of machines and other physical assets like delivery vehicles, warehouses, etc., increase visibility across the logistics life-cycle.

2) Digitalisation of the trade life-cycle enables greater autonomy across the trade life-cycle

   This is driven by digitalisation of individual components and actors across a fragmented trade ecosystem. For example, warehouse management tools digitalise warehouse availability, which can then interact with a fleet management system allowing greater autonomy across the logistics life-cycle. 3D printing and driverless vehicles will create greater autonomy across the supply chain by leading to distributed manufacturing and autonomous fulfilment.

3) Rise of e-commerce

   The rise of e-commerce, and particularly cross-border SME trade fundamentally changes the materials flows themselves, as more flows move away from established supply chains onto platforms like Alibaba. As a result, the movement of materials flows is becoming more decentralised and will need to be coordinated not through traditional contractual means, but through digital platforms.

A combination of these three factors is creating the perfect storm leading to the rise of platform business models in logistics, trade and maritime industries.

3.3.2.1 Opportunities in the Platform Business Model – Platform Owners

Opportunity 1 – Platforms to Manage the Shipping Life Cycle

Platforms that manage the end-to-end shipping life-cycle across all stakeholders by managing participating fleets, their assets, and their availability on one single system will create the strongest control position in the logistics and maritime industry. While most other platforms mentioned earlier manage certain parts of the shipping lifecycle, the platform that can most effectively manage the end-to-end shipping lifecycle occupies the most powerful position in the value chain.

Maersk and IBM have partnered to launch TradeLens,[61] a blockchain-based platform for tracking global shipments. As of 2018, 94 participants, including 20+ ports and terminal operators were using this common ledger. The blockchain digitalises the end-to-end shipping lifecycle by digitising two specific types of data, event data and document data, which together lay out the shipping lifecycle. As of Q4 2018, this data was growing at a rate of nearly one million events per day. The blockchain creates a single source of truth on this data across all participants and its smart contracts use these events to trigger the execution of documents across the shipping life cycle.

XPO Logistics, a provider of technology solutions across the logistics supply chain, has also launched XPO Connect, a platform that integrates data across the logistics supply chain to create superior decision support around managing the shipment life-cycle across a range of stakeholders.[62]

Opportunity 2 – B2B Integrated Logistics and Fulfilment Platform

A second powerful platform position involves creation of a central logistics management platform that integrates information about warehouses and fulfilment services and orchestrates the end-to-end shipping process across various stakeholders.

UPS's Ware2Go[63] platform onboards warehouses and fulfilment partners onto an end-to-end order fulfilment platform with guaranteed two-day delivery by UPS. E-commerce merchants using the platform can access and manage all possible options in one central location.

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61 "IBM, Maersk Launch Blockchain-based Shipping Platform with 94 Early Adopters", Computer World, Aug 2018
62 "XPO Logistics Launches Single-entry Platform for Multimodal Freight Transportation Solutions", XPO Logistics, Apr 2018
63 "UPS Launches Technology Company and Platform to Match Merchant Needs with Flexible Fulfillment", UPS, Aug 2018

Alibaba's Cainiao[64] data platform connects e-commerce companies with players across the logistics chain and manages end-to-end orchestration. The platform works across a variety of stakeholders. Delivery firms leverage the platform's smart routing and sorting service, and, in the process, actively update their availability for merchants to book them. The platform provides integrated warehousing services to large brands. The Cainiao Guoguo app provides integrated package tracking and order-placing for consumers. All stakeholders are managed through one data platform, allowing Cainiao to manage the end-to-end logistics chain without actually owning the physical assets itself.

Opportunity 3 – Marketplaces with Fleet Management Capabilities

Many platforms seeking to build the 'Uber for logistics' try to create a marketplace of vehicles that customers can book for shipments. However, most logistics marketplaces that aim to connect supply and demand fail to gain traction as they are able to provide the real-time availability of vehicles, leading to inefficient transactions on the platform.

In order to build a logistics marketplace, the real-time availability of the vehicle needs to be digitalised.

Fleet management is a common pain point in the logistics industry. But with platforms, fleet management is not merely a way to reduce management costs, it also provides an inroad to digitalise the real-time availability of a fleet, as well as their specific asset characteristics, which can then be exposed as supply on a marketplace allowing customers to book relevant vehicles for shipping. Marketplaces that integrate into fleet management systems to draw on real-time fleet availability will also lock-in fleets. While fleet owners can easily register their assets on multiple platforms, they can manage their fleets only on one system, which creates the technical lock-in required for emerging as the dominant platform in the long run.

In Singapore, the Transport Integrated Platform (TRIP)[65] connects container transport operators and other logistics stakeholders onto a single platform. It provides fleet management and job allocation tools to haulers, allowing them to better allocate jobs and track their fleet across the shipment journey. The platform integrates data collected across depots, port authorities and freight forwarders and provides a single view of the shipment across this integrated data.

Opportunity 4 – SME Cross-Border Logistics Platform

As cross-border trade increases, another important platform position, is that of an SME-focused cross-border trade and logistics platform. This is especially relevant to a region like ASEAN comprising

[64] "Cainiao Factsheet", Alizila, Sep 2016
[65] "New Data Platform Launched to Boost Singapore's Logistics Sector", Channel News Asia, Nov 2017

multiple countries, with significant cross-border trade activity and cooperation and with a very fragmented logistics and payments infrastructure.

As e-commerce increases and lowers barriers for SMEs coming on board, logistics can prevent SMEs from effectively participating in e-commerce by imposing high shipping fees. Growth of cross-border e-commerce with SMEs coming on board requires a logistics backbone and a multi-party logistics platform. These platforms connect SMEs with logistics players and marketplaces.

Much like other logistics platforms mentioned here, cross-border logistics platforms manage and coordinate the end-to-end delivery cycle by breaking down the various steps and coordinating across multiple specialised parties that each manage a specific step in the cycle. The platform coordinates the various parties, centralises procurement and documentation and offers monitoring and analytics to the various parties. It also links in to a host of marketplaces to aggregate and centralise all operations for participating SMEs.

Singapore-based Anchanto[66] provides a cross-border logistics platform for SMEs looking to participate in e-commerce. Its main product, SelluSeller, provides participating companies a one-stop interface to manage listings, inventory, orders and payments across multiple e-commerce marketplaces. In partnership with Enterprise Singapore (ESG), Anchanto has built logistics networks across ASEAN and beyond.

Opportunity 5 – Logistics-as-a-Service API Exchange

As e-commerce activity increases, the number of e-commerce players as well as the number of shipping providers are progressively increasing, leading to an increasingly fragmented logistics landscape. E-commerce players need to ship with multiple carriers and integrating with their individual technical systems requires custom development which is time-and-effort-intensive. Platforms that provide a single common interface for integration across all APIs can create significant value and aggregate and organise the logistics needs of the e-commerce industry.

EasyPost[67] provides a unified API exchange that integrates with more than 60 shipping carriers on the supply side and allows online retailers on the demand side to access all these shipping options through a unified interface, allowing them to compare prices and delivery times.

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66 "Anchanto Aims to be SE Asia's Top E-commerce Selling and Logistics Platform by 2019", TODAY, May 2017
67 "Software That Helps Small Businesses Ship Like Amazon", The New York Times, Apr 2014

3.3.2.2 Opportunities in the Platform Business Model – Capabilities Providers

Opportunity 1 – Analytics-as-a-Service

Logistics processes create vast quantities of data. Data analytics capabilities are critical to the success of logistics firms as platforms. Providers of analytics-as-a-service gather and process data to help with demand forecasting, inventory optimisation, predictive maintenance and other use cases.

ClearMetal[68] provides an analytics capability that allows logistics players (e.g. shipping carriers, freight forwarders) to make the most well-informed trade decisions across the shipment life-cycle. ClearMetal models and simulates the movement of every ocean container using machine learning. The company uses booking, container event, and voyage data, in conjunction with other third party data (e.g. currency rates, commodity trends, weather) to simulate the shipment life-cycle and help logistics firms make better decisions.

