CHAPTER 3

Digital Services

Kilnam Chon

Contents

3.1 Introduction

The original services offered on the Internet were file transfer and remote access in 1969 [ARPANET 2024]. The email service was added in the 1970s. The World Wide Web (WWW) was added in the early 1990s and has become the dominant platform for sharing contents. Then, various digital services based on the Internet, in particular on the web, have emerged since the 1990s.

Digital markets are defined in the U.S. government report, which includes online search, social networking, and social media services, among others [Judiciary 2020]. The report lists the following sectors in the digital markets;

- Online Search
- Online Commerce
- Social Networking and Social Media
- Mobile App Stores
- Mobile OS
- Digital Mapping
- Cloud Computing
- Voice Assistant
- Web Browser
- Digital Advertising

The European Commission also classifies in similar sectors with the Digital Markets Act as follows [DMA 2021; EC 2020];

- Online search engines
- Online intermediation services
- Social networks
- Video sharing platforms
- Communication platforms
- Advertising services
- Operating systems
- Cloud services

Social media (and social networking) are some of the prominent services on the Internet today, and they are defined in Wikipedia as "Social media are interactive technologies that facilitate the creation and sharing of *information, ideas, interests, and other forms of expression through virtual communities and networks"* [Wikipedia 2023]. Social Media are also defined in Merriam-Webster as **"***Social media as the forms of electronic communication through which users create online communities to share*

information, ideas, personal messages and other content." [Merriam-Webster 2019].

The most popular social networking services are offered by U.S. and Chinese companies.

Facebook, WhatsApp, Instagram, and Facebook Messenger are provided by Meta/Facebook, and Google provides YouTube. WeChat is provided by Tencent, and TikTok and Douyin are provided by ByteDance.

TikTok broke the social media record of the first 100 million users in 9 months in the late 2010s. ChatGPT had its first 100 million users in 2 months. Incidentally, end-users' artificial intelligence service launched in the 2020s with ChatGPT with GPT-3 in 2022, followed by GPT-4 in 2024.

Pinduoduo (PDD) operates Temu with a new business model, which sells products from producers to users without any intermediary at a low cost [Temu 2024]. It is the largest e-commerce portal site in the world now.

According to the Glocom Fakenews Symposium in 2023, media usage in Japan was as follows [Glocome 2024];

Internet	more than	50%
Television	less than	50%
Video	less than	5%
Radio	less than	1%
Newspaper	less than	1%

In this chapter, we will cover the following topics;

- Digital Transformation
- Digital Payment and Digital Currency
- Social Media
- Artificial Intelligence

We chose Metaverse as one of the digital services for this decade of Asia Internet History. Although the Metaverse was expected to be one of the significant new digital services at the beginning of this decade, we no longer expect it to be one of the most important digital services in this decade. On the other hand, several immersive technologies such as virtual reality, glasses, and immersive arts, in addition to Second Life, were well received in the 21st century, and are described in Appendix G Virtual

Reality, of this volume.

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3.2 Digital Transformation

Introduction

"Digital transformation (DX) is the adoption of digital technology by an organization to digitize non-digital products, services, or operations," according to Wikipedia [Wikipedia 2022]. The goal for its implementation is to increase value through innovation, invention, customer experience, or efficiency."

Digital transformation started from the applications of digital computers to organizations in the second half of the twentieth century. This was used to be called "Management Information System (MIS)" [Wikipedia 2023b]. The primary organization of the management information systems is business organizations. Similar applications were implemented in the governments and other organizations, too. Individuals also started to use digital computers once personal computers became available. These computer applications, based on the mainframe computers and personal computers, became cloud computing.

The next significant move on the digital transformation is the application of the Internet to organizations and individuals in the late

twentieth century. The Internet, with the personal computers in the last century, followed by smartphones in the twenty-first century, has impacted individuals substantially. Most people have Internet access now, and many have email addresses. It is often the case that people are required to have an email address to live in advanced societies. Once the World Wide Web (WWW) appeared in the late 20th century, much of the Internet access moved to the WWW. Messaging and social media became some of the most popular Internet applications in the late 20th century and the early 21st century. The smartphones accelerate the digital transformation even further through messaging and other social media in the 21st century. Almost all organizations have access to computers and the Internet for their daily operations. Much of the access to computers and smartphones is done through cloud computing now.

