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Recent China's Patent Activity and Innovation Capacity

Sungho Rho[1]

Abstract

Recently, patent applications of Chinese innovative entities have been increasing and approved patents have been increasing, so attention has been focused. It shows that China's innovators rapidly increasing their capacity. This study describes the increase in patent activity and investigates the background of increased patent activity in China. The results can be summarized as follows. Firstly, China has evolved into a system in which local governments lead innovation activities with strong motivations and patent activities are increasing around local governments. Secondly, as China has pushed forward indigenous innovation policy and has an innovation system friendly to domestic firms, the patent activity of Chinese firms has far exceeded that of foreign-invested firms in China.

Keywords: *China; Patent Activity; WIPO; Local Government; Indigenous Innovation*

1. Introduction

Recently, patent applications of Chinese innovator have been increasing and approval patents have been increasing, so attention has been focused. According to the World Intellectual Property Organization (WIPO) report in 2019, the China National Intellectual Property Administration (CNIPA) received 55,211 applications for PCT in 2018 alone, the second largest number of patent applications in the world after the U.S. Patent and Trademark Office (USPTO), which received 55,330 applications for PCT. The number of applications for PCT patents by an applicant residing in China to 53,345, the second position after the U.S. with 56,142.

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Until 2016, the number of patent applications for PCT by innovative entities residing in Japan was the second-largest in the world, but the number of patent applications by Chinese innovators exceeded that.

Table1: China's business entities in 2018 Patent application Top 50 business entity

	Change	Corporation	PCT patent application		
			2016	2017	2018
1	0	Huawei Tech. Co. LTD	3692	4024	5405
5	-3	ZTE Corporation	4123	2965	2080
7	0	BOE Tech. Group Co. LTD.	1673	1818	1813
17	23	Guangdong OPPO MOBILE Tele. CORP., LTD.	80	474	1042
28	4	TENCENT TECH. (Shenzhen) CO. LTD.	172	560	661
29	56	SZ DJI TECHNOLOGY CO., LTD	197	241	656
39	-22	Shenzhen CSOT CO., LTD	1163	972	463
49	19	WUHAN CSOT CO., LTD	86	290	395

Source: WIPO PCT Yearly Review (2019, p. 35)

In particular, Chinese firms' patent applications are notable. Huawei was ranked as the world's largest patent-applicant the one the year of 2018, with PCT patents nearly twice as much as No. 2 Mitsubishi. As shown in Table 1, eight Chinese firms were included in the top 50 list of firms with high patent applications from 2016 to 2018. Huawei is ranked second after Panasonic on the list of companies that applied for many patents from 1978 to 2018 (WIPO, 2019).

It shows that China's innovators rapidly increasing their capacity. The "Made in China 2025" plan, announced in 2015, aims to increase the share of R&D spending to manufacturers' sales by 1.26 percent in 2020, 1.68 percent in 2025, and increase the number of inventions per 100 million yuan in manufacturers' sales by 0.7 in 2020 and 1.1 in 2025. To that end, Chinese firms are spending a lot of R&D expenditure to create innovations.

The ultimate goal of the race in these efforts is to enhance China's innovative competitiveness. Such China's goal-setting and actual rise are expected to have a great impact on the global economy. In particular, it can have a great impact on industry and employment in many countries around the world. Therefore, it is worth studying in depth from various points of view on increasing the patent activities of Chinese innovators and enhancing innovation capabilities.