Opportunity 2 – Last-Mile-Delivery-as-a-Service

While much of the logistics chain is moving towards standardisation and automation, last-mile delivery continues to be a challenge. However, recent technological innovations are impacting last-mile delivery as well. Amazon has been testing drone-based last mile delivery while Uber has tested self-driving cars. Carry, an autonomous robot built by logistics start-up Dispatch, seeks to automate last-mile delivery with a robot that travels at the pace of pedestrians on sidewalks and delivers items.[69]

Matternet provides a more comprehensive capabilities-suite to solve "last mile" logistics problem by creating an orchestration capability to manage a fleet of automated drones.[70]

Opportunity 3 – Fleet-Management-as-a-Service

Logistics involves vast fleets of trucks, ships, and other delivery vehicles. It also involves large networks of warehouses. Managing assets across these fleets and networks will be one of the most important capabilities in a platform economy.

Amsted Rail's platform[71] enables asset owners and fleet managers to effectively manage their assets. The platform uses real-time data on an asset's movement to predict arrival times. The platform also uses wireless sensors to provide empty/loaded status, temperature of the shipment and the amount

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68 "A New Big Data Predictive Analytics Solution for Ocean Carriers", Forbes, Feb 2016
69 "Self-Driving Delivery Robots Are Coming to a Sidewalk Near You", Forbes, Apr 2016
70 "Meet the Startup Building Drones that Could Save Lives", Business Insider, Nov 2014
71 "The End-to-End Platform for Global Fleet Visibility" by Amsted Digital Solutions

of load being transported. Finally, the platform provides a predictive analytics suite to determine the health of specific components on an asset.

Opportunity 4 – Monitoring-as-a-Service

A related capability moves beyond asset management to integrate other forms of data and enable continuous automated monitoring for digitalised trade flows. This may involve monitoring of shipments, transport, warehouses, workers, essentially any stakeholder and their associated materials flow. Monitoring-as-a-service providers help to optimise operations but also create new value by enabling sustainability and track and trace across the supply chain.

Weft tracks shipping containers and analyses data flows from these containers vis-a-vis historical data for the planned route to identify potential issues and alert stakeholders accordingly.[72]

Opportunity 5 – AI-Enablement of Fleets

Connected fleets can be made more intelligent and autonomous leading to greater self-managed orchestration in logistics. Firms that provide the capability to AI-enable a connected vehicle will play an important role in the logistics industry.

Brain Corp creates algorithms that model the nervous system's sensory and motor capabilities to transform existing machines into intelligent self-driving robots. Similarly, Neurala creates capabilities for machines and devices to be more intelligent and autonomous. The technology can be deployed across a fleet of robots, drones, and self-driving vehicles to create alternate logistics solutions.

3.3.2.3 Opportunities in the Platform Business Model – Producers

Opportunity 1 – Integrate Logistics and Commerce

E-commerce firms like Alibaba and Amazon started by focusing only on commerce but eventually moved into logistics as well. Other Chinese e-commerce players like Jingdong Mall as well as Japan's Rakuten and India's Flipkart have moved from commerce into logistics to create an integrated solution.

Many logistics companies are moving in the opposite direction and getting into e-commerce as a means of differentiation to provide a vertically integrated e-commerce-cum-logistics solution to clients.

In other cases, traditional logistics firms are tweaking their business model to better provide services that cater to the growing e-commerce market. For example, Singapore Post and Australia Post have launched their e-commerce services to ride on the growth of platform-based e-commerce.

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[72] "Supply Chain Intelligence with Weft", 3PL News, Mar 2016

Opportunity 2 – Internal Logistics Management in a Platform Business Model

Traditional firms can also become more competitive, as producers, by improving their internal logistics. These firms leverage an internal logistics platform to drive greater integration across internal assets coupled with a control tower functionality that helps them monitor and manage all internal operations in one place, with integrated dashboards and notification systems. Having a single view of internal logistics can also serve as a starting point towards eventually integrating ecosystem assets and moving towards a platform business.

Kuehne + Nagel, a Germany-based logistics company with 1,000+ offices and 60,000+ employees centralises all logistics planning and execution using such an internal platform and creates central data integration across all assets and processes.[73]

3.3.3 Manufacturing and Supply Chain Management

Manufacturing has traditionally been an asset-intensive industry. While the early shifts towards a digital economy impacted the consumer industries further downstream, the rest of the supply chain remained largely unaffected. However, these industries are now becoming increasingly digitalised and leveraging the rise of new technologies to create entirely new production models and re-architect supply chains.

The digitalisation of manufacturing and supply chains is being driven by three factors in particular: the digitalisation of machine performance, the digitalisation of business workflows, and the digitalisation of product flows.

1) Machine manufacturers have embraced digitalisation on the promise of improved efficiency management and predictive maintenance.
   Using sensors, the digital twin of a machine's performance can be created, allowing a range of stakeholders to interface with the machine's data flows and make operational and business decisions.
2) Business workflows are getting digitalised.
   This occurs as enterprise communication and coordination functions are migrated from on-premise IT systems to cloud-hosted applications, on both private and public clouds. Irrespective of whether it is a private or public crowd, this migration drives digitalisation of workflows leading to greater data flows and interoperability between processes.
3) Product flows across the supply chain are being digitalised.

[73] "KN ControlTower: Enhancing Flexibility and Accelerating Time to Value" by Kuehne+Nagel Integrated Logistics

This enables track and trace capabilities further down the supply chain as well as to gain insight into the sourcing of product inputs further up the supply chain. This digitalisation also allows the creation of new platform opportunities, including the creation of secondary inventory marketplaces.

In addition to digitalisation, emerging technologies enable new production paradigms and allow even a re-architecture of supply chains.

Emerging technologies like additive manufacturing and prefabrication allow more distributed models of manufacturing, where several manufacturing activities can be performed at the edge of the supply network, rather than a centralised production facility. The advantages of large-scale manufacturing are getting eclipsed by the advantages of an agile and responsive supply chain. As additive manufacturing impacts the production process, self-driving vehicles and supply chain digitalisation will transform the logistics processes that interface with production.

As we move towards distributed manufacturing models coupled with autonomous logistics, centralised platform-based orchestration will be required to manage flows across the distributed supply network.

A common misconception around the rise of additive manufacturing and 3D printing is that these technologies will democratise manufacturing, much as desktop publishing tools democratised 2D printing. Unlike 2D printing, however, industrial manufacturing requires greater safety controls and testing, leading to a higher need for standardisation and oversight. As a result, large industrial firms that own testing capabilities are best positioned to leverage 3D printing across their supply chain. Additive manufacturing will make manufacturing more distributed, but it will still largely be controlled by companies that can best manage the assembly and testing capabilities required to take products to market. Coordinating distributed manufacturing across standardised testing and management processes will require central platform coordination.

The manufacturing value chain consists of three key players: component manufacturers, machine manufacturers, and system integrators. As we look through various opportunities below, some opportunities may be more relevant to certain kinds of players along the value chain than to others. For example, machine manufacturers may be best positioned to create platforms that organise component manufacturers. Similarly, system integrators may be well-positioned to create platforms of their own, leveraging their access to the end customer as well as the machine manufacturer ecosystem, or in the absence of any unique IP, may end up participating in a machine manufacturer's platform ecosystem.

3.3.3.1 Opportunities in the Platform Business Model – Platform Owners

Opportunity 1 – Industrial Process Management and Factory Automation Platforms

The initial driver for the digitalisation of heavy industry was machine performance. As more machines create data flows and enable constant monitoring and predictive maintenance, the data flows from these digitalised machines can be integrated across an industrial process, to digitalise the overall process. A digitalised view of the entire industrial process serves as the starting point for creating value for all stakeholders through a factory automation platform. At a minimum, process digitalisation leads to greater visibility for various stakeholders, all of whom have a single view of the process. Next, process performance digitalisation can also drive the identification of bottlenecks in the process, leading to predictive maintenance at a process or factory level. Finally, greater digitalisation across the industrial process can also help orchestrate a whole range of other players around the smart factory, including logistics players, suppliers, and other supply chain actors. These platforms also bring together an ecosystem of app developers who create applications on the digitalise industrial process data, to solve the pain points of various stakeholders.