More Digital Systems in the Twenty-First Century

In the 21st century, many more digital systems in addition to smartphones appeared. They include the following;

- E-commerce,
- Internet of Things (IoT),
- Artificial Intelligence (AI), and
- Data Science and Engineering.

E-Commerce and e-Payment started in the late 20th century, and became widespread in many Asian countries in the 21st century, especially with the advent of the smartphone in the first decades of the 21st century. They have replaced the traditional payment systems, including cash, checks, and credit cards, in the case of business-to-customer (B-to-C) and customer-to-customer (C-to-C). These phenomena are particularly evident in many parts of Asia, where personal checks as well as credit cards are not commonly used.

The Internet of Things (IoT) emerged in the late twentieth century. It has taken over humans as the main “users” of the Internet, as there are more IoT devices than human users in the twenty-first century. We expect the IoT to be the dominant “users” of the Internet in this century, and many

of the digital transformations will occur with the IoT.

Artificial Intelligence (AI) is expected to significantly change society in this century. AI began in the mid-twentieth century, but its widespread adoption did not occur until this century, when generative AI was developed. AI is now being used in many areas, and we expect that it will impact every aspect of our lives.

Data is being generated through the use of computers and smartphones now. Dealing with this data would be an important aspect of the digital transformation in the coming decades. The disciplines of data science as well as data engineering are emerging.

Applications in the Twenty-First Century

The digital economy is one of the first areas where digital transformation took place, and Google estimates the size of the digital economy at 14.5 trillion dollars in 2021, and expects it to grow to 20.8 trillion dollars by 2025 [Google 2023]. This is around 14.5 percent of the global economy [Visual Capitalist 2023]. We expect this percentage to grow in the coming decades.

Digital society is defined in IGI Global as “A society in which everything runs on digital technology where paperless and electronic means are the norm” [IGI-Global 2023]. It also defines the digital society as “A society that adopted information technologies.” We expect the digital technologies to be adopted to human society globally in the coming decades so that the digital transformation of the digital society would be realized extensively.

Digital government, as a part of digital society, is the first area where the digital transformation is taking place. UN has been publishing UN E-government Survey in its biennial report since 2001[UN 2023]. The report covers the following topics;

Global trends in e-government
Regional e-government development
Leaving no one behind in the hybrid digital society
The future of digital government

Digital culture is defined as “A type of culture that separates an

organization from others and executes digital transformation," [IGI-Global]. It is further defined "as a new form of culture in which the culture of humanity will digitize and turn into a new form. Digital culture is the whole of the lifestyle and habits created by the innovations brought by the age in which human beings live, with technology taking more place in daily life."

Digital education is "the innovative use of digital tools and technologies during the teaching and learning, and is often referred to as technology enhanced learning or e-learning" [Edinburgh 2023]. The recent COVID-19 Pandemic in 2020-2023 has provided an opportunity for digital education to be implemented globally with successes and failures. AI is also impacting education, as AI is being developed substantially with generative AI.

Issues

Benefits: The deployment of digital transformation is extensive and has recently accelerated. We expect that the digital transformation will bring benefits to the world despite various problems as side effects. Most people don't want to go back to the "pre-digital transformation era." We need the benefits to be distributed as evenly as possible.

Problems: Unfortunately, there would be many problems associated with the implementation of the digital transformation, too. Some of the obvious issues are minorities, including seniors and the disabled. For example, many people cannot use smartphones today, but the digital transformation encourages the use of smartphones as social infrastructure. Minorities also have similar disabilities. We need to anticipate abuse of the digital transformation, as we have seen with social media and other Internet applications.

Large multinational corporations: Large global corporations are playing dominant roles in digital transformation, and almost all of them are American companies. This would lead to many unfair treatments of other countries around the world.

