

**YANGON UNIVERSITY OF ECONOMICS
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**THE RELATIONSHIP BETWEEN ICT DEVELOPMENT AND
ECONOMIC GROWTH IN MYANMAR**

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Master of Development Studies (MDevS) Degree

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ABSTRACT

The UNDP's Sustainable Development Goals describe information and communications technology as a critical contributor of economic activity and progress. Many nations in development have implemented national ICT plans, laws, and regulations to combat cybercrime and encourage the development of the sector's supporting infrastructure. The thesis is analyst the linkage between the ICT development and economic growth. The method used in the study is descriptive method with secondary data. This study found that there is a positive relationship between the ICT development and economic growth by the four indicators GDP, Per Capita GDP, Teledensity and ICT Development Index (ID). The study suggests that the government should provide a good internet facility and electricity in fair price. The Cyber Law should be enacted to protect the cyber violations but must have a proper consideration before any limitation is adopted.

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LIST OF ABBREVIATIONS

4G	Fourth Generation Mobile Network
5G	Fifth Generation Mobile Network
ADSL	Asymmetric digital subscriber line
APTA	Asia-Pacific Trade Agreement
ASEAN	Association of Southeast Asia Nations
FTTH	Fiber to The Home
Gb	Gigabit
GB	Giga Bite
GDP	Gross Domestic Product
GMS	Grate Mekong Sub region
ICT	Information and Communication Technology
IDI	ICT Development Index
IEEE	Institute of Electrical and Electronics Engineers
ITU	International Telecom Union
LTE	Long-Term Evolution
Mb	Megabit
MB	Mega Bite
MCF	Myanmar Computer Federation
MCIA	Myanmar Computer Industrial Association
MCIA	Myanmar Computer Industrial Association
MCPA	Myanmar Computer Professional Association
MMCERT	Myanmar Computer Emergency Response Team
MOTC	Ministry of Transport and Communications
MPT	Myanmar Post and Telecommunication
PRC	People's Republic of China
SeaMeWe	South-East Asia-Middle East-Western Europe
SIGMAR	Singapore Myanmar
SMEs	Small – Medium Enterprises
TH	Thailand
TVET	Technical and Vocational Education and Training
UMTS	The Universal Mobile Telecommunications System
UN ICT TF	The United Nations Information and Communication Technologies Task Force
UNESCO	United Nations Educational, Scientific, and Cultural Organization
WTO	World Trade Organization

CHAPTER I

INTRODUCTION

1.1 Rationale of the Study

The world is globalized. The term "globalization" refers to the process through which national economies, as well as those of other countries, are integrated into a larger global market (Investing Answers, 2019). This, in turn, made it easier for local economies, international trade, and the global market economy as a whole to grow. In today's interconnected world, ICT is indispensable. Growth in information and communication technologies raises a country's GDP, trade volume, and net foreign investment. A further knock-on effect of progress in the ICT industry is the widespread improvement of integrated circuit technology across the revolution, as well as official support for this improvement. The information and communication technology industry is one of a kind because it doesn't make any smoke when it makes things. Information and communication technology (ICT) is also known as the general production technology (GPT), and it has been shown to help growth in all areas of the economy.

ICT 4.0 and digital transformation are being implemented by the Myanmar e-government steering group. The advent of the ICT 4.0 stage will bring about an increase in careers and job possibilities while simultaneously lowering the unemployment rate. Policymakers should prioritize ICT development if they want to optimize the technology's favorable influence on economic growth. In order for ICT to function, communication infrastructure should be well setup.

The productivity of a company and its ability to compete in the marketplace may both benefit from improvements to its communication systems, as can its ability to save money on things like financing and other operational expenses. It also has the potential to bring in new funds and perhaps create new employment possibilities. In addition to its role as a manufacturing input, which boosts the national economy.

Therefore, this study intends to prove the relationship between ICT development and economic growth by the four variable values such as GDP, Per capita

GDP, Teledensity and ICT Development Index.

1.2 Objective of the Study

The objective of this thesis is to examine the relationship between ICT Development and Economic Growth in Myanmar.

1.3 Method of Study

This study used the descriptive method with secondary data. The secondary data are collected from texts, Country Economic Reviews, Ministry of Transports and Telecommunication , Survey data from the International Telecom Union website, World Bank reports, United Nations Information and Communication Technology Task Force's report , ITU (International Telecom Union) reports, Asian Development Bank' reports, Myanmar Computer Federation's data, ASEAN reports, articles and journals and Statistical Year Books of C.S.O. The internet websites, published reports are main sources of facts, figures, and statistics for secondary data, International Labor Organization's report.

1.4 Scope and Limitation of the Study

This thesis is intended to study to find out the ICT contribution in country economics growth. ICT Infrastructures of the country, government participation, State's Policy and Importance of Information and Communication Technology (ICT) sector are focus areas for this study. The study on the change of ICT development and GDP in Myanmar from the period from 2014 to 2018. Analytical indicators of the study are GDP, per capital GDP, Tele density (Fixed telephone per 10,000-person, Mobile phone per 10,000 persons) and ICT development Index. The limitation of the study is difficulties to perform key informant interviews both in person and internet survey to collect the primary data for the time being.

1.5 Organization of the Study

This thesis consists of five chapters. Chapter 1 is introductory chapter. Chapter 2 is Literature Review. Chapter 3 is ICT development status. Chapter 4 is ICT development and Economic Growth, and Chapter 5 is conclusion.

CHAPTER II

LITERATURE REVIEW

2.1 ICT Contributions to Economic Growth

The International Telecom Union published a book titled "ICT for Sustainable Development Goals" with contributions from authors Ahmad R. Sharafat and William H. Lehr, in which they discuss the ways in which ICT has contributed to economic growth. Information and communication technologies (ICTs) are an essential part of the economic infrastructure and may be put to use in a wide variety of profitable ways inside any given enterprise. This means that the use of ICTs has an impact not only on the organization's internal operations but also on its relationships with its external stakeholders, including its suppliers and its consumers (Bresnahan and Trajtenberg, 1995). When it comes to sourcing employees and other resources, B2B eCommerce platforms, for instance, may save costs and increase efficiency. Businesses may improve their supply chain management with the aid of mobile phones since they provide constant access to market data. Accounting and payroll administration are two examples of back-office tasks that benefit from business decision systems, while computer-aided manufacturing is one way that computers may assist in the actual production of things. Improvements in information and communication technology (ICT) could make it easier for people to be creative, start businesses, grow the economy, and make things. As a result of all the monitoring, it is now difficult to pin down the precise impact of ICTs on the economy. Our most accurate estimates come from more developed countries with bigger ICT sectors (which makes it easier to measure), longer ICT adoption rates among businesses (which gives benefits more time to show up), and easier access to data. For example, Jorgenson's (2001) seminal research found that information and communication technologies (ICTs) were responsible for 2.3% of the increase in GDP and 65% of the increase in total factor productivity between 1995 and 2000. This makes it clear why the American economy got better in the second half of

the 1990s. According to Fuss and Waverman (2005), Canada's weaker labor productivity increase in 2003 was caused in large part by the country's less intensive use of ICTs. The evidence for the beneficial benefits of ICTs on economies in developing nations is less, but it is consistent with research from more industrialized nations (Stanley et al., 2015; Aker and Mbiti, 2010; BIRTHAL et al., 2015; Fu and Akter, 2016).

In fact, there are probably a lot of unrealized opportunities that could lead to high social returns from strategic ICT investments in developing countries. This is true even though macroeconomic studies may not be able to find significant effects until ICT adoption, ICT capital stocks, and ICT investment reach a critical mass. Despite newer research suggesting ICTs have the potential to spur economic transformation and accelerate development (Gordon, 2000, 2014), A slower global economy makes it more difficult to improve people's quality of life and reduce inequalities. The SDGs will be more difficult to achieve as a result of this. The speed with which digital technologies may be put to use after the necessary infrastructure has been set up is one of their main advantages. This makes it seem more likely that the digital divide and the economic gap between rich and poor countries can be fixed quickly. ICTs have the most potential to create jobs in other industries because the ICT industry is so small (it only makes up about 6% of the GDP in OECD countries and a lot less in developing countries) and because jobs in the ICT industry tend to require more education and skills. In addition, the greater income of those who work in ICT helps the economy as a whole generate additional employment since these individuals tend to be better at their occupations and paid more. ICTs make it easier for the economy to grow, become more productive, and hire more people.

However, as a result of these changes, consumer surplus has decreased in a big way. Customers now have access to information and marketplaces online that allow them to shop around and get the best deals on products from a variety of vendors, no matter where they happen to be located. Increased competition as a result of ICTs has helped to drive up efficiency, lower costs, and enhance product quality across the board.

2.2 Why the ICT Sector is Important for Inclusive Growth

Just-in-time production, outsourcing, "market-of-one" customization, and many other innovations made possible by ICTs have helped to increase participation, make production more flexible (including in terms of labor), give consumers more choices, lower quality-adjusted prices, and improve consumer welfare all over the world. Businesses, whole industries, and the world economy have all adjusted to the new realities that B2B and B2C e-commerce have brought about. This has encouraged and sustained a meteoric increase in global commerce. A positive outcome might be increased global specialization, expanded breadth, and economies of scale. Sharing knowledge makes it possible for nations that are behind to catch up and perhaps skip decades of technical growth. This is so because it is now much simpler to spread examples of excellent conduct. Business expansion is accelerated when entrepreneurs tap into ICT-enabled marketplaces. This might make it simpler for individuals to get into the industry and foster innovation.

In order to expand into new markets, streamline internal processes, and improve communication with consumers and suppliers, businesses of all sizes, but notably SMEs, are increasingly turning to ICT-enabled skills and online platforms. With the help of ICTs, governments may be able to improve how they talk to the public and offer more services. Information and communication technologies are essential for managing critical infrastructures like power grids, water distribution networks, transportation networks, and public security systems in real time. As we've come along in our efforts to achieve the MDGs, it's become clear that ICTs have contributed and will continue to do so. In this age of information and communication technologies, the globe really does seem smaller. Many studies have shown that ICTs are good for growth, productivity, and efficiency in both global and local economies.

Several econometric studies of ICT's effects at the international, national, industry, and business levels, as well as many case studies of how ICTs change productive activities, have shown this. The general conclusion is unmistakable, yet individual findings vary greatly, and there are several obstacles to defining or quantifying the effects exactly. To begin, it is difficult to determine the impact of ICTs on outputs like GDP or employment rates since they are simply one of many factors

that go into productive activities. By freeing up competent employees to focus on higher-order problems rather than the everyday jobs that have been automated away, ICTs boost the effectiveness of other inputs like labor and capital as well. As a result, both labor and capital are used more efficiently.

ICTs also change the way resources are used in big ways, like by letting businesses reorganize. The investment in information and communication technology inputs is negligible relative to the sum of all output. Because of this, it might be difficult to determine how much ICT was really used. The rapid pace at which ICT evolves and costs decrease in proportion to performance exacerbates this issue. There are several ways in which ICTs may aid employees in obtaining better education and skills. On the one hand, ICTs may free up more skilled people from boring, time-consuming jobs so they can focus on more complex, brain-taxing jobs. On the other hand, a machine tool may be able to create more than a number of human employees. ICTs open up new job opportunities in the digital economy for people with the necessary skills. Local application developers, for example, may benefit from the growth of mobile broadband, but they will have to put in time and effort to learn the information and communication technology (ICT) skills they need to write software. ICTs can also help speed up the innovation cycle in all sectors because they can be changed to fit different needs.

As a result, the rate at which people lose their expertise has increased thanks to the spread of ICTs. This might be particularly harmful for elderly employees who are unable to acquire new skills as the ICT-enabled economy evolves and flourishes. With the steady improvement of ICT, it is possible that eventually robots may be able to replace many human jobs. According to some estimates, up to two-thirds of human labor may eventually be replaced by computers. Thanks to ICTs, workers are no longer restricted to a certain location, freeing multinational corporations to search for more affordable labor wherever it may be. Specifically, (ITU 2017; Ahmad R. Sharafat) (ICT-centered economic development, innovation, and job creation in 2017; ITU).