GE's Predix and ABB's Ability are platforms that started with digitising machine performance but have since moved into creating greater value through process digitalisation and organising an app developer ecosystem to create applications using the process data flows.

Dassault Systems' 3DEXPERIENCE platform is a manufacturing operations management platform enabling the coordination of complex manufacturing workflows across multiple stakeholders. The ecosystem comprises manufacturers who use the platform as customers, as well as a larger community of designers and engineers in Dassault Systems' 3DEXPERIENCE Marketplace, who provide their know-how and capabilities to manufacturers using the platform. Dassault's acquisition of IQMS, an ERP company, in Dec 2018, further reinforces this vision of moving from product lifecycle management to an end-to-end business management platform.[74]

Trumpf, a German manufacturer of machine tools and laser-cutting machines, launched the Axoom platform, as a central platform to coordinate the end-to-end manufacturing process. The platform digitalises factory tasks, enables inventory tracking, and materials re-ordering. Axoom's IoT Management with Connection Centre helps machine manufacturers to connect and manage their devices in the field, to improve availability and service. Axoom's Condition Monitoring monitors machine behaviour while Remote Services enable remote configurations and troubleshooting, reducing maintenance effort. Finally, Axoom Analytics analyses machine data to improve productivity

[74] "Dassault Systèmes Acquires IQMS to Extend the 3DEXPERIENCE Platform to Business Operations for Small and Midsized Manufacturers", Business Wire, Dec 2018

for industrial users while its app store attracts external applications that enable greater workflow optimisation.[75]

Opportunity 2 – Platforms that Organise Industry Ecosystem Interactions

As cloud-hosted services get adopted by companies across the supply chain, they digitalise inter-firm interactions in any industrial ecosystem. Consider an invoicing software that digitalises interactions between firms and their suppliers and gather data about the goods and money flows between these companies. Similarly, a customer relationship management tool digitalises interactions between firms and their customers. In both cases, the digitalised interactions yield data that give insight into the nature of the relationships that firms have as well as the reputation of independent firms, based on their interactions in the industry ecosystem.

Tradeshift started out as an invoicing software-as-a-service application and used that initial service as a mechanism for digitalising inter-firm relationships. Over time, this digitalisation has allowed the creation of a reputation system across firms that can enable third parties like banks and insurance firms to offer tailored trade finance and trade insurance products to participating trading firms. The platform also extends available functionalities with an app store hosting external applications. Other companies like Procurify and SPS Commerce are pursuing similar strategies to move from a targeted software solution to coordination of flows across an industry ecosystem.

Opportunity 3 – End-to-End Ecosystem Monitoring and Management

Many parts of the industrial economy already apply the marketplace model but these systems are only partially effective because they still need to plug into a traditional supply chain. With increasing digitalisation, a digitalised manufacturing process could interact with a digitalised logistics system, lending itself to greater coordination across the end-to-end supply chain. End-to-end ecosystem monitoring and management platforms will gain the strongest position as they drive coordination across an industrial ecosystem by bringing together the advantages of both the platform models mentioned above.

Jabil, one of the largest manufacturing services companies in the world, has built out the Jabil InControl platform. The platform started by monitoring, controlling, and driving visibility across Jabil's internal operations and supplier ecosystem but is now provided to other companies looking to manage their own industrial ecosystems. The platform monitors flows across the supply chain and can re-route products flows and re-engineer processes to better manage the overall supplier ecosystem. The platform integrates with control systems and can even modify individual machine behaviour to

[75] "Trumpf's In-house Invention Turns Rivals Into Potential Clients", Financial Times, Nov 2016

be responsive to demand. The platform analyses more than seven million types of raw materials and equipment parts and can be customised to a company's supply chain requirements. It can identify potential supply chain risks, as well as bottlenecks in material flows. It also monitors financial solvency of suppliers and can monitor social media to analyse sentiments regarding a supplier's products.[76]

3.3.3.2 Opportunities in the Platform Business Model – Capability Providers

Opportunity 1 – Infrastructure, Communications and Cybersecurity Providers

Infrastructure, communication, and security needs for industrial platforms are different from those required for consumer platforms. This creates opportunities for capability providers to provide data management, cybersecurity, and communication capabilities for industrial use cases. While traditional cybersecurity and communication firms are migrating to providing these capabilities for industrial markets, the unique needs of the industrial markets will also provide an opportunity for entirely new capability providers who solve these problems particularly well for industrial markets.

Opportunity 2 – Analytical Capabilities for Smart Manufacturing

Many technology companies provide critical analytical capabilities for industrial platforms, instead of directly providing the end platforms themselves. This helps the technology firm scale across different industrial ecosystems as a capability provider, while also allowing them to play in the less regulated sections of the value chain. Given that industrial platforms do not often see winner take all scenarios, being a capability provider could provide much larger scale to a technology firm than being the platform provider in industrial ecosystems.

IBM Watson uses sensors and connected machines as inputs to power a selection of capabilities, including a plant performance analytics tool for productivity management, a visual inspection for quality tool for quality management, and prescriptive maintenance on cloud to identify and address manufacturing bottlenecks and risks.[77]

Opportunity 3 – ERP Capability Providers

Enterprise resource planning (ERP) tools are the traditional storehouses of resource planning and management data for manufacturing companies. While industrial platforms will create much more dynamic data flows using the Internet of things, they will need to partner with or acquire ERP companies that managed resource planning and management data for manufacturing firms and have

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[76] "The Pan-Industrial Revolution: How New Manufacturing Titans Will Transform the World", Richard D'Aveni, Oct 2018

[77] "IBM Maximo PQI -- Visual Insights" by IBM Marketplace

already created massive technical lock-in through the ERP software. As a result, the ERP companies will provide critical capabilities for industrial platforms.

Many industrial platforms already realise this and are making partnership and acquisition moves. Dassault Systems acquired IQMS, an ERP company to supplement its 3DEXPERIENCE platform. Similarly, Carbon, a California-based manufacturer of 3D printers, has partnered with Oracle in a bid to create a larger platform business. UPS has partnered with SAP, which in turn provides many critical capabilities beyond ERP through SAP Distributed Manufacturing.[78][79]

Opportunity 4 – Edge Intelligence and Fog Computing Providers

As the industrial Internet scales, industrial IoT platforms will require greater intelligence at the edge that allows connected devices to process information locally and take action. FogHorn provides a fog computing solution for industrial IoT applications, which allows analytics and edge computing applications for a range of manufacturing use cases.

3.3.3.3 Opportunities in the Platform Business Model – Producers

Opportunity 1 – Shift in the Core Manufacturing Model

The shift towards platforms provides three possible future scenarios for traditional manufacturers to change their business model as producers.

First, manufacturers that prioritise economies of scale over responsiveness will need to move towards greater end-to-end automation, leveraging a smart factory/manufacturing platform that enables greater automated coordination across the manufacturing process. These manufacturers will be best equipped to produce high volumes of commoditised products at low costs.

Second, manufacturers that cannot compete on cost and scale will focus on becoming a niche producer. This is a particularly important position because of the rise of new technologies in manufacturing. While in industrial manufacturing, economies of scale played a big role, the right of additive manufacturing allows manufacturers to become a niche producer. Sumitomo Heavy Industries,[80] one of the leading Japanese industrial equipment manufacturers, is making significant movements in this direction by getting into additive manufacturing. The company acquired Persimmon Technologies, which uses a spray-based 3D printing method to create the binding quote of an electric motor, thereby creating smaller and more efficient motors. Other manufacturers will also increasingly invest in

[78] "UPS and SAP Deliver On-demand Additive Manufacturing Technology", TechTarget, Dec 2017
[79] "Dassault Systèmes Acquires IQMS to Extend the 3DEXPERIENCE Platform to Business Operations for Small and Midsized Manufacturers", Business Wire, Dec 2018
[80] "Sumitomo Buys US Developer of Spray Motor Technology", DFA Media, Apr 2017

technologies that allow them to succeed as niche producers and differentiate on the product performance itself.

