

**A PRELIMINARY STUDY ON  
PLATFORM AND PLATFORM THINKING**

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## Abstract

This thesis presents a preliminary study on the concepts behind platform and platform thinking supplemented with (a) questionnaire survey on intuitive certainty of a platform and (b) comments on the assumptions behind the concepts. Moreover, we anticipate that network of devices as a platform should be one future trend. Another trend is that many enterprises could be treated as economies as their spending (revenues minus profit margin) are comparable to many countries GDP.

By surveying the literatures on platform, product platform, platform economy and platform strategy, it is found that the conception of a platform varies from scholar to scholar. There is no unique definition on platform among management scholars. Nevertheless, the platforms concerned in platform economy literatures exclude physical product platforms. The platforms concerned are mainly (i) the electronic marketplaces for product exchange and labor force exchange, (ii) the platforms for software development and (iii) the social network platforms. Platforms for delivery service, such as Uber Eat and Foodpanda, are clearly a triggering force for the investigations on platform economy. But, non-unified definition on a platform and hence the platform economy shade problems on the analysis on the rise of platform economy, the decision of a firm to initiate a platform strategy and the difficulties underneath the implementation of the strategy. In these regards, this paper presents a survey on platform and platform economy, with our comments on the some issues in platform and platform economy.

First of all, our sense on a platform is given – a platform is simply defined as a place for gathering people. On the platform, people could exchange goods, labor works, professional services, ideas and knowledge. Once people number has been increased to a certain scale, markets could thus be formed and people could exchange resources over the markets for profit. Secondly, we summarize the economic activities to be included in platform economy and comment that the economic activities included in a platform have been changing in the last few decades. In the 1990s, while platform economy was not advocated, product platforms and their related activities were largely investigated. In 2016, many activities associated with product platforms are not considered in platform economy. Finally, several issues related to platform and platform economy are discussed and commented. They include the scholarly advocates on platform, product platform and platform economy. The stories of Apple as a platform enterprise, Uber as a platform enterprise

and other platforms are described. More important, the concepts regarding product platform are delineated.

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# Chapter 1

## INTRODUCTION

For the last four decades, many researches have been conducted on *platform*, including the development of a digital or software platform. With the impacts of Facebook, Apple App Store, Google Play, Alibaba, Amazon, Shopee, Uber and Foodpanda to the society, an increasing number of investigations on the impacts of platforms on the economy have been conducting since 2011 (Evans et al., 2011). These works were generally entitled under the name *platform economy* (Evans and Gawer, 2016; Zhu and Iansiti, 2019; Villafuerte et al., 2021; Wu et al., 2021), the implementation framework for a digital platform (Simpson et al., 2006; Lawton, 2008; Radonjic-Simic and Pfisterer, 2019; Derave et al., 2020), the influence of platforms on labors (Friedman, 2014; Bearson et al., 2019; Kenney and Zysman, 2019; Garcia et al., 2022, 2023) and the implementation of platform strategy<sup>1</sup> in a firm (Meyer and Mugge, 2001; Cusumano, 2010; Gawer and Cusumano, 2014; Parker and Van Alstyne, 2014; Parker et al., 2016; Andersson Schwarz, 2017; Podolny and Hansen, 2020). A number of surveys have subsequently been conducted along these lines of researches (Xue et al., 2020; Jia et al., 2021; Sanchez-Cartas and Leon, 2021).

It should be stressed that researches on platform have been conducted for decades, especially in the communication and telecommunication (ICT) industry (Gawer et al., 2002)<sup>2</sup>. Moreover, there are studied on platforms for electronic commerce (Kaplan and Sawhney, 2000)<sup>3</sup>, platforms for labor sourcing (Vallas and Schor, 2020)<sup>4</sup> and social network platforms (Villafuerte

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<sup>1</sup>Platform strategy refers to applying product platform as a strategy in a firm.

<sup>2</sup>It includes the use of platforms to drive product innovation throughout the high tech firms, like Intel, Microsoft, Apple and Cisco.

<sup>3</sup>It includes the electronic marketplace like Amazon, eBay and Alibab.

<sup>4</sup>It includes the platforms like Amazon Mechanical Turk, Uber Eat, Foodpanda, Top-coder and Utest.

Table 1.1: List of technologies and firms by year launched or founded.

Technologies	Firms	Year
	IBM	1911
	DEC	1957
IBM 709X, IBSYS		1959
DEC PDP-1, BBN		1959
	Walmart	1962
IBM System/360, BOS 306		1964
DEC PDP-11		1970
	Microsoft	1975
	Apple	1976
Apple I, Apple DOS		1976
Apple II		1977
IBM PC, MS DOS		1981
Macintosh, MacOS		1984
Windows OS		1985
	symbolics.com, dec.com	1985
	ibm.com	1986
	apple.com	1987
	Huawei	1987
Internet service for public	DIALix, The World	1989
Motorola 8900X		1992
	Amazon, Yahoo	1994
	eBay	1995
	Netflix	1997
	Google, JingDong (JD)	1998
	Alibaba, QQ	1999
iPod, iTunes		2001
	Lindedln, Tesla, BYD Auto	2003
Huawei Handset		2003
	Facebook	2004
	Youtube	2005
	Shopify	2006

Table 1.2: List of technologies and firms by year launched or founded (Cont'd).

Technologies	Firms	Year
iPhone, iOS		2007
Youtube App (iOS)		2007
HTC Dream, FB App (iOS)		2008
Tesla Roadster, Tesla OS		2008
BYD F3DM, BYD OS		2008
	Uber, Weibo, Whatsapp	2009
iPad, FB App (Android)		2010
Youtube App (Android)		2010
Netflix App (iOS)		2010
	Instagram	2010
Netflix App (Android)		2011
	Snapchat, WeChat, LINE	2011
	DiDi, Foodpanda, Lyft	2012
	Uber Eat	2014
Windows 10		2015
	OpenAI, Shopee	2015
	TikTok	2016
Huawei 5G, Harmony OS		2019
Samsung S20 5G		2019
iPhone 12 (5G)		2020
Google Bard/Gemini		2023
Adobe AI Assistant		2024
Microsoft Copilot		2024



et al., 2021)<sup>5</sup>.

## 1.1 Humanitarian Tech Advancement

Table 1.1 and Table 1.2 list the changes in (i) computing devices, (ii) data communication technology, (iii) telecommunication devices and (iv) telecommunication technology. From the tables, one could witness the impacts of the advancement of humanitarian technologies on the advancement of other humanitarian technologies and eventually leading to the platforms of today.

### 1.1.1 Computing technology

These technologies include various computing devices including commercial mainframe computers in the 1950s, personal computers in the 1970s, cell phones in the 1990s, smartphones in the 2000s, tablets in the 2010s and electric vehicles in the 2020s. Along with the computing devices, several software technologies have been advanced, especially the operating systems which include Apple DOS, Microsoft DOS, MacOS, Windows, iOS, Android, Harmany OS and other product specific operating systems, not to mention are Unix and Linux.

### 1.1.2 Internet & domain name registration

To facilitate data communication among computing devices, computer network technologies have been advancing since the 1960s. It ends up a giant computer network, the Internet. In 1980s, the top-level domain (TLD) COM was allowed for commercial firms to register which led to a raise on the number of technology firms registering dotcom domain name, like `dec.com` and `ibm.com`. In the 1989, Internet access was available for general public. A firm was able to get an IP address from a local Internet service provider (ISP) and register a domain name for its firm.

Hence, a number of new online businesses had been launched from their respective websites in the 1990s, notably the Alibaba, Amazon, Ariba, Barnes & Noble, Commerce One, eBay, Google, i2 and Yahoo. Many traditional brick-and-mortar enterprises developed their websites to strengthen their customer supports and their outreaches to their potential customers. In today terminology, these websites are essentially the platforms which provided services for the members on the platforms.

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<sup>5</sup>It includes the platforms like Facebook, LINE, WhatsApp, Instagram and Weibo.

For some tech firms, like Apple and Microsoft, they developed so-called developer networks for the in-house developers and the third party developers to exchange ideas in new product development.

### **1.1.3 Telecommunication technology**

In telecommunication, the technologies have even been developing for more than a century. Early data communication service telegraph and voice communication service telephone had been developed a lot more earlier than the technologies for Internet. Along with the advancement in telecommunication technology, telecommunication devices have gone through a number of generations of advancement, from wired telephone, to wireless telephone, to cell phone and to smartphone.

One should be noted that both Internet and telecommunication networks are inevitably supported by both wired communication and wireless communication technology. While the so-called 4G and 5G are the technological generations for wireless communication, the infrastructures to support those generations are still required various wired and wireless communication technologies.

### **1.1.4 iPhone and Facebook**

Owing to the new computing and telecommunication devices; and their operating systems have been developed, various types of platforms have then been developed and launched in 2000s. A key invention is the smartphone iPhone, together with the Google Map App and Youtube App, which was released in 2007. The other key invention is the Facebook, a social networking platform, released in 2004.

iPhone, Google Map and Youtube influenced the subsequent developments of platforms. They include the social networking platforms like Whatsapp and LINE; video or music contents distribution platforms like Netflix; and delivery platforms like Lyft, Uber and later Foodpanda. In this regard, there had been an increasing attention on digital platforms in the early 2010s; and a trigger to the scholars' attention on the impacts of digital platforms.

## **1.2 Platform Economy Studies**

Since 2016, there has been a raise on the number of articles focusing on *platform economy*. Figure 1.1 shows the statistics on the number ranging from 1990 to 2023. Here, the numbers are obtained from Google Scholar

by entering "*platform economy*" and then set the year to the corresponding year. For reference, Figure 1.2 shows the statistics on the number of articles focusing on *platform* ranging from 1980 to 2023. Figure 1.1 shows clearly that there is a sharp increase on the number of articles appeared on and after 2016. In Figure 1.2, there is no such raise.

By comparing the shapes of the accumulated number of articles as shown in the BOTTOM panels in Figure 1.1 and Figure 1.2, we believe that the platforms being investigated in *platform economy* are confined in a limited scope. Internet and telecommunication networks are not included. Moreover, it is believed that enterprises supporting Internet and telecommunication services are not included in the platform economy. One evidence is that American Online (AOL) is not on the list of platform enterprises mentioned in (Evans and Gawer, 2016) and (Parker et al., 2016).

The turning point is at the year 2015. On or before 2015, the accumulated number grows exponentially. On and after 2016, the growth rate suddenly jumps. One reason is likely due to a survey report authored by Evans and Gawer (Evans and Gawer, 2016) on *the rise of platform economy* in 2016 and a book authored by Parker, Van Alstyne and Choudary (Parker et al., 2016) on *platform revolution* in 2016.

## 1.3 Platform Diversity

To us, a platform is simply a place for people gathering. A person usually joins a platform with certain purpose(s). For instance, an engineer joins the IEEE to get connected with other engineers get news about the latest telecommunication technologies. A person goes to a department store because he/she needs to buy a new suit for a birthday party.

### 1.3.1 Platforms for shopping

Exemplar platforms include fish markets, farmer markets, flea markets and department stores. A person goes to a market because he/she would like to buy something. The things could be some foods for a dinner. They could be some creative products for home decoration. They could be a suit, a shirt, a tie, a belt and a pair of leather shoes.

### 1.3.2 Platforms for idea or knowledge exchange

A platform could be a place for scholars to exchange ideas. The ancient Agora in Greek was clearly a place for philosophers. An academic conference is an

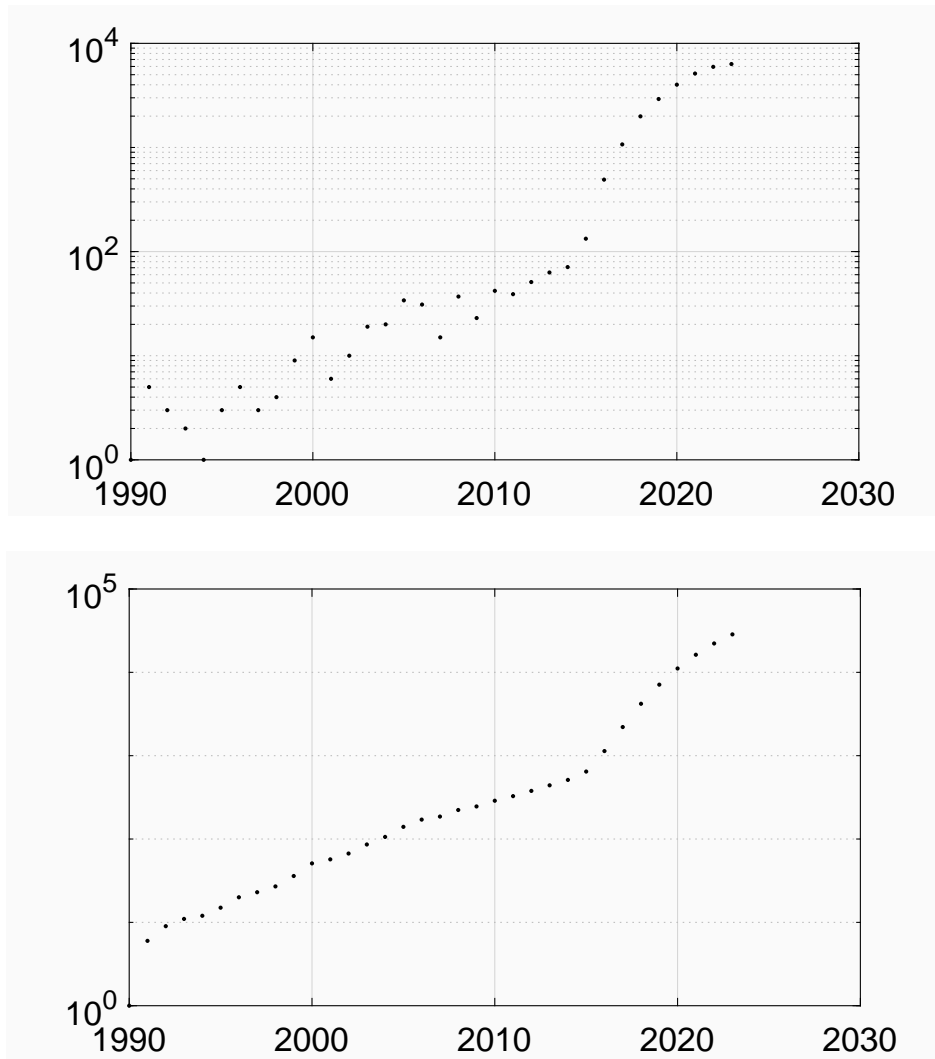


Figure 1.1: **TOP**: The number of articles related to "Platform Economy" recorded in Google Scholar. The number of articles appeared before 1990 is counted as zero. **BOTTOM**: The accumulated number of articles is shown in the bottom panel.

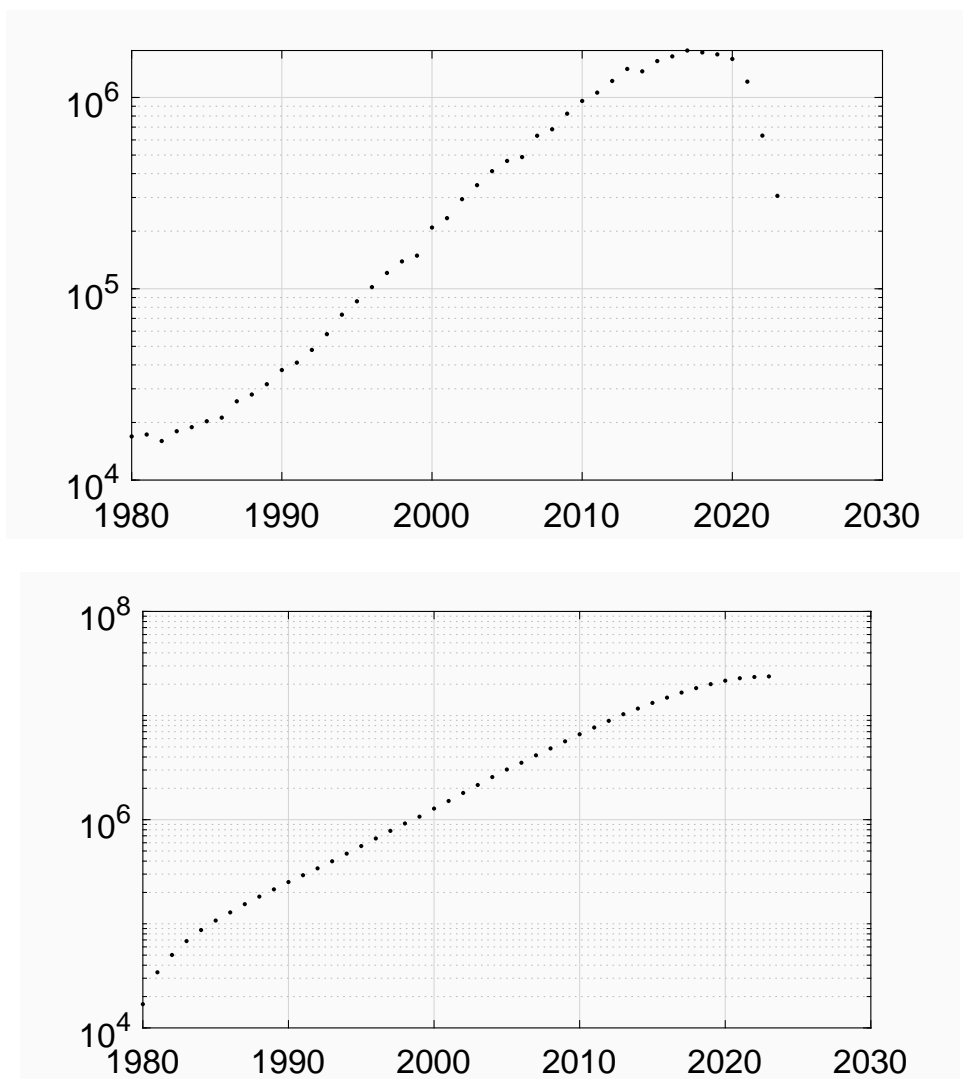


Figure 1.2: **TOP**: The number of articles related to "Platform" recorded in Google Scholar, excluding patents and citations. The number of articles appeared before 1980 is counted as zero. **BOTTOM**: The accumulated number of articles is shown in the bottom panel. Note that the number of articles declines after 2017.

event for scholars to exchange their findings and ideas in a particular research area. An association, like Royal Society<sup>6</sup> or IEEE<sup>7</sup>, is an organization for scholars from various research areas to exchange their findings and ideas. An education institute is a platform for knowledge exchange, from teachers to students. A platform could also be a meeting for students and instructors to exchange their opinions for curriculum design (Wilson, 1923).

### 1.3.3 Platforms for product development

In computer industry, the usages of *platform* are even diversified. A central processing unit (CPU) could be treated as a platform. A computer could be treated as a platform, a PC platform. For instance, a personal computer (PC) running Windows operating system is called a Windows platform. A personal computer with Intel CPU and Windows operating system is called a Wintel platform. A workstation running Unix operating system is called a Unix platform. A PC running Linux operating system is called a Linux platform. By the same principle, a cell phone running with iOS is called an iOS platform. A cell phone running with Android is called an Android platform. Furthermore, communication networks such as telecommunication networks and Internet are also considered as a platform. The aforementioned platforms serve as the foundation for the development of application systems.

In the 1990s and 2000s, many studies were centered on *product platform* McGrath (1995); Meyer and Lehnerd (1997); Meyer and Seliger (1998); Muffatto (1999); Meyer and Mugge (2001); Cusumano and Gawer (2002); Cusumano (2010). We call it in this thesis product platform as a strategy . While its goal is also for new product development, the principles and practices behind

### 1.3.4 Platforms for kill-time

Occasionally, a person goes to a department store without particular reason. Imagine that we have been working on a research problem for three consecutive hours. Likely, we might go to a coffee shop having a coffee break. Some might walk to a garden nearby to have a rest.

### 1.3.5 Platform is naturally evolved ?

Some of these platforms are naturally evolved. Some of these platforms are artificially created. Some of these platforms are administrated by organiza-

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<sup>6</sup><https://royalsociety.org/>.

<sup>7</sup><https://www.ieee.org/>.

tions or governments not for profit. Some of these platforms are administered by firms for profit. Thus, it is difficult to have a complete picture and framework for platforms. Some platforms are competing among each other and some platforms are cooperating for common purposes.

### 1.3.6 Platforms for users versus for developers

In software industry, two types of platforms exist. One type of platforms is built for users who use the services provided by the platforms for living, for learning and for work. Another type of platforms, usually called developer network or developer platform, is built for the developers to develop new products based on the infrastructures and resources provided by the platforms. Take Microsoft Copilot as an exemplar platform, it consists of a number of AI tools for the users to use them for living, for learning and for work. OpenAI Platform consists of a number of resources for the AI developers to develop applications on top of the AI tools and resources provided on the platform.

Many digital platforms have now been available on the Internet. As long as you have login an Google account, a user can access a number of tools provided by Google, such as Google Drive and Gmail. Google bundles the tools (resp. services) and provides them in a form of platform. Microsoft does similar. Once a user login an Microsoft account, the user will be brought to an interface showing all the tools available for use. Hence, the way of the tools (resp. services) provided by Microsoft is in a form of platform.

For the developers, Amazon, Google and Microsoft provide platforms with resources, development kits and sometimes the cloud services for the developers to develop innovative application systems. These developer platforms are clearly different from the platforms for the users.

## 1.4 Definitions on Platform

In so far, the definition of a platform has not been unified<sup>8</sup>. In the context of *platform economy*, different scholars have given different definitions on a platform, in which these definitions attempt to give a generalized definition

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<sup>8</sup>The definition might not even be unified. In the investigation on *product platform and how does it facilitate innovation and business growth*, Meyer and Mugge have stressed in (Meyer and Mugge, 2001, P.26) that *it is essential to gain organizational consensus on the definition of platforms for your business and, if possible, to facilitate the terms and language by which various groups define their own product platforms..* Therefore, definition on a product platform could vary from one software firm to another software firm.

embracing product platform, electronic B2B, B2C and C2C marketplaces, websites for labor exchange, websites for labor exchange, websites for content exchange and social networking websites.

#### 1.4.1 Parker-Van Alstyne-Choudary definition

By Parker, Van Alstyne and Choudary (Parker et al., 2016, Chapter 1), a platform is defined as that "A platform is a business based on enabling value-creating interactions between external producers<sup>9</sup> and consumers. The platform provides an open, participative infrastructure for these interactions and sets governance conditions for them. The platform's overarching purpose: to consummate matches among users [producers and consumers] and facilitate the exchange of goods, services, or social currency<sup>10</sup>, thereby enabling value creation for all participants [including the platform enterprise<sup>11</sup>, users, producers and consumers]."

#### 1.4.2 Kenney-Zysman definition

Parker-Van Alstyne-Choudary definition restricts value-created platforms. A looser definition from Kenney and Zysman in (Kenney and Zysman, 2016) is that a platform is one in which social and economic interactions are mediated online, often by APPs. The platform defined is so-called a digital platform.

#### 1.4.3 Evans-Gawer definition

In a survey by Evans and Gawer (Evans and Gawer, 2016), the authors explicitly stated that *they are concerned with platform business models and the design choices that allow these business models to be successful. Platforms have unique characteristics, with a central feature being the presence of network effects. Network effects are prevalent in platforms, and they mean that more users beget more users, a dynamic which in turn triggers a self-reinforcing cycle of growth. Further, most of today's platforms are digital: they capture, transmit and monetize data, including personal data, over the Internet. They may not be purely digital; in that they may have physical elements included in the product offering, but most successful platforms today take advantage of the power of pervasive Internet connectivity in the hand of billions of users and have at their heart a software engine.*

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<sup>9</sup>The producers who are not an employee of the platform enterprise.

<sup>10</sup>It includes, but not limited to, the social influence of a person in a society and the number of followers of a YouTuber.

<sup>11</sup>In this paper, platform owner and platform enterprise are used interchangeably.



By checking the survey methodology (Evans and Gawer, 2016, P.8), a platform enterprise must have a capital market cap over one billion US dollars and it must be operating at least one digital platform. In this regard, it should be noted that startup platform firms are excluded from Evans-Gawer definition.