2.3 ICT for Sustainable Development

Important features of ICTs include mobile, calculation, electronic communication, and information collection. More efficient, timely, and adaptable

means of communication and decision-making are made possible by these technological advancements. When more individuals can get information quickly and easily, markets may expand throughout the whole economic production cycle, from the sale of completed products and services to the purchase of raw materials and the exchange of commodities across countries. This makes it easier to make and use resources in a way that is more dynamic, adaptable, and flexible. Because of this, every aspect of resource production and use is open to modification. This will have far-reaching consequences for the economy and how people relate to one another and the globe at large. Just-in-time production, outsourcing, "market of one" customization, and a whole host of other ICT-enabled innovations have helped to increase participation, make production more flexible (including in terms of labor), and give consumers more choices at lower prices when quality is taken into account. Businesses, whole industries, and the world economy have all adjusted to the new realities that B2B and B2C e-commerce have brought about. This has encouraged and sustained a meteoric increase in global commerce. A positive outcome might be increased global specialization, expanded breadth, and economies of scale. Sharing data helps countries that are falling behind catch up quickly, and they might even be able to skip a whole generation of technological progress. This is so because it is now much simpler to spread examples of excellent conduct.

Business expansion is accelerated when entrepreneurs tap into ICT-enabled marketplaces. One possible benefit of this is that it lowers the barrier of entry into the market, which in turn may stimulate more creative thinking. In order to expand into new markets, streamline internal processes, and improve communication with consumers and suppliers, businesses of all sizes, but notably SMEs, are increasingly turning to ICT-enabled skills and online platforms. With the help of ICTs, governments may be able to improve how they talk to the public and offer more services.

Information and communication technologies are essential for managing critical infrastructures like power grids, water distribution networks, transportation networks, and public security systems in real time. The success we've had so far in pursuing the MDGs is evidence that ICTs have helped us and will continue to do so. There is a lot of potential upsides to using ICTs to advance the SDGs. However, this will only occur

if other conditions are met.

First, a solid foundation of information and communication technology is required. Mobile broadband services must be widely available, affordable, and used by a lot of people for this goal to be reached today. If you have information and communication technology resources but don't put them to good use, they're useless. In many parts of the globe, access to even the most fundamental forms of information and communication technology (ICT) remains severely limited. While less developed nations are making strides to catch up, the more advanced nations still have superior ICT infrastructure and service options. Most people around the globe already have access to basic cell phone service, but the focus has shifted to expanding mobile broadband's reach because of its superior functionality and reduced power consumption. ICT infrastructure, on the other hand, is not enough to get the most out of ICTs.

Businesses and customers both need to have access to ICTs and the training they need to use them properly. In order to reap the benefits that information and communication technologies (ICTs) offer while mitigating the risks that they present, businesses must adapt their operations to work in tandem with these technologies. Also, there must be civil society institutions and government policies in place to support and encourage these good changes. Positively, expanding economies have the potential to increase the availability of global resources. The use of ICT may allow for increased adaptability in the layout of businesses. As a result, this could make it easier for women, people with disabilities, and people who live in economically underserved or remote areas to get jobs. With the help of ICTs, people can find more ways to spend their free time and have access to a global market that was not available to them before. Information and communication technologies (ICTs) can improve the efficiency of monitoring and administering sectors as diverse as healthcare, energy production, agriculture, and even government. ICTs promote economic inclusion and make it easier for SMEs to get into markets by giving people verified digital identities that make it easier to get access to financial resources, better manage transactions, and stop fraud.

2.4 Reviews on Previous Studies

Ei Ei Aung (2005), examined “ICT development in Myanmar”. The study used a descriptive method and used data from the Myanmar Computer Professional Association, the Myanmar Computer Federation, and government websites. She also said that information and communication technologies (ICT) are playing an increasingly critical role in driving economic expansion throughout the country's industrial and service sectors. As the rate of globalization and technological progress speeds up, it is more important than ever to speed up and broaden the development of education and technology. We think that the people of Myanmar are in a good place to take advantage of the current revolution in information and communication technology (ICT). Establishing an interconnected system of regional and international data networks at the national level. To construct an efficient and effective national communications network, careful planning is required. The communications infrastructure needs a long-term strategy that factors in how human and commercial activities will evolve.

Myo Aye (2015) studied "Information and Communication Technology for Development." The study was done using a descriptive method, and secondary data was gathered from the Myanmar Computer Federation and the websites of Myanmar's ministries. By looking at the growth of GDP and the development of ICT infrastructure in many ASEAN countries, the study showed that ICT is the engine of economic progress. There is a link between a country's gross domestic product (GDP) and its ICT infrastructure, which means that countries with more money are better prepared for a networked world. Having a developed ICT infrastructure has been proven to increase a country's GDP. Enhancing a nation's ICT infrastructure is an investment in that nation's future prosperity.

Lei Lei Moe (2016) studied “A Study on Telecommunication and Economic Growth in Myanmar” in 2016. The study's method is a description with secondary data, and its goal is to find out how telecommunications affect economic growth. Globalization had a positive effect on the development and use of ICT, according to the research. Now it's obvious that the information and communications technology sector is underdeveloped. However, most individuals in a poor nation lack the necessary technological expertise. To help the IT industry, the government should put money into

updating the country's telecommunications network and the rules for accessing the internet. Less rules and more incentives are needed to get the private sector to invest in ICT innovation. A lot of studies and analyses have shown that improvements in mobile communication and ICT have a big effect on how fast the economy grows. The impacts on economic development were especially noticeable in emerging nations, where they contributed to greater productivity and economic activity.

Rita Remeikiene of Vilnius University (2021) studied “The Role of ICT Development in Boosting Economic Growth in Transition Economies”. The study used the method of correlation linear calculation formula to show that there is a positive relationship between ICT development and economic growth for 11 EU countries from 2000 to 2019. His study used the ICT Development Index, Teledensity, Per Capita GDP, GDP, and Economic Growth Rate as ways to figure out the values. Most people think that progress in information and communication technology (ICT) is an important part of the change to a new economic system because it could have a big effect on macroeconomics. The research proves that giving more people access to information and communication technologies helps the economies of the countries that were looked at. But the number of people who use the internet and the growth of the economy are not directly linked in any way that goes beyond a simple statistical correlation. Because of this, encouraging people to use the Internet should be a top priority for economies in transition. More individuals in these nations should be encouraged by their governments to utilize the Internet for personal and commercial purposes as the first and most crucial step toward the information era.

CHAPTER III

OVERVIEW OF MYANMAR ICT DEVELOPMENT

3.1 Brief History of Myanmar ICT

Information and Communication Technology has been used in Myanmar for about 40 years ago. As the agreement with United Nations Program, UNESCO supported a Main Frame computer and technology to Myanmar in 1971. This is the start of Information and Communication Technology (ICT) in Myanmar, which began with the establishment of the Universities' Computer Center (UCC) under the Ministry of Education. The Universities Computer Center (UCC) was temporarily launched under the Yangon University Mathematics Department at Mandalay Hall in Yangon University campus in 1971. The UCC gave the lectures for the fundamentals of computer programming and computer operation. In October 1972, the first Myanmar-owned mainframe computer, ICL 1902S, arrived and the UCC relocated to a new building in Yangon University's Hlaing campus. Later, that building was the Yangon Computer University, Hlaing campus.

After assembling all the equipment for the mainframe computer in March of 1973, the first Myanmar-owned mainframe computer, ICL 1902S, started its services. Operating system of the computer was George 2 system, and the programming languages were COBOL, FORTRAN and ALGOL. The UCC encouraged departments of every ministry in Myanmar to apply computer technology.

3.1.1 Achievements of ICT in National Level Project

As for the first achievement milestone of Myanmar ICT, the mainframe computer could successfully assist the Burma Population Census Project in April of 1973. This was the first computer-aid national level project in Myanmar. Then, nationwide Leprosy Campaign and Prenatal mortality and mobility survey conducted by applying the Myanmar first computer. The UCC launched the Integrated Computer Training Courses, Postgraduate Diploma in Applied Computer and M.Sc. (Computer Sciences) at Yangon University, Hlaing campus in the 1972-1974 academic year . In

the early 1980s, as personal computers started to be used in western countries, universities' computer departments transformed into computer-ages with newly purchased eight personal computers in 1984. Private computer technology markets, including training centers, services centers, and sales centers, were started in Myanmar in the age of personal computers. The Universities' Computer Department was upgraded into the Institute of Computer Science and Technology on 29 March 1988 after launching a pilot lecture department in 1986-1987 academic year. Computer technology market were developed more after 1988 and private computers training center and computer selling shops increasingly opened in Myanmar as the country economics system was also shifted to market economy system. During the 1988, Myanmar Post and Telecommunication (MPT) installed and used the Myanmar's first leading internetwork system X.25 Leased line. In the 1990s, the word Information Technology (IT) was globally renamed into the Information and Communication Technology (ICT) and the using of the internetwork infrastructure more increase in business. Software development industry was also transformed from traditional computer based to network-based online platforms

3.1.2 Upgrading Computer System from Batch Processing to Interactive

During the late of 1970s, the age of mainframe computer technology was upgraded to Minicomputer and Micro Computer age and therefore, Micro Computer (Chromeno System 3) and PDP-11/70 Minicomputer were assembled at UCC in December 1979 and August 1980 respectively. PDP-11/70 Minicomputer could effectively practice Time Sharing and Interactive System by distributing up to 16 user terminals at the same time. The performance significantly increased although the size of computer was reduced. In 1983, The UCC department received the Portable Computer (Osborne) by Government fund and applied it in the official projects.

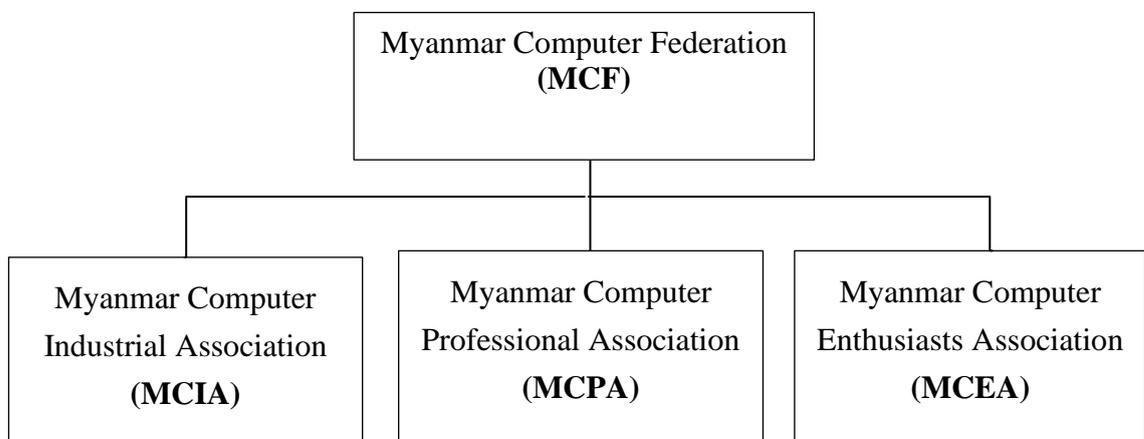
In 1983, The UCC developed the Computer Development Programme (CDP) as the second phase of Myanmar ICT, and it was presented to United Nation Development Programme (UNDP). This could be said as the very first step of Myanmar e-Government. Another computer called IBM 4381 Mainframe was received by the UCC as for the success of the CDP. Central Statistical Organization of Myanmar (CSO) took responsibility the newly received mainframe computer to utilize the computer technology in all departments in Ministry of Planning and Budget. Later, Myanmar Oil, Natural Gas department occupied the VAX-11 mainframe and No.1 Ministry of

Industry bought IBM system 32 Minicomputer and the Forest department owned the Digital, minicomputer respectively.