Finally, manufacturers that prioritise responsiveness and agility over economies of scale will differentiate themselves through personalised offerings and the ability to shift their product line rapidly in response to market shifts. In particular, these manufacturers will pursue decentralised manufacturing using additive manufacturing technologies like 3D printing. These companies will have the supply chain agility to respond to consumer demand. They will have the ability to let consumers design their products, and will use all this consumer data to better predict future needs across their supply chains.

Opportunity 2 – Shift from Products to Services

Machine manufacturers are increasingly moving from a business model of selling machinery to a usage-based or outcome-based business model of selling services. This is more than merely a shift from CAPEX to OPEX. It is a shift from selling machines to selling outcomes, a shift that creates competitive advantage over other manufacturers who continue to sell machines without any commitment to outcomes. The data flows from the operation of the machine can be used to create multiple revenue streams by providing value to different stakeholders.

Rolls-Royce uses the data generated from its jet engines to create a services-based business model. Instead of charging for jet engines as products, the company charges for product uptime and reliability as a service. Rolls-Royce TotalCare provides a suite of predictive maintenance and repair services for its jet engines, by monitoring the health of its engines, and modifying them to increase reliability.

Opportunity 3 – Monetise Spare Capacity

In a platform economy, spare production capacity in supply chains can be uncovered and reallocated on-demand. While a machine might be located on the production site of one manufacturer, its idle time could be sold to another manufacturer that produces in the same area. On-demand available of spare capacity will move manufacturing from rigid supply chains to modular production networks.

4 PLATFORM OPPORTUNITIES FOR SMALL COMPANIES

Most successful platforms today are large multi-billion dollar firms with millions of users. Looking at these examples, one may conclude that only large companies can pursue a position of strength in a platform economy. While it is true that the largest platform firms eventually become large companies, even small companies can pursue very profitable positions in the platform economy and use its mechanics to build competitive advantage for themselves. This section lays out eight positions that small firms can pursue, and many firms successfully pursue a combination of multiple positions.

Figure 6 : Platform Opportunities for Small Companies

Position 1 – Provide Critical Capabilities to Other Platforms

One of the most powerful positions for small firms is to provide capabilities to other platforms. By focusing on a specific capability, a small firm that owns unique intellectual property can scale across platforms without needing to build a platform itself. To minimise dependence on any one platform, the capability provider should ensure that the capabilities are not platform-specific and apply generally across platforms. Facebook Connect's identity management, Stripe's payments integration, and Twilio's communication services are examples of such horizontal services. Stripe and Twilio have scaled as their capabilities were used across platforms, but both these companies started as small companies with a unique capability that other platforms needed.

Position 2 – Partner with Platforms to Co-Create Intellectual Property

While small firms may not have the scale to compete directly with large platforms, they can partner with platforms to co-create intellectual property and benefit from the platform's scale. Alibaba's TMall Innovation Centre (TMIC) allows third party firms, particularly consumer products manufacturers, to co-create new products by combining the data and insights from the platform as well as its market reach with the product capability of the partner. Small firms, particularly those that excel at niche product design and development capabilities can partner with platforms to create specific market-relevant products and co-own the intellectual property in these products. With the platform's greater

scale and the small firm's unique capabilities, this partnership model helps a small firm scale without any risks of commoditisation by the platform.

Position 3 – Pursue a Platform Strategy in a Small Industry Ecosystem

While a small firm cannot easily build a platform at global scale with billions of users, it can still pursue a platform strategy within a small industry ecosystem. By selecting a smaller and underserved ecosystem, a small firm can benefit from a platform strategy within that particular bounded ecosystem.

Position 4 – Differentiate as a Producer in a Particular Niche and Create a Multi-Platform Strategy

Small firms, particularly those with niche specialisation, can partner with a platform to gain greater distribution. In doing this, they must ensure that they pursue a multi-platform distribution strategy and avoid being overly dependent on one single platform. A small firm is better positioned to win against platforms on the basis of niche specialisation and brand-building than as a mass commodity player.

Position 5 – Partner with a Platform to Migrate from Product-Based Models to Services-Based Models

Small firms can also partner with platforms to change their business models and move from product-based models to services-based models. For example, several machine manufacturers work with platforms like GE Predix and ABB Ability to move towards a services-based business model, based on the digital twin data generated for the machine by the platform. However, it is important to note that as the platform brings more machine manufacturers on board, the digital twin data created by the platform will not remain a sustainable differentiator for the small firm, which should then look to supplement this with additional sources of proprietary and non-replicable data.

Position 6 – Integrate into a Platform which allows Interoperability without Lock-In

Small firms should also look to integrate with platforms that allow interoperability over APIs. This is as opposed to platforms that require other deep integrations from partner firms. Platforms that allow interoperability without deep integration allow partner firms to access the market without locking them in. The enterprise messaging platform, Slack is one such example that allows interoperability for many other productivity apps. In contrast, a development platform like Apple iOS or Google Play requires developers to build applications specifically for the platform, thereby creating technical lock-in.

Position 7 – Consume from a Platform and Build a New Layer of Value

Small firms can also consume open data and content from a platform, using its APIs, and create new value in the form of analytics or decision support tools. Many social media monitoring tools take open

data and content from social media platforms and create analytics for their clients using this data. In such cases, the small company runs the risk of building a business model that is overly dependent on the underlying platform, and must carefully evaluate the terms and conditions and expected future policy changes on the platform.

Position 8 – Run Lean Operations at the Back-End by Tapping External Platforms for an On-Demand Workforce

Small firms can also leverage platforms to run leaner operations. Without having in-house R&D, small firms can leverage open innovation platforms to gain R&D capabilities. Without needing to hire full-time employees, small firms can leverage an on-demand workforce by consuming from a labour platform like Upwork.

As these examples demonstrate, the platform economy presents opportunities not just for large platform firms but also for small firms looking to gain a competitive edge. By understanding the mechanics of the platform business model, these firms can occupy strategic positions that empower them to best leverage the advantages of this new world.

5 CHALLENGES FOR THE PLATFORM BUSINESS

As illustrated through several examples in the preceding sections, platform business models create competitive advantage in a digital, connected and data-rich world. Transitioning to a platform business model is an attractive proposition for every firm looking to differentiate itself in the digital economy. However, building platforms as well as partnering with platforms involve inherent risks which need to be understood and exhaustively evaluated before firms decide to invest in this direction. This section lays out the various challenges associated with building or partnering with platforms.

Figure 7 : Challenges for the Platform Business

5.1 Challenges of Building Platforms

Challenge 1 – Failure to Launch and Gain Adoption

One of the most common reasons for platform failure is the failure to mobilise the ecosystem in order to drive adoption and build network effects. Most platforms have little or no value without users. Hence, they suffer from a cold start problem. Without consumers using the platform, producers do not want to come on board and vice versa.

To solve this cold start problem, platforms often require significant investment to get to critical mass. They also need to structure the right incentives in order to attract the market.

As an example, as consumers spend more time on platforms like Facebook, Instagram, Snapchat, and WhatsApp, it is increasingly difficult for a new platform with no activity to attract these consumers who are already engaged on high activity platforms. Similarly, new marketplaces may find it difficult

to solve the cold start problem. Without buyers, sellers will not come onto the marketplace and without sellers, there is no incentive for buyers to join the marketplace.

This problem is particularly pronounced when building developer ecosystems. As an increasing number of companies create developer ecosystems, the developer base they compete for is small and building a platform that attracts developers is becoming increasingly difficult.