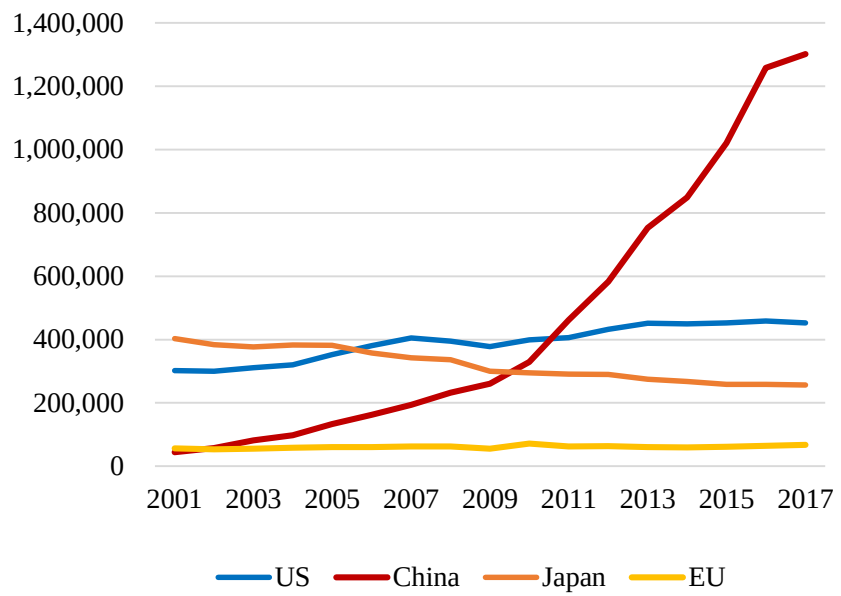
In this background, this paper analyses China's rapidly increasing patent applications and examines whether the use of patent assets by Chinese innovators can be linked to enhancing innovation competitiveness. China has a strong incentive for innovators to acquire internal patent applications, so the phenomenon of increased patent applications and the enhancement of innovative competitiveness may have a weak direct relationship. Section 2 analyzes China's recent patent phenomenon. Section 3 analyzes the transformation of innovation system centered on local government and the motivation of the patent application of local government. Section 4 analyzes the changing status of foreign-invested firms and the increase of innovation capacity of Chinese domestic firms. Section 5 summarizes the analysis results and summarizes the conclusions.

2. China’s recent patent activity increase

Above all, we need to take a closer look at China's growing patent applications. According to Kashcheva, Wunsch-vincent and Zhou (2014), which analyzed China's patent phenomena, Chinese innovators have been very active in acquiring patent applications abroad in the 2000s, especially recently, and the percentage of patent applicants to the Chinese patent authorities has also increased significantly compared to non-residents. Both the number of patents held by innovators residing in abroad registered with the Chinese patent authorities and those held by innovators residing in China are rapidly increasing. However, many of Chinese domestic patent applications are patent for utility models. In addition, while the number of patent applications in China is increasing, the number of overseas patent applicants is concentrated in several firms and institutes (Kroll, 2011; Eberhardt, Helmers and Yu, 2014).

A closer look at the analysis of Santacreu and Zhu (2018) shows that the increase in Chinese patent applications is very noticeable, but in three respects it has different characteristics from those of other developed countries. The first is that for PCT international applications, the patent approval rate is lower than in other developed countries. Based on the 2000-2016 statistics, the approval success rate stood at 23.44 percent, lower than that of Germany at 43.5 percent and the U.S. at 44.93 percent. Second, China's patent applications are mostly focused on utility model patents rather than invention patents (19.3 percent), so their innovation is relatively low. Third, most of China's patent-applicants focus on domestic patent applications and do not obtain patents from foreign countries, with only 4.17 percent of patents filed in China in 2016. Of the patents approved in China, only 6.31 percent have obtained patents in foreign countries. This is a huge difference compared to 48.1 percent of patents obtained in the U.S. that were also obtained in foreign countries. In other words, China's patent application and acquisition activities are competing for the world's top position in terms of quantity, but in terms of content, they have yet to reach the level of advanced countries in the world.