3.1.3 Computer Law and Formation of ICT Professional Institutions

Government of Myanmar had already been efforted in the last thirty years ago to improve the human development in accordance with the development of Myanmar ICT sector. The government enacted the Myanmar Computer Development Act on 20 September 1996 and formed the Myanmar Computer Sciences Development Council on 21 September 1996 in accordance with the Myanmar Compute Development Act which was recently enacted on 20 September. Myanmar Computer Professional Association and Myanmar Computer Industrial Association were established in March 1998, Myanmar Computer Enthusiasts Association was formed in July 1998 respectively. Later on 15th October 1998, Myanmar Computer Federation was formed by electing representatives from the already established three associations.

Figure (3.1) Formation of Myanmar Computer Associations



Source: Myanmar Computer Federation

In 1999, the State Peace and Development Council assigned the task on Myanmar Computer Federation to participate in the leading role of a national committee to oversee the Y2K process in order for Myanmar to resolve the Y2K problem that might occur in the year 2000 transition period. State Peace and Development Council government (SDPC) enacted rules and regulations to support the ICT sector development in Myanmar. The Computer Science Development Law on 20 September 1996 and it was amended on 23 February 1998. As a part of the Myanmar

ICT Master Plan, MICT park in Yangon and ICT park in Mandalay were established to support and encourage ICT development of Myanmar, to collaborate the ICT companies and to support the standardized infrastructure in a common place. Yatanarpon Cyber City was also opened on 14 December 2007.

The ICT Master Plan development committee, a subcommittee of Myanmar Computer Federation, developed ICT Master plan (2001-2005) and reported to Myanmar Computer Sciences Development Council and it was approved in 2001 by the council. Also, the Myanmar ICT Development Master Plan 2006-2010 was successfully developed with assistance of ASEAN Integration (IAI) programme.

3.2 ICT Infrastructure in Myanmar

The ICT infrastructure mean not only the basic telecommunications services but also the fundamental requirements for e-Commerce, e-Government, and e-Learning. A country's economics cannot growth itself alone without having a proper ICT infrastructure without having a proper telecom infrastructure. Telecom infrastructure is the key to the ICT to be enabler for implementation of 17 goals of Sustainable Development Goal that was developed by the UN in 2015. High-tech infrastructure and personal equipment are the fundamental of ICT infrastructure of the country. Myanmar's tele-infrastructure can be extinguished into international network communications and access networks communications.

Figure (3.2) Submarine Cables and Cross Border Optical Fiber Cables



Source MPT

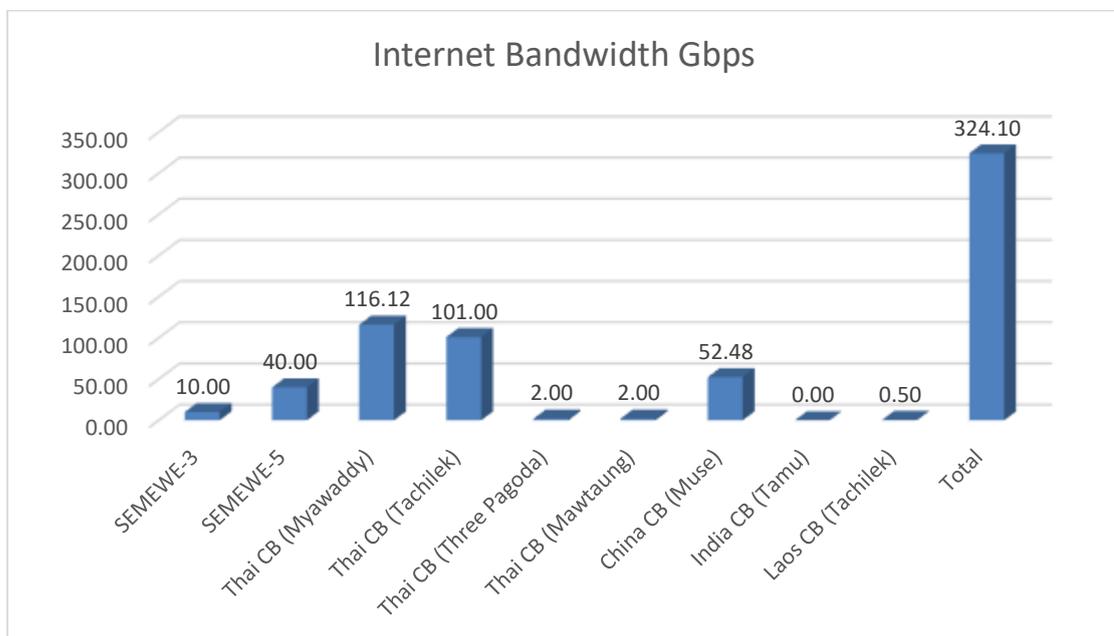
Internetwork communication links can be divided into three types.

- (a) Cross border communications ,
- (b) International communications, and
- (c) Last mile satellite communications.

Cross border communications to neighbor countries are in land line fiber such as Myanmar-Thailand, Myanmar-India, Myanmar-China, Myanmar Laos, and Myanmar-Thailand. International communications are underwater fiber cables such as SAE-ME-WE 3, SEA-ME-WE 5, AAE-1, MIST and SIGMAR are installed for communications links to international. Last mile satellite communications are using C Band technology for the connection between Thailand-Myanmar (Three Pagoda), Thailand-Myanmar (Myawaddy), Thailand-Myanmar (Tachileik), Thailand-Myanmar (Mawtung), China-Myanmar (Muse), India-Myanmar (Tamu), Laos-Myanmar (Tachileik).

Myanmar also has national backbone fiber cable links between major cities for all states and regions. The total internet bandwidth capacity of Myanmar reached 324.10 Gbps in 2018.

Figure (3.3) Total Internet Bandwidth of Myanmar



Source: Myanmar Computer Federation

3.2.1 Internet Services Providers in Myanmar

Internet Services Providers are Frontiers Co., Ltd, Myanmar Post and Telecommunication (MPT), Myanmar Broadband Telecom (MBT), Myanmar Net,

Mytel, Ocean Wave Communications, Ooredoo Myanmar, Telecom International Myanmar, Telenor Myanmar and Welink. Total of 9 ISPs and 200 Local Internet Services Provider License were granted under the Telecommunications Law 2013. The access network communications in Myanmar are Fiber To The Home (FTTH), Fiber To The Premise (FTTX), Wireless broadband access, ADSL and Satellite terminals services. The access network of Myanmar is almost equal the services that were provided in ASEAN neighboring countries after granting local services provider licenses in 2018.

3.2.2 ICT Education

There are 2 ICT universities and 28 government computer universities across the country providing diplomas to doctoral degrees on ICT related subjects. There are also a significant number of private and international university affiliated training centers and schools providing diplomas to degrees in ICT. Among them there are four Centers of Excellence (COE) under the University of Computer Studies (UCS) and Technological University (TU) . University of Information Technology and University of Computer Studies Mandalay are the COEs under the UCS and Yangon Technological University and Mandalay Technological University are the COEs under TU.

Collaborating with international organizations, the MCF is also providing capacity building programs. Some of which are; CICC Onsite Training Courses, Joint ICT training programs (with Singapore, Japan and India), Japan-Myanmar e-Learning center in MICT Park, MCSA/JTEC certificate programs with Japan and various scholarship programs. The detail list of the locations of Computer Universities and COEs and expressed in the Appendix -1.

Universities of Computer Studies lecturing seven bachelor's degrees, six master's degrees and a doctorate degree programs in computer sciences related subjects. There are total of 20,024 students were graduated from the University of Computer Studies while Technological Universities are running Bachelor of Technology in IT, Bachelor of Engineering in IT, Master of Engineering in IT and PhD in IT programs throughout the country.

Table (3.1) Graduate Absolute Values of Computer Studies

Number of Graduated from University of Computer Studies						
Title of Degree	Academic Years absolute values					
	2005-2006	2010-2011	2015-2016	2016-2017	2017-2018	2018-2019
Pre-Diploma	61					
Post-Diploma	527	1	142			
Graduates	5,678	3,446		2,349	430	2,401
Master	2,600	308	162	61		81
Ph.D.			42			10
Total	8,866	3,755	346	2,410	430	2,492

Source: Myanmar Statistical Yearbook 2020

Computer Post graduate Diploma in Computer Science, Bachelor of Computer Science, Master of Computer Sciences programs are providing by the Yangon University's Computer Study Department. National Human Resources Development and Yangon University's distance Education have a joint program to produce professional with Diploma in IT.

In the private sector, KMD and MCC are joint with NCC under the UK education system providing Computer Sciences Diploma and Degrees.

3.2.3 Department of Information Technology and Cyber Security:

The department was formed on 1st April 2015 by the order no. (9/215) of the Ministry of Communication and Information Technology as the results of cabinet meetings (2/2015) that held in Nay Pyi Daw.

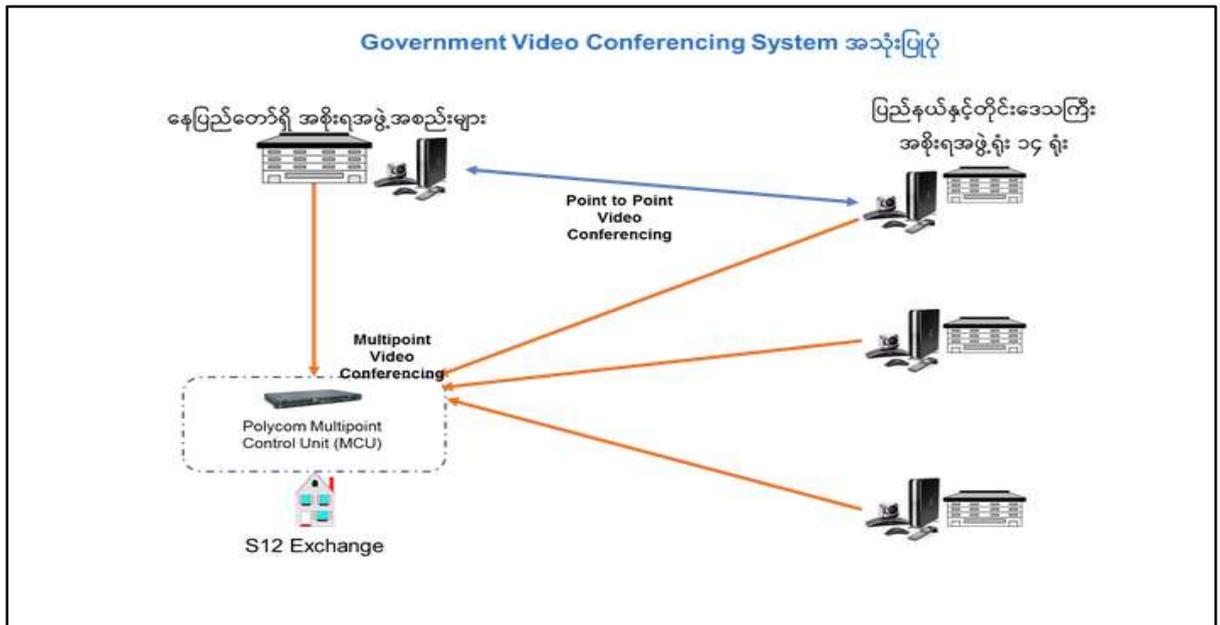
The department formed with six sections as follows.

- (1) Admin, Finance and Logistic Section,
- (2) e-Government Section,
- (3) Law, International Relationship, and Information Section,
- (4) National Cyber Security Center (NCSC),
- (5) Satellite Communications Section, and
- (6) Training Section,

e-Government section is the main responsible section supporting ICT infrastructure services to all the government departments in the country. The ICT infrastructure services provided by the section are.

- (a) Government Video Conferencing System,
- (b) Data Center,
- (c) Information Access Center (IAC), and
- (d) E-Government Integrated Data Center (e-GIDC).