## 1.5 Controversies

Parker-Van Alstyne-Choudary, Kenney-Zysman and Evans-Gawer definitions on a platform are general enough to cover almost every platform in our society. In accordance with the enterprises being investigated in their articles, three assumptions could be made.

1. Not-for-profit platforms, like US government, the IEEE and the United Nations, are not considered in the *platform economy*.
2. Internet and telecommunication service providers are not considered.
3. Startups are not considered.

The above blind spots, i.e. assumptions, uncover an implicit problem in the investigations of *platform economy*. The investigations can hardly be complete.

Moreover, it is found that a person perception of *platform* depends on the age of the person and the place where the person is living. One of us (John Sum) has conducted informal interviews to some of his friends asking about their perceptions of a platform. All young guys, aged below 30, response by saying that Foodpanda and Uber are platforms. They only perceive that some digital platforms, like Alibaba, Instagram, Foodpanda and Uber, are platforms. For the friends aged in between 30 to 45, they not only consider Alibaba, Instagram, Foodpanda and Uber as platforms, but also Facebook, YouTube, LINE and WhatsApp as platforms. For the friends aged above 45, they further include associations, universities, organizations and firms are platforms. From the results of the interviews, it reveals that the perception (resp. concept) of a platform is possibly aged and educational level dependent.

## 1.6 Organization of the Thesis

In view of the aforementioned arguments, the definition of a platform and its related concepts are still illusive or controversial, as also mentioned in

(Cusumano, 2010; Derave et al., 2020; Piasna, 2021; Perez Mengual et al., 2023). In this thesis, we are going to give a survey on platform and platform economy from the literatures with statistical analysis from various sources of data and a questionnaire survey. From that, we bring out our interpretations on those concepts.

This thesis consists of eight chapters. Apart from this introductory chapter, three chapters are included in Part I *On Platform* and three chapters are included in Part II *On Platform Thinking*<sup>12</sup>. In Part I, the basic concepts regarding a platform are delineated. Our sense of a platform and the scholarly works on a platform are presented. The results on the intuitive certainty of a platform from the Hong Kong respondents and Taiwan respondents are presented. Based upon of the data collected from the respondents, we argue that the general perception of a platform is illusive. Only Foodpanda, Shopee, Taobao and Uber, out of 46 items, are perceived as a platform for those respondents. Owing to figure out this restricted perception on a platform, additional survey on platform economy, product platform and platform strategy are presented in Part II with our comments. Finally, the conclusions of the thesis is presented in Chapter 8. Supplementary materials are added in the Appendix.

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<sup>12</sup>In Andersson Schwarz (2017), it is called platform logic.

# PART I : ON PLATFORM

# Chapter 2

## SENSE OF A PLATFORM

In accordance with Meyer and Lehnerd (Meyer and Lehnerd, 1997, Page vii), a product platform is *a set of subsystems and interfaces that form a common structure from which a stream of derivative products [families of products] can be efficiently developed and produced*. Thus, a product platform is a *technical architecture* consisting a number of software modules facilitating developers to build new software (resp. products) (Meyer and Seliger, 1998). The idea resembles the idea *software reuse* (Krueger, 1992) advocated in the earlier 1990s and the idea *web service* (Ferris and Farrell, 2003) in the earlier 2000s in the context of software engineering (Sommerville, 2011). The nature of this product platform has nothing to do with resource exchange. It is excluded from our study.

### 2.1 Our Sense of a Platform

A platform is a place (either physical or online) gathering people with common interest, like resources exchange and sharing. The resources could be products, services, labor skills, knowledge or ideas. Yet, a platform could be a place gathering people to stay for a period of time with or without any reason. The place could be a ballroom or a playground, in which people can meet new friends. If a platform can generate transactions (i.e. cash flow) among the people gathered, this platform definitely plays a part in platform economy.

Gathering people is the first purpose for the existence of a platform. Clearly, people gathering on a platform are also a potential customer for certain products. In this regard, merchants could advertise their products over the platform to attract buyers. Thus, providing advertising services is the second purpose for the existence of a platform. To sustain a platform,

the owner is responsible for marketing the platform and maintaining the infrastructure to attract people to come and stay.

## 2.2 Exemplar Platforms

One should note that the number of platforms in our society is exhaustive and the number of platform types is large. Some platforms are entirely physical, like a football field and a ladies room. Some platforms are entirely digital, like an operating system and a cloud. Some of them operate in hybrid mode which consist of both physical and digital elements.

For illustration, the following describes some platform types. They include marketplace, association, school, social activity, platforms for hospitality, city/nation, casino/stock exchange, operating system, video game platforms, home network systems and firm. Listing and descriptions of all platforms are exhaustive. Reader can refer to Appendix A and [https://en.wikipedia.org/wiki/List\\_of\\_gig\\_economy\\_companies](https://en.wikipedia.org/wiki/List_of_gig_economy_companies) for addition list of platforms.

### 2.2.1 Ladies/Mens room

Ladies room and mens room are basically the toilets in a public building or sports club for ladies and gentlemen. These rooms turn out to be a space for people gathering together to chat and engage in gossip. In other words, ladies room or mens room is a platform for information exchange.

### 2.2.2 Association

A professional association like IEEE is a platform gathering scholars. Their common interest is idea sharing and exchange for knowledge generation and innovation. School is a platform gathering teachers and students. Their common interest is knowledge exchange. A journal is a platform gathering scholars. Their common interest is idea sharing and exchange for knowledge generation and innovation.

United Nations is a platform gathering representatives from countries. Their common interest is to discuss issues regarding world peace and sustainability. World Health Organization is a platform gathering medical health experts. Their common interest is to exchange ideas on worldwide health issues.

There are platforms, running by non-profit organizations, for information

technology innovation. Linux Foundation <sup>1</sup> and World Wide Web Consortium<sup>2</sup> are two of them. The former facilitates the advancement of the Linux operating system and the development of the software which are running on Linux. The latter facilitates the worldwide experts to develop technical standards for the world wide web.

### **2.2.3 Social activity platform**

A ballroom and club house are platform for gathering people to have parties, such as Christmas ball and New Year Eve party. One of their common interests of the people is to get a date. A bar is a platform gathering people who are in love drinking and singing. Their common interest is to relax and meet people. Facebook (resp. LINE, WhatsApp and TikTok) is a platform gathering people around the world. Their common interest is to get connected with their friends and meet new friends.

### **2.2.4 Academy**

A school is a place for the teachers and students exchanging knowledge and skills. For instance, a university gathers professors and students exchanging knowledge. So that, the students are able to get sufficient knowledge for their careers. Martial art school gathers masters and students exchanging martial art skills. So that, the students are able to get sufficient skills to protect themselves against future violence.

### **2.2.5 Accommodation**

Real estate agency is a platform gathering property owners, renters and buyers. Hotel is a platform providing similar service. Their common interest is space exchange or sharing. A hotel is a platform gathering travelers. Their common interest is to have a warmly hosting. AirBNB is a platform gathering room providers and travelers. Their common interest is in hospitality.

### **2.2.6 City and nation**

A city (resp. a nation) is a platform gathering residences. Their common interest is to live safely in the city (resp. a nation). A public transportation system is a platform gathering the passengers. Their common interest is to go safely from one spot to another.

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<sup>1</sup><https://www.linuxfoundation.org/>.

<sup>2</sup><https://www.w3.org/>.

### **2.2.7 Transportation system**

To let a passenger to move from one location to another, transportation system has to be constructed. In other words, a transportation system is a platform. The people staying on this platform are passengers, who are basically the citizens of the city (resp. nation).

### **2.2.8 Financial service**

Bank is clearly a traditional platform providing financial services for individual and corporate customers. Three basic services are cash deposit, cash transfer and credit card service. Since 1998, PayPal has been a major electronic payment platform for cash transfer. Today, many electronic payment platforms have been launched, including Apple Pay, Ali Pay and LINE Pay.

Electronic payment platforms play an important roles in those marketplace platforms. In the 1990s, payment methods provided by an emarketplace were limited. Credit card payment was almost the only option. As its high service charge, it led to the later development of country-wise electronic payment platforms for online payments.

### **2.2.9 Casino and stock exchange**

A casino is a platform gathering gamblers. Their common interest is to win. A stock exchange is a platform gathering enterprises and investors. Their common interest is to make money.

### **2.2.10 Communication network**

A communication network can be considered as a platform. Telecommunication network provides data and voice services for the inline (resp. mobile) phone users. Internet is a platform providing data communication service for the computers to exchange data among computers. While telecommunication network and Internet are two distinct platforms, the services supported by these two platforms have recently been emerged.

### **2.2.11 Computer hardware**

A computer hardware system can be considered as a platform (Tanenbaum, 2009). For instance, a computer with Intel x86 CPU can be called a x86

platform. A computer with Intel x86-compatible processor running with Microsoft Windows operating system is called Wintel platform<sup>3</sup>.

### 2.2.12 Operating system

A computer system can be perceived as a platform for a user. In which, the operating system can also be considered as a platform (Meyer and Seliger, 1998, P.63) especially in the 1980s. An operating system acts as an interface between the computer hardware and the application systems. On one side, it supports various application systems to be running on top of it. On the other side, it manages the computer system to support the running of these applications. Thus, a Windows-based (resp. MacOS-based) personal computer is a platform (Cusumano and Gawer, 2002, 2003). Windows (resp. MacOS) operating system is a platform (Tanenbaum, 2009).

If a computer is running with Windows OS, we sometimes say that an application software is running on the Windows platform. If the OS is Linux, we say that the application software is running on a Linux platform. If an application software is able to running in cross-platform, it means that the software is able to be installed and running in more than one OS.

By the same reasons, a smartphone can be perceived as a platform for a user. Android phone, iPhone and Huawei phone are platforms. Besides, the operating system running in a smartphone is a platform. Apple iOS, Android, Harmony OS and Windows are platforms.

### 2.2.13 Software developer network

In software industry, an operating system or a cloud acts as a platform gathering application system developers<sup>4</sup>. Their common interest is to develop useful application systems running on top of the operating system or a cloud (Barros and Dumas, 2006). Those APPs running on those operating systems or clouds are the application systems. Owing to make benefits to those application system developers, marketplaces like Apple APP Store<sup>5</sup>, Google Play<sup>6</sup> and Microsoft Store<sup>7</sup> are the platforms gathering the APP developers and APP users to exchange the APPs for money.

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<sup>3</sup><https://en.wikipedia.org/wiki/Wintel>.

<sup>4</sup>It is sometimes called an innovation platform (Evans and Gawer, 2016, P.5).

<sup>5</sup><https://www.apple.com/app-store/>.

<sup>6</sup><https://play.google.com/>.

<sup>7</sup><https://apps.microsoft.com/>.



### **2.2.14 Video game developer network**

In the video game industry, a video game console could be considered as a platform gathering game developers and game players. Game developers develop games for a game console for players. Thus, Sony PlayStation, Microsoft XBOX and Nintendo Wii are platforms.

### **2.2.15 Smart home systems developer network**

Amazon ECHO and Google HOME are two typical home network systems developed by Amazon and Google. To enable the users to buy the appropriate application software to be running in a home network system, Amazon (resp. Google) provides a platform for the users to buy and download the software. On the other hand, Amazon (resp. Google) provides a platform the developers to develop their products for use in the home network system.

### **2.2.16 Marketplace**

A marketplace is a platform gathering sellers and buyers. Their common interest is resource exchange. A department store is a platform gathering merchants and buyers. One of their common interest is resource exchange. Similarly, eBay, Alibaba, JD, Apple APP Store and Google Play are platforms gathering sellers and buyers. Their common interest is resource exchange. For the labor market, there are Uber, FoodPanda, Amazon Mechanical Turk, UTest, Topcoder and many others.

### **2.2.17 Seller business development**

Today, many emarketplaces provide not just a platform for sellers to sell their products. Like Ailibaba, Amazon, eBay and JD, they have now provided platforms for sellers to learn how to run their businesses. These platforms provide materials, courses and assistances for the sellers to learn the skills and knowledge necessary for running their businesses online. Alibaba and JD simply call them the learning center<sup>8</sup>. Amazon calls it Amazon Seller University<sup>9</sup>.

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<sup>8</sup><https://seller.alibaba.com/learningcenter> and <https://xue.jd.com/>.

<sup>9</sup><https://sell.amazon.com/learn>.

### 2.2.18 Content sharing (Digital distribution)

Wikipedia is a platform gathering scholars to contribute their knowledge as contents shared. In other words, Wikipedia is a knowledge sharing platform. Apple TV, Netflix and YouTube are platforms gathering video generators and viewers to share video contents. Napster, iTunes and KKBox are platforms for music generators and listeners to share music. As long as the number of people gathering in a platform is large enough, advertisers would be attracted to be the other group of people participating in the platform.

### 2.2.19 System of platforms (Conglomerate)

In computer industry, it always happens that a firm is itself a system of platforms. For instance, Apple provides a number of platforms each serves for one particular software product. MacOS developers are able to access the corresponding platform to get resources (documents and development kit) and exchange ideas for MacOS application system development. iOS developers are able to access the corresponding platform to get resources (documents and development kit) and exchange ideas for iOS APP development. Owing to test the systems to be running on corresponding operating system, Apple provides a platform for sourcing testers to test and assess those systems. A brief on the platforms in Apple can be found in Appendix B.

By the same reasons, tech firms like Google and Microsoft have similar platforms developed. As a matter of fact, Alibaba is also a system of platforms. On one hand, Alibaba provides a platform for sellers to sell products to buyers. On the other hand, Alibaba provides a platform for the merchants to grow and eventually make competitive products.

A city, a nation, United Nation or an association is inevitably a system of platforms. A firm is also a system of platforms. The platforms under any one of these systems are cooperating to make the system better.

It should be noted that *platform of platforms* is a term appeared in some articles (Evans and Gawer, 2016; Kenney and Zysman, 2016) with meaning the same as what we interpret *system of platforms*.

### 2.2.20 AI platforms

Owing to the advance development of generative AI tools, a number of platforms<sup>10</sup> have been launched to provide a collection of services including document summarization, literature survey, documents (with figures and tables)

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<sup>10</sup>Like Microsoft Copilot (<https://copilot.microsoft.com/>) and IBM Watson Studio (<https://www.ibm.com/products/watson-studio>).

generation, image recognition, voice recognition and others. The AI platforms providing AI tools (resp. services) similar to *Microsoft Copilot* could be found in *IBM Watson*<sup>11</sup> and *Google Gemini*<sup>12</sup>.

### 2.2.21 Metaverse

Recently, Facebook has launched the Metaverse<sup>13</sup>. It is yet another system of platforms. Any member of the Metaverse could develop his/her platform under the Metaverse for fun or for profit. Ultimately, the Metaverse is just like a virtual country. If the number of members (resp. citizens) gains enough scale, Metaverse forms its own economy.

## 2.3 Naturally Evolved ?

From the above illustrations, it is clear that some platforms are naturally evolved. Examples include flea markets and traditional markets back to a few hundred years ago. Some platforms are artificially created. Examples include night markets, department stores, newspapers and TV broadcasting channels. Many artificial platforms are developed due to the use of new technologies to transform the way of a platform is operating

### 2.3.1 Living

Clearly, a city and a nation are naturally evolved platforms for gathering people. A bay area and fisher market are naturally evolved platform for fishermen and their families. A village is a naturally evolved platform for farmers and their families. In the old days, the major economic activity of these platforms<sup>14</sup> was product (resp. natural resource) exchange.

### 2.3.2 Knowledge exchange

In the ancient Greek, Agora<sup>15</sup> was a platform for getting knowledge. In modern day, getting knowledge could be via a school or an online platform. With the advancement of technology, the way of knowledge exchange has been transforming.

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<sup>11</sup><https://www.ibm.com/watson>.

<sup>12</sup><https://gemini.google.com/>.

<sup>13</sup><https://www.facebook.com/business/metaverse>.

<sup>14</sup>It is better to call them communities. One activity apart from product exchange was to taking care of each other in the community.

<sup>15</sup><https://en.wikipedia.org/wiki/Agora>.

For instance, a distance learning institute delivered the teaching materials, assignments and examination papers to the students via postal mail. Once a student has completed the assignments and the examination papers, the student sent back the assignment sheets and examination papers with answers to the distance learning institute via postal mail for grading. With the advancement of Internet technology, these processes can now be conducted online.

Thus, a distance learning institute is now an online platform for knowledge exchange. This platform is naturally evolved due to the technological advancement.

### 2.3.3 Naturally evolved

While many digital platforms have been created in the last two decades. They include Amazon, Alibaba, Uber, Foodpanda, Topcoder and Utest. The development of such platforms are naturally evolved. These platforms are the artifacts of the traditional marketplaces for product and skill exchange due to the advancement of the ICT technology. A platform could also simply public space where large numbers of people could gather and discuss current events and local politics<sup>16</sup>. Thus, these *platforms are indeed naturally evolved*.

The above argument is not just applicable for those electronic marketplaces, but also applicable to the operating systems. Before the second world war, a computer could only be used to perform one task (i.e. a program) at a time. The program was designed to direct interact with the processor. Only some skillful programmers were able to develop those programs. To ease the program development process, operating system was thus developed. It facilitates a programmer to develop programs running on a computer without knowing the processor specification of a computer. Therefore, operating system is a naturally evolved platform.

## 2.4 We are Living on Multiple Platforms

As long as an open area is available, it could become a platform. Each of us is living on multiple platforms. For instance, a professor is living on a city, an university, a bar, the Facebook, the LINE, the YouTube and a professional society. A student is living on a city, an university, a coffee shop, a badminton club, the Uber Eat, the Foodpanda, the LINE and the Instagram.

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<sup>16</sup>Like the ancient Greek Agora, as mentioned in Section 2.3.2 and fish markets [https://en.wikipedia.org/wiki/Fish\\_market](https://en.wikipedia.org/wiki/Fish_market).

For each of these platforms we are living on, each of us must have certain obligations. For instance, we cannot do anything illegal on these platforms and we cannot do anything to anyone on these platforms<sup>17</sup>.

## 2.5 Market Formation on a Platform

As long as the number of people gathered is large enough, a platform could attract merchants to sell products on it. It is simply because the people on the platform are potential buyers. In the end, a marketplace could be created.

For some platforms which gather skillful labors, the platform is able to attract merchants or people to get skillful labors to work for them. Hence, the platforms create labor markets.

## 2.6 On Social Platforms, Blogs and Forums

Social platforms, blogs and forums have no buy-and-sell transaction conducted. However, the posts, messages and ideas exchanged via these platforms could inspire or trigger a person to buy something. For instance, a forum on financial investment might trigger its audience to buy-in or sell-out a stock. A post on a delicious food of a restaurant might trigger some people to dine in the restaurant. Thus, a social platform, a blog or a forum could *indirectly* facilitate the economic activities in the platform economy.

## 2.7 Physical Platforms versus Digital Platforms

Starting from the 1990s, many digital platforms have been realized. Alibaba, Amazon, Apple App Store, eBay, Google Play, Google Search and Yahoo have been built. While these digital platforms have shown tremendous benefit to the people accessing them, one should not ignore the importance of some physical platforms. Some social activities are best realized in physical platforms and some of them are best realized in digital platforms.

At least five physical platforms, their functions are mostly relied on physical interaction.

- Hospitals and health care centers.

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<sup>17</sup>As this issue is not the focus of this thesis, we leave it for future investigation.

- Universities.
- Restaurants.
- Bars and clubs.
- Funerals and commentaries.

Even if these physical platforms have provided with digital platforms, we do not prefer the digital ones.

Therefore, making a digital platform to benefit its physical counter part and vice versa is always a problem to a platform decision maker and a platform designer.

## **2.8 Reasons for Accessing a Platform**

As mentioned in Section 2.4, we are living on multiple platforms. After all, there are a few reasons why we access platforms, irrespective the physical or digital platforms. First, the platform where I am living on must be comfortable and without much pressure. Second, a platform should let me have a good connection with my friends and let me have a social presence. Third, a platform should let me learn more knowledge and skills. Forth, a platform should let me earn more profit.

## Chapter 3

# SCHOLARLY WORKS ON PLATFORM

In this chapter, a few scholarly works on platform are introduced. Major ideas advocated by the scholars are highlighted and commented. The contents presented are served as a links to the works presented in the later chapters.

### 3.1 Geoffrey G. Parker, Marshall W. Van Alstyne and Co-Workers

Parker, Van Alstyne and their co-workers have made significant contributions to the field of two-sided (resp. multi-sided) markets and platform strategy. Two-Sided market (resp. network) is a simple conceptual model framing the economic activities occurring on a platform. By that, mathematical analysis on some properties of a platform could be done.

#### 3.1.1 2006 interpretation on platforms

In 2006, they have given in (Eisenmann et al., 2006, P.94) an interpretation on a platform. *Products [like Linux, MacOS and Microsoft Windows] and services [like B2B, B2C and C2C emarketplaces] that bring together groups of users in two-sided networks are platforms. They [i.e. the platforms] provide infrastructure and rules that facilitate the two groups' transactions and can take many guises. In some cases, platforms rely on physical products, as with consumers' credit cards and merchants' authorization terminals. In other cases, they are places providing services, like shopping malls or Web sites such as Monster and eBay.* This interpretation is an early attempt to

generalize the concept of platforms from which focuses on *products*, i.e. *product platform*, to that includes *product platforms* and *electronic marketplaces*. As social network platforms, like Facebook and LINE, have not yet launched. The above interpretation has not yet generalized to social platforms.

In the same paper, the authors argued that *platforms (resp. two-sided networks) are different from traditional pipeline value chain, in which value is created either left-to-right or right-to-left. Value creation in a platform (resp. two-sided network) can be from either side. Cost and revenue are both to the left and to the right.* Thus, a platform enterprise should have strategies to (1) raise the number of participants on all sides (resp. groups) of a platform so as to reach an economic of scale which can boost the inter-group and intra-group network effects; (2) decide which group(s) to subsidy ; (3) decide if a platform should compete or collaborate with adjacent platforms; and (4) make the platform or the enterprise to be the winner who takes all the benefits. Finally, a platform enterprise must be alert anytime. Any move of a platform competitor or nearby platform enterprise will affect the movement of the participants of a platform. Platform enterprise has to take reaction to it.

### 3.1.2 2016 interpretation on platforms

In 2016, together with Sangeet Paul Choudary, Geoffrey G. Parker and Marshall W. Van Alstyne stated in (Parker et al., 2016, Chapter 1) their interpretation on platform<sup>1</sup>. *A platform is a business based on enabling value-creating interactions between external producers and consumers. The platform provides an open, participative infrastructure for these interactions and sets governance conditions for them. The platform's overarching purpose: to consummate matches among users and facilitate the exchange of goods, services, or social currency, thereby enabling value creation for all participants.* This interpretation generalizes the concept of platforms by covering the product platforms, electronic marketplaces for product sales, the social network platforms, the cloud platforms and the electronic marketplaces for labor markets.

If the word 'external' in the first sentence is removed, this interpretation will be general enough to cover many product platforms, like Windows as a platform and MacOS as a platform. Their application system developers are not limited to external developers. In-house software engineer could also be a system developer. Three exemplar application systems are Microsoft Word, Edge and Safari.

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<sup>1</sup>This definition has been presented in Section 1.4.1 in this paper.



### 3.1.3 Platform as a strategy

Observing the successes of Amazon, Apple, Cisco, eBay, Intel, Microsoft and other tech firms, Geoffrey G. Parker, Marshall W. Van Alstyne and their co-workers have summarized the strategies that the tech firms have implemented (Parker and Van Alstyne, 2014). These strategies are somehow centered on the idea of platform.

For instance, Windows operating system is a key product of Microsoft. Hence, Microsoft implements *developer network* platform for the third party software developers together with the in-house software engineers to innovate and excel the functions of Windows. As the same time, the platform facilitates the third party software developers to build application software (equivalently, systems or complementary products) to be running on Windows. This product-centered strategy is called *product platform*.

Apart from product platform, Geoffrey G. Parker, Marshall W. Van Alstyne and their co-workers have summarized a number of issues for a platform enterprise. They include the issues on the launch of a platform, platform governance, platform openness and platform competition.

## 3.2 Sangeet Paul Choudary

Sangeet Paul Choudary is a co-author of the book *Platform Revolution: How Networked Markets Are Transforming the Economy and How to Make Them Work for You* (Parker and Van Alstyne, 2014) and the CEO of the *Platform Labs*. Choudary has been analyzing on the transformation of traditional pipeline business model to platform business model in the Internet era (Choudary, 2013).