Security: Security requires significant attention because digital systems,

including the Internet, have not performed well [Schneier 2023]. Cybercrime is $10.5 trillion with the global digital economy of $20.8 trillion in 2025, according to Google [Google 2023]. We don't know how to get the security right now.

Ecosystem: The digital ecosystem needs much attention. After all, we are building the digital ecosystem, which evolves and is hard to change once it becomes matured. We should build a good digital ecosystem, which we will have to leave to the next generations, whether they like it or not.

Multistakeholder: We need to build the digital system and manage the digital transformation with an appropriate multistakeholder approach, with public and private sectors playing the major roles, with civil societies and technical communities both globally and regionally. This may not be easy to implement.

In addition, an interdisciplinary approach needs to be taken into account as the digital transformation and the digital systems are inherently interdisciplinary.

Green Transformation: Green transformation (GX) must go hand-in-hand with the digital transformation [EC 2022; Soones 2015]. After all, the green transformation has a much longer timeframe, and it may be the ultimate goal with the digital transformation as one of the means to achieve the green transformation in the coming decades and centuries.

Concluding Remarks

Digital transformation (DX) has been taking place since the last century. It is gaining momentum with many new digital systems in this century, including artificial intelligence (AI), which is still in its early stage with its discriminative and generative AIs [Ataka 2023; Wikipedia 2023c].

Digital transformation was accelerated during COVID-19 in the 2020s with remote work, remote meetings, and remote education.

The digital ecosystem needs to be further developed with digital transformation. We also need to pay good attention to the green transformation in our world. We hope that the current digital transformation can contribute to the green transformation in the coming decades.

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3.3 Digital Payment and Digital Currency

Digital Payment

Gary Gensler's 2018 class, "Blockchain and Money" at the Sloan School of Management, MIT, has a good overview of digital payments as well as central bank digital currencies [Gensler 2018]. He stated the history of the digital payments as follows;

- 1998 PayPal
- 1999 Ericsson Telenor
- 2003 AliPay
- 2007 M-Pesa
- 2011 Mobile App (Starbucks)
- 2011 Google Wallet
- 2013 WeChatPay
- 2014 ApplePay

More Gensler's classes on the digital payments and digital currencies are as follows;

- Class 13 Payment System 1
- Class 14 Payment System 2
- Class 15 Digital Currency/Central Bank

Digital payment is also referred to as mobile payment, mobile money, and mobile wallet, among others. They are all carried out with a mobile device such as a smartphone.

M-Pesa has been used with the mobile phone since 2007, when smartphones were not available. Many other digital payment systems are smartphone-based.

"Alipay overtook PayPal as the world's largest mobile (digital) payment platform in 2013. As of June 2020, Alipay serves over 1.3 billion users and 80 million merchants" [Alipay2023]. Alipay has around 55% of the Chinese third-party payment market, with WeChat Pay by Tencent as the

second largest third-party payment system in China. Both are now available in many countries around the world. Many countries in Asia including Japan and South Korea offer similar digital payment systems now.

Digital Currency

The cryptocurrency called Bitcoin was invented by Satoshi Nakamoto in 2009. Since then, many other cryptocurrencies have been developed. Currently, the market capitalization of Bitcoin is 1.4 trillion US dollars, which ranks seventh after gold and several high technology companies. Bitcoin is ahead of silver, which ranks ninth with 1.38 trillion dollars.

Many central banks around the world are also working on the cryptocurrencies based on the blockchain technology. *"Central Bank Digital Currency (CBDC) is a digital currency issued by a central bank, rather than by a commercial bank"* [Wikipedia 2023]. Many central banks around the world are working on the CBDC now. Cambodia is one of the first countries to offer CBDC called Bakong in 2020 [WEF 2021]. China also offered CBDC named e-CNY during the Beijing Olympic Games in 2022.

Stablecoin was introduced to offer a type of digital currency designed to maintain a stable value by pegging to a traditional fiat currency like the US dollar [McKinsey 2025]. Its total market capitalization is $250 million, and it is expected to reach up to $2 trillion by 2028.