Figure (3.4) Government Video Conferencing System of Myanmar

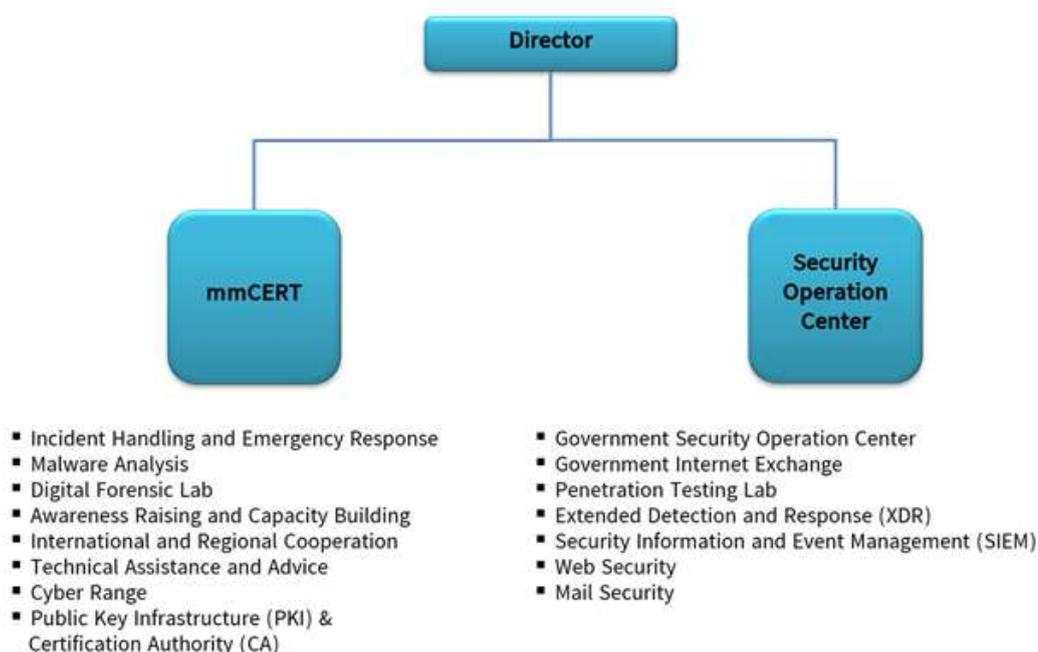


Source: Department of Information Technology and Cyber Security

National Cyber Security Center (NCSC) has two sub sections Myanmar Cyber Emergency Response Team (mmCERT) and Security Operation Center. The following services are providing by the National Cyber Security Center.

- (a) Extended Detection and Response Services (XDR),
- (b) WEB security Services,
- (c) Cyber incident handling and emergency response services,
- (d) Building the cyber security awareness and cyber capacity building services,
- (e) Cyber Law development services,
- (f) Coordination with regional countries to responsive cyber-attack services, and
- (g) Technical Assistance and advice as required on the cyberbreaches in the country.

Figure (3.5) Formation of National Cyber Security Center (NCSC)



Source National Cyber Security Center (NCSC)

3.2.4 ICT Legal Framework

The first law enforcement to Myanmar ICT sector was the Computer Science Development Law which was enacted 20 September 1996 and amendment on 23 February 1998 by the State Peace and Development Council government (SDPC). The Electronic Transactions Law on 30 April 2004 and amendment on 29 August 2017. Communication Law enacted on 8 October 2013, and it was also amended in two times on 25 February 2014 and 15 February 2021.

The e-Legal infrastructure working committee has been assigned to draft the Cyber Law, but it is still in the processing status.

Table (3.2) Enforcing Law Relating to ICT

Law Name	Date	First Amendment	Second Amendment
Computer Science Development Law	20.9.1996	23.2.1998	
Electronic Transactions Law	30.4.2004	25.2.2014	15.2.2021
Communication Law	8.10.2013	29.8.2017	
Cyber Law	Draft in 2021		

Source: Myanmar Law Information Services (mlis.gov.mm)

3.3 Telecommunication Sector in Myanmar

The Myanmar telecoms market has changed a lot in the last seven years. Myanmar used to be one of the least developed markets in Asia, but its mobile and mobile broadband services have grown at a rate that has never been seen before. Foreign investment has been the driving force behind telecoms boom that is changing the economy, creating opportunities for the future, and giving people a place to try new things. Even though fixed broadband use is still very low, Myanmar's mobile market is getting more and more active and competitive. Since 2014, Myanmar's three biggest telcos, MPT, Ooredoo, and Telenor, have served more than 50 million mobile subscribers. This gives Myanmar a mobile penetration rate of close to 95%. Since January 2017, when Mytel became the fourth telecom operator, there are now four telecom operators in Myanmar. In the near future, there will be a lot of growth, and telcos will keep making their networks faster and more connected. Since the telecoms business is now a possible one for attracting more foreign investments, it is a sector that needs to be watched.

3.3.1 License, Telecom Law, and Regulation

On October 8, 2013, the Telecommunications Law No. 31/2013 (Telecoms Law) was enacted. It provides Myanmar's communications sector with a contemporary means of regulation. The Telecoms Law regulates network facility services, network service providers, and application service providers. On August 29, 2017, this legislation was modified. The Telecoms Law is supplemented by Notification No. 16/2014 (Licensing Rules), issued by the Ministry of Communications and Information Technology (now Ministry of Transport and Communications) of the Union Government (MCIT), which established licensing rules and regulations as well as Telecoms Law implementing regulations. Additional legislation has been added to the Telecoms Law and Licensing Rules.

Table (3.3) Licensing Rules

	Legislation	Date
Notification No. 1/2015	Interconnection and Access Rules	06-Jan-15
Notification No. 21/2015	Telecoms Competition Rules	09-Jun-15
Notification No. 49/2015	The Numbering Rules	03-Dec-15
Notification No. 10/2016	The Spectrum Rules	07-Mar-16
MCIT reorganized as Ministry of Transport and Communications (MOTC)		
Notification No. 9/2016 (25 May 2016)		
MOTC Notice	Technical Specifications for Short Range Device	17-Jul-16
MOTC Notice	Guidelines on the Provision of International Gateway Services	08-Sep-16
MOTC Notice	Telecommunications Numbering Plan	31-Jan-17
MOTC Notice	The Technical Specification and Quality of Service for International Gateway Service	05-Apr-17
MOTC Notice	Draft Myanmar Communications Regulatory Commission Law (MCRC Law)	15-May-17
Law No – 26, 2017	Amendments to the Telecommunication Law	18-Aug-17
MOTC Notice	Amendments to Rules of the Licensing Rules	03-Sep-18

Source: Department of the Directorate of Communications (MPT)

In Myanmar, the Posts and Telecommunications Department under the Ministry of Transport and Communications regulates telecommunications.

Among the Department's duties are the following:

- the giving out and renewing of licenses for service providers.
- rules about the numbering plans and frequency spectrum.
- making sure that consumers are safe.
- Service providers being inspected and kept an eye on.
- putting service providers through administrative actions.

As part of reforming the sector, the MOTC is allowed to set up the National Telecommunications Advisory Committee. This committee will make suggestions about technical standards, consumer protection, and the strategic development of Myanmar's telecommunications sector. It will also hear administrative appeals against the MOTC's decisions.

3.3.2 Investment Regime

The production of telecommunications equipment, the installation of telecommunication lines, the construction of telecommunication towers, the operation of businesses related to regional fiber lines, and the provision of telecommunication services are all considered "promoted" economic activities by Notification No. 13/2017 issued by the Myanmar Investment Commission under the Myanmar Investment Law (MIL). All of the tax breaks and other incentives listed in the MIL are available to investors. Under the Telecoms Law, foreign organizations may submit applications for licenses. Under the Licensing Rules, a foreign entity is a legal entity in which a non-Myanmar person or foreign corporation directly or indirectly controls more than 50% of the entity's interests. However, the definition of a "foreign corporation" under the Myanmar Companies Law is different from this one (MCL). Foreign corporations have more than 35% foreign ownership under the MCL.

Table (3.4) Telecom License Holders in Myanmar

Licensee	Awarded	Ownership	Term	Subscribers (millions)
MPT	Mar-15	This publicly-held company is managed by the Transportation and Communications Ministry. MPT has agreed to partner with KSGM, which is ultimately controlled by KDDI Corporation (Japan) and Sumitomo Corporation (Japan)	15 years	25

Table (3.4) Telecom License Holders in Myanmar (Continued)

Licensee	Awarded	Ownership	Term	Subscribers (millions)
Telenor (changed to ATOM on 30 May 2022)	Feb-14	Telenor ASA (Norway)	15 years	19
Ooredoo	Feb-14	Ooredoo Group (Qatar)	15 years	9
Mytel	Jan-17	This organization is a joint venture between Viettel Group (Vietnam) (49%), Star High Telecom Limited (Myanmar) (28%), and Myanmar National Telecom Holding Company (23%).	15 years	1

Source: Directorate of Communication Department (MPT)

3.3.3 License Regime (Service licenses)

Businesses with either domestic or foreign investment must first get a service license (Service License) from the Department before they can legally offer network facility services, network services, or application services. The Licensing Rules permit the following types of service licenses:

- (a) Network Facilities Service (Individual) License (NFSI),
- (b) Network Facilities Service (Class) License (NFSC),
- (c) Network Service License (NS) and
- (d) Application Service License (AS).

(a) Network Facilities Service (Individual) License (NFSI)

In terms of licenses, the "NFSI" license is the pinnacle. Those who possess it are granted all privileges accorded to those who possess the NFSI License, the NFSC License, the NS License, and the AS License. Construction, maintenance, and operation of terrestrial fixed line transmission facilities, terrestrial radio transmission facilities, mobile base station facilities, submarine cable facilities, international

gateway services facilities, satellite earth station facilities, and other satellite facilities in the Union of Myanmar that can transmit telecommunications services are all covered by the NFSI License.

(b) Network Facilities Service (Class) License (NFSC)

Even though you need the NFSC License for the activities on the NFSC list, you can also apply for the NS License and the AS License if you already have the NFSC License. Constructing, installing, and maintaining the infrastructure needed to transmit, receive, and route communications, such as towers, masts, ducts, trenches, poles, and black fiber, are all covered by the NFSC license. The holder of an NFSI license, or a third party on their behalf, may also lease out the holder's communications infrastructure to those who don't have their own NFSC license.

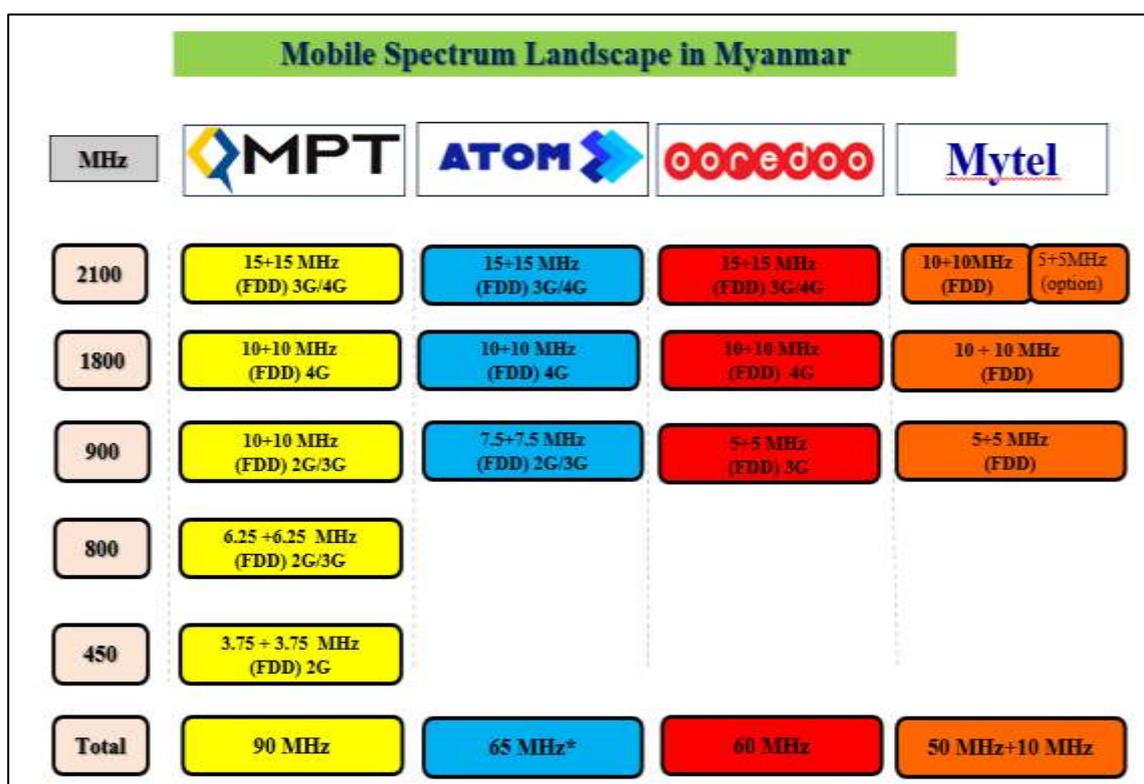
(c) Network Service License (NS)

Users of the "NS License" can only do things that are allowed by the "AS License" and the "NS License." The NS License lets telecom network infrastructure, like switches, routers, and processing equipment, be built and kept up to date. Additionally, the NS permit allows for the resale of terrestrial wireless connection services, the provision of network transport and switching services both domestically and internationally, and the provision of international gateway services.