Figure 1: Number of applications received for direct patent by the economy



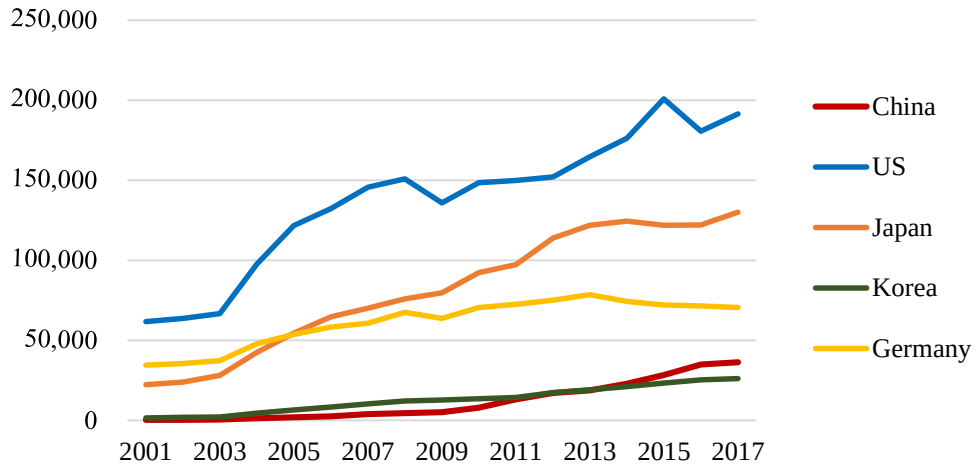
Source: WIPO Data Center

Figure 1 shows the number of patents submitted directly to the patent authorities in the U.S., China, EU and Japan on a yearly basis, except for the number of patent applications entered the national phase with PCT applications. While other economies are showing a stable trend, China has seen its patent applications grow at a very fast pace, with the number dominating other economies.

According to the location of the innovators who applied for the patents, 95.68 percent of the total number of patent applications directly applied to China as of 2017 were innovators residing in China, while 4.31 percent were from non-resident innovators in China. On the other hand, 42.36 percent of non-residential innovators in the U.S. were patent applications for non-residential innovators and 41.21 percent of non-residential innovators in the EU.

These figures show that China's patent applications dominate other economies in the world in terms of the volume of patent activity. Given that the size of China's domestic market is smaller than that of the U.S. and is not much different from Japan, however, one can expect that Chinese innovative players have an incentive to apply for patents other than applying for patents to transfer their innovation performance to the market. It is difficult to explain the exponential increase in patent activity in China alone by intensifying internal market competition in China.

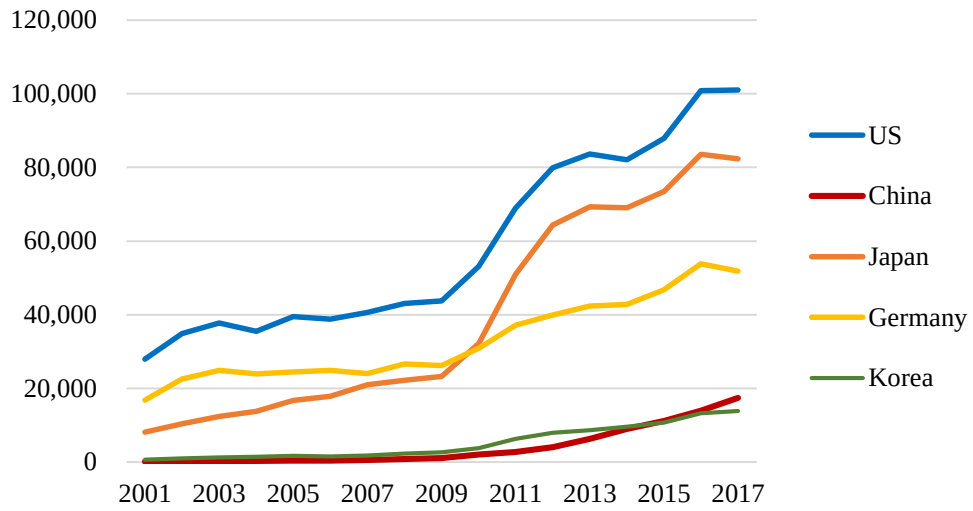
Figure 2: Number of patents aggregated in PCT national phase entries



Source: WIPO Data Center

Figure 2 shows the number of patents aggregated in the national phase-in of designated foreign countries by the location of the innovator after preliminary screening through the PCT procedure. Compared to 191,532 cases in the U.S. as of 2017, there are not many cases in which Chinese-based innovators applied for patents in foreign countries through PCT procedures. It is below Japan and Germany and somewhat more than Korea.