Research in motion, or R.I.M, the creator of the Blackberry smartphone, was a late follower as a platform after Apple and Android had already established a large growing base of installed smart phones. As a result, the best developers headed to iOS and Android, while the low quality developers and apps stayed on Blackberry. This became a vicious cycle, because low quality applications attracted a smaller base of consumers, which in turn discouraged the creation of high quality apps.

R.I.M even tried to create better incentives for developers by guaranteeing every app developer a minimum sum of $10,000, provided that their app was certified through Blackberry's quality control process, and that the app had generated a minimum of $1000 through actual sales. Even though RIM was guaranteeing a minimum payout, it failed to attract high quality developers, who preferred working with a competing platform that already had a thriving market.

R.I.M's experience demonstrates the challenge of overcoming the cold start problem. By far, the most common reason for early stage failure of platform companies is their inability to mobilise the ecosystem and overcome this cold start problem.

Challenge 2 – Failure to Expand Beyond a Core User Base

Some platforms overcome the cold start problem very effectively and are able to build a core user base with high activity, but fail to expand beyond this core user base.[81]

For example, Reddit has successfully created a high activity platform but has repeatedly failed to expand beyond its core user base. While Reddit has very high engagement among its core user base, critics of the platform often claim that this core user base encourages a 'hivemind mentality'; which is less inclusive of new users with differing viewpoints. As a result, despite high engagement, the platform has failed to scale beyond its core user base.

The question-answer platform Quora has faced a similar issue. As Quora scaled, it was able to grow beyond its initial user base of Silicon Valley engineers but its content drastically changed, reflecting the creations of the new users. As a result, many of the original users abandoned the platform.

[81] "Upvotes, Downvotes, and the Science of the Reddit Hivemind", Popular Mechanics, Aug 2013

Challenge 3 – Failure to Manage Access Rights and Quality

As a platform scales, it may find it increasingly difficult to curate participants, manage the quality of the goods and services they produce, and the rights they have on the platform.

This is particularly observed on platforms that use manual vetting procedures that do not scale as the ecosystem starts scaling non-linearly.

Social networking platform MySpace failed to scale quality control on its platform with rapid growth in content creation on the platform. Subsequently, high growth social platforms like YouTube, Facebook and Twitter have had to invest significant resources in identifying undesirable activity and scaling quality control through algorithmic means.

This problem is also observed on platforms that entirely fail to manage the identity and reputation of its ecosystem participants.

Chatroulette, an anonymous video chatting platform that pairs random users for webcam-based video chat. With no user vetting and curation in place, the platform lacked basic identity management. Owing to the low barriers to usage, it gained rapid growth through viral effects, but the quality of content on the site dropped rapidly as the anonymity and random connections encouraged some users to participate in inappropriate behaviour, including nudity and exhibitionism. Other users who wanted to use the platform for chatting started abandoning the platform as the proportion of such inappropriate content increased. Chatroulette demonstrates the importance of identity, reputation and quality management on a platform.[82][83]

Wikipedia uses a range of tools and a sophisticated reputation system to manage quality on the platform. Over time, Wikipedia policies and reputation management have evolved to guarantee high quality for the most important content. However, despite the sophisticated tools and policies, even Wikipedia suffers from low quality in the long tail of content on the platform. This, again, demonstrates how the quality management requirements on a platform scale beyond the scope of its tools and policies over time.

Challenge 4 – Failure to Scale Matchmaking

Platforms may also fail to scale matchmaking as they grow. Unlike quality management, matchmaking failures stem less from a failure to manage quality of the content produced, and more from a failure to gather enough data about the two sides in order to match them effectively.

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[82] "The Decline and Fall of Chatroulette", The Wall Street Journal, Aug 2010
[83] "What Remains of Chatroulette: It's Gone to the Do(n)gs", The Verge, Feb 2018

Most platforms focus on gaining data about consumers to effectively serve them the right content. Platforms like YouTube have often been criticised for surfacing inappropriate content in their video recommendations. When a platform fails to gather data about consumers, it fails to make effective matches.[84][85]

Challenge 5 – Failure to Manage Platform Fragmentation

In addition to quality management and matchmaking issues, a platform may also suffer from fragmentation.

Platform fragmentation is observed when different versions of a platform evolve in ways that reduce the ability of users of one version to interact with users of another version.

There are two broad ways in which fragmentation occurs:

1) Fragmentation by Omission

   This is a result of poor ecosystem management by the platform owner who releases new versions of the platform without other ecosystem partners adopting these new versions.

   For example, in the early days of Android, Google's periodic updates to Android were not adopted by smartphone manufacturers. As a result, the experience for end users was fragmented and many of the applications would not work consistently across the various Android phones with different hardware and software combinations. Since applications would run well only on some versions of Android and only on some phones, developers failed to benefit from system-wide network effects by launching their applications on Android.

2) Fragmentation by Commission

   Another form of fragmentation results from explicit decisions by ecosystem partners to create a version of the platform that is incompatible with other versions.

   Amazon created a forked version of Android for its Amazon Fire phone. As a result, some Android applications do not work well with Amazon Fire phones.

   Google eventually solved these challenges by addressing fragmentation, but the example demonstrates how the most sophisticated of platform companies may also fail to effectively govern their ecosystem.

Challenge 6 – Failure to Manage Conflict of Interest

Finally, a platform may also encounter governance challenges owing to conflicts of interest allowing from ownership of the platform. These conflicts of interest arise in industry platforms when the

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[84] "Children's YouTube is Still Churning Out Blood, Suicide and Cannibalism", Wired, Mar 2018

[85] "YouTube Related Videos Feature Inappropriate Content - How to Fix It", WebLift, Aug 2012

platform owner is also a producer in the ecosystem, or when one or more of their ecosystem producers gain an investment stake in the platform. This dual platform-producer role makes other producers wary of participating on the platform.

One of the reasons for Symbian's failure was such a conflict of interest. By 2004, Nokia owned nearly 48% of Symbian's equity and accounted for more than 75% of its annual handset sales. As its largest customer, Nokia controlled Symbian's revenues. This made other OEMs wary of using Symbian. As Nokia's market share grew from 2004-2007, it increased its control over Symbian. In contrast, Google steered clear of the handset business for several years to encourage adoption of Android without conflicts of interest. Similarly, Qualcomm sold its handset and chip businesses to be a neutral platform player.

GM OnStar was similarly launched as a cross-industry platform to give wireless capabilities to automobiles for navigation systems, remote diagnostics, remote maintenance, remote unlocking, etc. However, GM's position as a manufacturer as well as platform owner created a conflict of interest and discouraged other manufacturers from joining the platform.

EMC, a market leader in data storage technology, tried to establish WideSky as an industry-wide platform. WideSky was a middleware platform for easily integrating and managing third-party hardware. However, being a technology vendor itself, EMC had a conflict of interest and failed to persuade its competitors to adopt WideSky. EMC's competitors meanwhile colluded to create the Storage Networking Industry Association and released an open platform. EMC eventually abandoned WideSky.

These examples illustrate how a conflict of interest can lead to governance failure and discourage the adoption of an industry platform.

Challenge 7 – Failure to Prevent Multi-Homing

In order to successfully retain its ecosystem, a platform must have high multi-homing costs. Multi-homing costs refer to the costs involved for a user to participate (or 'home') simultaneously on multiple platforms. The higher the multi-homing costs, the more difficult it is for producers and/or consumers to participate on multiple competing platforms.

When developers develop for the Android and iOS platforms, they incur high multi-homing costs as they have to build separate applications for the two platforms. Consumers also cannot easily multi-home as they need to buy two separate phones.

In the case of Uber and Lyft, however, multi-homing costs for drivers to co-exist on the two platforms are relatively low. Many drivers participate on both platforms, often simultaneously using multiple

handsets. Given the ease of booking rides, multi-homing costs are very low for riders on these platforms as well. As a result, Uber struggles to retain its ecosystem and it is usually difficult to arrive at a winner takes all scenario. For this reason, Uber had to close its operations in China and SE Asia, where the local competition - Didi and Grab, respectively — was well funded, leading to Uber's failure in these two geographies.