(d) Application Service License (AS)

The AS License only lets licensees do the things that are specifically allowed by the AS License. Under the AS License, you are allowed to offer public payphone services, public switched data services, opt-in audio text hosting services, directory services, ISP services, public access center services, messaging services, private line voice and/or data services, and value-added services. According to the Spectrum Rules, the Department must talk to the public before deciding how to get a license to use radio spectrum, how to decide who has the right to use spectrum, and how much it will cost to use spectrum. Spectrum may be assigned by auctions, bids, or set pricing. Spectrum licenses can't be given without permission from the department first. The transferee must adhere to all applicable telecom laws and related regulations.

Figure (3.6) Mobile Spectrum Landscape in Myanmar



Source: MPT

3.4 e-Government in Myanmar

Myanmar put the e-government initiative into action based on the e-ASEAN framework agreement, which was agreed at the ASEAN summit in Singapore in October 2000. The goal of the agreement is to make sure that all ASEAN countries have the same amount of information and technology. E-government is the use of information and communication technology to improve and simplify the way the government works. The deployment of e-government initiatives in Myanmar focuses on three purposes.

- (1) To effectively offer government programs and services to people
- (2) to cultivate business, and
- (3) to enhance departmental collaboration and openness.

The e-ASEAN framework agreement, reached at the ASEAN summit in Singapore in October 2000, served as the basis for Myanmar's e-government initiative. The pact's stated objective is to help ASEAN member states catch up to one another in terms of technological development. E-government is the practice of using electronic means of government administration. There are three basic objectives of Myanmar's

online government programs. In 2004, with help from Korea, Myanmar established its first rudimentary e-government services. Every government agency now has access to a high-speed network, streamlining routine bureaucratic procedures. Government document digitalization has progressed from a pilot program to a countrywide endeavor since then. Online government programs in Myanmar are being rolled out with the help of the e-ASEAN framework agreement. E-Visa, e-Passport, e-Procurement, an online system for the D-Form (departure form), e-Trade, Certification Authority, Smart School, and Smart Card are only some of the e-government experimental projects that have been introduced.

The scope of e-government initiatives includes:

1. National IT infrastructure
 - Yangon Data Center
 - Yangon (Asymmetric Digital Subscriber Line) ADSL Data network
 - Technical support for New City 1G/100M data network.

2. Application Developments
 - Basic e-Government application EDMS (Electronic Document Management System) and Groupware
 - GPMS (Government Personnel Management System)

3. Education and Training
 - Computer Server Operation
 - Administrator and user training for Applications
 - Training on e-Government provided to government officials since 2003 are:
 - E-Government workshop training courses
 - Basic e-Government user courses
 - Preliminary Basic e-Government courses
 - GPMS (Government Personal Management System) user courses
 - GPMS administrator courses
 - EDMS (Electronic Document Management System) user courses
 - EDMS administrator courses

3.4.1 Myanmar's other e-Government Projects

Other e-Government projects include building the management information system, which is a computer network that connects different government ministries and lets them send each other information, documents, reports, and data. There are six e-Government projects, including e-passport, e-visa, e-certification authority, e-Passport, e-Procurement, D-form (Departure form) online system, e-Trade, Certification Authority, Smart school, and Smart card.

e-Passport project was launched in August 2002, Myanmar became one of the first countries in the world to embed passports with computer chips containing personal and biometric (fingerprint) information about the holder. In its initial phase one project replaced 3500 business passports and 1500 diplomatic and official passports

The e-Visa project has been made so that people who want to go to Myanmar can find out about visas online.

e-Certification authority: The National Certification Authority project will focus on security issues, such as digital signatures and certificates, which are an important part of any electronic transaction. Smart cards: Two thousand smart cards containing personal, health and biometric information have been issued to officials at the Ministry of Defense on a trial basis. The multipurpose cards can be used as driver's license and for national registration, security checking and cash withdrawals.

Smart school: The Ministry of Education and the Multimedia Development Corporation of Malaysia worked together to make the smart school program. Lessons can be made in one place and sent to all participating schools and classrooms via a computer network. Students and teachers can also use the computer-based training system, the digital library system, and other helpful teaching and learning tools. There are plans to add more schools to the project in the future. For now, the project is only in three schools in Yangon.

The e-visa, e-procurement, and certification authority projects all started in 2004. In April 2010, the Future more e-Procurement process also began. There are more than forty departments and services, as well as sales bids and price quotes.

3.4.2 The Structure of the e-Government Project in Myanmar

The department of e-government service, Information Technology and Cyber Security Department, which is part of the Ministry of Transport and Communications, made the following structure so that e-government projects can be done in Myanmar.

The e-government department provides the following essentials for the successful implementation of the e-government process by every government department in Myanmar:

- (a) ICT infrastructure building services; (Network, Data Centers, IACs, etc.,)
- (b) Building and providing services for common applications (e-Mail, EDMS,
- (c) providing technical support; Recommending and conducting Capacity Building activities
- (d) Conducting e-Government development activities in cooperation with international organizations
- (e) Monitoring and evaluation of e-Government processes of the ministries which is being conducted

(a) ICT Infrastructure

For or the development of e-Government, the Ministry of Transport and Communications is providing the following ICT infrastructure construction services:

- (1) Government Video Conferencing System/Network
- (2) Data Center
- (3) Information Access Center (IAC)
- (4) e-Government Integrated Data Center (e-GIDC) construction project

(b) Common Application

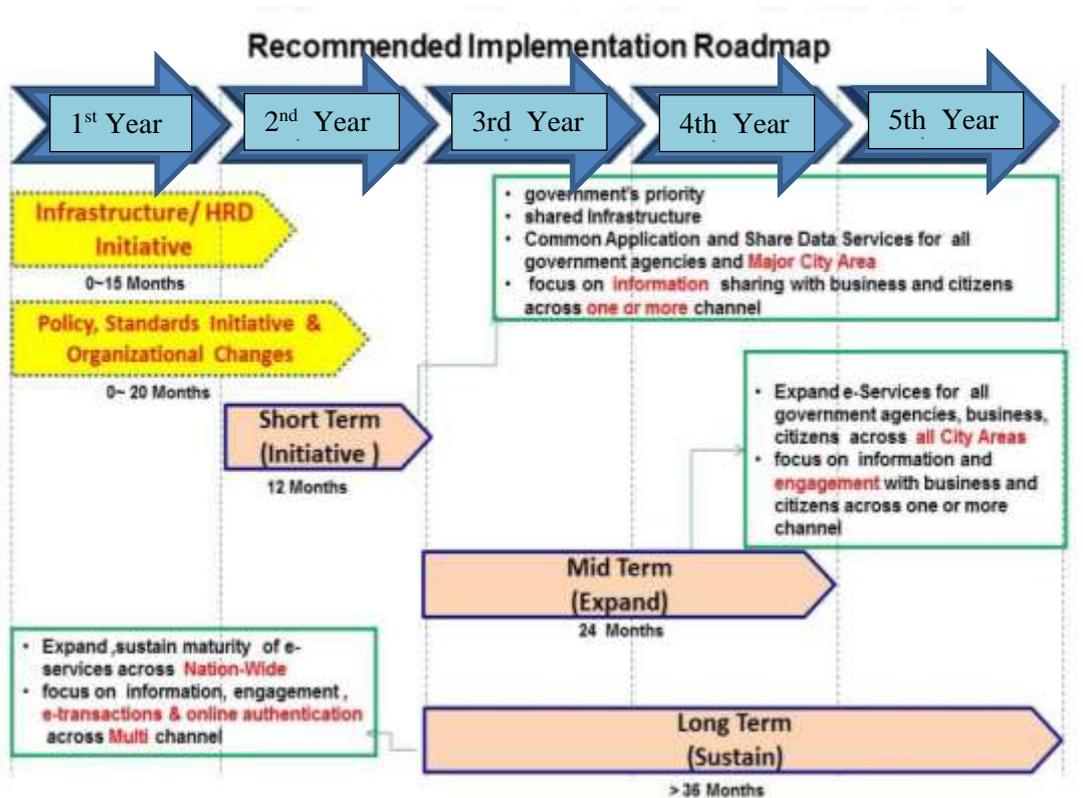
The department providing the following Common Application services to enable businesses of the same nature to be combined and shared between government organizations:

- (1) Government Personnel Management System (GPMS)
- (2) Electronic Document Management System (EDMS)
- (3) e-mail
- (4) Ministry Website
- (5) Myanmar National Portal construction project

(c) Development of e-Governance Master Plan

The department develops the strategy, process frameworks, and action plans to guarantee that e-government policies are systematically created and executed. The Myanmar e-Governance Master Plan (2021–2030) is being constructed to ensure its continued growth.

Figure (3.7) Recommended Implementation Roadmap



Source: Ministry of Transport and Communications

(d) Conducting E-Commerce activities

Together with the Ministry of Economy and Commerce, a draft of the e-Commerce Law is being made. As Myanmar's negotiator in the Working Group on e-Commerce (WGEC) of the Regional Comprehensive Economic Partnership (RCEP) initiative, a partnership between ASEAN and FTA nations, Myanmar is also responsible for its operations within the ASEAN Coordination Committee on E-Commerce (ACCEC), which was created to execute the ASEAN Economic Community (AEC) Blueprint 2025. Working as a focal point in the ASEAN-Australia-New Zealand Free Trade Area (AANZFTA) Committees on E-Commerce (CEC), which is a collaboration between ASEAN and Australia-New Zealand nations,

(e) Implementation of 4th IR for ASEAN activities

Myanmar's focus department is working with other ASEAN countries to make the Consolidated Strategy on the Fourth Industrial Revolution (4IR) for ASEA policy.

- a) To promote economic growth that works for everyone; to speed up economic development and connections.
- (b) To preserve transparency and security, it is an ASEAN policy to provide as many chances as feasible via 4IR as a community.

First consultative workshop in 2020 and a second consultative workshop on November 25, 2021. On April 27th, it was conducted twice through video conferencing, and currently member nations are submitting feedback on the "First Draft of Consolidated Strategy on the Fourth Industrial Revolution (4IR) for ASEAN."

3.5 e-Government Development Index

Since 2001, the UN Department of Economic and Social Affairs (UN DESA) has put out the EGDI and the survey report that goes with it. Over the course of 10 editions, it has become a trusted resource for e-government benchmarking and an essential policy tool for decision-makers. This study is the first and only comprehensive analysis of e-government progress across all 193 UN Member States. This research doesn't give a single grade, but instead looks at the state of e-government around the world.

It states that each nation should set the scope and scale of its e-government initiatives in light of its own national development priorities and the SDGs. The study is written for people who work in the fields of sustainable development, public administration, digital governance, and information and communication technologies (ICTs) for development. Since 2001, the UN Department of Economic and Social Affairs (UN DESA) has put out the EGDI and related survey reports every year. With eleven editions under its belt, it has become a standard in the field of e-government and an important resource for policymakers. This report is the first comprehensive analysis of the state of e-government in all 193 of the UN's Member States. Instead of providing a single score, this study compares the effectiveness of e-government across countries. According to the document, every country should tailor the breadth of its e-government projects to its own national development goals and the SDGs. The survey's primary audience consists of professionals working in the fields of sustainable development,

public administration, digital governance, and ICTs for development, including policymakers, government officials, academics, members of civil society, the business sector, and other practitioners and experts. The Electronic Government Development Index (EGDI) is a tool that helps governments compare their progress in e-government to that of other countries, figure out where they can make improvements, and start new policies and programs.