### 3.2.1 Pipe vs platform

Obviously, pipe thinking and platform thinking are two distinct logics for business development. Pipe thinking is a linear value creation paradigm, while platform thinking is a network value creation paradigm. Platform thinking is an inevitable logic in the Internet era. A platform is a place for the participants to create an ecosystem along with the platform and hence co-create values for themselves.

### 3.2.2 Value co-creation

In a platform, network effect is clearly an important facilitator for the value co-creation. Like Facebook with millions of members and partners attaching

to it, the members could create values on the platform. A member could gain social value by his/her information or knowledge exchange to others. At the same time, those members got the information or knowledge have definitely a value raised. A member could gain value by selling his/her products via Facebook Live. At the same time, those buyers got values from the products they have purchased.

### **3.2.3 Platform scale**

Clearly, the arguments as stated in (Choudary, 2013) have revealed that some online businesses are able to gain benefits from platform thinking. The advantages of platform thinking could be beneficial to other businesses. For instance in online game business, a massively multi-player online role-play-game platform provides a gaming environment and rules for the game designers. Small actions by individual players will make conditions change in real-time. Choudary believe that this phenomenon in designing games is similar to design how the interaction runs on platforms which is based on rules and instructions of platforms but platform providers have to consider user actions. And to think how to encourage appropriate user actions. All these advises are akin to a generic question to all platform startups – how to gain scale for a platform (Choudary, 2021).

## **3.3 Andrew McAfee and Erik Brynjolfsson**

McAfee and Brynjolfsson<sup>2</sup> study how technological progress, with particular on the information technology, changes the world (McAfee and Brynjolfsson, 2017). From their point of view, a platform is a digital environment with near-zero marginal cost of access, duplication, and distribution.

### **3.3.1 Platform is a technological artifact**

Information on internet and platforms are free, perfect and instant. World Wide Web (WWW) is built on top of original Internet information transfer protocols. Internet and WWW are the foundational building blocks for websites and hence platforms; and where platforms start and develop. That is to say, a digital platform as a website. It is a technological artifact.

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<sup>2</sup>It should be highlighted that Erik Brynjolfsson is Stanford professor interesting in digital and information economy for more than two decades (Brynjolfsson and Saunders, 2009; Brynjolfsson and Collis, 2019).

### **3.3.2 Measuring the impact of platforms is a challenge**

The nature of a platform is irrespective to the functional purpose of a platform (resp. website). The nature of a platform is irrespective to a platform enterprise if it is profit making or non-profit. The nature of a platform is irrespective to the platform participants if they will make profit or not. The scholars have witnessed the benefits of platforms to a society. However, quantitative analysis on the impact of platforms on a society (resp. economy) is a challenge to the analysts (Brynjolfsson and Collis, 2019).

## **3.4 On Evans and Gawer Survey**

Evans and Gawer 2016 survey report on the rise of platform enterprise is a earlier report on platform economy on and before 2020 (Evans and Gawer, 2016). In the survey, the authors with collaboration of worldwide scholars collected data from 176 selected [platform] enterprises.

### **3.4.1 80+ mentioned platform enterprises**

As the full list of enterprises in the survey can only be obtained by request, we can only check from the text in the paper on the names of the enterprises and found that 80+ enterprises are mentioned. These enterprises are listed in Figure 3.1.

### **3.4.2 Internet and telecom networks are not platforms**

From the above list, a number of enterprises are excluded from the survey. Internet service provider and telecommunication service provider, like American Online (AOL), AT&T and Verizon Communications, are excluded from the platform economy<sup>3</sup>. A bank (resp. financial institute) with online banking (resp. stock trading) platform is excluded. Tech giants, such as IBM and HP, with online platforms for developers are excluded. Television broadcast media firms are excluded.

### **3.4.3 On platform categorization**

In the survey, the authors classified the enterprises into four categories (Evans and Gawer, 2016, P.9), namely (1) transaction platform enterprises, (2) inno-

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<sup>3</sup>Internet and telecommunication network are considered as a platform in some scholars consideration on platform economy (Rochet and Tirole, 2006).

1DocWay	Africa Internet Group	Airbnb	Alibaba
AliPay	Allegro	Amazon	America Well
Apple	Ask Apollo	Atlassian	Baidu
Beijing Feixiangren	Ceneo	Credit Karma	Daimler
Delivery Hero	Dianping	Didi Kuaidi	Doctor.com
Dropbox	Easy Taxi	eBay	Everjobs
Facebook	Fanatics	Fashion Days	Fiverr
Flipkart	Freelancer	Gigwalk	Google
Guru	IAC Interactive	Intel	Javago
JD.com	Johnson Controls	Jumia	Konga
Lamudi	LinkedIn	Lu.com	Lufax
MDLive	Meituan	Meizu.com	Microsoft
Myntra	Naspers	Naver	Netflix
NuPhysicia	Olacabs	OLX	Oracle
Paypal	PayU	Pinterest	Priceline
Rakuten	Redbus	RideScout	Rocket Internet
Salesforce	Samsung	SAP	Shanghai Han Tao
Snapchat	Softbank	Souq	Specialists on Call
Spotify	Stripe	TaskRabbit	Tencent
Twitter	Uber	Upwork	WeWork
Witmart	XiaMi	Yahoo	Yahoo Japan
Zando	Zenefits		

Figure 3.1: List of the platform enterprises mentioned in Evans and Gawer 2016 survey report.

vation platform enterprises, (3) integrated platform enterprises and (iv) investment platform enterprises.

- A *transaction platform* is a technology, product or service that acts as a conduit (or intermediary) facilitating exchange or transactions between different users, buyers, or suppliers.
- An *innovation platform* is a technology, product or service that serves as a foundation on top of which other firms (loosely organized into an innovative ecosystem) develop complementary technologies, products or services.
- An *integrated platform* is a technology, product or service that is both a transaction platform and an innovation platform. This category consists of companies like Apple which has a matching platform App Store and a developer network platform for third-party developers creating innovative APPs.
- *Investment platforms* consist of companies that have developed a platform portfolio strategy and act as a holding company, active platform investor or both.

### 3.4.4 Additional comments

Here, we would like to have a few comments on this categorization. (Aspers, 2009; Guarascio et al., 2023)

- First, the platforms concerned in the survey are *digital platforms*. Thus, the enterprises included in the survey are those enterprises which have been running at least one *digital platform*.
- Second, the definitions on these four categories are vague, especially on the innovation platforms and the integrated platforms. Apple, Google and Microsoft have many platforms for third party developers to develop innovative application systems aligning with their products. Thus, these platforms are able to drive innovations. So, classifying Apple, Google and Microsoft as either innovation or integrated is yet to be confirmed.
- Third, the nature of Yahoo and Tencent could be considered as integrated platform enterprises as their platforms provide integrated services for their members. Putting them in *Transaction* category is debatable.

- Forth, the definition of investment platform enterprise is even confusing as those enterprises are just investors. It is questionable if they are a platform or an investor.
- Ignore the categorization, the enterprises included in the survey are definitely the major players in the *digital platform industry*, even in 2024.
- Enterprises with product platform as a strategy are not all included in their survey. This issue will be discussed later in Section 6.1.

### 3.5 On Kenny-Sysman Paper

In (Kenney and Zysman, 2016, P.61), the authors clearly stated from the emerging of digital platform economy in the middle 2010s that *the application of big data, new algorithms, and cloud computing will change the nature of work and the structure of the economy. But the exact nature of that change will be determined by the social, political, and business choices we make.*

In (Kenney and Zysman, 2016), the authors have made a number of opinions on (1) their perception on the changes leading from the digital platforms, (2) the key technologies driving the development of such platforms, (3) types of digital platforms and what a society could be benefit from them, (4) the possibly economic values to be created by the platforms, and (5) the US government regulations on the platforms.

In regard to the Kenny and Zysman paper (Kenney and Zysman, 2016) on *the rise of platform economy*, many issues could be mentioned and commented.

#### 3.5.1 40 mentioned platform enterprises and platforms

Owing to have a better understanding on the nature of the platforms investigated in the paper, the platform enterprises and the platforms being mentioned in the paper are listed in Figure 3.2. After read through the paper, 40 enterprises and platforms are found and they could be categorized into five groups.

1. Enterprises providing electronic marketplace platforms.
2. Enterprises providing labor workforce platforms.
3. Enterprises providing application services on a cloud for an enterprise to conduct business administration and management or an individual to manage his/her personal information.

4. Enterprises providing cloud services for everyone.
5. Enterprises providing financial services for platform entrepreneurs.

One should be noted that an enterprises providing cloud services could also be an enterprise providing electronic marketplace platforms, labor workforce platforms and application services. Clearly, the above platform categorization is not the same as the categorization presented in (Evans and Gawer, 2016).

### 3.5.2 Comments

- (P.61-62) This digitally based new economy has been given a variety of names derived from some of its perceived attributes. How we label this transformation matters because the labels influence how we study, use, and regulate these digital platforms.
- (P.62) Indeed, the advantage of platform-based companies often rests on an arbitrage between the practices adopted by platform firms and the rules by which established companies operate, which are intended to protect customers, communities, workers, and markets.
- Uber, Airbnb, and Facebook are not based on 'sharing' but they monetize human effort and consumer assets.
- (P.60) We prefer the term “platform economy,” or “digital platform economy,” a more neutral term that encompasses a growing number of digitally enabled activities in business, politics, and social interaction. If the industrial revolution was organized around the factory, today’s changes are organized around these digital platforms, loosely defined.
- (P.64) Digital platforms are complicated mixtures of software, hardware, operations, and networks. Android and IOS are platforms. Platforms can grow on platforms.
- (P.69) In the era of the platform, the future remains open. Answers to crucial questions are for the moment unknowable. The answers depend on our choices, not just on the technology.
- Enterprises with product platform as a strategy are not all included in their survey. This issue will be discussed later in Section 6.1.

ADP	Airbnb	AngelsList	Amazon
Amazon AWS	Amazon AMT*	Amazon ASP**	Apple App Store
eBay	Etsy	Facebook	GitHub
Google	Google Cloud	Google Play	Handy
Indiegogo	Innocentives	Job Rooster	Kickstarter
LinkedIn	Lyft	Microsoft Azure	Napster
Netflix	Oracle	Rate Setter	Salesforce
TaskRabbit	TechShops	Transfergo	Transferwise
Uber	UPwork	Wikipedia	Wonolo
Youtube	Zenefits	Zipcar	Zopa

\* Amazon Mechanical Turk; \*\* Amazon Self-Publishing.

Figure 3.2: List of the US platform enterprises and platforms mentioned in the Kenny-Zysman paper.



# Chapter 4

## INTUITIVE CERTAINTY OF A PLATFORM

As highlighted by Meyer and Mugge in (Meyer and Mugge, 2001, P.26), *it is essential to gain organizational consensus on the definition of platforms for your business*. To do so, a factor to consider is on the intuitive certainty of an employee on a platform. As a matter of fact, the intuitive certainty of a platform is a key factor for succeeding a platform strategy implementation. Low intuitive certainty of a platform among the employees in a firm could lead to unsatisfactory performance of a firm which has initiated platform strategy. However, focusing study on the intuitive certainty of a platform in the last two decades is scarce.

### 4.1 Platform Strategy Implementation

Once a firm has adopted the idea of platform strategy, the firm would likely need to decide and plan what specific strategies have to be implemented. It is the first step. The second step is that the executives would have to design the operations for the implementation of such strategies. The third step is that the executives need to pass the design of the operations to the operational staffs to implement.

#### 4.1.1 Problem in knowledge transfer

The third step resembles the process of knowledge transfer (Argote et al., 2000; Argote and Ingram, 2000) and its difficulty lies in the information asymmetry between the group of executives and the group of operational staffs. The concept of a platform from the executives might not be the same

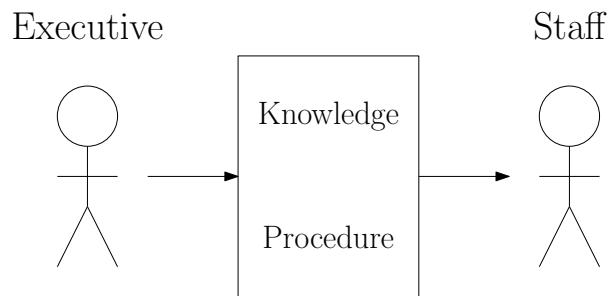


Figure 4.1: Illustration of knowledge transfer (resp. communication).

as the concept of a platform from the operational staffs, see Figure 4.1.

The executives and the operational staffs might have heard of and even learnt some concepts from various scholarly works. Hence, the executives and the operational staffs might have already had their subjective perceptions on *platform* and *platform strategy*. In view of the findings in those scholarly works, it is clearly that the concept of platform strategy and its actual implementation vary from industry to industry.

#### 4.1.2 Problem in intuitive uncertainty

Strategy implementation has long been a problem and under investigation in academic (Hambrick and Cannella Jr, 1989; Brinkschröder, 2014; Vigfússon et al., 2021). Problem inherent in a strategy implementation is a complicated issue. For example, the implementation of platform strategy in software industry is quite different from the implementation of platform strategy in automobile industry. In the former industry, production of a new software product relies on coding. Reusable components could simply be copied and pasted in the program code of the new software product. In the later industry, production of a new car model requires manufacturers to produce the physical components. Nevertheless, the platform strategy for an emarketplace, like Alibaba or Amazon, will be quite different from the platform strategy for new product development.

## 4.2 A Survey on Intuitive Certainty

As a result, an employee's interpretation of a platform might affect his/her understanding the philosophy of a platform strategy and its implementation. Then, it is inevitable to figure out the uncertainty among people on their

interpretation of a platform. That is to say, it is necessary to conduct a survey on the intuitive certainty of a person on a platform.

### 4.2.1 Questionnaire design

Owing to figure out if there is any cultural discrepancy, two versions of questionnaires are designed and released via SurveyCake<sup>1</sup>. The actual questionnaires are presented in Appendix C for reference. In the questionnaire, there are three questions.

- The first question is asked about the respondent's age group, which include (i) 25 or below, (ii) 26 to 35, (iii) 36 to 45, (iv) 46 to 55 and (v) 56 or above.
- The second question is asked the respondent if he/she has heard of the term *platform* or *platform economy*.
- The third question is asked the respondent to check from the list of 46 items if anyone of it is a platform.

The items are listed in the following. The numbers conform to the indices shown in the figures and the tables in this chapter.

1. Uber & Uber Eat
2. 58/55688
3. Foodpanda
4. Whatsapp
5. Youtube
6. Facebook
7. Instagram
8. Playstation
9. Taobao/Shopee
10. Wikipedia
11. Yahoo Knowledge

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<sup>1</sup>For HK respondents: <https://www.surveycake.com/s/x9an9>. For TW respondents: <https://www.surveycake.com/s/Md7d4>.

12. Apple Pay
13. LIHKG/Dcard
14. Airbnb
15. Klook/KKday
16. Tinder
17. JobsDB/104
18. Online games (e.g. LoL, PUBG)
19. Google Drive
20. Apple App store
21. Spotify
22. Android, iOS, Harmony
23. iPhone
24. iPad
25. Metaverse
26. ChatGPT
27. Publisher
28. School
29. Cram school
30. Department store
31. Real estate agency (e.g. Yungching)
32. Bar & Club
33. Bank
34. Public transportation service provider (e.g. KMB, Citybus)
35. Hong Kong/Taichung City
36. Hotel

37. Student Union
38. United Nations
39. Library
40. Internet
41. Computer
42. Flea market
43. Newspaper
44. TV Broadcasts (e.g. BBC, Fox, NBC)
45. Government
46. Credit card (e.g. Mastercard, Visa)

Owing to figure out if there is any discrepancy between cultures, two questionnaires are designed. One is for the Hong Kong respondents and the other is for the Taiwan respondents. The questionnaires are then designed and post on Survey Cake<sup>2</sup>.

### 4.2.2 Data collection

In each questionnaire, 46 items are asked to the respondents to identify if any item is a platform. The questionnaires were released from April 4, 2024. Friends of KaKa Cheung and John Sum were invited via social medium, like LINE and Facebook, to fill the questionnaire.

At April 22, 2024, 158 responses are collected from the Hong Kong respondents and 195 responses are collected from the Taiwan respondents. The number of respondents on each age group is depicted in Table 4.1.

### 4.2.3 Measure of intuitive certainty

Here, the intuitive certainty of an item as a platform is defined as the number of respondents checking yes on the item over the total number of respondents in the group. Let  $x$  be an item. We denote  $IC\text{-}HKY(x)$  and  $IC\text{-}HKN(x)$  (resp.  $IC\text{-}TWY(x)$  and  $IC\text{-}TWN(x)$ ) as the intuitive certainties of the item  $x$  on the Hong Kong (resp. Taiwan) respondents who have heard of and who have not

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<sup>2</sup>Hong Kong version: <https://www.surveycake.com/s/x9an9>; Taiwan version :<https://www.surveycake.com/s/Md7d4>.

Table 4.1: Demographic of the respondents.

Age	HKN	HKY	TWN	TWY	Total
25 or below	12	13	21	51	97
Between 26 – 35	45	36	15	38	134
Between 36 – 45	10	9	15	35	69
Between 46 – 55	3	8	6	9	26
56 or above	2	20	2	3	27
Total	72	86	59	136	353

heard of the term *platform* or *platform economy*. Hence, we define intuitive certainty as follows :

$$\text{IC-HKY}(x) = \frac{\text{No. of respondents who check yes for item } x}{\text{No. of respondents in the HKY}}, \quad (4.1)$$

$$\text{IC-HKN}(x) = \frac{\text{No. of respondents who check yes for item } x}{\text{No. of respondents in the HKN}}, \quad (4.2)$$

$$\text{IC-TWY}(x) = \frac{\text{No. of respondents who check yes for item } x}{\text{No. of respondents in the TWY}}, \quad (4.3)$$

$$\text{IC-TWN}(x) = \frac{\text{No. of respondents who check yes for item } x}{\text{No. of respondents in the TWN}}, \quad (4.4)$$

$$\text{IC-XXY}(x) = \frac{\text{No. of respondents who check yes for item } x}{\text{No. of respondents in the XXY}}, \quad (4.5)$$

$$\text{IC-XXN}(x) = \frac{\text{No. of respondents who check yes for item } x}{\text{No. of respondents in the XXN}}, \quad (4.6)$$

$$\text{IC-ALL}(x) = \frac{\text{No. of respondents who check yes for item } x}{\text{No. of respondents in the ALL}}. \quad (4.7)$$

The last three intuitive certainties are defined based on combining the groups XXY, XXN and ALL.

- The group XXY corresponds to the group which combines both the Hong Kong and Taiwan respondents who have heard of the term *platform* or *platform economy*.
- The group XXN corresponds to the group which combines both the Hong Kong and Taiwan respondents who have not heard of the term *platform* or *platform economy*.
- The group ALL corresponds to the group combining all respondents.

## 4.3 Statistical Analysis

### 4.3.1 Intuitive certainty by item

Figure 4.2a shows the bar-plot of the group of Hong Kong respondents who have not heard of *platform* or *platform economy*, i.e. the HKN group, and the group of Hong Kong respondents who have heard of *platform* or *platform economy*, i.e. the HKY group. Figure 4.2b shows the bar-plot of the group of Taiwan respondents who have not heard of *platform* or *platform economy*, i.e. the TWN group, and the group of Taiwan respondents who have not heard of *platform* or *platform economy*, i.e. the TWY group.

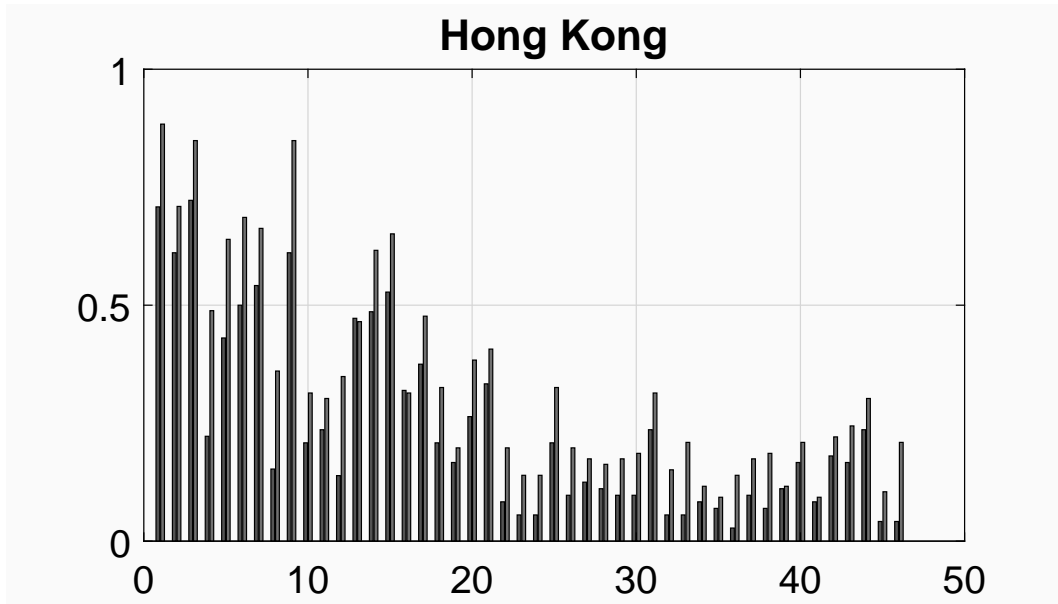
Figure 4.3 and Figure 4.4 show the correlations of the intuitive certainties among different groups of respondents. It is clear that the intuitive certainty of a platform varies from Hong Kong to Taiwan; and from the group of respondents who have heard of *platform* or *platform economy* to group of respondents who have not heard of.

### 4.3.2 Statistical results

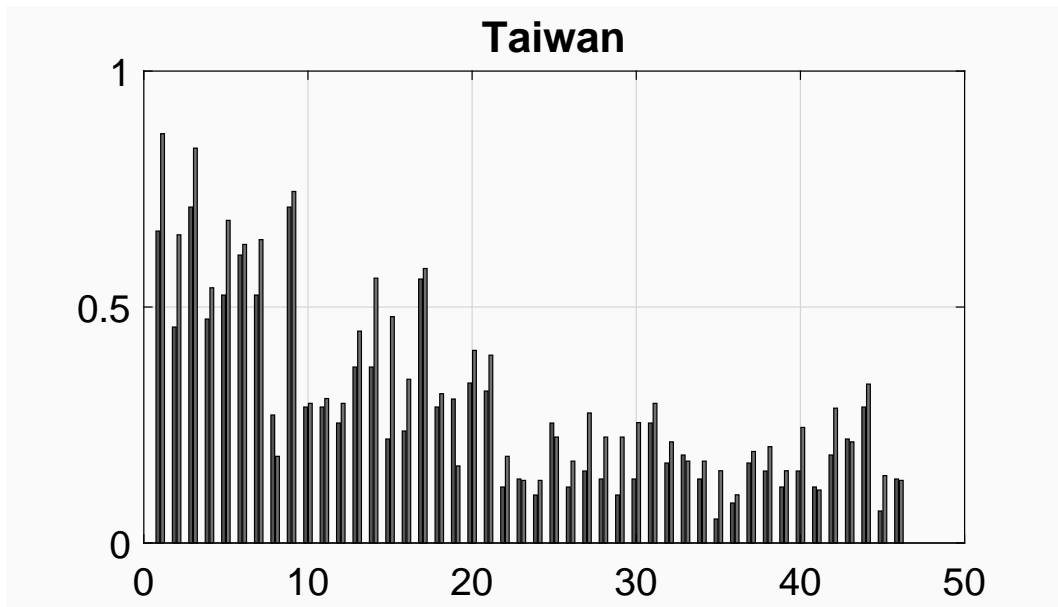
Let  $\mathcal{I}$  be the set of 46 items (equi. options) included in Question 3; and  $x$  be an item in  $\mathcal{I}$ . The intuitive certainty of an item  $x$  from the Hong Kong (resp. Taiwan) respondents who have not heard of the term *platform* or *platform economy* is denoted as IC-HKN( $x$ ) (resp. IC-TWN( $x$ )). The intuitive certainty of an item  $x$  from the Hong Kong (resp. Taiwan) respondents who have heard of the term *platform* or *platform economy* is denoted as IC-HKY( $x$ ) (resp. IC-TWY( $x$ )).