Challenge 8 – Failure to Effectively Control the Transaction

Platforms that enable the exchange of services may find it difficult to effectively control the transaction. These platforms cannot facilitate a transaction before the buyer and service provider agree to the terms of the service. This often requires the two sides to interact directly with each other.

Connecting the two sides directly before capturing a transaction cut weakens the platform's control over the transaction and its ability to capture value. The party that is paying is naturally motivated to abandon the platform and conduct the transaction off-platform.

This is particularly observed in the case of professional services platforms for two reasons. First, it is much easier to take the transaction off-platform as the two sides can discover each other on the platform and then connect directly on LinkedIn or other professional networks, thus avoiding the platform cut. Second, professional services platforms require discussions, exchanges, and workflow management during the provision of services before the actual charge can be levied. As a result, charging the client ahead of the transaction is difficult.

Some of these platforms solve these problems by moving beyond the basic matchmaking role to providing the workflow management and monitoring tools that control the actual delivery of the service through the platform. For example, platforms like Upwork provide work-tracking and billing solutions that allows clients to monitor service providers and also provide escrow solutions that guarantee payment to the service provider, as the client deposits the payment with the platform ahead of the delivery of work.

Companies building professional services platforms must particularly focus on building the right tools, and instituting the necessary policies required to retain the transaction on the platform.

Challenge 9 – Failure to Monetise without Harming Network Effects

Platform monetisation involves challenges not observed with traditional product monetisation. The value on a platform is created by the users using the platform and charging users directly may discourage them from participating, thereby coming in the way of value creation and weakening the

network effect. Hence, a platform business needs to identify monetisation models that do not negatively impact the network effect created.

Zvents, an online platform enabling users to discuss local events posted by event organisers learned this lesson the hard way. When the company tried to make event organisers pay for setting up a listing, they refused to put their listing up, which would have impacted the network effect as fewer listings would result in an incomplete guide for local events, making consumers move to other platforms.[86]

MySpace, after being acquired by News Corporation, faced a similar dilemma between improving the network effect and monetising the platform. Instead of focusing on improving user experience and engagement, News Corporation overtly focused on monetisation, flooding the site with advertisements and creating a poor user experience. Most users migrated to Facebook during this period, which offered a better user experience and had fewer quality control issues as well.[87]

Challenge 10 – Organisational Concern Over Cannibalisation and Loss of Control

Incumbents building platforms in industrial markets express concern over the third parties on the platform competing with their legacy business. These incumbent organisations fear that opening up the platform to third parties will cannibalise their own traditional product sales. As a result, such organisations resist the promotion of the platform, leading to failure.

Johnson Controls' Panoptix platform[88], targeted at the building and construction industry, failed to gain adoption by third party developers. The launch of the platform was accompanied by internal concerns surrounding the risk of Johnson Controls cannibalising their own building automation product and providing third party app developers access to data from customers' buildings.

Challenge 11 – Failure to Build a Practical Phased Out Roadmap

Large incumbent organisations building out platform businesses may also fail to gather internal organisational commitment to the project because of other reasons. One of the most common reasons for abandoning platform projects involves the longer time horizon over which platforms generate large scale returns. Since most platform efforts fail to build network effects, large organisations are hesitant to invest millions of dollars for several years before seeing returns. To solve this problem, every platform initiative must be structured in a phased out roadmap with a business case tied to every step of the roadmap. This serves to allay concerns for investors at these incumbent firms.

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86 "The Curse of the Network Effect", Psychology Today, Jun 2013
87 "The Rise and Inglorious Fall of Myspace", Bloomberg Businessweek, Jun 2011
88 "Internet of Commercial Buildings: Changes at Johnson Controls", Harvard Business School Digital Initiative, Nov 2016

5.2 Challenges of Being a Producer or Consumer of Platforms

Companies that do not build platforms or provide critical capabilities to other platforms are likely to participate as producers and/or consumers in other platforms' ecosystems. As a producer, a company benefits from market access while as a consumer, the company may benefit from value created on the platform, including access to data flows on the platform through APIs. However, both producers and consumers on the platform are also exposed to a range of risks while working with early stage platforms. They may also face threats from the platform once the platform becomes dominant in its market segment. Through this sub-section, we outline the various risks and threats associated with being a producer or a consumer on other platforms.

Evaluation of Risks

Companies that participate on early stage platforms may also take several forms of risk. While participating on early stage platforms, especially as a producer, firms must evaluate their exposure to risk along several dimensions. These dimensions are outlined below.

No.	Risks	Remarks
1.	Adoption Risk	An early stage platform, particularly before network effects set in, may fail to gain adoption. Accordingly, producers that build their business on the platform are faced with a dilemma. Early participants on a platform often benefit in the long term as they benefit from a longer period of building reputation and following on the platform, as well as from the platform's promotional activities in the early days. On the other hand, early participants also take the risk of investing in a platform that may never gain adoption. As with all risks, businesses participating in early stage platforms should try to diversify and work across multiple platforms to mitigate this risk. The business must also determine the multi-homing cost involved - the cost of participating on more than one platform. For example, developers who were already building applications for Apple and Android did not want to also incur additional effort and cost in building applications for Blackberry. In addition to evaluating multi-homing costs, the business should also determine whether the sponsors of the platform are capable of funding the platform till it gains massive adoption.

2.	Technology Risk	Businesses participating on early stage platforms may also face technology risk if the platform leverages technology that has not yet found industry-wide adoption. For example, platforms that work with technologies which have relatively few validated use cases increase the risk of platform adoption.
3.	Regulatory Risk	An emerging platform may also not be compliant with regulation and may fall prey to frequent regulatory changes. Businesses that invest time and effort in participating in such platforms are exposed to the risk of regulatory changes impacting the platform.
4.	Credibility Risk	Early stage platforms also come with risks of quality management and governance. If the platform fails to govern or curate the market in a desirable manner, the business participating in its ecosystem may lose credibility. This is especially true in quality-sensitive markets like financial services and healthcare.
5.	Brand Confusion Risk	Participants must also evaluate whether participating on an external platform leads to brand confusion regarding their brand. For example, merchants selling on platforms like Amazon should ensure that the platform clearly communicates whether the product is sold by the platform owner or by a third party merchant.
6.	Customer Migration Risk	In certain cases, companies that participate on a platform are required to bring their audience from other destinations onto the platform. For example, on a platform like Chictopia, bloggers may bring followers from their blog onto the platform. The platform provides a new avenue for monetisation for these bloggers. However, before participating on such platforms, businesses need to evaluate the terms and conditions to determine user relationship and data rights on the platform as they may risk customers migrating to the platform. Companies participating on early stage platforms may benefit from the first mover advantage in the ecosystem where they gain reputation and influence at an early stage. However, these companies face a variety of risks and need to evaluate these risks and diversify their bets across competing platforms before committing resources.

Evaluation of Threats

Companies that participate on large platforms may face threats from the platform owner, owing to the much higher negotiation power and scale of the platform owner. There are several factors that determine the extent to which a company may be adversely impacted while participating on a large platform. These factors are outlined below.