- The Scope and quality of online services as online Service Index (OSI)
- The Status of the development of telecommunication infrastructure or the Telecommunication Infrastructure Index (TII)
- The inherent human capital or the Human Capital Index (HCI).

Table (3.5) e-Government Development Index of Myanmar (EGDI)

	2008	2010	2018	2020
Myanmar	0.2922	0.2818	0.3328	0.4316

Source: UN E-Government Survey Full Report 2020 Anex Table-2

3.5.1 Myanmar E-Governance Master Plan (2016~2020)

The Asian Development Bank (ADB) helped create Myanmar's e-Government Master Plan in 2015. Foreign specialists and the appropriate parties from the Department of Information Technology and Cyber Security and the Ministry of Transport and Communication collaborated to rewrite the Myanmar e-Government Master Plan (2016–2020). The goals of Myanmar's e-government strategy for 2016-2020 are as follows:

- a) Establishing specific entities to participate in the deployment of e-government in Myanmar and defining their roles.
- b) To be informed of the current status of e-government implementation and its advantages in Myanmar.
- (c) Make a list of what needs to happen before e-Government can be put into place, based on what you've learned from meetings with e-Government agencies in Myanmar and from feasibility studies.

Prioritize the preparation of an e-government project and work plan based on an analysis of best practices in nations with successful e-government systems.

- e) To design a better and more comprehensive system by analyzing Myanmar's current ICT infrastructure and e-government implementation status.
- (f) Determine the foundation or processes to commence and the ongoing procedures.
- (g) Evaluating the skills and skill development gaps in order to determine the required strategies to close these gaps.
- (h) To make arrangements for capacity development and skill enhancement.

- (i) provide comments on the appropriate organizational structures, administration, and outlining of tasks for the formation of an e-government system implementation agency.

- j) Establishing the rules and standards necessary for the successful and efficient deployment of the e-government system in Myanmar.

- (k) ensuring that the system is accessible to users (government, corporations, residents, and other stakeholder organizations).
- (l) To create a route map
- (m) Specify the financial resources required for project execution.

3.5.2 Guidelines

There are several rules that will help get e-government up and running in Myanmar. In theory, given the available resources, it should maximize efficiency. (For instance, the fiber network already in place along train and road corridors will be used in the building of the e-government network.)

- a) It ensures that G2G, G2B, and G2C services fulfill the utility requirements of residents and companies.
- b) Its purpose is to extend the usefulness of current resources.
(For example, the e-Government network will be constructed using the existing fiber network along the railroad and road)

- c) It ensures that G2G, G2B, and G2C services fulfill the utility requirements of residents and companies.

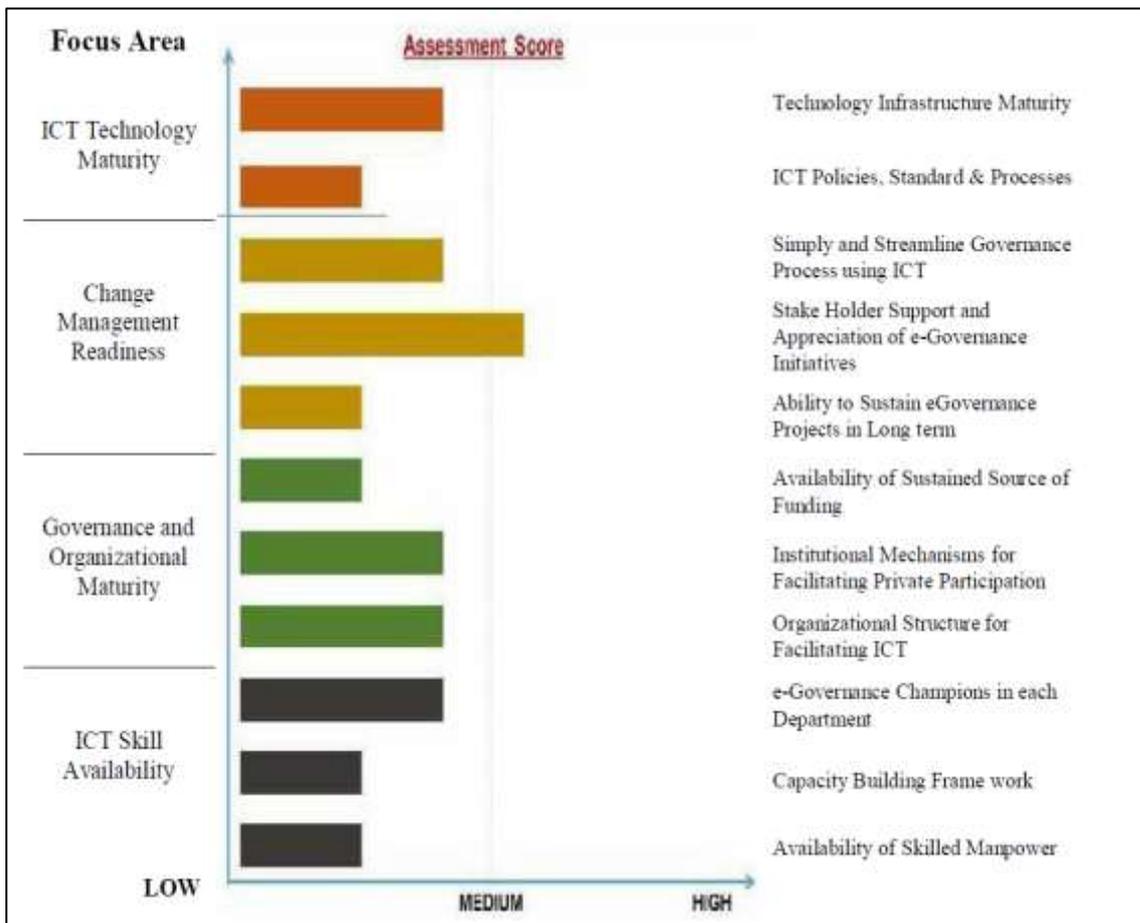
3.5.3 Different Steps of Roadmap

So that the process may be carried out in the prescribed order, it is broken down into a series of initial tasks, short-term projects, medium-term projects, and long-term projects. Successful deployment of Myanmar's e-government system requires the kind of conceptual architecture shown in Figure. It's broken down into seven steps, each of which recommends a different set of actions that might be taken by different branches of government to save money.

- (a) Governance, Policies, and Skills.
- (b) Shared Network and Infrastructure.
- (c) Common Data Services.
- (d) Shared Applications; and
- (f) Integrated Services
- (g) Channels

The current state of e-Government infrastructure (the condition of hardware, data centers, and networks), the utilization of e-Government applications, the establishment of an implementing agency for e-Government processes, the availability of ICT-skilled personnel, and the establishment of policy and standardization in ICT-related areas are broken down into the four categories shown in Figure.

Figure (3.8) Current E-Government Implementation Status in Myanmar



Source: Myanmar e-governance Master Plan (2016~2020)

CHAPTER IV

ICT DEVELOPMENT AND ECONOMIC GROWTH

ICT plays a big part in creating new jobs, new ways to make money, new business models, and lowering the cost of getting to public services. This is due to the fact that technology has altered people's routines, lives, ways of working, methods of communication, business practices, and even how they govern themselves. Jorgenson and Vu (2016) say that "the development of ICT infrastructure and the use of this infrastructure have a significant effect on economic growth, especially in places where communication, access to information, learning, research, and innovation are the main drivers of economic growth." People believe that investing in ICTs not only reduces expenses in the future but also boosts productivity and sales potential. The greatest returns are generated by changing and modernizing corporate procedures and maximizing ICT's capabilities. The expansion of the ICT industry affects both macroeconomic and microeconomic growth. This impact is mostly seen at the macro level in increased productivity, effectiveness, innovation, and financial market efficiency. At the micro level, instantaneous access to information, expertise, and social networks accelerates communication, opens the door to new markets, reduces production and capital costs, and promotes the sustainability of firms.

4.1 Important of ICT to Economic Growth

Many researchers approved that ICT development is one of the most important things that drives economic growth. Economic growth depends a lot on the level of national economic development and the ICT facilities that available in the country. This means that ICT development can help to ease economic activities and the growth of economies. The future growth potential and prospects of economies in transition depend to a large extent on ICT development, investment in ICTs, and the ability to make sure that the country at both the macro and micro levels by using ICT infrastructure efficiently.

According to a 2011 report from the United Nations, ICTs can have a positive

effect on the economy when:

1. the ICT sector itself is more productive,
2. ICT investment across the economy raises labor productivity, and
3. ICTs help businesses come up with new ideas and work more efficiently.

Macro level research helps us understand what motivates businesses to invest in ICTs, how ICTs are used in business processes and models, and how ICT development affects business performance, productivity, return on investment, and the flexibility of other factors (like organizational structure, human resources, customer interface, etc.).

ICT help in the following five ways to growth the country economy.

Economy: ICTs make it much easier and cheaper to get data and information that are important to the supply chain. The more information a country has, the more entrepreneurs there are, which makes the country more efficient and productive. All of these help the economy grow in the end.

Efficiency: Using ICTs can make a whole country work better. The production sector becomes more efficient as a work force made up of humans and technology works faster, longer, and much harder than a staff made up of only humans. Also, when ICTs are used at the state level, they lead to "e-governance," which brings transparency, accountability, and a great deal of simplification to the often-time-consuming bureaucracy of developing countries. This cuts down on corruption and makes business much easier by getting rid of middlemen and other time-consuming problems. ICTs also make it less necessary to take long trips repeatedly to do things like go to meetings, place orders, deliver packages, etc. These, in turn, boost business activity at home and bring in investment from other countries. So, the economy grew and got better.

Profitability: The output is high quality when the cost of the inputs goes down and the process becomes more efficient. Then, this product can be sold at a high-priced market (the information about which is also obtained from ICTs). Add to that a process that is open and free of corruption, as we've talked about above, and this makes a nation's goods much more profitable. This also helps bring about growth in the economy.

Upgrading: Upgrading means changing the way things are made from ones with less value to ones with more value. ICTs help with this too. With the help of ICTs, a business can go online likes e-commerce, where it may be able to get more orders

from different places and cover a wider area. ICTs like drones can also be used to deliver the customer's orders. Several e-payment platforms are also used to make the payment process much more modern. This makes the whole process more valuable.

Restructuring means moving resources from an area that is less productive to one that is more productive. As we've talked about above, ICT makes many parts of the economy very productive and opens up whole new parts of the economy to production. So, resources can be focused on these areas where they will have the most impact on the economies of developing countries. So, ICTs help developing countries grow their economies by bringing down the cost of inputs, streamlining production, making outputs more profitable, upgrading low-value sectors, and opening up completely new sectors for investment.

4.2 Teledensity and ICT Development Index (IDI)

Teledensity is the most prominent indicator of measuring the Telecommunication infrastructure of a specified geographic area or a country which was adopted by the International Telecom Union (ITU), the world leading telecommunication and ICT infrastructure standardization organization under the United Nation. As the telecom infrastructure is the skeleton of the ICT infrastructure development, we cannot exclude the tele density when we measure the ICT development of a country's economy status. It is also used to compare the level of access to voice and data communications services between metropolitan and rural areas, or between one country and another. The governments of many economies are focused on increasing teledensity as an economic enabler. But the case of mobile-phone access substitution the fixed-line telephones in developing countries, it is become to use the method of fixed-line telephone plus mobile-phone access to measure the teledensity of a country.

A standard definition of teledensity means the number of telephones available per hundred inhabitants of a particular country. Today, teledensity is the basic measure of ICT development as like GDP per capita which shows the economic strength of a country, it is shows the strength of telecom infrastructure to support the ICT infrastructure development. Following sub-indicators are the used to calculated Teledensity in the study.

