

CHAPTER 1

Introduction

1.1 Principle, Theory and Rational

Human communication is essential for not only communications among individuals in societies but also business transactions (Deak, 2004). In addition, human communication has undergone an evolution for thousands of years and can be divided into six sections. Firstly, a verbal language which is the language widely spoken by human beings in every part of the globe creates associations among individuals and communities to come to an identical understanding. Secondly, sometimes oral communications can mislead and get lost over time. Consequently, the writing using the symbols was initiated into the portrayals of words and thoughts. The ancients started using colours and words to write on the cave walls, stones, pieces of wood, etc., so as to document information and draw up plans (Smithsonian National Museum of Natural History, 2016). After that, symbolic written language had emerged as one of the powerful means of communication. Together, the verbal and symbolic written languages are the enrichment of the state-of-the-art human life. Thirdly, before 1439, a book was copied by hand and sometimes, there were some human errors. Additionally, one year was not enough to finish a copy of one book. Fortunately, Johannes Gutenberg, German, established his press shop and invented the movable some human errors. Additionally, one year was not enough to finish a copy of the book. Fortunately, Johannes Gutenberg, a German, established his press shop and invented the movable type printing technology. The printing press could produce mass amounts of books, making them affordable for average people. From that point forward, there were officially portable reading materials or printed books available and spreading all over the world (Junior Scholastic, 2009).

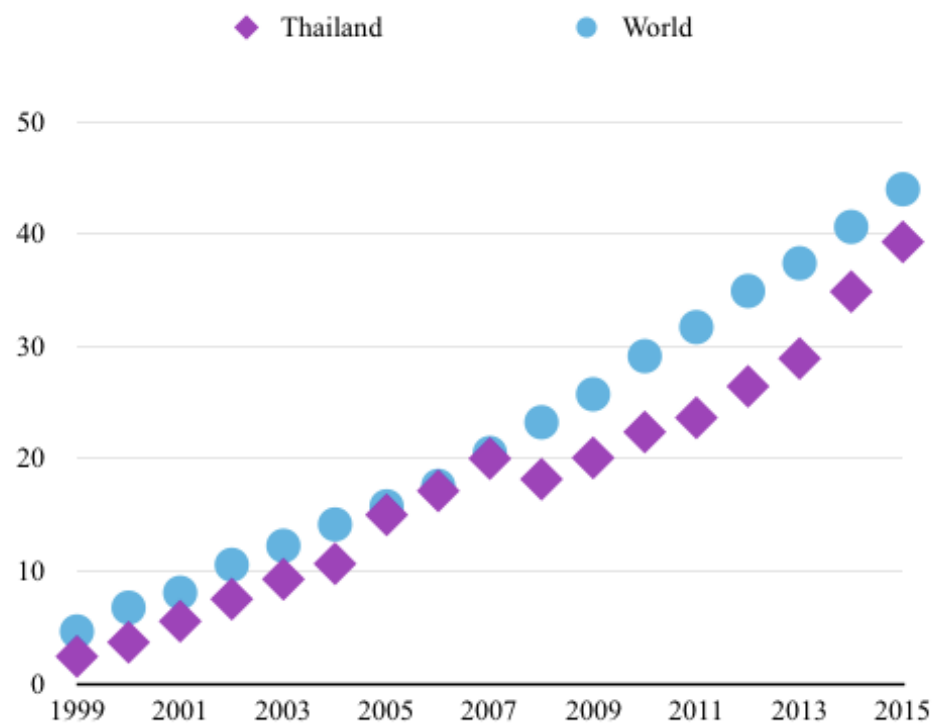
Fourthly, in the old days, communication from a distance was rather challenging. Successfully, in 1844, Samuel Morse had sent his first distant message from Washington, D.C. to Maryland (Timmons, 2016) by using a system which conducted electronic signals