No.	Threats	Remarks
1.	Bait and Switch	Platforms often create favourable incentives for ecosystem members in their early days in order to gain participation from the ecosystem. After gaining scale and building network effects, a platform may change its policies in a manner that harms the ecosystem but plays to the platform's immediate advantage. As the platform scales, its negotiation power increases and the ecosystem gets increasingly locked in, making it easier for the platform to implement such a bait and switch tactic. Twitter has made several changes to its API policies over the course of its evolution that have repeatedly taken away incentives from developers in order to strengthen its position as a platform. Twitter started out with very few features and capabilities and the developer ecosystem around it helped to create additional capabilities. However, as it scaled, it has created checks and balances to limit user growth on third party apps in its ecosystem, as well as actively discourage third party Twitter clients that seek to engage users on their own.[89][90] Android, similarly, started out as a completely open platform, but over time, has absorbed key functionalities like Google Maps and Google Cloud Messaging away from the open AOSP to the proprietary Google Play.[91]
2.	Gatekeeping and Market Access	Platforms are gatekeepers of market access. In a common bait and switch pattern, marketplaces and social networks may create increasing barriers between their users for the purposes of monetising user access. Facebook, for example, has curtailed the organic reach that brands and users can achieve on its platform, as its advertising network has grown. Brands and users that build an audience on Facebook are left with little

[89] "Twitter's API Update Cuts Off Oxygen to Third-Party Clients", Mashable, Aug 2012
[90] "Twitter Wants a Billion Users, and It's Prepared to Sacrifice Developers to Get There", The Next Web, Aug 2012
[91] "Google's Iron Grip on Android: Controlling Open Source By Any Means Necessary", Ars Technica, Jul 2018

		choice but to pay Facebook for a promoted post to target the same user base that they would have targeted for free earlier.[92] This is especially harmful to participating companies when they have invested considerable resources on the platform to build an audience and influence them.
3.	Unfair Competition by the Platform	When the platform owner also acts as a producer on the platform, it may have a conflict of interest with other producers. In such cases, the platform may compete directly with producers in highly profitable categories to benefit from higher margins. Successful producers, having invested in building their business on the platform, may get pushed out as the platform's algorithms and policies prevent them from accessing the market. Research from Harvard Business School demonstrates that Amazon increasingly enters profitable categories as a merchant and directly competes with merchants in its ecosystem. In such cases, the products sold directly by Amazon often become the preferred option showcased in search results as the platform's algorithms deprioritised products from other companies.[93] Similarly, the live video streaming app Meerkat, which gained a lot of traction on Twitter, was removed from the platform. Twitter instead acquired its less successful copycat Periscope and cut off Meerkat's access to Twitter's users and social graph.[94] In general, whether working with early stage or mature platforms, companies that participate as producers or consumers in their ecosystem must seek to reduce over-dependence on one specific platform by working with multiple platforms. In particular, companies should avoid committing too much resources to one platform. They should also ensure that their business models are not overtly dependent on the platform. For example, Demand Media, a content farm, built its business around exploiting Google's algorithms and failed when Google changed its SEO guidelines.[95]

[92] "'Organic Reach on Facebook is Dead': Advertisers Expect Price Hikes after Facebook's Feed Purge", Digiday, Jan 2018
[93] "When Platforms Attack", Harvard Business Review, Oct 2013
[94] "Meerkat Founder On Getting The Kill Call From Twitter", TechCrunch, May 2015
[95] "Epic Fail: The Rise and Fall of Demand Media", Variety, Dec 2013

		Similarly, Zynga gained rapid scale on Facebook gaining a million daily active users in just 4 days and generating revenues of $30M in the first 6 months. But it failed to sustain as a business once Facebook changed its policies.[96] As these examples demonstrate, the platform business model provides the opportunity for rapid growth for companies looking to partner with platforms but these companies must be wary of over-dependence on one specific platform.

5.3 Challenges of Being a Capability Provider

A capability provider to other platforms also needs to be wary of many of the risks and threats listed above. Additionally, they need to ensure that the capability is not over-catered to a specific platform, in a manner that creates over-dependence and technical lock-in and an inability to provide the capability as a service to other third party platforms. Meerkat on Twitter and Zynga on Facebook are examples of applications that were core to driving engagement on the platform but could not be scaled beyond the platform onto other platforms. On the other hand, backend capabilities like storage, payments management, communication management, and security are more extendible across other platforms. The capability provider should ensure that technical choices made while building these capabilities do not over-cater to the initial few platforms but are standardised and modular enough to be incorporated into other platforms.

[96] "The Rise and Fall of Zynga: A Cautionary Tale for Mobile Game Developers", TranslateMedia, Jun 2017

6 IMPLICATIONS OF BLOCKCHAIN FOR PLATFORM BUSINESSES

Platform business models have created massive value by opening out markets, increasing transparency between market actors and reducing transaction costs. However, all platforms are centrally owned and governed, which can sometimes create a conflict of interest, if the interests of the platform owner are not aligned with the interests of the ecosystem participants. This is especially likely once a market consolidates around a platform, leading to monopolistic power for the platform. Some of Amazon's third-party sellers[97], for example, have seen their business be impacted by changes to the platform's policies. Developers on Twitter[98] have faced similar challenges, as have drivers on Uber.[99]

Blockchain-based models may help to address this risk. The blockchain provides an alternate distributed architecture for managing an ecosystem of participants. Instead of one company serving as the central intermediary, the blockchain codifies the rules of intermediation and distributes it across a larger number of parties, with no single party in full control of intermediation. By codifying and executing these rules across a distributed system, it creates a new distributed architecture of governance.

The blockchain has the potential to take the various building blocks of a platform and progressively decentralise them, reducing the control of any one central intermediary. These building blocks include identity, governance, payments capabilities, and hosting capabilities. This is best illustrated through the platform stack.

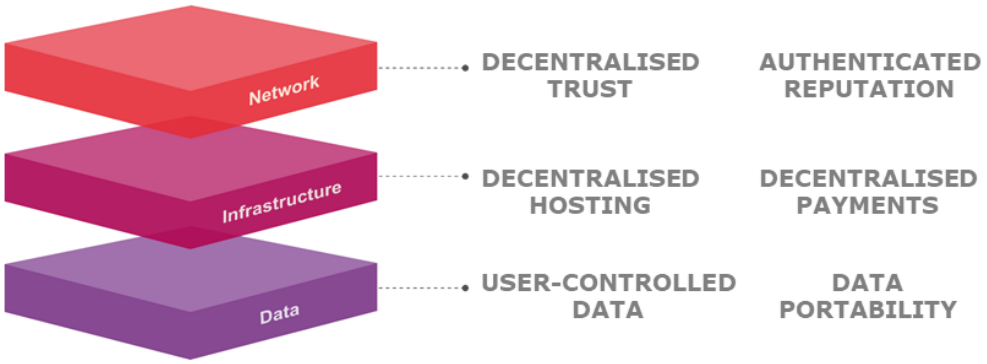

Figure 8 : Platform Stack and Blockchain

97 "An Amazon Revolt Could Be Brewing as the Tech Giant Exerts More Control Over Brands", Recode, Nov 2018
98 "Twitter Handcuffs Client Apps with New API Changes", TechCrunch, Aug 2012
99 "Uber Drivers are Staging Their First Multi-City Strike, and It's A Sign Their Anger Over 'Exploitation' is Getting Harder to Ignore", Business Insider, Oct 2018

At the network layer, the blockchain can create a new mechanism for trust between participants in the network, by using smart contracts. The conditions to enable platform transactions can be codified and executed entirely on the blockchain using smart contracts, thereby reducing the need for central curation and oversight to guarantee trust. A smart contract could execute the movement of goods and services and the transfer of money in an entirely rules-based automated fashion. Finally, the blockchain could also be used to authenticate reviews on a platform, thereby leading to more robust reputation systems. The blockchain would ensure that reviews could only be posted by users who actually participate in a particular interaction.

At the infrastructure layer, blockchain-enabled cryptocurrencies could potentially provide an alternate payment model with lower transaction fees and without the need of a central intermediary. The blockchain could also provide a mechanism of decentralised hosting where the ecosystem's resources and intellectual property are not hosted on a central platform server but are hosted on instances that are managed and executed across the platform's network of users.

At the data layer, the blockchain can potentially move power to the users by allowing them to control their data without the need for centralised storage and by allowing users to easily port data across platforms. Identity management and authentication could also be managed on the blockchain.

All of the above applications of the blockchain can be illustrated through four specific models in which blockchain implementations are already impacting the platform business model.