- (1) Fixed-Telephone in use
- (2) Mobile-Telephone in use
- (3) Total Population

The formula applied to calculate Teledensity in the study is

$$\text{Teledensity} = \frac{\text{Fixed Telephone in use} + \text{Mobile Telephone in use}}{\text{Total Population}} \times 100$$

The ICT Development Index (IDI) is the global benchmark for indicating the level of ICT development of member countries, which has been regularly controlled by the ITU since 2017 after computing 11 sub-indicators based on annual national reports to the ITU by member countries. The International Telecommunication Union has 189 member states under the United Nations. ITU is the official source for worldwide ICT statistics. The International Telecommunication Union is the UN organization responsible for ICTs. The International Telecom Union came up with and made the international ICT Development Index. It has been published every year since 2009. It is a composite index that, until 2017, combined 11 indicators into a single benchmark measure. The International Telecom Union came up with and made the international ICT Development Index. It is used to track and compare the evolution of information and communication technology (ICT) across nations and through time.

The following are the eleven indicators to measure ICT development the status of an economy:

ICT infrastructure and access indicators

- (1) Fixed-telephone subscriptions per 100 inhabitants
- (2) Mobile-cellular telephone subscriptions per 100 inhabitants
- (3) International Internet bandwidth (bit/s) per Internet user
- (4) Percentage of households with a computer
- (5) Percentage of households with Internet access

ICT Usage Indicators

- (6) Percentage of individuals using the Internet
- (7) Fixed-broadband subscriptions per 100 inhabitants
- (8) Active mobile-broadband subscriptions per 100 inhabitants

ICT skills indicators

- (9) Mean years of schooling ratio
- (10) Secondary gross enrollment ratio
- (11) Gross enrolment ratio (secondary and tertiary level)

Furthermore, there is an issue with receiving the quality data from some countries including Myanmar, they used to measure with most estimated data values for some countries for regulating IDI report for the member states. Therefore, it becomes to me to use only IDI index values that regulated by the ITU's for presenting the Myanmar's yearly ICT development status in the next sub-chapters.

Therefore, I will be using two indicators: Teledensity and the ICT Development Index, which are regulated by ITU on an annual basis to measure the ICT development of Myanmar; and Gross Domestic Product (GDP in USD) and Gross Domestic Product Per Capita (GDPP in USD) to measure the country's economic growth, and then will prove the relationship between ICT development and the economic growth of the country.

4.3 Comparison of ICT Development among the ASEAN Countries

Table (4.1) show teledensity and ICT Development Index of ASEAN countries in 2021 according to the Statistical Yearbook of International Telecommunication Union, 2021. There can be noticed that although Myanmar's Teledensity ranking is average, but the ICT Development Index is the second lowest than other countries while the total population of the country is the average among the countries.

Table (4.1) Status of Teledensity and IDI of ASEAN Countries

No.	Country	Fixed-Telephones in uses values	Mobile Phone uses in values	Total Phone Uses	Population	Teledensity per 100 inhabitants	ICT Development Index Value (Regulated by ITU)
1.	Brunie	103,885	536,590	640,475	441,532	145	6.75
2.	Cambodia	55,603	21,086,790	21,142,393	16,946,446	125	3.28
3.	Indonesia	9,662,135	355,620,390	365,282,525	276,361,788	132	4.33
4.	Laos	1,491,000	4,100,000	5,591,000	7,379,358	76	2.91
5.	Malaysia	7,467,900	43,723,600	51,191,500	32,776,195	156	6.38
6.	Myanmar	523,951	78,548,330	79,072,281	54,806,014	144	3
7	Philippines	4,731,196	149,579,410	154,310,606	111,046,910	139	4.67
8.	Singapore	1,891,000	8,444,800	10,335,800	5,453,566	190	8.05
9.	Thailand	5,003,000	116,294,000	121,297,000	69,950,844	173	5.67
10.	Vietnam	3,205,775	138,934,630	142,140,405	98,168,829	145	4.43

Source: ITU, Statistical Yearbook, 2021

Singapore, Thailand, Malaysia, Brunie and Vietnam exceeded the average 144 in telephone density while Laos, Cambodia, Indonesia, Philippines below than average (ITU2021), Myanmar located exactly at the average rate 144. Myanmar is the second lowest IDI is still less than other ASEAN countries, although telecommunication infrastructure is the most fundamental skeleton for ICT development which had been implemented with high momentum and allowed foreign investment in 2014.

4.4 Relationship of GDP and ICT Development

ICT development is important for two reasons. First, it is indispensable to the structure and operation of the modern global economy. Second, it can solve the problems with managing and regulating the ICT industry, which have led to a lot of important economic research that can be used in other parts of the economy. In the last part of the 20th century, ICT became the primary driver of economic development. ICT turns the whole world economy into a single market by lowering transaction costs, increasing productivity, and directly making the economy stronger.

Teledensity and the ICT index are examined in the study as indicators of ICT development that aid in the growth of the country's economy. Analyze the relationship

between ICT development and economic growth using two important teledensity metrics, the ICT Development Index to represent national ICT development and GDP and Per Capita GDP to reflect economic growth, respectively. In this research, descriptive methodology and secondary data from 2013 to 2018 were employed.

4.4.1 Myanmar ICT Development and Economic Growth

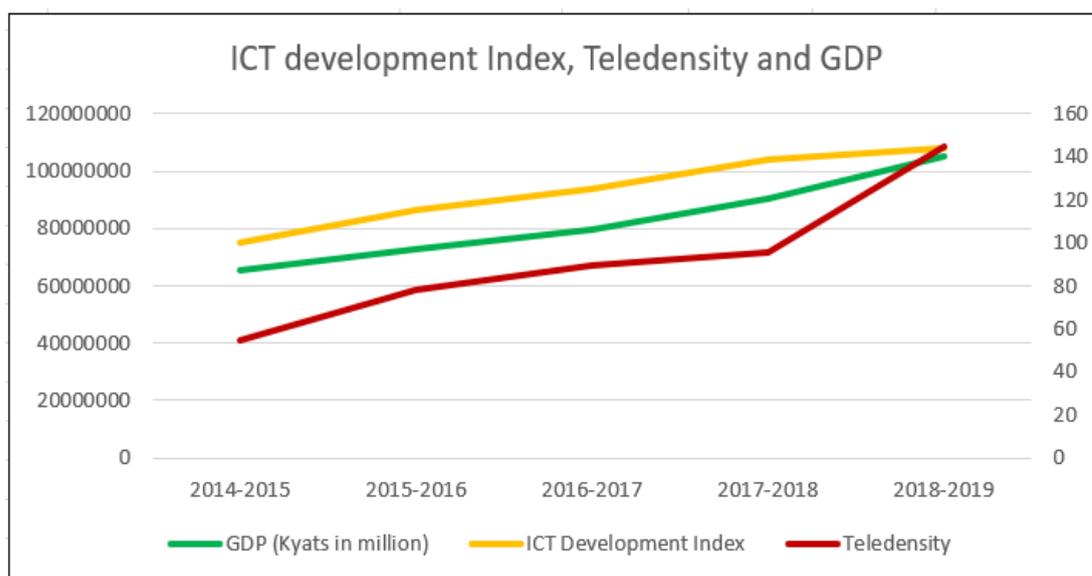
As a result of the International Telecommunication Union's yearly regulation in 2019, Myanmar's ICT Development Index ranks "144" among United Nations member countries based on the values affecting Myanmar's ICT Development Index in the following sub-indicators.

Table (4.2) Improvement of ICT Development Index, Teledensity and GDP

Fiscal Years	ICT Development Index	Teledensity	GDP (Kyats in million)
2013-2014	100	49.53	60261890.2
2014-2015	100	54.57	65261890.2
2015-2016	115	77.8	72714021.2
2016-2017	125	89.817	79760096.5
2017-2018	139	95.365	90450949.1
2018-2019	144	144.362	105258500.8

Source: Teledensity and IDI from ITU and GDP from Myanmar Statical website

Figure (4.2) Improvement of ICT Development Index, Teledensity and GDP



According to Figure (4.2), the Gross Domestic Product increased from 2014-2015 to 2018-2019. Between the fiscal years of 2014-2015 and 2016-2017, it grew considerably, and this trend persisted over the subsequent three years. The quick increase in GDP from 2017-2018 to 2018-2019, when both the teledensity index and the ICT development index rose sharply simultaneously.

The civilian government of Myanmar during the period of 2014-2015, enacted Foreign Direct Investment Law and persuaded FDI. Therefore, it is noticeable that the GDP, teledensity and ICT development increase when the FDI arrive in Myanmar. Correctly implementing the policy promotes the growth of the nation's technology and economy.

The economic growth rate is the change in GDP per capita in percentage.

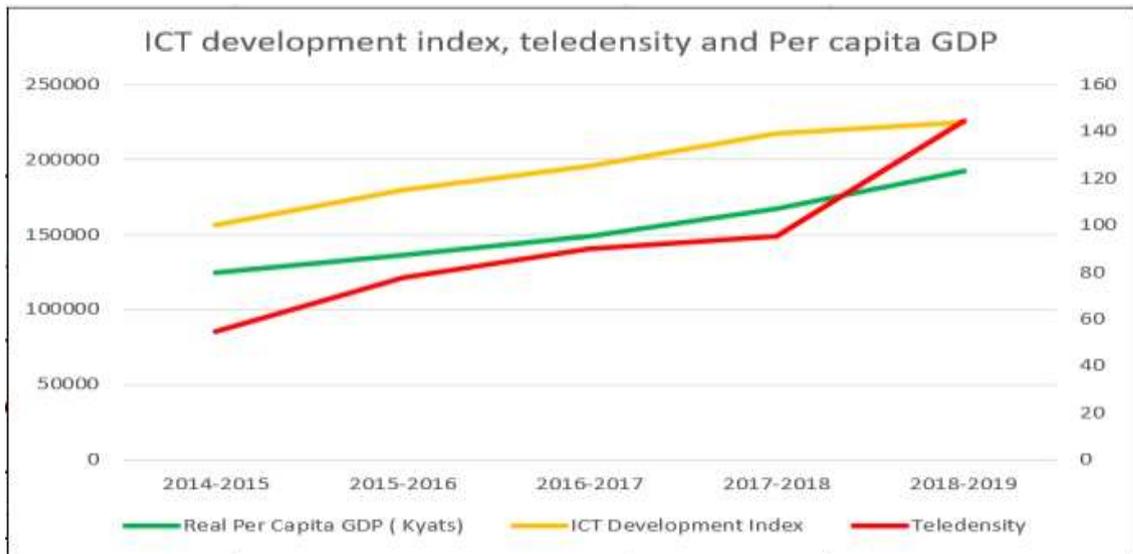
$$\text{Economic Growth rate} = \frac{(\text{GDPPERCAPITA IN CURRENT YEAR} - \text{GDP IN PREVIOUS YEAR})}{\text{GDP IN PREVIOUS YEAR}} \times 100$$

Table (4.3) Improvement of ICT Development Index, Teledensity and Per Capita GDP

Fiscal Years	ICT Development Index	Teledensity	Per Capita GDP (Kyats)	Economic Growth Rate
2013-2014	100	49.53	115265	
2014-2015	100	54.57	124829	9.119676
2015-2016	115	77.8	136213	9.024836
2016-2017	125	89.817	148506	12.69578
2017-2018	139	95.365	167360	14.75621
2018-2019	144	144.362	192056	8.297402

Source: Teledensity and IDI from ITU and GDP from Myanmar Statical website

Figure (4.3) Improvement of ICT Development Index, Teledensity and Per Capita GDP



As per the Figure (4.3), it can be seen that ICT development , teledensity and per capita GDP gradually went up from 2014-15 to 2018-19 and per capita GDP substantially increased in 2014-15 to 2016-17 , then it sharply climbed up for the next year 2018-19 while ICT development index and teledensity rose up for the following five years and was at its highest level in 2018-19 because of the competitiveness of the Internet services provider companies and telecom companies in Myanmar in prices, services and its coverage. The perfect competitive market in the economy under equal rule and regulations make consumers to more affordable to use internet services and telecommunication services. When to the fair prices in the fundamental communication services could reduce the cost of doing business in Myanmar, many foreign cooperation arrived and started business in Myanmar in accordance with the enactment of FDI Law in 2014. The more the domestic and foreign investment in Myanmar, the greater the employment prospects for the inhabitants and the higher the GDP per capita.