The results as shown in Figure 4.3 and Figure 4.4 can be summarized in the following.

1. For all  $x \in \mathcal{I}$ ,  $0 < \text{IC-HKY}(x) < 1$ ,  $0 < \text{IC-HKN}(x) < 1$ ,  $0 < \text{IC-TWY}(x) < 1$  and  $0 < \text{IC-TWN}(x) < 1$ .
2. For almost all  $x \in \mathcal{I}$ ,  $\text{IC-HKY}(x) \geq \text{IC-HKN}(x)$  (resp.  $\text{IC-TWY}(x) \geq \text{IC-TWN}(x)$ ). Hence,  $\text{IC-XXY}(x) \geq \text{IC-XXN}(x)$ .
3. For all  $x \in \mathcal{I}$ , IC-HKY( $x$ ) and IC-TWY( $x$ ) are highly correlated.
4. For all  $x \in \mathcal{I}$ , IC-HKN( $x$ ) and IC-TWN( $x$ ) are not highly correlated.
5. The number of item with intuitive certainty larger than 0.5 is no more than 11, to be shown in Table 4.2.



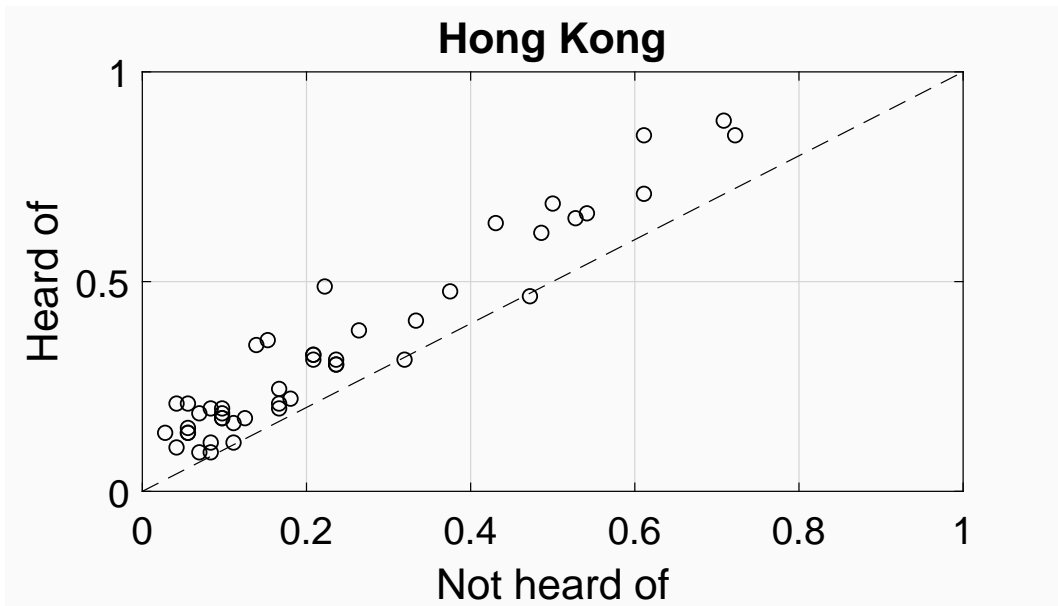
(a) Hong Kong (HKN & HKY)



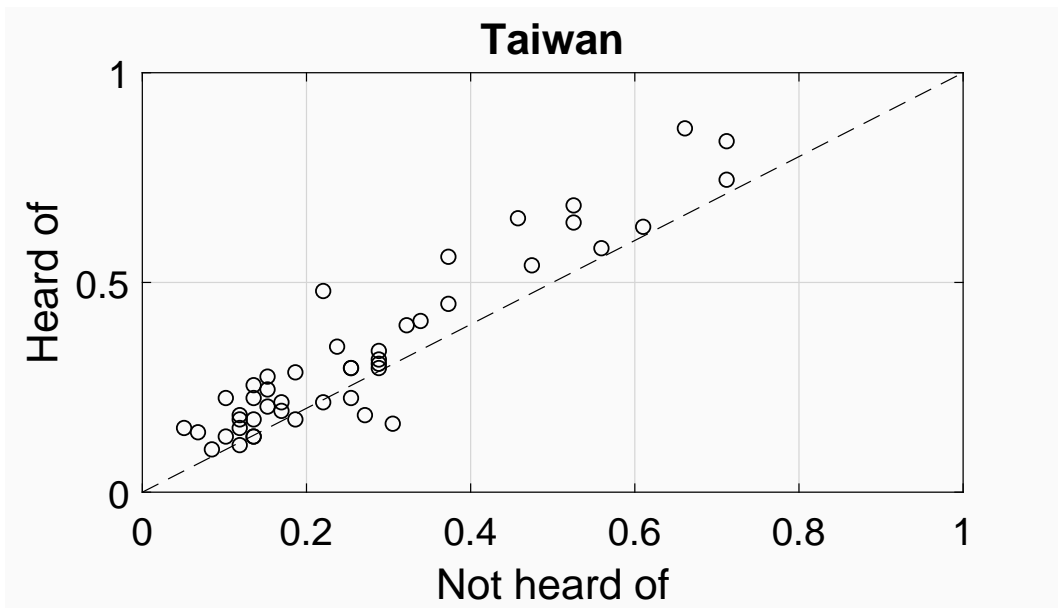
(b) Taiwan (TWN & TWY)

Figure 4.2: Bar plot of the intuitive certainty of a platform. (a) HKN (left bar) & HKY (right bar). (b) TWN (left bar) & TWY (right bar).



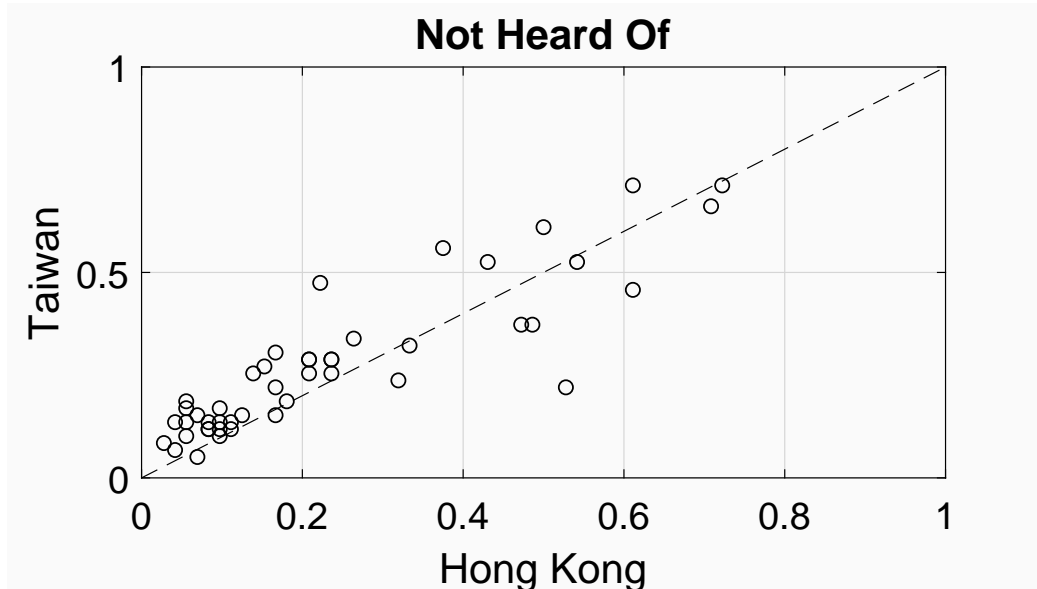


(a) Hong Kong

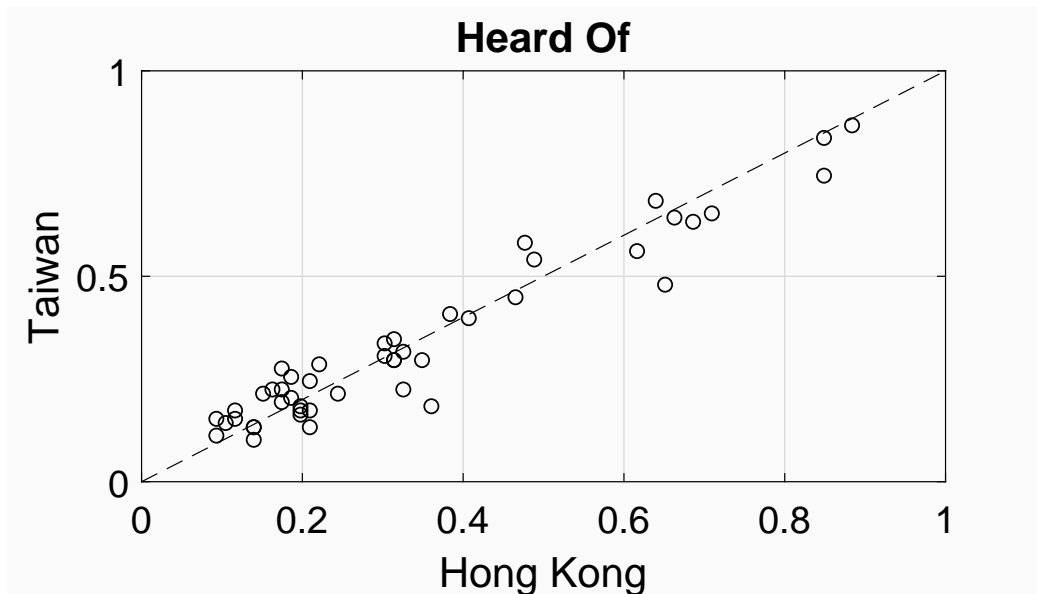


(b) Taiwan

Figure 4.3: Intuitive certainty of a platform. (a) HK respondents who have heard of versus who have not heard of. (b) TW respondents who have heard of versus who have not heard of. Clearly, the correlation on the respondents who have heard of is high among the TW and HK respondents.



(a) Not heard of



(b) Heard of

Figure 4.4: Intuitive certainty of a platform. (a) Respondents who have not heard of: TW vs HK. (b) Respondents who have heard of: TW vs HK.

### 4.3.3 'Not Heard Of' versus 'Heard Of'

It is found that the respondent group who have not heard of the term *platform* or *platform economy* responses slightly different from the group who have heard of the term *platform* or *platform economy*.

1. The intuitive certainty on a platform is quite difference from the scholars perception of a platform as mentioned in (Choudary, 2013; Evans and Gawer, 2016; Kenney and Zysman, 2016).
2. Intuitive certainty of an item as a platform depends on whether a respondent has heard of the name of the item. If a respondent has not heard of the name of the item, the item will not be considered as a platform. It is based on the informal interview of the authors to some respondents.
3. Intuitive certainty of an item as a platform of a respondent who has heard of the terminology either platform or platform economy is higher than the intuitive certainty of a item as a platform of a respondent who has not heard of.

### 4.3.4 Intuitive certainty larger than 0.5

From Figure 4.2 and consider those items with intuitive certainty greater or equal to 0.5, we get that the number of items on the list is no more than eleven as depicted in Table 4.2. As there is insufficient data collected, age group-wise analysis has yet to be accomplished.

### 4.3.5 Cultural difference

Intuitive certainty of an item as a platform is cultural dependent, as depicted in Table 4.2. The Hong Kong respondents consider the travel website KLook as a platform but not the job recruitment website JobsDB. On the other hand the Taiwan respondents consider the job recruitment website 104 as a platform but not the travel website KKday.

### 4.3.6 Low intuitive certainty

Thus, in accordance with Figure 4.3, Figure 4.4 and Table 4.2, we can draw a number of findings in the following.

1. None of the items has 1.0 intuitive certainty and most of them have intuitive certainty less than 0.5, as shown in Figure 4.2. It is true for all four groups.

Table 4.2: Items with intuitive certainty greater than or equal to 0.5. Here, a  $\checkmark$  indicated that the intuitive certainty of the corresponding group is greater than or equal to 0.5. ALL corresponds to the result obtained by combining the data from HKN, HKY, TWN and TWY. Here  $\vee$  is the OR operator and  $\wedge$  is the AND operator. The results shown in the ALL column are from Figure 4.6.

Item	HKN	HKY	TWN	TWY	HKN $\vee$ TWN	HKY $\vee$ TWY	HKN $\wedge$ HKY $\wedge$ TWN $\wedge$ TWY	ALL
Uber	$\checkmark$	$\checkmark$	$\checkmark$	$\checkmark$	$\checkmark$	$\checkmark$	$\checkmark$	$\checkmark$
85/55688	$\checkmark$	$\checkmark$	-	$\checkmark$	$\checkmark$	$\checkmark$	-	$\checkmark$
Foodpanda	$\checkmark$	$\checkmark$	$\checkmark$	$\checkmark$	$\checkmark$	$\checkmark$	$\checkmark$	$\checkmark$
LINE/Whatsapp	-	-	-	$\checkmark$	-	$\checkmark$	-	-
Youtube	-	$\checkmark$	$\checkmark$	$\checkmark$	$\checkmark$	$\checkmark$	-	$\checkmark$
Facebook	$\checkmark$	$\checkmark$	$\checkmark$	$\checkmark$	$\checkmark$	$\checkmark$	$\checkmark$	$\checkmark$
Instagram	$\checkmark$	$\checkmark$	$\checkmark$	$\checkmark$	$\checkmark$	$\checkmark$	$\checkmark$	$\checkmark$
Taobao/Shopee	$\checkmark$	$\checkmark$	$\checkmark$	$\checkmark$	$\checkmark$	$\checkmark$	$\checkmark$	$\checkmark$
AirBNB	-	$\checkmark$	-	$\checkmark$	-	$\checkmark$	-	$\checkmark$
Klook/KKday	$\checkmark$	$\checkmark$	-	-	$\checkmark$	$\checkmark$	-	-
JobsDB/104	-	-	$\checkmark$	$\checkmark$	$\checkmark$	$\checkmark$	-	$\checkmark$
<b>Total</b>	<b>7</b>	<b>9</b>	<b>7</b>	<b>10</b>	<b>9</b>	<b>11</b>	<b>5</b>	<b>9</b>

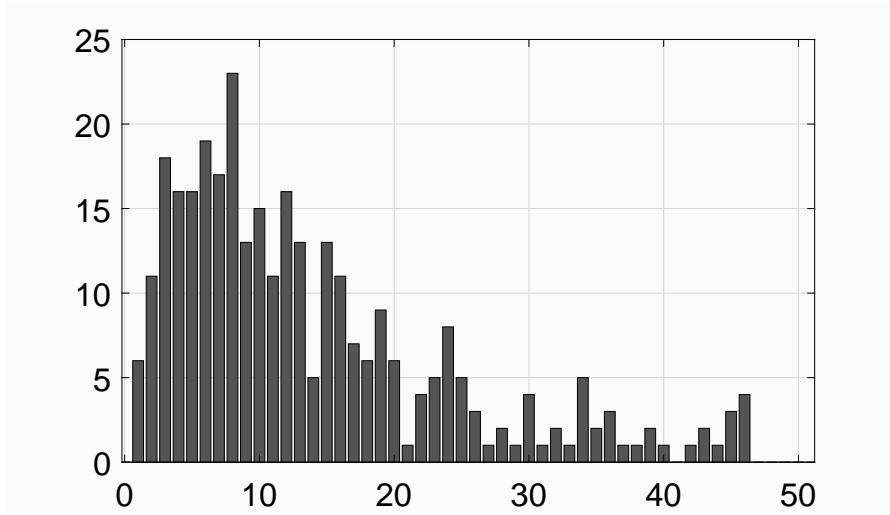
2. Even if a respondent has heard of the term *platform* or *platform economy*, the respondent treats Uber and Foodpanda not a platform.
3. The top three items checked as a platform are Uber, Foodpanda and Taobao/Shopee.
4. A digital platform, like Uber or Wikipedia, is not always considered as a platform. It is true for all four groups.
5. Uber, Foodpanda, Facebook, Instagram and online shopping website (like Taobao or Shopee) have intuitive certainties greater than or equal to 0.5 across all four groups, as shown in Figure 4.2.
6. Consider that an item has intuitive certainty greater than or equal to 0.5 on either one of the four groups, eleven items are short-listed, Table 4.2.
7. As a cross check, all four groups of data are consolidated. It is found that the number of items being checked by the respondents with intuitive certainty larger than 0.5 is around nine or ten, as evidenced in Figure 4.5 and Figure 4.6. These numbers are inline with the numbers 'total' of the 'HKY', 'TWY', 'XXY' and 'ALL' columns in the Table 4.2.
8. Physical entities, like a school or a city, have the intuitive certainty lower than 0.5 across all four groups. Thus, we imply that respondents do not consider physical places as platforms.

### 4.3.7 Statistics from all samples

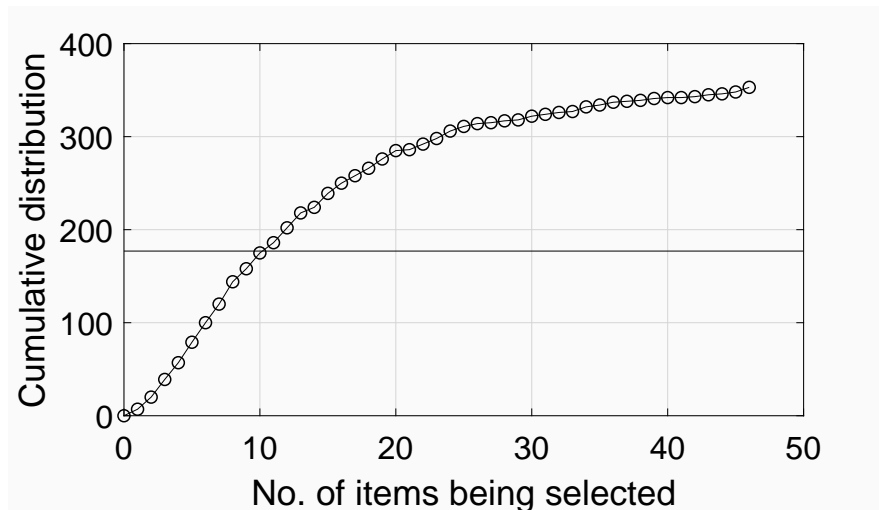
Consolidate all four groups of data, we get a dataset with 315 samples. For this dataset, two statistical analyses have been conducted.

The first analysis is on the cumulative distribution of the number of items checked yes. Let  $y_i$  be the number of items checked yes by the  $i^{th}$  respondent. Here  $i = 1, \dots, 315$ . Let  $f(k)$  be the number of respondents who have checked  $k$  items yes. The frequency distribution, i.e.  $f(k)$  versus  $k$ , is shown in Figure 4.5a. The cumulative distribution is shown in Figure 4.5b. From Figure 4.5b, it is clear that half of the respondents checks fewer or equal to 10 items to be a platform.

The second analysis is on the intuitive certainty from all samples. For the consolidated dataset, the intuitive certainty for each item is calculated, as defined in (4.7), and shown in Figure 4.6a. Then, the number of items with



(a) Frequency distribution.



(b) Cumulative distribution.

Figure 4.5: Frequency distribution (a) and cumulative distribution (b) of the number of respondents versus the number of items being selected. The horizontal line corresponds to the number of respondents equal to 177. Half of the respondents selects fewer than 10 items to be a platform. One should be noted that the distribution of the number of respondents against the number of items being selected has no direct correlation with the distribution of HKN, HKY, TWN and TWY.

intuitive certainty larger or equal to  $p$ , where  $0 \leq p \leq 1$ , is plotted against  $p$  in Figure 4.6b. It is found that only 9 items having intuitive certainty larger or equal to 0.5.

From these numbers, 10 and 9, and the number 11 which is obtained from the  $\text{HKY} \vee \text{TWY}$  in Table 4.2. Moreover, we can conclude that the set of items included in  $\text{HKN} \wedge \text{HKY} \wedge \text{TWN} \wedge \text{TWY}$ , denoted as  $\mathcal{I}_{AND}$ , is a subset of the set of items included in ALL, denoted as  $\mathcal{I}_{ALL}$ . The set of items included in ALL  $\mathcal{I}_{ALL}$  is a subset of the set of items included in  $\text{HKY} \vee \text{TWY}$ , as denoted as  $\mathcal{I}_{YOR}$ .

$$\mathcal{I}_{AND} \subset \mathcal{I}_{ALL} \subset \mathcal{I}_{YOR}. \quad (4.8)$$

Besides, we get from Table 4.2 that

$$\mathcal{I}_{NOR} \subset \mathcal{I}_{YOR}, \quad (4.9)$$

$$\mathcal{I}_{AND} \subset \mathcal{I}_{NOR}, \quad (4.10)$$

$$\mathcal{I}_{NOR} \neq \mathcal{I}_{ALL}. \quad (4.11)$$

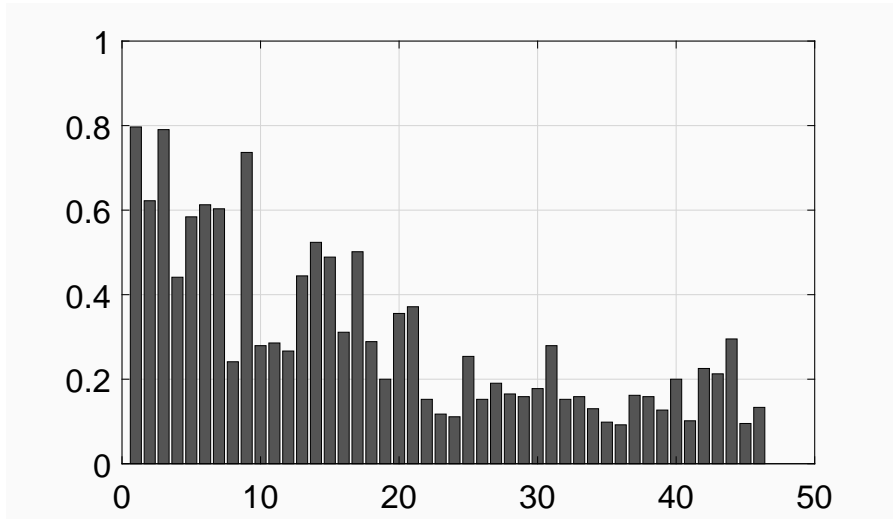
## 4.4 Implications & Suggestions

By the findings as listed in Section 4.3.5, Section 4.3.6 and Section 4.3.3, we could have a few implications and suggestions for platform strategy implementation.

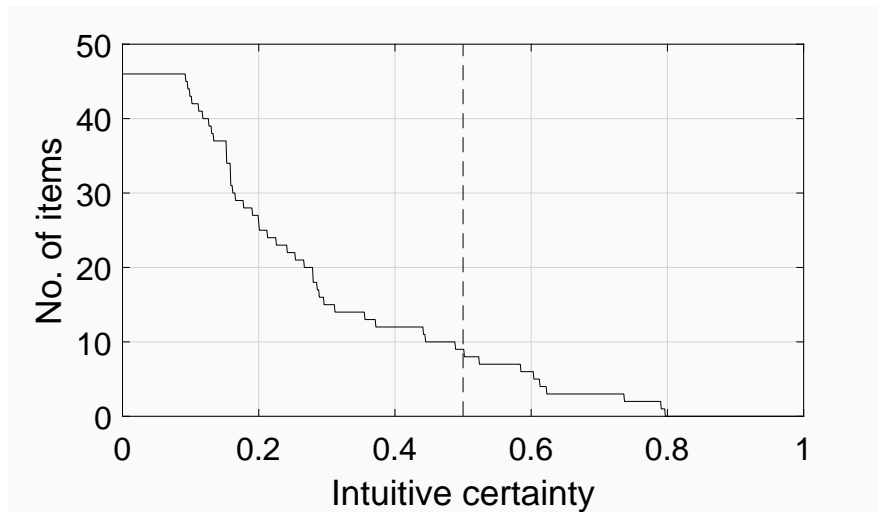
### 4.4.1 Beware of low intuitive certainty

Uncertainty on the intuitive certainty of a platform is clearly an issue to be aware of.