6.1 Model 1: Permissioned Blockchains to Manage Industry Ecosystems

In the platform business model, permissioned blockchains (and other forms of distributed ledger technologies) may be effectively used to create new protocols for communication and coordination within an industry ecosystem. Unlike the permissionless blockchain, permissioned blockchains allow distributed governance while managing privacy and access to the ledger. These initiatives are typically sponsored by a consortium of participating industry players that agree on using a common permissioned blockchain to digitalise information required for coordination between the participating players. This digitalisation of information across multiple parties allows new platforms to be created using this data and infrastructure.

Blockchain-Based Digitalisation in Trade

Permissioned blockchain initiatives are already being effectively deployed to create a new coordination infrastructure for trade.

Maersk and IBM[100] have partnered to launch TradeLens, a blockchain-based platform for tracking global shipments. The ledger digitalises the end-to-end shipping lifecycle by digitising two specific types of data, event data and document data, which together lay out the shipping lifecycle. The blockchain allows all participating parties to view key events, including shipment arrival times, and related documents, including customs releases, invoices and bills of lading in near real-time. Using smart contracts, Maersk's platform can leverage events to trigger the execution of documents across the shipping life cycle.

Blockchain as the New Financial Infrastructure

Permissioned blockchains can also be used to create new infrastructure for financial transactions and can create a new infrastructure for value exchange in the platform business model.

JP Morgan's Interbank Information Network (IIN)[101] is one such initiative, built on the bank's proprietary blockchain, Quorum, which acts as a shared ledger for managing cross-border payments, allowing participating banks to easily add or edit the information needed for payments sent between banks. The IIN competes with traditional networks like SWIFT and had 75 participating banks as of Sept 2018.

The People's Bank of China (PBoC)[102] has similarly launched a blockchain-based trade finance platform to streamline interbank payments among trading SMEs, allowing them to access a larger variety of financing options.

In the ASEAN region, where many developing countries still lack efficient payments and financial infrastructure, blockchain-based solutions can create an alternate technology stack for enabling financial transactions. For example, the National Bank of Cambodia[103] has partnered with Soramitsu Co., a Japanese blockchain identity company, to pilot blockchain-based payment mechanisms.

Blockchain to Manage Supply Chain and Track and Trace

As supply chains transition to the platform business model, a blockchain-enabled infrastructure could be deployed to digitalise supply chain flows and better track and trace the origin and movement of goods.

In 2017, Walmart,[104] in partnership with IBM, launched a blockchain powered solution to track food supply across its supply chain in the US. Several food suppliers and retailers, including Kroger,

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100 "IBM, Maersk Launch Blockchain-Based Shipping Platform with 94 Early Adopters", Computerworld, Aug 2018
101 "75 Banks Have Joined JPMorgan's Blockchain Payments 'Party'", Business Insider, Sept 2018
102 "People's Bank of China Pilots Trade Finance Blockchain Platform", Cryptovest, Sept 2018
103 "Cambodia's Central Bank Signs Deal to Develop Blockchain Tech", CoinDesk, Apr 2017
104 "Walmart is Betting on the Blockchain to Improve Food Safety", TechCrunch, Sept 2018

McCormick, Nestlé, and Unilever collaborated on the initiative. In 2018, Walmart launched the Blockchain Food Safety Alliance in China, in collaboration with Chinese e-commerce company JD.com to improve food tracking and tracing.

Blockchain to Manage Public Infrastructure Ecosystems

Finally, permissioned blockchains can also serve as an infrastructure for managing more asset-intensive industries in the platform business model.

In the Philippines, Energo Labs[105] is using blockchain technology in combination with microgrids to decentralise energy production and consumption and allow off-grid locations to create and consume their own energy. In this manner, these communities of energy producers and consumers can be enabled using the blockchain. The company's microgrids and storage systems allow energy producers, e.g. households with solar panels, to trade with neighbours who need the excess energy, creating a peer to peer energy trading platform.

6.2 Model 2: Permissionless Blockchains to Create Alternate Platform Governance Models

Blockchains challenge the platform status quo. Most platforms today rely on centralised ownership and governance which may often capture large profits without delivering enough value to the ecosystem. Blockchain technology can enable decentralised governance models that help to transfer more of the value back to the ecosystem. In particular, blockchain-based governance is especially well suited to platforms backed by industry associations and collectives, which aim to distribute value fairly across the ecosystem.

LaZooz is one such example of a blockchain-based ride-sharing platform. Much like Uber and Grab, LaZooz connects drivers with riders. However, unlike Uber and Grab, which control the payout to drivers and have limited rewards for superior performance, LaZooz incentivises members to perform actions that generate community activity and rewards them in Zooz tokens for such actions. Drivers earn Zooz tokens as they drive which they can then use to take a subsequent ride. Similarly, riders who share their movement data also earn Zooz tokens. LaZooz uses these activities and tokens to manage the network.

6.3 Model 3: Shared Identity, Reputation Management and Trust for Platform Businesses

Blockchain technology may also serve as a new mechanism for managing identity, trust, and reputation for the platform business model. Managing trust is critical to successful platform

[105] "Blockchain Energo Labs to Establish Singapore Regional Hub", FinTechnews, Dec 2017

interactions. However, without sufficient interoperability between platforms and in the absence of data sharing and open standards, managing trust is increasingly complex. Blockchain technology can serve as the underlying infrastructure for managing identity. Using blockchain, user data can be stored at the user's end, instead of on the platform owner's central servers. This reduces concerns around how data is used by the platform, especially in the light of incidents like Facebook's data breach through Cambridge Analytica.

A blockchain implementation of shared identity and reputation would also create an open identity storage which would allow the users to use their identity and reputation across multiple platforms, instead of being tied to one. This increased portability of identity and reputation would also reduce the lock-in for users on specific platforms, as users are currently unable to move to competing platforms where they would have to build their reputation from the start, in the absence of reputation portability. In Singapore, Xenchain is one such start-up working to manage personal data or asset identification data on a distributed blockchain.[106]

Platforms also rely on reputation management mechanisms like consumer reviews, which can often be faked. Fake reviews reduce trust in the platform. Blockchain technology could also be used to authenticate reviews such that only specific users who actually participated in the transaction could write the review, by digitally signing the review.

It is also important to note that critics to the idea of blockchain-based identity management observe that a permissionless blockchain could also heighten cybersecurity risks by increasing the potential attack surface. Any blockchain-based identity management solution will need to address privacy and security concerns in order to gain widespread adoption.

6.4 Model 4: Digital Infrastructure that Supports Platforms Moving to the Blockchain

Finally, blockchain initiatives could also help to create the underlying digital infrastructure for the platform business model. For instance, most digital platforms are built on centralised hosting but blockchain-based platform OpenBazaar works on a distributed hosting infrastructure where platform users run the client application on their private computer. Every user contributes the computing power needed to power the network. This distributed hosting architecture also ensures uptime and reliability of the system. Similarly, the blockchain's smart contracts may also be used to create a more automated escrow service, instead of the traditional payments escrow service that many platforms have. Smart contracts could accelerate payments from buyers to sellers by triggering payments based on specific conditions.

[106] "The Evolution of eKYC and Digital Identity in the Age of Blockchain", FinTechnews, Jun 2018

7 CONCLUSION

In a networked and data-rich world, platforms will continue be to the dominant model of organising ecosystems of connected actors. While we have seen platforms create value in information-intensive industries, much of new value creation remains to be uncovered in the rest of the economy. This presents a unique opportunity for economic upside for the firms that understand the mechanics of the platform business model, and either choose to create platforms themselves or partner strategically with platforms.

As we also note towards the end of this paper, new technologies will create new interoperability infrastructures for traditional industries and will also create new options for platform governance. Since 2016, there has been a growing concern about the monopolistic power exercised by platforms. Even as regulators continue to address platform power, new technologies like the blockchain and other distributed ledger technologies may provide an alternate mechanism for governing a platform business, thereby reducing the risks of monopolistic abuse.

The platform business model is here to stay and the companies that embrace its mechanics will benefit from the economic upside that it creates, while those that choose to ignore it risk commoditisation in the long run.

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