Per capita GDP and GDP are expected to decline in the coming years because FDI in Myanmar had to close down and leave the country due to political insecurity for foreigners, and the country has just been placed on the FATF (Financial Action Task Force) blacklist for the discovery of money laundering in Myanmar.

From the Figure (4.4) graph, it can be seen the ICT development indicators (ICT Development Index and Teledensity) and economic indicators, GDP and Per capita GDP exhibited the same trend. As illustrated in the figure, it can be observed that once the ICT development indicators rose, another two economic indicators measured the

economic growth also rose. All of the patterns shown in the figures indicate that there is a relationship between the ICT development and indicators of economic growth throughout the period from 2014-15 to 2018-19.

Table (4.4) Correlation Values (Excel formula) ICT Development Index, Teledensity, Per Capita GDP and Economic Growth Rate

Types of Indexes	Per Capita GDP	Economic Growth Rate
ICT Development Index	0.968	0.463
Teledensity	0.975	0.478

Source: Calculated by the data collection

The level of correlation between the variables being looked at and the values of Table (4.3) in Table (4.4). The results of correlation coefficients are as shown in the table after calculation the correlation of the four variables ICT development index (IDI), teledensity, Per Capita GDP and economic growth rates which can represent the economic growth and ICT development of Myanmar. Table 4.4 provides the correlation values which reveal that a reasonably strong relationship between the ICT development index and Per Capita GDP; and there is also strong relationship between teledensity and Per Capita GDP. However, there has weak relationship between teledensity and economic growth rate. Similarly, a weak relationship is existed between the ICT development index and economic growth rate of Myanmar. The meaning of the Table 4.3 result is that Myanmar's per capita GDP is relatively increasing yearly along with ICT development; however, Myanmar cannot improve its economic growth rate solely through ICT development because there are many other factors that directly affect it, such as peace, the country's economic stability, and the international relationship figure. Furthermore, it implies that the more ICT development, the higher the per capita GDP, and this may lead to the sustainable economic growth in Myanmar.

The Ministry of Communication & Information Technology (MCIT) has set target for the ICT development of the country to reach 82 per cent by the end of 2022 fiscal year. The MCIT is also taking the roles as the policymaker, the regulatory and shareholder in the incumbent fixed-line internet, mobile internet services providers, and the mobile operators to implement its target. The MCIT has issued license to four mobile operators selected from more than 90 applicants. Four mobile operators (Atom, Ooredoo, MPT – a joint venture between the MCIT and KDDI/Sumitomo and Mytel

owned by the Myanmar Economic Cooperation) are currently operational and are expected to spend upwards of US\$7 billion over the next five years to build up their networks. On the other hand, Myanmar is expectedly trying to launch its own satellite before 2028 to protect its spatial sovereignty.

Based on the finding results, there is relationship between the ICT indexes and economic growth in Myanmar, therefore, it is suggested that the MCIT should support mobile network backhaul, satellite services because these are crucial for the development of economic and social sectors such as defense, education, health, banking, mining, agriculture.

CHAPTER V

CONCLUSION

5.1 Findings

As Myanmar utilized the ICT technology could transform government services to citizen and communicate with both individuals and businesses. Technology advancements cannot propel technological growth on their own. Efficiency, openness, and transparency could well-balanced as sub-objectives of the government's fundamental objective. People rural locations should have good internet connections in affordable price , and the government should provide internet access or services to the public on a national scale to shape the balance of development between rural and urban. For the purpose of promoting democracy, the digital assist of e-government will provide people with an additional service. ICT largely benefits literate and healthy people. Adoption of ICT and e-government is more successful at higher levels when government and user organizations have the necessary skills and HR systems to support it. In addition to computer literacy and management support, employee engagement in the implementation is crucial. Information and knowledge have emerged as a fundamental part of economic competitiveness in the new economy, which is backed by revolutionary advancements in ICT technology. The world's ICT infrastructure is evolving minute by minute, and human resource development cannot be realized without appropriate ICT development and its underlying telecom infrastructure. e-value Citizen-centeredness, inclusion, integrated governance, universal access, and the use of new technologies are all parts of government. If a society wants to expand its capabilities, it must adopt ICT in a way that is both effective and efficient for law enforcement and administration.

With the help of UNDP, the first computer arrived in Myanmar in 1971, and the establishment of the University Computer Center (UCC) was the first step for Myanmar's future ICT development. After that, nationwide projects such as the leprosy campaign, the prenatal mortality project, and the country population mobile survey were successfully carried out with the help of computer systems. After that, for the

development of human resources for ICT, UCC was upgraded to the university level, and now there are 28 computer universities in Myanmar. Other private computer centers, such as MCC and KMD, have also contributed a lot to the development of ICT human resources. On the other hand, after the State Peace and Development Council enacted the Myanmar Computer Development Law in 1996, the Myanmar Computer Federation emerge. In accordance with the guidance of the Myanmar Computer Federation, the Myanmar Computer Professional Association, the Myanmar Computer Industrial Association, and the Myanmar Computer Enthusiasts Association were also able to shape the nation's ICT sector with strong connections. The Myanmar ICT Master Plan has also been developed and implemented since 2001, and MCF has been responsible for the roles of organizer and developer for the Myanmar ICT Master Plan. The international network communication system, which is the skeleton of ICT, has recently been installed with AAE-1 (Asia Africa Europe-1), SEA-ME-WE-5 (South East Asia-Middle East-West Europe-5), and SIGMAR (dedicated submarine fiber between Singapore and Myanmar) in 2018. was able to increase the country's total internet bandwidth to 324.10 Gbps. The enactment of the Foreign Investment Law, 2012, and the Telecommunication Law, 2013, has significantly improved FDI in telecom and ICT. Myanmar's mobile internet system has also upgraded from a 2G system to a 4G (4th Generation) or LTE (Long Term Evolution) system. In addition, the previous home internet systems such as ADSL, dial-up, and remote location internet systems have been replaced by mobile internet, FTTH (fiber to the home), and wireless broadband systems. In the past, remote offices were able to replace expensive satellite-based internet services systems such as IPSTAR with cheap internet services such as mobile internet, making it easier to start ICT-based businesses in rural areas. Therefore, starting from 2013, Myanmar's GDP has increased significantly according to the reports of the Myanmar Central Statistical Organization. E-government services such as e-passports, e-visa, smart card , e-billing systems were also successfully adopted by the efforts of the Myanmar e-government steering committee in 2019.

5.2 Suggestion

ICT play an important role in the development process of the country, will surely become indispensable ingredient in all forms and processes of economic activity integrated in all industrial services sectors of the country. As globalization increases and technological change accelerates, the need to speed up and broaden learning and innovation becomes critical. Myanmar society is positioning to take advantage of the ongoing ICT revolution. Development of Myanmar's data communication network such as metropolitan area network, wide area network, regional communication links, and international networks should be more setup and well planned with enough consideration to efficient resource usage and allocation. A strong master plan for the ICT development should be formulated, reflecting the future development of internet traffic after analyzing the geographical density distribution of social and economic activities. Should pay attention to uplift access to the internet and ICT because those are the goal targets under the Goal No. 9 of the UNDP's Sustainable Development Goals. Innovative ICT technologies can improve some important indicators of the ease of doing business, such as starting a business, registering property, and trading across borders, by using innovative ICT technologies such as e-filing, e-registration, and e-commerce. There is a huge gap in ICT literacy and the availability of ICT resources between urban and rural areas of Myanmar. Rural residents are suffering from the digital divide and digital discrimination because of this technological gap. In order to reduce the digital divide, more and more public access centers need to be set up in rural areas. As today is the knowledge age and people are in the life-long learning phase, their capacity-building. The low cost of mobile and broadband internet services makes it easier for more people to use the internet and get involved in the digital age. The Law relating to ICT such as Cyber Security Law should be enacted but is should be done with enough consideration. For example, using the VPN (Virtual Private Network) is used reduce the risk of vulnerabilities of a private network covering privacy of data with high security encryption. This is not crime. The policymaker should have a proper fundamental knowledge before touching a sentence in the law of Cyber Security. Also, it should be noted that Law is the shield not a sword. Therefore, every enacted Law related to ICT such as Cyber Law must protect the citizen rather than banning citizens not to utilize all resources of internet facilities. All administrative procedure should focus on the national posteriority by using the modern technology, e-Government to future building the better environment.

In Computer Universities, there are not enough computers in lab to practice per student, electricity is not being properly supplied to the universities, the cost of using internet bandwidth and electricity is much expensive. Electronic devices including ICT devices cannot work without electricity. Government should be aware to provide good electricity and internet facility in cheap price not just for the students in universities but also for the rest of citizens because any businesses can run smoothly without having electricity . The percentage well trained government staff in technology literacy is very low for most of government departments and technology is always updating by minutes. The situation of ICT development in Myanmar is a gap between the supply and demand of services. The demand for ICT in the country has grown more than the supply since internet and telecom services are no longer regarded as a luxury item but a necessity item. As the emerging technology is for the ease of doing business, Myanmar should also pay attention to implement e-filing system and e-license services for the attractions of foreign direct investment and local investment.

Last but not least, some people are suffering from the cyber violations, cyber breaches and cybercrimes due to the technology misuse, the government should take the leading role to establish a good strategy as national level project to uplift the digital literacy and cyber awareness of the citizens such as Myanmar Computer Professionals Association yearly visited to the rural area for ICT awareness, ICT knowledge and education.

Finally, Myanmar Cyber security Emergency Respond team is being the only one responsible team to prevent and cover all the cyber-attack to Myanmar everywhere from the world, but this is not a good enough solution, being a weak cyber vulnerability that can be exploded, and the country is under cyber risks. Therefore, cyber security sections should be established for every government department and should appoint Chief Cyber Security Officers for all ministries. The results of this study show that ICT as an enabler for long-term economic growth. The adopted policies should mainly target to encourage the people to utilize the benefits of ICT. On the other hand, as the results of the study clearly show that the ICT is positively contribution to economic growth and thus it should be utilized as the important factor in the long-term sustainably growth for the counties that were left behind in the development process likes Myanmar.

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APPENDIX

Universities of Computer Studies in Myanmar

- 1 University of Computer Studies, Yangon
- 2 University of Computer Studies, Mandalay
- 3 University of Computer Studies (Taungoo)
- 4 University of Computer Studies (Sittwe)
- 5 University of Computer Studies (Pyay)
- 6 University of Computer Studies (Hinthada)
- 7 University of Computer Studies (Thaton)
- 8 University of Computer Studies (Dawei)
- 9 University of Computer Studies (Hpa-an)
- 10 University of Computer Studies (Patheingyi)
- 11 University of Computer Studies (Maeik)
- 12 University of Computer Studies (Loikaw)
- 13 University of Computer Studies (Maubin)
- 14 University of Computer Studies (Kyaing Tone)
- 15 University of Computer Studies (Mandalay)
- 16 University of Computer Studies (Lashio)
- 17 University of Computer Studies (Taunggyi)
- 18 University of Computer Studies (Meiktila)
- 19 University of Computer Studies (Monywa)
- 20 University of Computer Studies (Pakokku)
- 21 University of Computer Studies (Banhmaw)
- 22 University of Computer Studies (Pinlon)
- 23 University of Computer Studies (Magway)
- 24 University of Computer Studies (Kalay)
- 25 University of Computer Studies (Myittha)
- 26 University of Information Technology
- 27 Information and Communication Technology Research Centre
- 28 University of Information Technology (MIIT)

Center of Excellences (COEs)

1. University of Information Technology (UIT)
2. University of Computer Studies (Mandalay)
3. Yangon Technological University
4. Mandalay Technological University