1. As stated in Section 4.3.6, the intuitive certainties of most items are lower than 0.5. The number of items being considered as a platform is just 5, as depicted in Table 4.2. It brings out an issue on the general perception of the term *platform*.
2. If an enterprise is going to implement a platform strategy, one approach is that the enterprise should provide a training program on either platform or platform economy for the employees to elevate the consensus of the employees on platform. Thus, it could reduce the intuitive uncertainty of the employees.
3. If an enterprise is going to implement a platform strategy, another approach is that the enterprise should provide a training program without



(a) Intuitive certainty vs item.



(b) No. of items vs intuitive certainty.

Figure 4.6: The number of items against the value of intuitive certainty. It is clear that no item has got the value larger than 0.8. The results are obtained by consolidating the data from HKN, HKY, TWN and TWY. The vertical line corresponds to the intuitive certainty 0.5. The number of items being selected is 9.



using the terminology like *platform* or *platform strategy* and targeting on the strategy to be launched and the implementation procedure to be executed. That is to say, the enterprise should forget about *platform* and *platform strategy* to its employees when it is going to launch a platform strategy.

This is inline with the argument highlighted in (Meyer and Mugge, 2001, P.26), *it is essential to gain organizational consensus on the definition of platforms for your business.*

#### **4.4.2 Beware of the network effect**

Network effect is another issue to be aware of, especially on the network effect exhibited among the employees.

1. Some platform strategies devised from network effect might not be applicable to the in-house developer platforms launched by Alibaba, Amazon, Apple, Google, Huawei, Microsoft and Xiaomi. It is simply because the number of participants in-house developer platform can hardly achieve the critical mass.
2. Similarly, those industry platforms for in-house new product development can hardly be beneficial from the network effect of a platform.
3. Network effect-based multi-sided market theory is not sufficient for the diversified nature of the digital platforms and for the enterprises to develop their platform strategies.

If the network effect of 'inconsistent perception of a platform' exhibits among the employees, the executives might have difficulty in launching a strategy with focus on platform.

#### **4.4.3 Beware of strategy implementation**

Once a team of executives has designed the implementation procedures for the operational staffs, the team should conduct a training program for the operational staffs to have a consensus on the concept of *platform* and hence the consensus on the procedures designed for the *platform strategy* to be implemented. Again, this is inline with the argument highlighted in (Meyer and Mugge, 2001, P.26), *it is essential to gain organizational consensus on the definition of platforms for your business.*

By doing these, the uncertainty on the operational staffs' intuitive certainty on a platform could be reduced and then the risk on the strategy

implementation could be minimized. This issue will be further discussed in Chapter 6 and Chapter 7.

# **PART II : ON PLATFORM THINKING**

# Chapter 5

## PLATFORM ECONOMY

For the platform economy reflecting the economic activities of a society, a nation or the world as a platform is too general to convey any information on a specific area of interest. These platform economies usually refer to something like Hong Kong economy, US economy and worldwide economy. Their economic activities covered and measured are all activities. The data revealed from these economies cannot indicate the trends on specific areas of interest, like B2C and B2B markets.

Owing not to make confusion, society (resp. nation and world) as a platform is not considered in our scope of the platform economy. A platform economy should focus on some industries, like computer industry, health-care and electronic commerce, in which platform is a strategy embedded in their business operations leading to economic activities. Clearly, the scope of a platform economy is still large. In recent years, there have been attempts to analyze the impacts of platforms to the society (Evans and Gawer, 2016; Kenney and Zysman, 2016, 2019; Acs et al., 2021; Greig and Sullivan, 2021; Zhang, 2021).

### 5.1 Non-Unified Definition

Throughout decades, the scope of a platform economy has been evolving. It is just like the case in *service economy* (Fuchs, 1965, 1968; Kaboski and Buera, 2009; Buera and Kaboski, 2012) in which the definition of service has been changing from time to time. In the last half a century, the scope of service has been extended from embracing the services in the service industry alone to the Internet services in the ICT.

The definition of platform economy has encountered similar situation. The scope and the measures of the platform economy essentially depends on

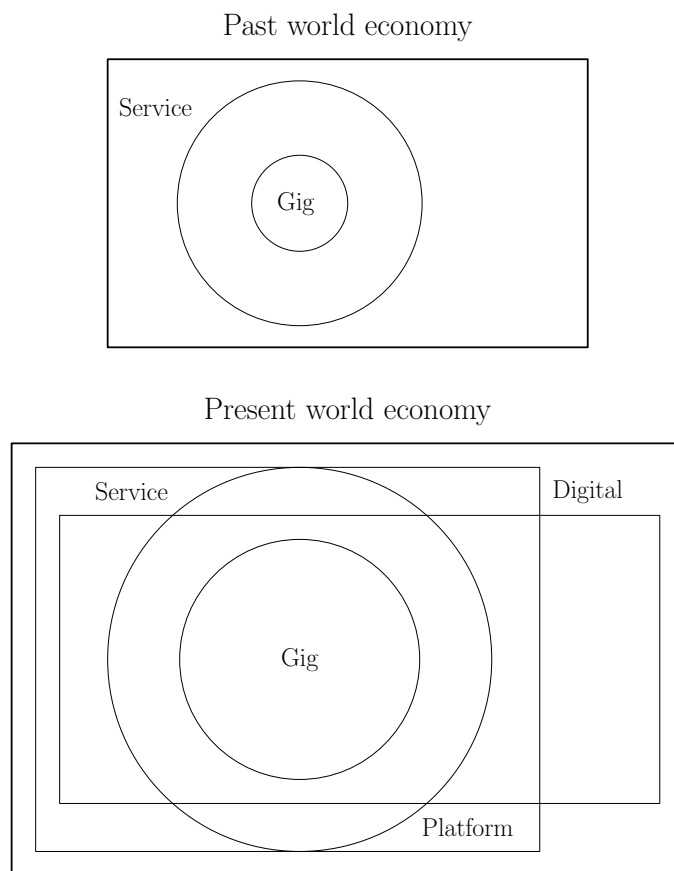


Figure 5.1: The raise of one economy might not indicate the decline of another economy. It is all depended on the definition and the scope of the economy. Here, it is assumed that there is a raise of the world economy and respectively the service and gig economies. Table 5.1 illustrates a few examples showing the overlap.

the definition of, the economic activities and the statistics to be included under the platforms concerned, as mentioned in Section 1.4. Figure 5.1 shows a conceptual diagram on the overlapping among different economies. Clearly, the scope of a platform economy also overlaps with the scopes of information economy (Eliasson et al., 1990; Godin, 2008; Porat, 2009), experience economy (Pine et al., 1998) and sharing economy (Schor and Attwood-Charles, 2017) which have not been included in the figure. Table 5.1 illustrates a few examples showing the overlap.

Table 5.1: Illustrations on economy overlap based on the common perception of an economy.

Entity	(Economy)			
	Service	Digital	Gig	Platform
Babysitting	Yes	No	Yes	No
Airline	Yes	Yes/No	No	No
OpenAI/Google Gemini	Yes/No	Yes	No	Yes
Amazon Marketplace	No	Yes	No	Yes
Microsoft	No	Yes	No	Yes
Internet	Yes	Yes	No	Yes/No
Telecom Network	Yes	Yes	No	Yes/No

### 5.1.1 Parker-Van Alstyne-Choudary definition

Follow the definition stated by Parker, Van Alstyne and Choudary (Parker et al., 2016, Chapter 1), platform economy from the sense of Parker, Van Alstyne and Choudary could be defined as *the phenomenon manifested from the collective social behaviors of an economic system in which the businesses are based on enabling value-creating interactions between external producers and consumers. The platform provides an open, participative infrastructure for these interactions and sets governance conditions for them. The platform’s overarching purpose: to consummate matches among users and facilitate the exchange of goods, services, or social currency, thereby enabling value creation for all participants.*

### 5.1.2 Kenny-Zysman Definition

In (Kenney and Zysman, 2016), Kenny and Zysman prefer the term *platform economy* to be equivalent to *digital platform economy*. It is a more neutral term that encompasses *a growing number of digitally enabled activities* in business, politics, and social interaction. Follow their definition on a platform, *platform economy* is defined as the phenomenon manifested from the collective social behaviors of an economic system with *digital platform* as a driving force.

### 5.1.3 Our Definition

To us, *platform economy* is defined as the phenomenon manifested from the collective social behaviors of an economic system with *platform* as a driving force. By the same token, *digital platform economy* is defined as the phenomenon manifested from the collective social behaviors of an economic system with *digital platform* as a driving force. Follow our sense of a platform, as presented in Section 2.1, *platform economy* is defined as the phenomenon manifested from the collective social behaviors of an economic system in which people gather together.

## 5.2 Overlapping Other Economies

Today, many tech firms have developed various platforms for various purposes. A publisher develops a platform for its reader to read articles. A cloud platform provides software tools for its subscribers. One key question on the publisher and the cloud provider is on what they have provided to their clients. Are they providing services to their clients? Are they providing information to their clients? Clearly, there is no definitive answer for the above questions. In sequel, the definitions of economies could certainly overlap among each other.

### 5.2.1 Service Economy

Consider a platform as a service provider. Apple APP Store, Google Play provide services for the developers selling their software. On the other hand, these platforms provide services for the buyers to search and pay. Amazon Mechanical Turk and Uber provide services for the labors to search for a free-lance job to earn money. At the same time, AMT and Uber provide services for the clients to place requests and conduct matching. Uber even provides a payment transfer service for the passenger and the driver. The people being supported by these platforms are essentially the service worker. Therefore, a platform plays a part in the so-called service economy (Fuchs, 1968; Kaboski and Buera, 2009; Buera and Kaboski, 2012). Platform economy overlaps, but not identical to, service economy.

### 5.2.2 Digital Economy

Digital economy embraces those economic activities conducted through digital platforms (OECD, 2003). Digital platforms include (but not limited to) Yahoo!, Google, Bing, Facebook, Amazon and Alibaba. Clearly, the scope of

digital economy covers the scope of digital gig economy. The scope of platform economy covers both the scope of gig economy and digital economy.

### 5.2.3 Gig Economy

The scope of platform economy has largely related to a recent topic about gig economy (Vallas and Schor, 2020). One reason is due to the widely adopted platforms Uber and Foodpanda (Friedman, 2014; Abraham et al., 2017; Vallas and Schor, 2020). Labor sourcing was used to be a time consuming process and the price for a labor work was uncertain. With Uber, the time for searching for a taxi driver is now much shorten and the cost of delivering is now manageable. Those transaction information can now be collected to indicate the economic activities on Uber and thus for analyzing the growth of the gig economy due to Uber. As Uber is simply a digital platform for delivery, it constitutes a part of the digital platform economy.

### 5.2.4 Experience & Information Economies

Clearly, the scope of platform economy also overlaps to other economies, like experience economy (Pine et al., 1998) and information economy (Zmud et al., 1986; Eliasson et al., 1990; Hayriye, 1999; Godin, 2008). Many online game platforms have already developed virtual reality (VR) or augmented reality (AR) environments for their users to experience the excitation of a game. Similarly, many metaverses have developed VR environments for their users to enjoy the social interaction among the users in a metaverse.

For the developer network platforms as mentioned above, an ultimate goal of these platforms is to facilitate new product development. In a process of new product development, ideas and knowledge are clearly an inevitable resource to be exchanged. In this regard, the activities manifested in a developer network platform are essentially the same as the captivities manifested in information economy.

## 5.3 Measuring Platform Economy

With the above reasons, collecting data and measuring the economic impact of platforms are difficult. For digital platforms, the enterprises are able to record all the transaction data. If a platform enterprise is willing to disclose the data to the public, investigation on the rise/fall of *digital platform economy* could be done. Even worse, what kinds of data should be collected



is yet another difficult problem. These difficulties are also the difficulties for the measurements in the service, digital, sharing and gig economies.

As elucidated in Section 6, it should be aware that the concept of product platform has been advocated for more than three decades as a strategy for new product development. With reference to the survey (Evans and Gawer, 2016) and other subsequent studies on platform economy (Kenney and Zysman, 2016, 2019; Acs et al., 2021; Greig and Sullivan, 2021; Zhang, 2021), not all enterprises with product platform is concerned.

## 5.4 Platform Economy is still Rising ?

In 2016 survey by (Evans and Gawer, 2016) by Evans and Gawer, it is claimed that there was a rise of platform enterprise. After eight years, this claim has to be re-examined. One approach is to look into the stock prices of those platform enterprises.

By collecting the historical data from Yahoo! Finance, the stock prices of fourteen enterprises are downloaded. These platform enterprises are included in the 2016 survey report (Evans and Gawer, 2016).

Alibaba	Amazon	AMD	Apple	eBay	Google	Intel
JD	Match Group	Meta	Microsoft	Salesforce	Tencent	Uber

Based upon their stock prices, except Tencent, their stock prices are rising after the COVID-19 pandemic. Precisely, their stock prices are rising since 2022 or 2023. Therefore, we argue that the platform economy is still rising. Here, we have excluded the sudden rise-and-drop of the stock price during the COVID-19 pandemic.

## Chapter 6

# PRODUCT PLATFORM

In the 1990s and 2000s, there were studies centered on *product platforms* (Meyer and Lehnerd, 1997; Meyer and Seliger, 1998; Robertson and Ulrich, 1998; Simpson, 2004; Simpson et al., 2006) and the benefits of a product platform in new product development (Simpson, 2004), mass customization (Pine et al., 1993; Simpson, 2004), driving innovation (Cusumano and Gawer, 2002; Gawer et al., 2002; Cusumano and Gawer, 2003; Cusumano, 2010). Product platform is usually referred to a company-wise platform, in which the components embraced are owned by the company.

A related term, the *industry platform*, is usually referred to an industrial-wise product platform which relies on the collaboration among the firms on a platform. On an industry platform, multiple firms open their technologies for other firms. That is to say, the usages of the components in the product platform are licensed to the firms on the platform.

In either product platform or industry platform, a goal is to let a firm develop and produce a new product in a shorter time span. Another goal is to facilitate the firms to develop innovative products.

Another related concept is *product as a platform*. It considers a product as a platform providing services for other systems and human users. For instance, an operating system like Microsoft Windows can be considered as a platform providing services, i.e. the system calls, for the application systems like Microsoft Word and Google Chrome to provide services for human users. An operating system like Microsoft Windows provides services for a human user to control the a computing platform like a PC or smartphone.

As practices of product platform have long been existed (Smith, 1776; Starr, 1965; Baida, 1987), dated back in the 18 century, it is necessary to present the ideas behind product platform and let readers understand the differences between a product (resp. industry) platform and the platform encompassed in platform economy.

## 6.1 Enterprises with Product Platforms are not all considered in Platform Economy

Notice that the nature of a product platform is extremely different from the natures of a social network platform like Facebook and TikTok, an emarket-place like Taobao and eBay, and a cloud platform like Ali Cloud and Amazon AWS. Thus, not all enterprises which apply the idea of product platforms in new product development are considered in platform economy. Car manufacturers like BMW are not included in platform economy (Simpson, 2004; Koren et al., 2015; Weiss et al., 2021).

On the contrary, an enterprise with a product as a platform is included in platform economy. So, the enterprises involved in the development of PC platforms with Microsoft Windows and Intel processor are included in platform economy. The enterprises involved in the development of Android phones are included in platform economy.

## 6.2 Modular Design and Re-Use

The idea and practice of product platform has its root in the idea of modular design, module<sup>1</sup> re-use, the idea of modular production (Starr, 1965) back in 1965, the idea of interchangeable part (Baida, 1987) back in 1798, and even the idea of division of labor (Smith, 1776) back dated in 1776.

### 6.2.1 Definition of a product platform

In 2004, Simpson (2004, P.4) summarized three definitions of a product platform.

- Product platform is a set of common components, modules, or parts from which a stream of derivative products can be efficiently developed and launched (Meyer and Lehnerd, 1997, P.7).
- Product platform is a collection of the common elements, especially the underlying core technology, implemented across a range of products (McGrath, 1995, P.39).
- Product platform is a collection of assets [i.e., components, processes, knowledge, people and relationships] that are shared by a set of products (Robertson and Ulrich, 1998, P.20).

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<sup>1</sup>Unless there is any remark, the terms module, subsystem and component are used interchangeably throughout the paper.

Thus, a product platform is a social-technical entity for the research and development team together with the third part developer to develop new products.

### 6.2.2 Product platform as a strategy is an old idea

The key idea behind *product platform as a strategy* can be rooted from (i) the idea of *modular production* advocated in the 1980s (Starr, 1965)<sup>2</sup>, (ii) the ideas of *modular design* and *software reuse* advocated in software engineering in the 1990s (Krueger, 1992) and (iii) the idea of *service oriented architecture* (SOA) advocated in software engineering in the 1990s and 2000s (Goyal, 1991; Ferris and Farrell, 2003).

## 6.3 On Standards

In (Cusumano, 2010), Michael Cusumano added a comment that standards (resp. protocols and rules) are not platforms. Standards are the protocols for the components in a product platform to interfacing among each other. Therefore, standards could be treated as technologies boosting innovations. But, standards are not platforms. Instead, standards can facilitate innovative products development from the product platforms.

### 6.3.1 Standards are not platforms

(Cusumano, 2010, P.33) *It is important to realize, though, that standards by themselves are not platforms; they are rules or protocols specifying how to connect components to a platform, or how to connect different products and use them together. Prominent historical examples of platforms incorporating specific standards include the telegraph, telephone, electricity, radio, television, video recording and, of course, the computer.*

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<sup>2</sup>Modular production has its root in the idea of division of labor It should be noted that the idea of modular design can be back dated to 1798 (Baida, 1987). The first concept of interchangeability occurred in the 18th century. Around 1798, the United States was influenced by the French Revolution, Whitney entrusted by the US government to make 10,000 to 15,000 rifles for the US military in 1800. At that time, each gun from beginning to end was built by a craftsman. The components of the guns of the same model were not interchangeable. Eli Whitney thus designed a gun which was assembled by interchangeable components. In other words, the components are interchangeable (Baida, 1987).

### 6.3.2 Standards are necessary for Platforms

While a standard is not a platform, some platforms have to be built on top of standards. Two notable examples are the Internet and the telecommunication networks. Both networks are developed on top of various standards. The standards ensure the inter-operability among different computer networks connected to the Internet. The standards ensure the inter-operability among different telecommunication networks. In the end every computer (resp. smartphone) is able to connect to other computer (resp. smartphone) over the Internet (resp. telecommunication networks).

## 6.4 On New Product Development

Product platform has its root in new product development. The goals of *product platform as a strategy* are three folds. First, the time spent on new product development is shorten. Second, the time spent on producing a new product (equivalently, the time to market) is shorten. Third, the cost on new product development and production is reduced. Therefore, a firm is able to faster develop and produce new product in reaction to a market change (Muffatto, 1999).

Here, it is stressed that the nature of product platforms (being studied in the 1990s and 2000s) is not the same as the nature of digital platforms (being studied in the survey by Evans and Gawer (Evans and Gawer, 2016)). While these two types of platforms share many common characteristics, such as boosting innovation and shorten the time to market of a product, they should be considered as two distinct types of platforms.

## 6.5 Computer as a Platform

In the last four decades in the computer industry, at least three components<sup>3</sup> have been treated as the focal products of the respective product platforms – the processor, the operating system and the browser. For the personal computer market, the major players and their products in the 1980s – 1990s are listed below<sup>4</sup>.

- Processor – Intel x86 series and Motorola 68000 series.

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<sup>3</sup>As a matter of fact, computer network product is the fourth component.

<sup>4</sup>Readers are encourage to browse Wikipedia for the history and the system requirement of each of these products.

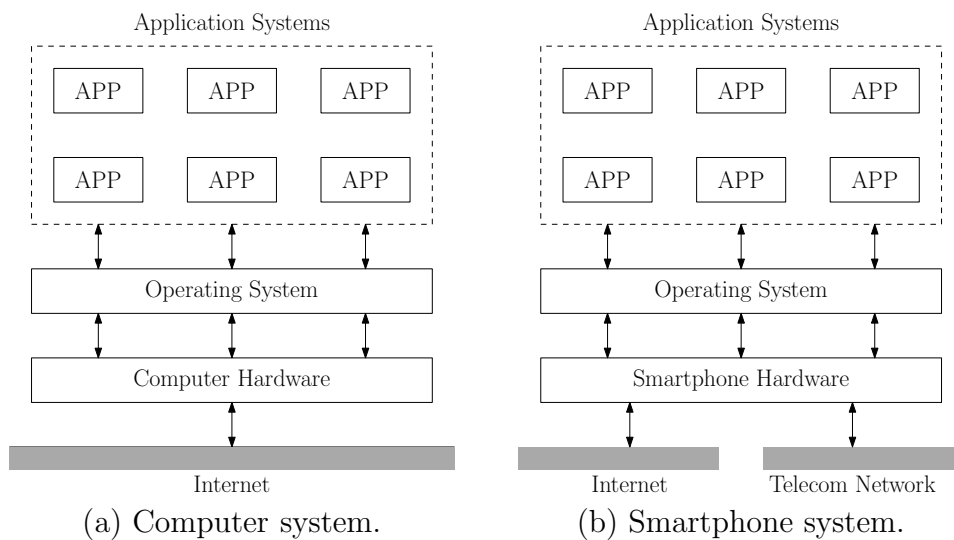


Figure 6.1: The technological components of a computing system (a) and a smartphone (b). Here APP stands for an application system, like word processing software, browser and social networking software. It should be noted that each component in this technological stack could be evolved to be a platform (product as a platform). Furthermore, the technological components in tablets, wearable devices and electric vehicles are essentially the same.

- Operating system – Linux (open source), Apple MacOS and Microsoft Windows.
- Browser – Netscape (open source) and Microsoft Internet Explorer.
- Word processor – MacWrite, Microsoft Word, WordPerfect and WordStar.

Browsers and word processors are application systems (equivalently, software) in accordance with the technology stack diagram of a PC as shown in Figure 6.1a.

For reference, here lists some major players and their products in today (year 2024) smartphone market.

- Processor – Apple A series, Qualcomm Snapdragon series, HiSilicon Kirin series, MediaTek Dimensity series and Samsung Exynos series.
- Operating system – Android, Apple iOS, Huawei Harmony, Windows Mobile<sup>5</sup> and other Linux-based or Android-like operating systems.
- Browser – Apple Safari and Google Chrome.
- Map – Apple Map and Google Map.

Browsers and Maps are application systems (equivalently, software) in accordance with the technology stack diagram of a smartphone as shown in Figure 6.1b.

## 6.6 Product Platform as a Strategy

To understand the ideas behind *product platform as a strategy*, one approach is to take a look on the technological components in a computer or a smartphone, Figure 6.1. The major components include the data communication network, the computer hardware, the operating system and the application systems. A challenge to this strategy is on which product to be considered as the focal product for a platform for supplementary products development.

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<sup>5</sup>It should be noted that the market share of Windows Mobile in smartphone market is very low.

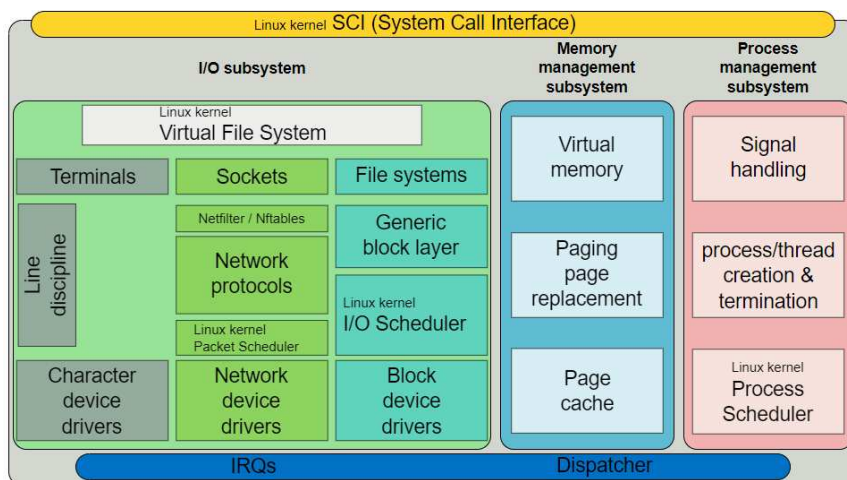


Figure 6.2: Architecture of a Linux operating system is indeed a product platform (resp. industry platform). Each block in the diagram is a component. The image is extracted from a book *Modern Operating Systems* which is authored by Andrew Stuart Tanenbaum and the image is protected by the CC BY-SA license.