through a wire from one station to another station (A+E Networks, 2009b). Accordingly, it came to an introduction of the telegraph and made it much more easy to contact via a message with someone living some distance away. Additionally, in 1876, Alexander Graham Bell firstly invented a speaking telegraph, the telephone, (Park, 1877) which permitted sound to be transmitted from one place to another place on a wire (A+E Networks, 2009a). Fifthly, the wireless technology, which was invented by Nikola Tesla and Guglielmo Marconi (Clark, 2012), began to be applied in communications. Surprisingly, unlike the original and speaking telegraph, it could transmit text messages, images and voicemails (West, 2012). Focusing mainly on the history of wireless mobile telephony development, there are five generations of mobile communications: the first, second, third, fourth and fifth generations which are, in short, 1G, 2G, 3G, 4G and 5G respectively. Currently, the 4G is the latest generation that is commonly available in most of the countries all over the globe (World Time Zone, 2016b). Furthermore, the 5G is under development and testing by some leading countries such as the United States, Finland, South Korea, England, etc., (World Time Zone, 2016a) and expected to be widely available by 2020 (European Commission, 2014). To summarise, the higher generation the mobile telecommunication is, the bigger and faster the data and information are able to be transmitted. Lastly, it has come to the Internet and World Wide Web era and both, in turn, illustrate the term: the digital economy. Tech Target (2016) has given the definition of digital economy: the worldwide economic transaction network which is allowed by Information and Communications Technologies (ICTs). In simpler terms, the digital economy is the economy depending on the digital technologies. What's more, in the OECD digital outlook report (2015) stated that ICTs have integrated with ranking from profession to personal lifestyle. ICTs have changed social interactions and personal relationships compared to the old days. People can be online anywhere that the internet is available: in public, at the workplace, at home or even on the move.

The digital economy has been growing so fast and has affected a variety of sectors in the economy, i.e., entertainment and media, tourism, hospitality, education, publishing, banking, transportation, retail, energy, health, etc. (British Computer Society, n.d.) Furthermore, Deak (2004) declared that ICT had killed distance. In other words, it makes the national, regional, continental and global connections more possible for individuals, businesses, and governments. The ICTs, not to mention the Internet, have created several

economic products: to name a few, the increase in the inflow foreign direct investment (FDI) (Choi, 2002), the decline of inflation rate (Yi and Choi, 2005), the determinant of the tourist arrivals (Naudé and Saayman, 2005) and the positive impacts on the economic growth (Sassi and Goaied, 2013; Salahuddin and Gow, 2015).

Focusing on the internet usage, the annually global Internet user numbers (per 100 people), plotted in Figure 1, grow increasingly every year. Simultaneously, in Thailand, the numbers of Internet users have climbed continuously year by year, see Figure 1. Importantly, there are many existing factors influencing the increase in numbers of Internet users or the penetration of Internet use. Namely, in case of the mobile internet usage, Srinuan et al. (2011) researched the determinate factors involving the consumer's mobile Internet accession. The findings revealed that price, availability of fixed-line phone, age and area of living gave the strongest determination to the mobile Internet use.



Source: World Bank, 2016

Figure 1.1: Numbers of Thailand and World Internet users for every 100 people from 1999 to 2015.

However, the worldwide Internet user numbers have grown increasingly every year; there is still a huge digital divide, the gap of the access to the ICTs between the Internet and

non-Internet users (Rouse, 2014), among countries all over the world: see Table 1 and Table 2. Accordingly, Mariscal (2005) proposed a study on the digital divide in a developing country, Mexico, and found that even though the telecommunications access had increased considerably for decades, the distribution of the ICT use was not equal in Mexico. In addition, Galperín (2015) investigated the Internet infrastructure development in Latin America. Based on the result, the new arrangement, localisation, of the Internet infrastructure gave a great positive effect on the Internet growth in the region.