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3.4 Social Media

There are the following global social media users in this century [PBS 2023];

2015 2 billion
2023 5 billion

Social media has grown beyond the Internet, and includes telecommunication services such as messaging services based on smartphones or mobile phones in addition to the Internet. The report, "Toward digital platforms and public purpose," provides a good historical analysis of social media [Harvard 2023]. Social media became an important medium for youth as well as older generations [Haidt 2024]. Social media could cause problems for the youth, even though it benefits the youth as well as other generations. Several countries are restricting the social media access including Australia and Florida State of USA.

The top social media platforms in 2023 are as follows [Search 2023];

Social Media Platform	**Users (in millions)**
Facebook	2,853
YouTube	2,291
WhatsApp	2,000
Instagram	1,386
Facebook Messenger	1,300
WeChat	1,242
TikTok	732
QQ	606
Douyin	600
Telegram	550
Sina Weibo	530
Snapchat	514
Kuaishow	481
Pinterest	478
Reddit	430
X (Twitter)	397

Quora	300

The top apps worldwide for 2020 by Total Downloads (Non-Game) [SensorTower 2023];

- TikTok
- Zoom
- WhatsApp
- Facebook
- Messenger
- Instagram
- Google Meet
- Aarogya Setu
- YouTube
- 10 Snapchat

Global usage of selective social media, according to Fareed Zakaria in CNN on 2023.4.16, are as follows [CNN 2023];

- TikTok ~70%
- Facebook ~10%
- Google ~10%

He also commented that Generative AI could transform social media.

Remark: The Most Popular Websites (monthly visits in billion) according to Similarweb in 2025 are as follows [Similarweb 2025];

Google	83.79
YouTube	30.12
Facebook	11.92
Instagram	6.48
ChatGPT	5.49
X	4.39
WhatsApp	4.21
Wikipedia	3.81
Reddit	3.81
Yahoo	3.06
Yandex	2.88

TikTok	2.64
Amazon	2.57
Baidu	2.15
LinkedIn	1.76

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3.5 Artificial Intelligence

Artificial Intelligence (AI) has become very popular lately [Art 2025; Deep Mind 2025, Open AI 2023]. AI can be divided into three categories [YouTube 2023]. Artificial Narrow Intelligence (ANI), or we can call it AI. The narrow AI does one task, but it cannot do other tasks. Artificial General Intelligence (AGI) is the next step of AI. If the current AI technology can do one specific task, it could be applied to other tasks. This is why we call it "general". When the level of intelligence is beyond human intelligence, we may call the technology Artificial Super Intelligence (ASI), or we may also call it Artificial General Intelligence (AGI). Please refer to Appendix AGI in this volume for further description of the AGI.

Generative AI is one of the AI technologies, and became very popular in the 2020s with the efforts initiated by DeepMind and OpenAI, among others. Generative Pre-trained Transformer (GPT) and its application, ChatGPT by OpenAI, are very popular now, and have more than 10 million users in the first months of 2022. The ChatGPT of OpenAI is based on the large language model for end users. OpenAI covers the following four areas as the major application areas based on GPT now [OpenAI 2023];

- Text with ChatGPT
- Vision with DALL.E
- Video with Sora
- Audio

OpenAI has come up with ChatGPT2, 3, 4, and 4o. Additionally, OpenAI also came up with OpenAI o1 and o3 [Shabano 2024; Sovorel 2024; OpenAI 2024; OpenAI 2024b; Lex 2024]. Similarly, Google came up with Gemini and Gemini 2.0. One can find popular AI tools in 2024 at [AItools 2024]. Other AI companies, including Microsoft and Google as well as Amazon and Meta among others have launched similar services based on the generative AI in 2023 [Microsoft 2023; Google 2023]; Many other countries, including China, are also working on research, product development, and commercial services on generative AI and other AI

technologies. Please refer to Section 4.3 AI Ecosystem and Appendix F Toward AGI for more information on AI-based digital services.

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