### 6.6.1 Product platform for OS development

A simple example to illustrate the concept of product platform is to consider a family series of operation systems as a product platform.

Take Linux<sup>6</sup> as an example. This series includes Arch Linux, ChromeOS, Debian, Fedora Linux, and Ubuntu for computers; and the notably Android for smartphones. A full list of the operating systems developed under the Linux series can be found in <https://en.wikipedia.org/wiki/Linux>. Figure 6.2 shows a simplified architecture of a Linux operating system which consists of three big components (equivalently, subsystems) namely I/O subsystem, memory management subsystem and process management subsystem. In each of these big components, there are many small components (equivalently, subsystems). The collection of all those already developed components is the product platform for Linux operating system series.

Developing an operating system from scratch is notoriously time consuming. A clever way is to re-use some components, either the big or small components, that have already been developed in an earlier operating sys-

<sup>6</sup>The product platform for Linux-based operating systems development is better considered as an industry platform. As Linux is an open-source operating system. Developers are anyone on the globe. Therefore, the product platform is definitely built by the developers from the software industry, instead of from a single tech firm.



tem. The advantages of applying the idea product platform for an operating system are many folds.

- These operating systems developed will ensure inteoperability among the devices which run any operating system under the same series.
- Once the functionalities of a new operating system has been determined<sup>7</sup>. Developers can simply re-use the components already developed for the old functions and put effort mainly on developing new components for the new (resp. innovative) functions.
- Developers can dedicate to make changes on those components which are affected by different processors. If necessary, new components are created on the product platform.
- Developers can dedicate to make changes and hence improve the efficiency<sup>8</sup> of any component on the product platform. Eventually, the performance of a Linux-based operating system can be optimized.
- Developers are able to build application systems effectively from this product platform.

The practice of this product platform is common in the software industry. Today, operating system is needed in many devices apart from computer and smartphone. Tablet computers and watches need an operating system. A home network connecting appliances needs an operating system. The processors and the hardware of these devices are different. Product platform is an inevitable practice for these operating systems development.

Microsoft Windows series includes Windows, Windows Server, Windows Home Server and Windows Mobile. A full list of the operating systems under Microsoft Windows series can be found in [https://en.wikipedia.org/wiki/Microsoft\\_Windows](https://en.wikipedia.org/wiki/Microsoft_Windows). The processors for an Intel computer, an AMD computer, a home network and a smartphone are quite different. Product platform is clearly an important idea for these operating systems development. This Windows-based product platform is a company-wise product platform.

Similarly, Apple MacOS series includes MacOS, iOS, iPadOS, watchOS, tvOS, and audioOS. A full list of the operating systems developed under

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<sup>7</sup>It should be noted that the functionalities of an operating system are determined by the application systems. As an application system is developed for human users, the functionalities of an operating system are partly determined by the services to be provided by the application systems to the human users.

<sup>8</sup>Less memory consumption and faster response.

the MacOS series can be found in <https://en.wikipedia.org/wiki/MacOS>. Similar to the case of Microsoft, developers can dedicate on developing new components to support the new functions. Moreover, developers can identify which components are affected if the processor of a device has to be changes<sup>9</sup>. Again, this MacOS-based product platform is a company-wise product platform.

### **6.6.2 Product platform for application system development**

Once an operating system has been developed, its system design will normally be diagrammed as a component-based architecture, in which the interactions and dependencies among the components are shown. A collection of application program interfaces (APIs) will be disclosed. By that, development of a new application system running on top of the operating system can be facilitated. Not just the time spent on a development can be shorten, more developers can be beneficial from the APIs to develop more application systems for the operating system.

The platform supporting application system development could be viewed as a collection of the components from the operating system together with the re-usable components for the application systems. It is true for a developer who develops application systems solely for running on a single operating system. For a developer who develops application systems for running on multiple operating systems, its product platform will consist operating system-dependent components

### **6.6.3 PC, smartphone or electric vehicle as a product**

Each of the above products can clearly be a focal product of its corresponding product platform. Take Apple MacOS as an example, the operating systems developed along with MacOS modules are clearly on the product platform. The innovative modules developed supplementary or advancing the existing modules are included in the MacOS product platform. The application sys-

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<sup>9</sup>See the Mac transition to Intel processor in 2005-2006 [https://en.wikipedia.org/wiki/Mac\\_transition\\_to\\_Intel\\_processors](https://en.wikipedia.org/wiki/Mac_transition_to_Intel_processors) and and the Mac transition to Apple Silicon in 2020 [https://en.wikipedia.org/wiki/Mac\\_transition\\_to\\_Apple\\_silicon](https://en.wikipedia.org/wiki/Mac_transition_to_Apple_silicon). As a matter of fact, Apple MacOS had made a change when the processor of a Mac was transited from Motorola 68000 series to PowerPC in 1994. In the early generation of iPhone, the processor was from Samsung. Starting from iPhone 4, Apple has been designing its smartphone processor – the A processor series. Thus, the iOS has made changes since the release of the iPhone 4.

tems developed on top of each of these operating systems are on the MacOS product platform.

By the same principles, a PC, a smartphone or an electric vehicle (EV) (Boehm et al., 2020; Anderson et al., 2022) can be a focal product to be targeted in its corresponding product platform. The technologies associated with the focal products are included in those product platforms. Competition among electric vehicles (resp. PCs and smartphones) would have not much difference from the competition among the EV (resp. PCs and smartphones) platforms.

## 6.7 Towards Industry Product Platform

In the end of the day, those products aforementioned have to provide services for the end users. The processor, the operating system and the applications systems in a PC are necessary systems to support the usages of a PC user or smartphone user. The processor, the operating system and the applications systems in an electric vehicle are necessary systems to support the usages of the driver and the passengers in a electric car.

Therefore, a PC, a smartphone or an electric vehicle could be treated as a product providing services for the end users, including PC users, smartphone users, drivers and passengers. The product platforms associated with these products are a lot more complex. Managing such complex platforms poses a challenge to the developers and the managers on the platform. It is speculated that these product platforms are industrial-wise platforms. In accordance to Michael Cusumano, they are called the industry platforms (Cusumano, 2010).

## 6.8 Product Platform vs Product as a Platform

The concepts of *product platform* and *product as a platform* are not the same, while their perceptions have certain overlap. It is important to highlight their differences.

### 6.8.1 Product platform : An architecture for product development

To end the discussions on product platform, we would like to emphasize the conceptual difference between product platform and product as a platform.

A product platform is a system architecture embracing all the reusable components and their dependencies. One of its goals is to facilitate new product development and production. For instance, the product platform for the Windows operating system series is an example. Once the services or the functionalities of a new system have been consolidated, the developers are able to re-use the existing components for the old functions and dedicate efforts to develop new components for the new functions.

### **6.8.2 Product platform : An architecture for product production**

For physical products, this component-based product platform architecture could raise the demands of certain physical components up to a reasonable scale. Thus, the quality (resp. product cost) of a component could be raised (resp. down). In the end, the quality (resp. product cost) of a physical product could be raised (resp. down). Quality raise and cost down are two advantages gained by the idea of product platform.

### **6.8.3 Product as a platform : A strategy for product development**

Product as a platform, from our sense, is a concept tightly associated to the usages of a product. It is about the identification of the functions (resp. services) to be delivered by the product. In the context of software engineering, a function to be delivered by a software product is called a requirement. The process figuring the requirements of a software product is called requirement analysis. It should be noted that a system requirement is just a service to support a user usage of the product. Thus, product as a platform is a scenario for the developers to identify the user usages on a new product.

Take an electric vehicle as a platform. Engineers would need to identify how an electric vehicle can benefit a driver and the passengers. The driver might want the electric vehicle helping him/her to avoid any accidents. The passengers might want the electric vehicle providing WiFi access. So that, the passengers are able to buy clothes online. From that, the engineers could design a new electric vehicle to meet these requirements.

#### **6.8.4 Product as a platform : A strategy for user dependency**

Once a product (resp. service) has gain sufficient scale, the product (resp. service) could become an inevitable part of a user and many users would depend on it in his/her daily work or living. In sequel, the product (resp. service) could be considered as a platform with user dependency. Supplementary products (resp. services) could be development along with this user dependent product.

In the hi-tech industry, many notable products or services have already been developed and gained increasing number of user dependency. If we consider PC as a platform or smartphone as a platform, processor and operating system are two important products to be platforms.

- Processors: AMD and Intel.
- Operating systems: Apple MacOS, Apple iOS, Google Android, Linux and Microsoft Windows.

From the user application point of view, the following products are the focal points for developing platforms for users to depend on.

- Cloud services: Amazon AWS, Apple iCloud and Google Drive.
- Browsers: Apple Safari, Google Chrome and Microsoft Edge.
- Documentation: Microsoft Office.
- Social networks: Facebook, Instagram, LINE, Snapchat, WhatsApp, WeChat, Weibo and X(Twitter).
- Video sharing platform: Youtube.
- Delivery services: Foodpanda and Uber.

For each of these products, a generic question about how to make this product as a platform with user dependency. In prior to a product has been released, the enterprise has to be so sure that the product attract a significant amount of users to use (resp. buy) it. It is clear not a simple question to be answered.

## Chapter 7

# PLATFORM AS A STRATEGY

To succeed a *platform as a strategy*, a number of issues have to be concerned. In this chapter, some of these issues to be discussed are listed below.

- Platform thinking is a mindset an enterprise has to be equipped. Instead of making a product, an enterprise should consider making a platform. The platform could be a platform of products or a product platform.
- The second issue to be discussed is about the role of a platform. Treating an application software (resp. online platform) as a service provider for the users, an application software (resp. online platform) is a platform providing functional services for the users.
- Network of devices is nowadays a potential platform for a technology enterprise to bundle the device users to be its potential customers aiming for producing additional revenue for the enterprise.
- Community support is almost a key feature in every platform. It is not a simple issue with customer service and a forum for customers exchanging ideas. To succeed a community support, it embraces a lot of features to be delivered.
- No wonder, implementing a platform as a strategy is no simpler than developing an enterprise. Thus, the issues on platform strategy implementation and development a business with platform strategy are to be discussed.

- Finally, an interesting observation has been discovered. By revealing the practices of some emarketplace platform, like Alibaba and Amazon, it is found that those enterprises can indeed be treated as economies with scale as a country.

These issues will be discussed in the following subsections. It is clear that the list of issues to be discussed is far from complete. Future research could be done along this direction.

## 7.1 Platform Thinking

Platform thinking has been advocated in the 1990s, as in (Sawhney, 1998). Subsequently, the advocacy of platform leader has been aroused in the 2000s, as in (Cusumano and Gawer, 2002; Gawer et al., 2002; Cusumano and Gawer, 2003; Cusumano, 2011), and later platform strategy has been aroused in the 2010s (Muffatto, 1999; Parker and Van Alstyne, 2014, 2018; Bughin et al., 2019; Rietveld et al., 2019).

Cusumano (2010) brought out the shift of *enterprise-wise platform thinking* to *industry-wise platform thinking* in the 1990s and 2000s. While his observation is intuitive, it has raised a new thinking logic – platform thinking. Platform thinking is tightly associated with platform strategy. To succeed an implementation of a platform strategy, the management team should have platform thinking capability.

### 7.1.1 Platform-Oriented thinking

To our understanding from the information delineated in (Cusumano, 2010), platform thinking embraces a number of thinking logics for the employees in an organization. First, an employee should think that the architectural design of a product (resp. family of products) should be technically treated as a platform. Second, treating the architectural design as a technical entity for new product development is not sufficient. Yet another necessary condition is the build a social platform for the employees to exchange ideas and knowledge. *If the number of participants on the platform is sufficiently enough and the qualities of the ideas are sufficiently high, this platform is able to facilitate new products development.*

### 7.1.2 Platform as a system architecture

In software industry, platform has been a philosophy for the system architecture design of a family of software. A notable example is the operating

system development as mentioned in Section 6.6.1. With the platform as the system architecture of an operating system, developers are able to develop advanced components to improve the performance of the operating system. Application system developers are able to develop application systems to be running on the operating system.

Apart from treating an operating system as a platform, browser could also be treated as a platform for Internet-access users. To enhance the experience of Internet-access users, developers are able to develop add-ons in accordance with the architecture of the browser.

### **7.1.3 Platform for product development**

Clearly, treating a system architecture as a platform is not sufficient for the success of a new product development. A *social platform* is needed. Through the social platform, developers are able to exchange ideas and knowledge for the development of new products.

### **7.1.4 Engineering thinking**

Consider an enterprise as an engineer, the ultimate purpose is to make a thing workable. In terms of the management terminologies, the ultimate purpose of an enterprise (resp. management team in an enterprise) is to make a product profitable, a strategy implementable, a project its results conformable to its anticipated goals and an enterprise achieving its growth plan.

Therefore, an enterprise (resp. management team) should treat a platform (as a system architecture) as a technical tool for the development of a new product for profit. The enterprise (resp. management team) should develop social platforms to fluid ideas and knowledge exchange among the members on the platforms. The platform development process is indeed an engineering process which includes (1) analysis on the requirements of the platforms, (2) designs of the platforms, (3) implementations of the platforms and (4) maintenance of the platforms.

Clearly, strategy implementation of a platform demands on the management team members with platform thinking. From the above arguments, the implementation of a platform strategy demands on the management team members (resp. talents) with engineering thinking.



## 7.2 Functional Service as a Platform

By analyzing the types of platforms manifested in Alibaba, Amazon, American Online, Apple, Facebook, Google, Instagram, LINE, Microsoft, Shopee, Weibo and Whatsapp at least six types of platforms can be identified.

1. Social network platform (digital) : It includes three different types of platforms.
  - (a) Social networking and making friends : Facebook, Instagram, LINE, Weibo, Whatsapp.
  - (b) Live chat : FB Messenger, Instagram, LINE, Whatsapp.
  - (c) Customer support : Apple Community, Google Community, Microsoft Community.
2. Marketplace platform (digital) : Alibaba, Amazon, Apple App Store, Facebook Marketplace, Google Play, Microsoft Store, Shopee.
3. Infotainment platform (digital) : It includes both platforms for information access and online games.
  - Searching engine : Google Search, Microsoft Bing.
  - Music and video : Alibaba TV, Amazon Prime Video, Apple iTune, Apple TV, Google TV, Microsoft Movie & TV, Netflix, Tencent TV ([v.qq.com](http://v.qq.com)), Youtube.
  - Game : Microsoft XBox, Nintendo Switch, Sony Playstation.
  - Information : Google Search, Google Scholar
4. Payment platform (digital) : Ali Pay, Amazon Secured Card, Google Pay, LINE Pay, Meta Pay (from Facebook).
5. Knowledge acquisition platform (digital & physical) : This type of platforms are realized by both digital and physical platforms.
  - (a) Developer network/community.
  - (b) Seller learning center/community.
6. Logistics platform (digital & physical) : Alibaba, Amazon, Shopee.
7. Information and communication platform (digital) : It includes cloud platforms, telecom platforms, Internet and email as platforms.

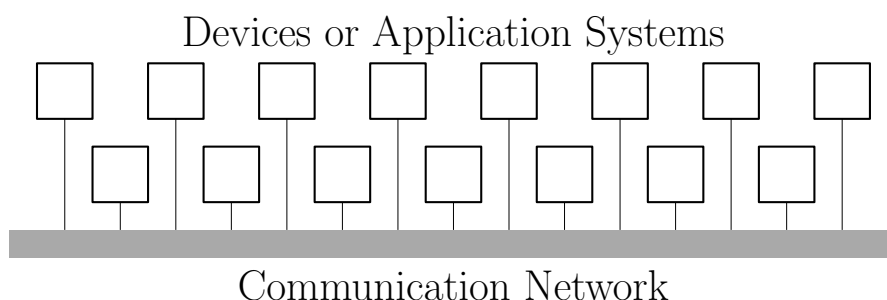


Figure 7.1: Network of devices as a platform.

- (a) Cloud platform : Ali Cloud, Amazon Web Service, Apple iCloud, Google Cloud, Microsoft Azure.
- (b) Telecommunication platform : American Online.
- (c) Internet : American Online.
- (d) Email service : Microsoft Hotmail, Gmail, Yahoo Mail.

The above seven types of platforms are now served as basic building blocks of a platform enterprise. As witnessed in a recent organizational restructure of Alibaba, the six business groups are akin to the above platforms.

## 7.3 Network of Devices as a Platform (NoD Platform)

With the advancement of the information and communication technology, almost all computing devices can now connect to the Internet without any delay. In sequel, those devices are virtually connected to form a networks. We call a network of this form a network of devices (NoD), as shown in Figure 7.1. These networks could definitely be considered as platforms.

### 7.3.1 Benefits from the NoD platforms

At least two potential benefits could be revealed from these NoD platforms. From application development point of view, these platforms could facilitate the developers to build useful applications for the users of the respective computing devices.

From monetization point of view, these platforms could let some firms<sup>1</sup>

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<sup>1</sup>Like Amazon, Apple, Google and Microsoft.

to get income by selling products to the device users<sup>2</sup>. These platforms could let some firms<sup>3</sup> to create markets for the users and then get income from the transactions on the markets. Clearly, one type of product to be transacted is the application software.

### 7.3.2 Types of NoD platforms

It should be noted each computing device must be associated with at least one user. Thus, each NoD platform is indeed a platform of the users of the devices. In view of the natures of the computing devices, at least six networks can be identified.

- Network of cell phone users.
- Network of tablet users.
- Network of computer, including desktop and notebook, users.
- Network of browser users.
- Network of home automation users.
- Network of electric vehicle drivers.
- Network of video game players.

As each computing device must be running with an operating system, an interesting phenomena is found. Operating system developers, like Apple, Google and Microsoft, could have influences on the NoD platforms as depicted in Table 7.1. Each  $\checkmark$  in the table corresponds to an NoD platform. Altogether, 33 NoD platforms are listed.

Excluding *Browser*, *Home Auto*, *Vehicle* and *Game Console*, there are 12 platforms listed. Three of them are Apple MacOS-based platforms. Three of them are Linux or Android-based platforms. Three of them are Microsoft Windows-based platforms. Three of them are Huawei Harmony-based platforms. The operating systems developed for home automation systems and electric vehicles are entirely based on the Linux operating system family which is an open source family of operating systems and the Huawei Harmony family.

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<sup>2</sup>It should be noted that the device user is only one able to spend money but not the device.

<sup>3</sup>Like Alibaba, Amazon, Apple, Google, Microsoft and Shopee.

Table 7.1: NoD platforms and their corresponding operating system families. Here, electric vehicle is considered as a device. Wearable devices and Internet TV devices are not included in the table. Each  $\checkmark$  corresponds to an NoD platform. Therefore, 33 NoD platforms are listed. Excluding *Browser*, *Home Auto*, *Vehicle* and *Game Console*, there are 12 platforms listed.

Device/APP	Operating System Series			
	MacOS	Unix/Linux	Windows	Harmony
<b>(Cell Phone)</b>				
Android Phone	–	$\checkmark$	–	–
Apple iPhone	$\checkmark$	–	–	–
Huawei Phone	–	–	–	$\checkmark$
<b>(Tablet)</b>				
Amazon Fire	–	$\checkmark$	–	–
Apple iPad	$\checkmark$	–	–	–
Google Pixel	–	$\checkmark$	–	–
Huawei MatePad	–	–	–	$\checkmark$
Microsoft Surface	–	–	$\checkmark$	–
<b>(Computer)</b>				
Apple Macbook	$\checkmark$	–	–	–
Huawei Matebook	–	–	$\checkmark$	$\checkmark$
Windows PC	–	–	$\checkmark$	–
<b>(Browser)</b>				
Apple Safari	$\checkmark$	$\checkmark$	$\checkmark$	–
Google Chrome	$\checkmark$	$\checkmark$	$\checkmark$	–
Huawei Browser	?	?	$\checkmark$	$\checkmark$
Microsoft Edge	$\checkmark$	$\checkmark$	$\checkmark$	–
<b>(Home Auto)</b>				
Amazon Echo	–	$\checkmark$	–	–
Apple Home	$\checkmark$	–	–	–
Google Nest (Home)	–	$\checkmark$	–	–
<b>(Vehicle)</b>				
BYD	–	$\checkmark$	–	–
Huawei	–	–	–	$\checkmark$
Telsa	–	$\checkmark$	–	–
Xiaomi	–	$\checkmark$	–	–
<b>(Game Console)</b>				
Microsoft Xbox	–	–	$\checkmark$	–
Nintendo Switch	–	$\checkmark$	–	–
Sony PlayStation	–	$\checkmark$	–	–

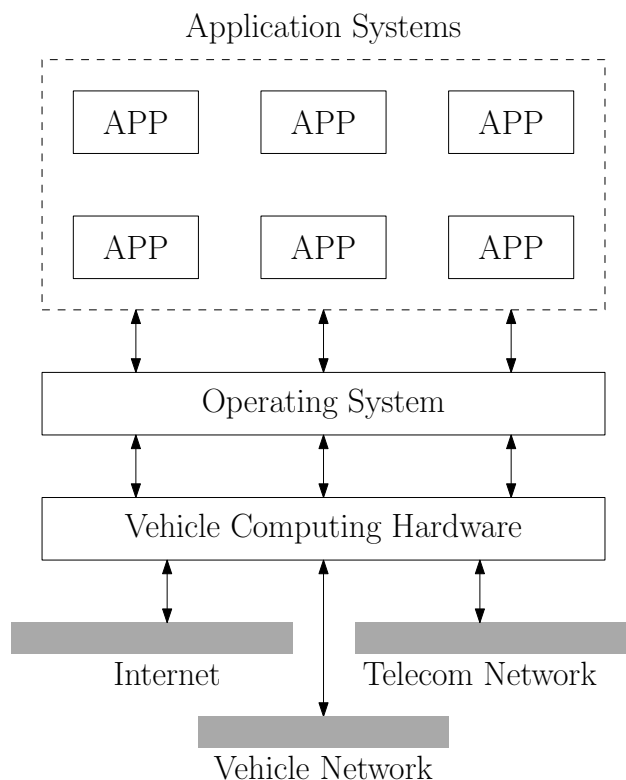


Figure 7.2: Electric vehicle as a platform. Today, the computing system in a vehicle can connect to the Internet via three communication networks. The first one of it is via WiFi connection. The second one is via the telecommunication network connection. The third one is via the vehicle network connection. All three network connections work together to optimize the Internet access efficiency for the vehicle computing system.

### 7.3.3 Network of electric vehicles

In recent years, technologies on electric vehicles have been advancing in a non-precedential high pace. The first example is the use of tablet computer as a control panel for the vehicle. The driver can control the vehicle either be accomplished by touch or by voice. The second example is on the network connection technologies. The in-vehicle computing system is now able to connect to (1) the Internet via WiFi connection for data communication, (2) connect to the telecommunication network for voice (resp. data) communication and (3) connect among other vehicle via the vehicle network for traffic information communication, see Figure 7.2. The third example is the auto-driving system.

With these advancements, the driver is able to spend more time in in-

formation access, such as reading news and watching movies. So as the passengers in the vehicle, they are able to check emails, play games or shop online during the delivery. As a results, an electric vehicle is in essence the same as a smartphone or a computer. The network of electric vehicles is yet another platform which gathering potential buyers (i.e. the drivers and the passengers) for merchants (Boehm et al., 2020; Anderson et al., 2022).

Here, we could like to emphasize that the application systems being developed for a vehicle are more demanding the application systems developed for a cell phone or a computer. It is because some vehicle application systems are developed to control some mechanical systems. Real-Time interactions among the software systems and the mechanical systems are a must. Any bug in an application system can cause a death. Therefore, developing a vehicle application system is more demanding than developing an application for a cell phone user or a computer user.

## 7.4 Customer support : Communities

To connect the device users to co-create value, an important practice is to establish a user community which is yet another platform for the users. For each device user, like us, might encounters problem in the use of the device. An immediate action is to get help. User community is definitely a platform for a user to get a solution for a problem.

Tech firms like Amazon, Apple, Google and Microsoft have already built platforms for these communities.