Table 1.1: Top 10 countries for Internet user numbers per 100 people in 2015

NO.	COUNTRY NAME	2015
1	Bermuda	98.3236
2	Iceland	98.2000
3	Luxembourg	97.3341
4	Andorra	96.9100
5	Norway	96.8103
6	Liechtenstein	96.6412
7	Denmark	96.3305
8	Faroe Islands	94.2000
9	Bahrain	93.4783
10	Monaco	93.3633

Source: World Bank, 2016

Table .12: Bottom 10 countries for Internet user numbers per 100 people in 2015

NO.	COUNTRY NAME	2015
1	Eritrea	1.0837
2	Somalia	1.7600
3	Niger	2.2202
4	Sierra Leone	2.5000

Table 1.2: Bottom 10 countries for Internet user numbers per 100 people in 2015
(continued)

NO.	COUNTRY NAME	2015
5	Chad	2.7000
6	Guinea-Bissau	3.5407
7	Congo, Dem. Rep.	3.8000
8	Madagascar	4.1740
9	The Central African Republic	4.5633
10	Guinea	4.7000

Source: World Bank, 2016

The Thai government has been promoting the digital economy for years because the government believes that the digital economy increases the competitiveness of the Thai industrial sector. Moreover, it is also an elementary aspect to drive Thailand economy by encouraging the innovation and growth (Royal Thai Government, 2015). Recently, Thailand's National Legislative Assembly approved the establishment of the Ministry of Digital Economy and Society which holds the mission of enhancing the country into a digital society (Zeldin, 2016). Accordingly, the Ministry of Digital Economy and Society's committee approved the National Digital Economy Master Plan for Digital Thailand. The goal of this master plan is to provide the full potential of development for the telecommunications infrastructure, information system, innovations, etc. Furthermore, the plan spreads over 20 years and holds 6 strategies: Hard Infrastructure, Digital Economy Acceleration, Digital Society, Service Infrastructure, Digital Workforce and Soft Infrastructure (Royal Thai Government, 2016). More interestingly, in the near future, the Royal Thai government expects to make availabilities of the broadband service to every village and also the free Wi-Fi spots all over the country.

To add more points, nowadays, the digital technologies provide a variety of benefits to the society. First, they help people save time and cost. For instance, people can shop at the online stores and the ordered goods are delivered to their doors. There is no more travelling to the store, and some stores offer more discounts if the customers shop online.

Another, they bring up the efficiency, for example, building one aircraft requires millions of parts. A very-well-known aircraft manufacturer, Airbus, has used the high technologies to communicate with the suppliers and among branches to manage the deliveries of aeroplane parts to the assembly lines correctly and on time, in turn, causes the production process and saves the cost of holding extra parts at the warehouse, respectively. (Airbus, n.d.)

Altogether, this paper has come to the study concerning the Internet user numbers. In addition, the stochastic exponential growth model is proposed for two reasons. First, the exponential growth model is the central model for the term population growth study. Another, according to the uncertainties in growth rates, the stochastic process, the process that includes the environmental effects, with the stochastic differential equation (SDE) driven by the standard Brownian motion (SBM) is introduced. This paper aims to signal businesses about the future trend of Internet use so that the individuals can be prepared and the businesses can be enabled to create the more appropriate strategies to cope with the trend and equally important, to give evidence to the government about the telecommunications infrastructure projects.

1.2 Purpose of the study

- 1) To model the time-dependent characteristics of the internet user numbers with the stochastic exponential growth model.
- 2) To apply the inferred model for the prediction of the time-dependent number of internet users to support the future economic planning.

1.3 Advantage of the study

- 1) To benefit individuals and businesses for the economic transaction planning.
- 2) To provide evidence to the policy-planners and -makers for the planning of telecommunications infrastructure projects.

1.4 Scope of the study

The aim of this thesis was to study the numbers of Internet users. Furthermore, the thesis proposed the stochastic exponential growth model in the Stochastic Differential Equation's form driven by a standard Brownian motion (SBM). The model identification was achieved by the Bayesian method, and the prediction of numbers of Internet users

was conducted by using the Monte Carlo method. What's more, the data used in this work is the secondary data collected annually.



ลิขสิทธิ์มหาวิทยาลัยเชียงใหม่
Copyright© by Chiang Mai University
All rights reserved