- Amazon Community: <https://www.amazon.com/gp/help/customer/display.html?nodeId=GHPQCG33U7WM883N>.
- Apple Support Community: <https://discussions.apple.com/>.
- Google Account Help Community: <https://support.google.com/accounts/community?hl=en>.
- Microsoft Community: <https://answers.microsoft.com/en-us>.

These communities leverage the workload of the customer support teams and thus raise the engagement of the device users. Clearly, these community platforms are not the only place for a device user to get help. Simply search on Google could also get a solution for a problem. Many blogs and forums sticking with the device are also the sources for getting solutions.

While the name of a customer support platform is called *community*, it is not a platform for social networking (resp. social connection).

## **7.5 Apple, Alibaba, Amazon & Shopee**

The platforms to be supported or maintained by a marketplace are depended on the nature of the products. For digital products, the marketplace has no need to concern the logistic problem. For physical products, logistic platform is a must.

### **7.5.1 Digital product marketplace**

For a software firm, like Apple and Google, there are four platforms to be maintained. There is a platform (marketplace) for the developers to sell their software products. Second, there is a platform for the buyers to search for the product to buy and pay. Third, there is a platform (developer platform) for the developers to build software for sales. Fourth, there is a platform (community) for the customer service support.

### **7.5.2 Physical product marketplace**

For an online marketplace, like Shopee and Shopify, there are again four platforms to be maintained. There is a platform (marketplace) for the sellers to sell their products. Second, there is a platform for the buyers to search for the product to buy and pay. Third, there is a platform (logistic) for the delivering a product from the seller to the buyer. Fourth, there is a platform (community) for the customer service support. One should be noted that the cost on a logistic platform is clearly higher than the cost on a developer platform.

### **7.5.3 Mixed product marketplace**

For Alibaba and Amazon, they provide cloud services and online marketplaces. Thus, either Alibaba or Amazon should maintain at least eight platforms. Four platforms are the same as those manifested in Apple or Google. The other four are the same as manifested in Shopee or Shopify. As the payment platform is applicable to both the software product marketplace and physical product marketplace, there are seven platforms to be maintained.

Figure 7.3 shows the similarities and differences among Apple, Shopee and Alibaba/Amazon. Apple is a software firm and hence the marketplace App Store is for software. Software is a digital product which can be distributed via the Internet. Shopee is a marketplace mainly for selling physical products. Logistic platform is necessary for the distribution of products. Alibaba and

Amazon have now expanded their business by creating more marketplaces for digital products, like games, videos and songs.

## 7.6 Platform Strategy Implementation

Strategy implementation is always a difficult problem to many enterprises (Hambrick and Cannella Jr, 1989; Brinkschröder, 2014; Vigfússon et al., 2021). Sometimes, a top management team raises a strategy might end up with a collection of strategies. If the management team and the executive team do not have a consensus on the *strategy*, it could lead to an ineffective implementation of the so-called strategy just due to their communication gap.

### 7.6.1 A complex engineering project

Today, platform strategy is no more referred to a simple strategy. In an enterprise, a platform could be in analog to a business unit. Each platform has services to support other platforms. If we consider a business unit as a server, the platform will be the interface of a business unit to other business units. Thus, determining the number of platforms to be realized and which employees to be involved are difficult problems to be solved, not to mention about the designs of such platforms. The design of a strategy implementation could be a complex engineering problem.

### 7.6.2 (Service) System engineering mindset

If we consider an enterprise as a service system and a platform as a service (sub)system, implementing a platform strategy could be considered as a business engineering project. The service systems among the enterprise service system are re-designed and new service systems are added to achieve the goals of the platform strategy. Enterprise implementation of a platform strategy would demand for the top management team, the executive team and the operational team to have sufficient knowledge on service system engineering (Sum, 2014).



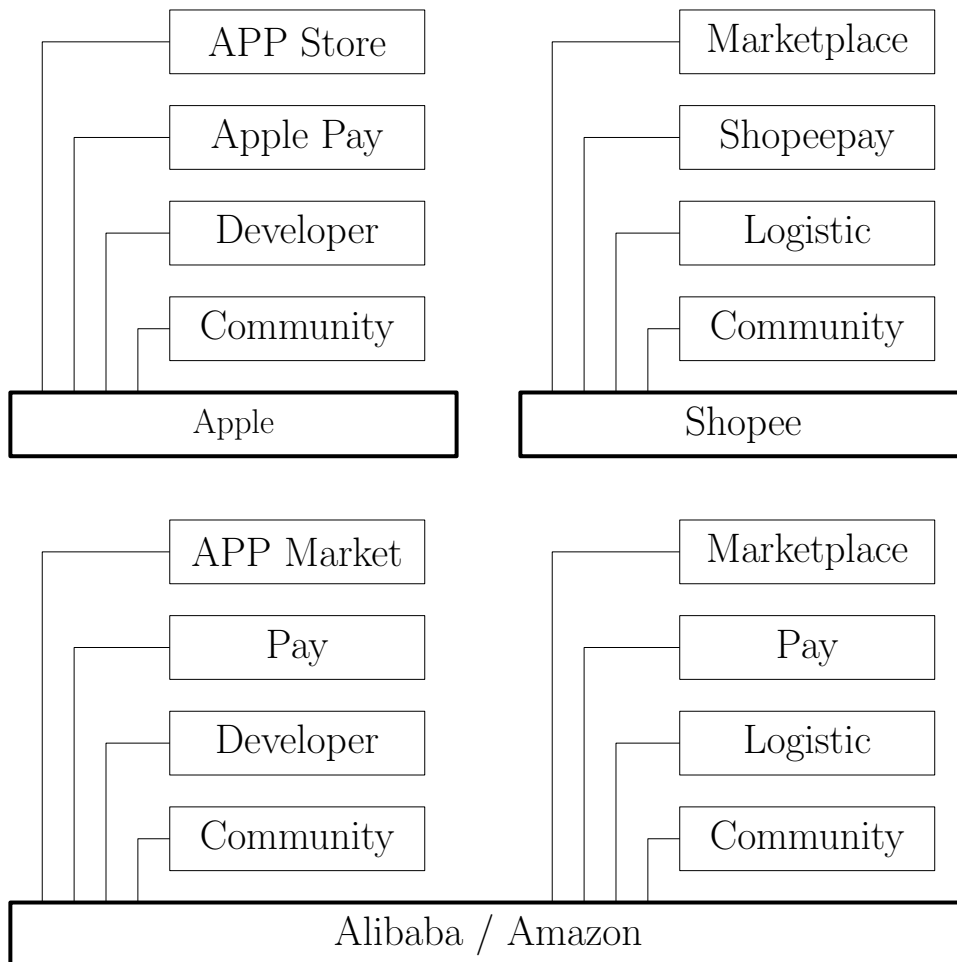


Figure 7.3: Comparison of the platforms to be maintained among Apple, Shopee and Alibaba/Amazon. For Apple, its online marketplace is provided mainly for selling digital products. For Shopee, its online marketplace is provided mainly for selling physical products. For Alibaba or Amazon, there are multiple online marketplaces. Some marketplaces are provided for selling digital products and some marketplaces are provided for selling physical products.

## **7.7 Platform as a Strategy for Business Development**

In view of Alibaba, Amazon and other tech firms, they have been working on expanding their product/service line from their core service. This phenomena has already be observed at least from Alibaba, Amazon, Apple, Facebook, Google, Instagram, LINE and Microsoft.

### **7.7.1 Alibaba, Amazon & Shopee**

In Figure 7.3, we have only highlighted that Alibaba and Amazon have many platforms to support the sellers to sell their physical products and digital products. As a matter of fact, both enterprises have now expanded their supports to the sellers to sell (digital) infotainment (i.e. either information or entertainment) products which include musical products, videos, educational materials and games.

### **7.7.2 Facebook & LINE**

These expansions illustrate that platform is not just a strategy for product/service development. It is now a strategy for business development, with notably witnessed from Alibaba, Amazon and Shopee. While Facebook and LINE have recently added electronic marketplace services, their lacking of (physical) logistic platforms could hamper their ambitious.

### **7.7.3 Platform-Oriented organization structure**

On March 2023, Alibaba announced a new organizational and governance structure to empower all its businesses to become more agile, enhance decision making, enable faster responses to market changes, and promote innovation to capture opportunities in their respective markets and industries, thereby unlocking the value of Alibaba Group's various businesses. Under the new structure, the organization is divided into six groups.

1. Cloud Intelligence Group, including cloud, AI, DingTalk and other businesses.
2. Taobao Tmall Business Group, including Taobao, Tmall, Taobao Deals, Taocaicai, 1688.com and other businesses.
3. Local Services Group, including Amap, Ele.me and other businesses.

4. Global Digital Business Group, including **Alibaba.com**, AliExpress, Daraz, Lazada, Trendyol and other businesses.
5. Cainiao Smart Logistics.
6. Digital Media and Entertainment Group, including Youku, Alibaba Pictures and other businesses.

From this new structure, one can see that the grouping is based on the natures of the platforms which have been launched. Platforms of similar nature are grouped together.

So, we believe that platform-oriented thinking could be a future paradigm for organizational restructuring. Essentially, this type of organizational structuring is the same as the idea of platform-oriented architecture for a software system design.

## **7.8 Enterprise as a Nation (equi. an Economy)**

Enterprise as a nation seems to be a strategy (resp. obligation) of a platform enterprise in the future. One reason is that many enterprises their spending, i.e. its revenue minus its profit, to their employees, suppliers and partners have exceeded 200 billion USD. This number is comparable to the GDP of a country.

### **7.8.1 Enterprise spending versus GDP**

In terms of their spending, these enterprises are helping many people to gain their GDP/PC. Alibaba, Amazon and Walmart are three notable examples. Their annual profit margins are less than 4 percent. Most of their revenues are spent on their employees, their partners, their sellers and their infrastructures being built. Thus, all the people working with them get benefit from these enterprises.

If we analogy the spending to GDP of a country, these enterprises could be treated as nations (resp. economies). Their sellers, their employees, the employees of their suppliers and partners of these enterprises are the markets to be targeted. As depicted in Table 7.2 and Table 7.3, one can see that the spending of some enterprises could be ranking from 23 to 53 countries in term of GDP.

- The spending of Walmart could be ranked 23 in accordance with GDP. Its spending is more than the GDP of Sweden 2022 GDP.

- The spending of Amazon could be ranked 27 in accordance with GDP. Its spending is more than the GDP of Israel 2022 GDP.
- The spending of Apple could be ranked 45 in accordance with GDP. Its spending is more than the GDP of Czech Republic 2022 GDP.
- The spending of Alphabet could be ranked 53 in accordance with GDP. Its spending is more than the GDP of Kazakhstan 2022 GDP.

Therefore, we argue that a strategy an enterprise should consider itself as a nation. On one hand, making money is clearly the primary strategy of an enterprise. After that, an enterprise should consider how to let the people involved in the enterprise to make money happily.

### **7.8.2 Role of an executive team**

How to make it work is clearly the job of the executive team of an enterprise. By that, an executive of an enterprise can be in analog to the government of the enterprise if we consider an enterprise as a nation. The role of an executive team has no difference from a government of a nation. An executive team has the obligation to make everyone associated with the enterprise to earn safely and happily.

Table 7.2: List of countries with GDP larger than 200 Billion USD in 2022.

United State	25,462,700	United Arab Emirates	507,535
China	17,963,171	Thailand	495,341
Japan	4,231,141	Nigeria	477,386
Germany	4,072,192	Egypt	476,748
India	3,385,090	Austria	471,400
United Kingdom	3,070,668	Singapore	466,789
France	2,782,905	Bangladesh	460,201
Russia	2,240,422	Vietnam	408,802
Canada	2,139,840	Malaysia	406,306
Italy	2,010,432	South Africa	405,870
Brazil	1,920,096	Philippines	404,284
Australia	1,675,419	Denmark	395,404
South Korea	1,665,246	Iran	388,544
Mexico	1,414,187	Pakistan	376,533
Spain	1,397,509	Hong Kong	359,839
Indonesia	1,319,100	Colombia	343,939
Saudi Arabia	1,108,149	Romania	301,262
Netherlands	991,115	Chile	301,025
Turkey	905,988	Czech Republic	290,924
Switzerland	818,427	Finland	280,826
Poland	688,177	Iraq	264,182
Argentina	632,770	Portugal	251,945
Sweden	585,939	New Zealand	247,234
Norway	579,267	Peru	242,632
Belgium	578,604	Qatar	237,296
Ireland	529,245	Kazakhstan	220,623
Israel	522,033	Greece	219,066

The data is from World Bank and the number is in term of million USD.

Table 7.3: List of companies with cost larger than 200 Billion USD in either 2022 or 2023. The number is in million USD.

Company	Revenue	Profit	Cost
Walmart	611,289	11,680	599,609
<b>Amazon</b>	574,785	30,425	544,360
State Grid Corporation of China	530,009	8,192	521,817
Vitol	505,000	15,000	490,000
China National Petroleum Corporation	483,019	21,080	461,939
China Petrochemical Corporation	471,154	9,657	461,497
Saudi Aramco	603,651	159,069	444,582
Shell	386,201	20,120	366,081
ExxonMobil	413,680	55,740	357,940
Berkshire Hathaway	302,089	(22,819)	324,908
CVS Health	322,467	4,149	318,318
Trafigura	318,476	6,994	311,482
Uniper	288,309	(19,961)	308,270
UnitedHealth Group	324,162	20,120	304,042
China State Construction Engineering	305,885	4,234	301,651
<b>Apple</b>	394,328	99,803	294,525
Volkswagen Group	293,685	15,233	278,452
McKesson	276,711	3,560	273,151
Toyota	274,491	18,110	256,381
BP	248,891	(2,487)	251,378
TotalEnergies	263,310	20,526	242,784
Glencore	255,984	17,320	238,664
Cencora	238,587	1,699	236,888
<b>Alphabet</b>	282,836	59,972	222,864
Costco	226,954	5,844	221,110
Foxconn	222,535	4,751	217,784
Chevron	246,252	35,465	210,787

[en.wikipedia.org/wiki/List\\_of\\_largest\\_companies\\_by\\_revenue](https://en.wikipedia.org/wiki/List_of_largest_companies_by_revenue) (May 10, 2024).

# Chapter 8

## CONCLUSIONS

In view of the illusive definitions of a platform and its related concepts, this thesis has given a survey on platform and platform economy from the literatures with statistical analysis from various sources of data and a questionnaire survey. From that, we bring out our interpretations on those concepts.

The concepts behind a platform and platform economy are elucidated. By surveying the articles related to platform, product platform and platform economy, it is found that the platform concerned in the platform economy does not include all product platforms. The platforms concerned in platform economy are mainly the electronic marketplaces (for product exchange and labor force exchange) with transactions, the platforms for software development and the social network platforms. Platforms for delivery service, such as Uber Eat and Foodpanda, are clearly a triggering force for the investigations on platform economy.

But, non-unified definition on a platform and hence the platform economy shade problems on the analysis on the rise of platform economy, the decision of a firm to initiate a platform strategy and the difficulties underneath the implementation of the strategy. In these regards, this paper presents a survey on platform and platform economy, with our additional comments and viewpoint on the topics of platform and platform economy.

First of all, our sense on a platform is given – a platform is simply defined as a place for gathering people. Once the number of people has up to a certain scale, people could sell products over the platform for profit and hence markets are naturally created on a platform. Secondly, we discuss on the scope of the economic activities to be included in platform economy and comment that the economic activities included in a platform have been changing in the last few decades. In the 1990s, while platform economy was not advocated, product platforms and their related activities were largely investigated. In 2016, many activities associated with product platforms

are not considered in platform economy. Finally, several issues related to platform and platform economy are discussed and commented. They include the scholarly advocates on platform, product platform and platform economy. The stories of Apple as a platform enterprise, Uber as a platform enterprise and other platforms are described. More important, the concepts regarding product platform are delineated.

To go beyond, we believe that technology advancements in smartphones, wearable devices and electric vehicles could change the future platforms. Integrating AI technologies to human-centric products would be a trend. The story about platform or platform economy has yet to be finished.



# Bibliography

- Abraham, K., Haltiwanger, J., Sandusky, K., and Spletzer, J. (2017). Measuring the gig economy: Current knowledge and open issues. *Measuring and Accounting for Innovation in the 21st Century*.
- Acs, Z. J., Song, A. K., Szerb, L., Audretsch, D. B., and Komlósi, É. (2021). The evolution of the global digital platform economy: 1971–2021. *Small Business Economics*, 57:1629–1659.
- Anderson, E. G., Bhargava, H. K., Boehm, J., and Parker, G. (2022). Electric vehicles are a platform business: What firms need to know. *California Management Review*, 64(4):135–154.
- Andersson Schwarz, J. (2017). Platform logic: An interdisciplinary approach to the platform-based economy. *Policy & Internet*, 9(4):374–394.
- Argote, L. and Ingram, P. (2000). Knowledge transfer: A basis for competitive advantage in firms. *Organizational Behavior and Human Decision Processes*, 82(1):150–169.
- Argote, L., Ingram, P., Levine, J. M., and Moreland, R. L. (2000). Knowledge transfer in organizations: Learning from the experience of others. *Organizational Behavior and Human Decision Processes*, 82(1):1–8.
- Aspers, P. (2009). How are markets made? Working Paper 09/2, Max Planck Institute for the Study of Societies, Cologne.
- Baida, P. (1987). Eli whitey’s other talent. *American Heritage*, 38(4):22–23.
- Barros, A. P. and Dumas, M. (2006). The rise of web service ecosystems. *IT Professional*, 8(5):31–37.
- Bearson, D., Kenney, M., and Zysman, J. (2019). New work and value creation in the platform economy: A taxonomy and preliminary evidence. *Berkeley, CA: Berkeley Roundtable on the International Economy*.

- Boehm, J., Bhargava, H. K., Parker, G. G., et al. (2020). The business of electric vehicles: A platform perspective. *Foundations and Trends® in Technology, Information and Operations Management*, 14(3):203–323.
- Brinkschröder, N. (2014). Strategy implementation: Key factors, challenges and solutions. B.S. thesis, University of Twente.
- Brynjolfsson, E. and Collis, A. (2019). How should we measure the digital economy ? *Harvard Business Review*, 97(6):140–148.
- Brynjolfsson, E. and Saunders, A. (2009). *Wired for innovation: How information technology is reshaping the economy*. MIT Press.
- Buera, F. J. and Kaboski, J. P. (2012). The rise of the service economy. *American Economic Review*, 102(6):2540–2569.
- Bughin, J., Catlin, T., and Dietz, M. (2019). The right digital-platform strategy. *McKinsey Quarterly*, 2:1–4.
- Choudary, S. P. (2013). Why business models fail : Pipes versus platforms. Available online at the URL: <http://www.wired.com/insights/2013/10/why-business-models-fail-pipes-vs-platforms/>.
- Choudary, S. P. (2021). *Platform Scale: For A Post-Pandemic World*. Penguin Random House India Private Limited.
- Cusumano, M. (2010). The evolution of platform thinking. *Communications of the ACM*, 53(1):32–34.
- Cusumano, M. A. (2011). The platform leader’s dilemma. *Communications of the ACM*, 54(10):21–24.
- Cusumano, M. A. and Gawer, A. (2002). The elements of platform leadership. *MIT Sloan Management Review*, 43:51–58.
- Cusumano, M. A. and Gawer, A. (2003). The elements of platform leadership. *IEEE Engineering Management Review*, 31(1):8–8.
- Derave, T., Sales, T. P., Gailly, F., and Poels, G. (2020). Towards a reference ontology for digital platforms. In *International Conference on Conceptual Modeling*, pages 289–302. Springer.
- Eisenmann, T., Parker, G., and Van Alstyne, Van Alstyne, M. W. (2006). Strategies for two-sided markets. *Harvard Business Review*, 84(10):92.

- Eliasson, G., Fölster, S., Lindberg, T., Pousette, T., and Taymaz, E. (1990). The knowledge based information economy. Technical report, IUI Working Paper.
- Evans, D. S., Schmalensee, R., Noel, M. D., Chang, H. H., and Garcia-Swartz, D. D. (2011). *Platform Economics: Essays on Multi-sided Businesses*. Competition Policy International.
- Evans, P. C. and Gawer, A. (2016). The rise of the platform enterprise: A global survey. Technical report, The Center for Global Enterprise.
- Ferris, C. and Farrell, J. (2003). What are web services? *Communications of the ACM*, 46(6):31.
- Friedman, G. (2014). Workers without employers: Shadow corporations and the rise of the gig economy. *Review of Keynesian Economics*, 2(2):171–188.
- Fuchs, V. R. (1965). *The Growing Importance of the Service Industries*, volume 96. National Bureau of Economic Research New York.
- Fuchs, V. R. (1968). Some implications of the growth of a service economy. In *The Service Economy*, pages 183–199. NBER.
- Garcia, C. A., Kenney, M., and Zysman, J. (2022). Understanding work in the online platform economy: A critical review. Technical report, Berkeley, University of California.
- Garcia, C. A., Kenney, M., and Zysman, J. (2023). Understanding work in the online platform economy: The narrow, the broad, and the systemic perspectives. *Industrial and Corporate Change*, 32(4):795–814.
- Gawer, A. and Cusumano, M. A. (2014). Industry platforms and ecosystem innovation. *Journal of Product Innovation Management*, 31(3):417–433.
- Gawer, A., Cusumano, M. A., et al. (2002). *Platform Leadership: How Intel, Microsoft, and Cisco drive industry innovation*, volume 5. Harvard Business School Press Boston.
- Godin, B. (2008). The information economy: The history of a concept through its measurement, 1949–2005. *History and Technology*, 24(3):255–287.
- Goyal, P. (1991). Issues in the adoption of object-oriented paradigm. In *COMPCON Spring’91*, pages 534–535. IEEE Computer Society.

- Greig, F. and Sullivan, D. M. (2021). The online platform economy through the pandemic. *Available at SSRN 3956057*.
- Guarascio, D., Coveri, A., and Cozza, C. (2023). War in the time of digital platforms. Available online at *Social Europe* <https://www.socialeurope.eu/war-in-the-time-of-digital-platforms>.
- Hambrick, D. C. and Cannella Jr, A. A. (1989). Strategy implementation as substance and selling. *Academy of Management Perspectives*, 3(4):278–285.
- Hayriye, A. (1999). The characteristics of the information economy. *Balikesir Üniversitesi Sosyal Bilimler Enstitüsü Dergisi*, 2(3):120–140.
- Jia, X., Cusumano, M. A., and Chen, J. (2021). Multisided platform research over the past three decades: A bibliometric analysis. *International Journal of Technology Management*, 87(2-4):113–144.
- Kaboski, J. P. and Buera, F. J. (2009). The rise of the service economy. Working Paper 14822, National Bureau of Economic Research.
- Kaplan, S. and Sawhney, M. (2000). E-Hubs: The new B2B marketplaces. *Harvard Business Review*, 78(3):97–97.
- Kenney, M. and Zysman, J. (2016). The rise of the platform economy. *Issues in Science and Technology*, 32(3):61.
- Kenney, M. and Zysman, J. (2019). Work and value creation in the platform economy. In *Work and Labor in the Digital Age*, volume 33, pages 13–41. Emerald Publishing Limited.
- Koren, Y., Shpitalni, M., Gu, P., and Hu, S. (2015). Product design for mass-individualization. *Procedia Cirp*, 36:64–71.
- Krueger, C. W. (1992). Software reuse. *ACM Computing Surveys (CSUR)*, 24(2):131–183.
- Lawton, G. (2008). Developing software online with platform-as-a-service technology. *Computer*, 41(6):13–15.
- McAfee, A. and Brynjolfsson, E. (2017). *Machine, platform, crowd: Harnessing our digital future*. WW Norton & Company.
- McGrath, M. E. (1995). *Product Strategy for High Technology Companies*. New York: Irwin Professional Publishing.

- Meyer, M. H. and Lehnerd, A. P. (1997). *The Power of Product Platforms*. Simon and Schuster.
- Meyer, M. H. and Mugge, P. C. (2001). Make platform innovation drive enterprise growth. *Research-Technology Management*, 44(1):25–39.
- Meyer, M. H. and Seliger, R. (1998). Product platforms in software development. *MIT Sloan Management Review*.
- Muffatto, M. (1999). Introducing a platform strategy in product development. *International Journal of Production Economics*, 60:145–153.
- OECD (2003). Seizing the benefits of ICT in a digital economy. Technical Report 72, OECD.
- Parker, G. and Van Alstyne, M. (2018). Platform strategy. In Augier, M. and Teece, D. J., editors, *The Palgrave Encyclopedia of Strategic Management*.
- Parker, G. and Van Alstyne, M. W. (2014). Platform strategy. In *The Palgrave Encyclopedia of Strategic Management*.
- Parker, G. G., Van Alstyne, M. W., and Choudary, S. P. (2016). *Platform Revolution: How networked markets are transforming the economy and how to make them work for you*. WW Norton & Company.
- Perez Mengual, M., Danzinger, F., and Roth, A. (2023). Physical interaction platforms: A taxonomy of spaces for interactive value creation. *Creativity and Innovation Management*.
- Piasna, A. (2021). Measuring the platform economy: Different approaches to estimating the size of the online platform workforce. In *A Modern Guide To Labour and the Platform Economy*, pages 66–80. Edward Elgar Publishing.
- Pine, B. J., Gilmore, J. H., et al. (1998). Welcome to the experience economy. *Harvard Business Review*, 76(4):97–105.
- Pine, B. J., Victor, B., and Boynton, A. C. (1993). Making mass customization work. *Harvard Business Review*, 71(5):108–11.
- Podolny, J. M. and Hansen, M. T. (2020). How apple is organized for innovation. *Harvard Business Review*, 98(6):86–95.
- Porat, M. U. (2009). The information economy: Definition and measurement. In *Rise of the Knowledge Worker*, pages 101–131. Routledge.

- Radonjic-Simic, M. and Pfisterer, D. (2019). Beyond platform economy: A comprehensive model for decentralized and self-organizing markets on internet-scale. *Computers*, 8(4):90.
- Rietveld, J., Schilling, M. A., and Bellavitis, C. (2019). Platform strategy: Managing ecosystem value through selective promotion of complements. *Organization Science*, 30(6):1232–1251.
- Robertson, D. and Ulrich, K. (1998). Planning for product platforms. *Sloan Management Review*, 39:19–32.
- Rochet, J.-C. and Tirole, J. (2006). Two-sided markets: A progress report. *The RAND Journal of Economics*, 37(3):645–667.
- Sanchez-Cartas, J. M. and Leon, G. (2021). Multi-sided platforms and markets: A literature review. *Journal of Economic Surveys*, 35(2):452–487.
- Sawhney, M. S. (1998). Leveraged high-variety strategies: From portfolio thinking to platform thinking. *Journal of the Academy of Marketing Science*, 26(1):54–61.
- Schor, J. B. and Attwood-Charles, W. (2017). The sharing economy: Labor, inequality, and social connection on for-profit platforms. *Sociology Compass*, 11(8):e12493.
- Simpson, T. W. (2004). Product platform design and customization: Status and promise. *Ai Edam*, 18(1):3–20.
- Simpson, T. W., Siddique, Z., and Jiao, J. R. (2006). Platform-based product family development: Introduction and overview. In *Product Platform and Product Family Design: Methods and Applications*, pages 1–15. Springer.
- Smith, A. (1776). *An Inquiry into the Nature and Causes of the Wealth of Nations*. Strahan and Cadell, London.
- Sommerville, I. (2011). *Software Engineering*. Pearson Education India, 9 edition.
- Starr, M. K. (1965). Modular production – A new concept. *Harvard Business Review*, 46(3):131–142.
- Sum, J. (2014). Service systems engineering: Framework & systems modeling. Online: [john.digit-pack.io/papers/Service\\_Engineering\\_TR007.pdf](http://john.digit-pack.io/papers/Service_Engineering_TR007.pdf).

- Tanenbaum, A. (2009). *Modern operating systems*. Pearson Education, Inc.,
- Vallas, S. and Schor, J. B. (2020). What do platforms do? Understanding the gig economy. *Annual Review of Sociology*, 46:273–294.
- Vigfússon, K., Jóhannsdóttir, L., and Ólafsson, S. (2021). Obstacles to strategy implementation and success factors: A review of empirical literature. *Strategic Management*, 26(2):12–30.
- Villafuerte, J., Narayanan, B., and Abell, T. (2021). Digital platforms, technology and their macroeconomic impact. *Managing the Development of Digital Marketplaces in Asia (Asian Development Bank 2021)*, 87.
- Weiss, N., Schrieck, M., Wiesche, M., and Kremer, H. (2021). From product to platform: How can BMW compete with platform giants? *Journal of Information Technology Teaching Cases*, 11(2):90–100.
- Wilson, G. (1923). A curriculum platform. *Journal of Education*, 98(24):657–660.
- Wu, J., Xu, J., Zhou, Y., and Zhu, X. (2021). The current situation and future trend of the platform economy. In *2021 3rd International Conference on Economic Management and Cultural Industry (ICEMCI 2021)*, pages 168–175. Atlantis Press.
- Xue, C., Tian, W., and Zhao, X. (2020). The literature review of platform economy. *Scientific Programming*, 2020:1–7.
- Zhang, P. (2021). Research on the revolution of the catering industry in the platform economy. In *6th International Conference on Financial Innovation and Economic Development (ICFIED 2021)*, pages 19–24. Atlantis Press.
- Zhu, F. and Iansiti, M. (2019). Why some platforms thrive and others don't. *Harvard Business Review (Online)*, pages 120–125.
- Zmud, R. W., Boynton, A. C., and Jacobs, G. C. (1986). The information economy: A new perspective for effective information systems management. *ACM SIGMIS Database: the DATABASE for Advances in Information Systems*, 18(1):17–23.

# Appendix A

## ADDITIONAL PLATFORMS

### A.1 Department Store

Department store leases spaces to retailers for selling goods or services. Customers come to a department store to shop and buy from these retailers. Thus, a department store is a physical location connecting retailers and customers with comfortable environment for both sides, such as air-conditioned and clean toilets. Besides, a department store usually has safety guards at the front door and sufficient parking lots for customers. There are usually enough washrooms and non-interruptive electricity supply. A department store has also to conduct marketing campaign like annual anniversary sales to attract customers to come and shop.

### A.2 Electronic Marketplace

In 1990s, Internet domain names administration had been released to the public. At the same time, hypertext transfer protocol (HTTP) was invented. Thus, various dotcoms were launched. Some of them were designed as online markets which allowed individuals or merchants to sell their products. At the same time, buyers could search an online market for a product. If the product was being sold, the buyer could buy it over the online market. These online markets are named as electronic marketplace, emarketplace in short. Notable dotcoms at that period of time are listed below.

**C2C** Amazon and eBay.

**B2C** Amazon, Barne & Noble, Dell.

**B2B** Ariba, Commerce One, VerticalNet.



Major components of an emarketplace include customers, sellers, products and services, infrastructure, front end, back end, intermediaries and other business partners or support services. The function of intermediaries of these components is near to the concept of platform; Intermediary is a third party that operates between sellers and buyers. They build and manage online markets, provide infrastructure and facilitate transactions. There are types of E-marketplaces, including electronic storefronts, electronic malls and information portals. The electronic malls discussed here is similar to the matchmakers that people discuss in platform economy nowadays.

### **A.3 HKTVMall**

HKTVMall is the largest online shopping mall in Hong Kong. It is a digital platform connecting merchants and customers. HKTVMall provides infrastructure for merchants to upload their shop and products information. Customers can search the goods they are looking for on HKTVMall site. It aggregates merchants on HKTVMall to attract customers to visit their site or APPs. On the same time, it attracts more customers to HKTVMall by advertisement and promotion. When more customers visiting HKTVMall will then attract more merchants join and sell on it. To facilitate the transactions between merchants and customers, HKTVMall provide infrastructure, payment and delivery method. There are three user interfaces for customers. Customers can visit the HKTVMall by smart phone, tablet (iOS and Android) or computer on website. For the merchant side, there are systems for them to operate their store on HKTVMall. HKTVMall has its own delivery team. Merchants have to bring their packed products to collection points and complete steps through the self-delivery system. Afterwards, HKTVMall delivery team will bring the products to customers according to their chosen delivery method. On customer side, there are few delivery methods for them to choose before complete the order. They can rather choose delivery to an address or a self pick-up service. For self pick-up service, customers can pick up order in physical HKTVMall O2O shops, self pick-up point or e-Lockers. All the settings and instructions that HKTVMall set are aiming to facilitate the transactions between two sides, merchants and customer.

## **A.4 Uber**

Uber is an American multinational transportation company that provides ride-hailing services, courier services, food delivery, and freight transport<sup>1</sup>. One of its business is to facilitate a passenger to get a ride from a driver.

### **A.4.1 Uber Apps & Route Recommendation**

To accomplish the delivery services, Uber develops two user interfacing APPs. One is for drivers and the other is for passengers. Passengers fill in the route he/she would like to travel through the passengers' version of Uber APP in order to request driver. By drivers' version of Uber APP, drivers can check whether there are passengers requesting driver in nearby area and pick up order. Uber actually provides an instant matching platform for passengers and drivers. Passengers and drivers can contact each other through the Uber APPs by text message or digital call without disclosure of their phone numbers.

### **A.4.2 Payment**

To ease the payment transfer, passengers and drivers need to sign in and fill in their bank or credit card information into the Uber APPs. So that, transaction can be completed automatically by provided payment information after the ride completed.

### **A.4.3 Credibility Rating**

To maintain credibilities among drivers and passengers, a rating system has been implemented for both passengers and drivers to comment after each ride. Low rating passengers or drivers will be banned by Uber APP as penalty. GPS function is a necessity for the Uber APPs to ensure the route and hence the efficient of a ride. If a complaint has been received in regard of wrong route, Uber will refund to the passenger the travel fee. According to the functions described above, Uber as a platform is the connection of passengers and drivers. It provides APP infrastructure, giving each other information and setting instructions to facilitate the transactions between two sides.

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<sup>1</sup><https://en.wikipedia.org/wiki/Uber>.

#### **A.4.4 Service Licensing**

It is suspected that Uber licences its brand and its electronic platform to local firms to operate the Uber business locally in a city or in a nation. A strategy of earning is essentially the same as McDonald and 7-11, by franchising. Each local in a city Uber firm pays to the Uber headquarter for a licensing fee to run Uber business locally. While the amount of licensing fee has not been disclosed, the income to the Uber headquarter from the local Uber firms could be uncountable. Therefore, the market cap of Uber headquarter cannot completely indicate the economy of Uber.

# Appendix B

## APPLE

People usually describe the Apple products as Apple ecosystem due to the convenience of function and interaction among different Apple products. They can always work seamlessly. For example, users can easily copy letters from iPhone to iPad by just clicking copy on iPhone and then click the paste on iPad within seconds. Another example is, users can check out photos taken by iPhone on other Apple product like iPad or Mac. The user-friendly environment making Apple products attractive for users to have more than one Apple products. These kinds of functions are really convenient in operation. But actually, the Apple ecosystem is not just about the functions among the Apple products. It involved the sub-platforms or the services provided by Apple such as App store, iCloud, Apple Pay and etc. Here, we will discuss how the Apple platform is running. And, try to briefly point out the connections between different sub-platforms among the Apple ecosystem.

### B.1 Platforms for Service Delivery

Apple produces various products. Some of them are developed in-house. Some of them are developed from partners. The main Apple products include Mac, iPhone, iPad, Apple Watch, Apple TV and Vision Pro. Their operation systems are MacOS, iOS, iPadOS, watchOS, tvOS and visionOS accordingly. As research and development (R&D) of the hardware devices and operation systems are progress by internal engineers and staffs, these will be categorized to internal development (maybe with internal platform). These kinds of development are internal with zero openness to outsiders. Besides the internal part, there is a large part of external section within the Apple platform. Some of the development is open to outsider under the platforms provided by Apple with designed infrastructure, rule and regulation.

External developers can join different programs to be involved in the Apple platform or ecosystem. The external platforms of Apple generate network effect and facilitate innovation which is one of the main factors of causing the success of Apple at present. The following is to introduce the platforms and services provided by Apple, and how does Apple work out with external developers.

### **B.1.1 iCloud**

iCloud is the cloud storage platform provide by Apple. Apple products users can enjoy iCloud service freely with limited amount of storage. They are able to save photos, documents, files, and easily share with other Apple products users. The service also includes auto device data back-up. It makes users can switch to different Apple products seamlessly. To enjoy more amount of storage, Apple provide several icloud+ plan for users to subscribe. On the other hand, the iCloud is open for external developers to build app by using Cloudkit in iCloud. Data can also be stored on iCloud.

### **B.1.2 Apple Pay**

Apple Pay is built into iPhone, Apple Watch, Mac and iPad. By adding credit cards or debit cards into the Apple wallet app, users can enjoy contactless payment when shopping outside in person. It also supports app purchases and in-app payment, or any other payment which accept apple pay. Besides, users can also add transit cards, tickets, keys and more into Apple wallet app. For merchants like credit card companies, banks or transit card companies, they can apply to be in the Apple wallet app and usable by Apple Pay.

### **B.1.3 App Store**

The App store is the Apple applications marketplace. Apple users are able to download or purchase Apple APPs on App store. App developers are able to release their APPs on apple app store under the developer program by Apple. Apple introduces various developer programs which suit different size of firms and for different usage. The programs are Apple Developer Program, Apple Developer Enterprise Program and App Store Small Business Program. The Apple Developer Program is the basic one, Apple provides all the tools, resources and support that a developer need, it includes access to beta software, app services, testing tools, app analytics, and more. Developers have to pay to join the program. Apple will collect 30% of commission on app purchases and in-app transactions. Secondly, the Apple Developer

Enterprise Program is for large organizations to build app that for internal use. The app released from this program is custom made for the organization and will be public on the App Store. Thirdly, the App Store Small Business Program was launched on 2021. It is a program for small and independent developers which Apple will collect less percentage (15%) of commission from them if they meet the program standard.

The App Store was launched in 2008. There have 123 times more APPs available in 2022 compared to the end of 2008. By 2022 data, users have made more than 370 billion downloads, and developer have earned more than US320 billion since it launched. Apple estimated that the ecosystem of App Store has facilitated more than US1.1 trillion in 2022 worldwide. More than 90% of it is occurred outside the App Store which is not include in the commission to Apple.

Apple believes that they will be benefited if users have more positive experiences on downloading and using APPs, and if developers have good support and tools from Apple, they create better APPs. The security is also a big focus from Apple which they aim to provide a safe and private users experience. With strict App Review process, Apple have prevented billions of dollars from frauds. Apple has programs for external developers to support the security part, it will be introduced in below paragraph.

#### **B.1.4 Apple Music**

Apple Music is a music subscription service which users can pay to enjoy online music steaming service. It is a sub-platform that letting music producers release their music and collect profits per music play rate. Besides, Apple provide iTunes which is a music marketplace. Users are able to purchase music singles or albums on iTunes. It is another sub-platform that music producers sell their music online. Apple had released an app Apple Music for artists to support music producers. It is for the artists and music producers to manage music upload, promoting and statistics review.

#### **B.1.5 Apple TV**

Apple TV provides users a comprehensive entertainment experience with the services, app and hardware in the following. First of all, the Apple TV app is a marketplace for users to buy and rent shows and movies. The Apple tv+ is a subscription-based steaming service. By subscribing the Apple tv+, users can enjoy variety of TV shows, movies, and other content included the Apple originals. From hardware-wise, Apple TV 4K is a TV set-top box device. It provides great picture and sound quality when it is connected to your TV

monitor. Apple TV support the APPs form tvOS App Store, users can enjoy music, games and other third-party streaming service such as Disney+. It is also able to operate with the other Apple Devices seamlessly. It can be set up with the home pods and accessories to create a smart home environment.

To providing users more content through Apple TV 4K at high quality, Apple introduce the Apple Video Partner Program since 2016. This program welcome other subscription-based steaming service to integrate with Apple devices and functions like AirPlay and Siri to let user enjoy a seamless experience on Apple TV.

### **B.1.6 Apple News**

The Apple News provide trusted news and information from world's top publishers with good mobile reading interfaces that users are able to read on different Apple devices in scales seamlessly. The News Partner Program is for subscription-based news publications, to provide news and content on Apple News in Apples specific format. Apple will provide support and fund for education on media literacy, in order to diversify newsrooms and news coverage. Apple may collect 15% of commission from in-app subscriptions, but the publishers can still keep all of the advertisement revenue within Apple New.

## **B.2 Platforms for Product Development**

Apart from those platforms for service delivery, a prominent practice in Apple is the Apple Developer Program <sup>1</sup> aiming to facilitate developers to develop products centered around Apple's core products. To accomplish such goal, Apple has launched a number of platforms assisting developers to learn, develop and test their Apple products.

### **B.2.1 Software developer network**

The collaboration of the above platforms, services or functions are what Apple call the App Store Ecosystem. All of the software is operating as app format while users must download them from the app store, including all we mentioned on the above. iCloud are the cloud storage for the app store ecosystem, no matter for users or developers. Apple Pay process all the payment (app purchase and in-app purchase) within the app store ecosystem. Apple Music, Apple TV and Apple News are examples of the Apple official

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<sup>1</sup><https://developer.apple.com/programs/>.

app. We describe these three examples as sub-platforms of apple platform because they open the supply part from outside firms respectively (Music, TV shows and news content). Last but not least is the APPs created by outside developers through the Apple Developers Programs. To The App Store is a platform that develop in software-wise.

### **B.2.2 Peripherals developer network – The MFi program**

For the hardware-wise development, we mentioned the internal R&D part of the Apple products and operation system. Besides, Apple has introduced the MFi Program. It welcomes outside firms to produce hardware that are able to connect to Apple products by using licensed technologies. Apple will support joined firm to get technical specifications, hardware components, certification tools, and badge artwork. Products approved by Apple will put the MFi Badges on product package to show it is certified and meet Apple performance standards. The figure below shows the MFi Badges.

### **B.2.3 Security testing platform**

Apple value a lot a safe and private using environment for their users. They describe iPhone as the most secure mobile device in the world. Despite the internal development and maintenance for the security, Apple have introduced Security Bounty Program to collect security reports and research from outside engineers in order to help the development and maintenance of Apple products??security. In addition, Apple having the Apple Security Research Device Program with limited number every year. This program is an education program to help researchers get started for the Security Bounty Program because Apple security system is complicated for even skilled security researchers.

### **B.2.4 Worldwide developer conference (WDC)**

Worldwide develop conference (WDC)<sup>2</sup> is an annual conference organized by Apple. A goal of this conference is to bring together the Apple developers to exchange their ideas and experience in product development. Furthermore, it is served as a platform for the developers to showcase their accomplishments. As a common practice, WDC is a platform for Apple to release new products and services to the public.

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<sup>2</sup><https://developer.apple.com/>.



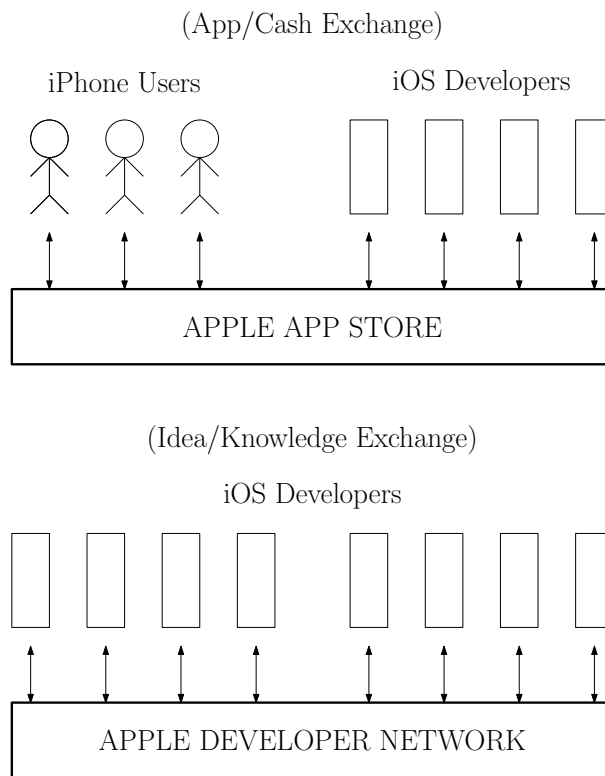


Figure B.1: To support the iOS developers to develop and upload high quality APPs on the Apple APP Store, a developer network has been built. Over the developer network, developers together with the in-house engineers can exchange ideas and get suggestions.

### B.3 Multi-Platform for App Exchange

To attract more iPhone users visit the Apple APP Store and download APPs, one solution is to get more iOS APPs developers to develop and upload high quality APPs on the platform. Owing to assist the developers in app developments, Apple provides a developer network platform<sup>3</sup> for a developer to get technical documents, raise a problem and exchange ideas.

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<sup>3</sup>For decades, this developer network has been a common strategy in many tech giants including Amazon, Apple, Google, Microsoft and Oracle.

# Appendix C

## QUESTIONNAIRES

As the cultures of Hong Kong and Taiwan are not identical, two questionnaires are designed for the respondents from Hong Kong and Taiwan so as to figure out if there is any discrepancy between the Hong Kong respondents and the Taiwan respondents.

In the questionnaire, there is a question asking the respondent to check if an item is a platform. In this question, 26 digital entities and 20 physical entities are selected and included as the items to be checked.

### C.1 For Hong Kong Respondents

#### Which is Platform? (HK ver.)

This questionnaire consists 3 questions. It takes approximately 5 minutes to complete.

##### C.1.1 Question 1

The first question about the age of a respondent?

- Age 25 or below.
- Age between 26 - 35.
- Age between 36 - 45.
- Age between 46 - 55.
- Age 56 or above.

### C.1.2 Question 2

Have you heard of *platforms* or *platform economy*?

- Yes.
- No.

### C.1.3 Question 3

Which in the following is a platform? For each of the following items, please check if it is a platform.

- Uber & Uber Eat
- 85 Taxi, HK Taxi
- Foodpanda
- Whatsapp
- Youtube
- Facebook
- Instagram
- Playstation
- Taobao
- Wikipedia
- Yahoo Knowledge
- Apple Pay
- LIHKG
- Airbnb
- Klook
- Tinder
- Jobsdb
- Online games (e.g. LoL, PUBG)

- Google Drive
- Apple App store
- Spotify
- Android, iOS, Harmony
- iPhone
- iPad
- Metaverse
- ChatGPT
- Publisher
- School
- Cram school
- Department store
- Real estate agency (e.g. Centaline Property, Ricacorp Properties)
- Bar & Club
- Bank
- Public transportation service provider (e.g. KMB, Citybus)
- Hong Kong
- Hotel
- Student Union
- United Nations
- Library
- Internet
- Computer
- Flea market
- Newspaper

- TV Broadcasts (e.g. BBC, Fox, NBC)
- Government
- Credit card (e.g. Mastercard, Visa)

## C.2 For Taiwan Respondents

### Which is Platform? (TW ver.)

This questionnaire consists 3 questions. It takes approximately 5 minutes to complete.

#### C.2.1 Question 1

The first question about the age of a respondent?

- Age 25 or below.
- Age between 26 - 35.
- Age between 36 - 45.
- Age between 46 - 55.
- Age 56 or above.

#### C.2.2 Question 2

Have you heard of *platforms* or *platform economy*?

- Yes.
- No.

#### C.2.3 Question 3

Which in the following is a platform? For each of the following items, please check if it is a platform.

- Uber & Uber Eat
- 55688
- Foodpanda

- Whatsapp
- Youtube
- Facebook
- Instagram
- Playstation
- Shopee
- Wikipedia
- Yahoo Knowledge
- Apple Pay
- Dcard
- Airbnb
- KKday
- Tinder
- 104
- Online games (e.g. LoL, PUBG)
- Google Drive
- Apple App store
- Spotify
- Android, iOS, Harmony
- iPhone
- iPad
- Metaverse
- ChatGPT
- Publisher
- School

- Cram school
- Department store
- Real estate agency (e.g. Yungching)
- Bar & Club
- Bank
- Public transportation service provider (e.g. KMB, Citybus)
- Taichung City
- Hotel
- Student Union
- United Nations
- Library
- Internet
- Computer
- Flea market
- Newspaper
- TV Broadcasts (e.g. BBC, Fox, NBC)
- Government
- Credit card (e.g. Mastercard, Visa)