Figure 3: Number of patents grant for PCT national phase entries



Source: WIPO Data Center

This aspect is better illustrated by the classification by location of the innovator whose patent has been granted through the PCT procedure. As seen in Figure 3, there are not many PCT-approved patents that have been applied by Chinese innovators. As of 2017, the number stood at 17,390 compared to 100,979 in the U.S., falling short of one-fifth. So what's behind this patent miss-match phenomenon in China? As to the causes of this phenomenon, Santacreu and Zhu (2018) predict that Chinese innovators have a large incentive to obtain the domestic patent.

3 Increase in patent applications driven by local governments

As can be seen in Figure 1, domestic patent applications in China have increased steadily since the early 2000s and explosively increased after the 2009 global financial crisis as a turning point. Many existing studies have presented detailed explanations about this phenomenon.

First, a fact pointed out as the most important factor in existing studies is that increases in domestic R&D expenditures in China led R&D activities to patent production. Through an analysis, Motohashi (2008) indicates that that patent activities of higher educational institutions linked to the industry have begun to become active from the early 2000s, and Hu and Jefferson (2009) explain that patent applications increased thanks to many incentives given to R&D and patent applications and acquisitions by the Chinese government authorities, and innovator-oriented revisions of patent systems.

Through regression analyses using Chinese domestic patents as a dependent variable, Zhang (2010) explains that increases in activities through R&D expenditures are the primary cause of the increase in patent applications.

Indeed, the increases in R&D activities and patent applications in the early 2000s are related to the changes in the internal innovation system of China (Gu and Lundval, 2006). To join the WTO, the Chinese government authorities reformed the Chinese state-owned planned industrial system into a modern system. The existing system borrowed from the Soviet Union's planned economy system where factories and R&D units were established in a hierarchical form, and resources were allocated according to a budget allocation by industrial sector planned by the central authorities was reformed. The system transition of government-affiliated research institutes made from 1999 to 2001 is important. At that time, most of the 1200 and some more government-affiliated research institutes changed their systems. About 300 were incorporated into other institutions, such as corporations, about 600 were converted into profit-making corporations instead of public institutions, and some were incorporated into colleges. In addition, government subsidies were reduced, and R&D organizations were encouraged to continue R & D activities by winning projects by themselves in the markets. The essence of the reform is the change in the motivation structure for innovators from the system where R & D activities were conducted according to the instructions of the planned economy authorities and demand to a system where R&D activities are driven by market demand. In addition, R & D projects began to be given based on performance so that the motive for innovators to emphasize patent creation as their performance was strengthened.

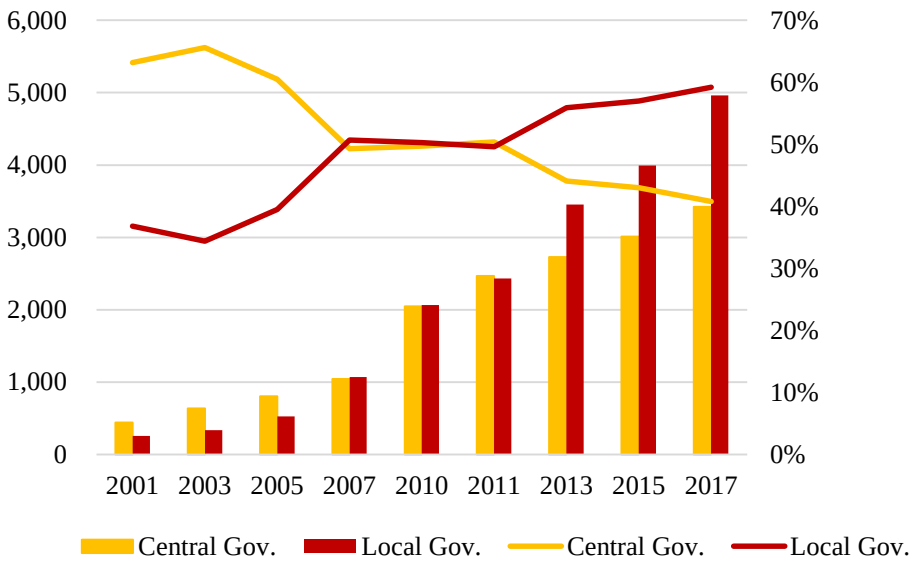
Table 2: Domestic R & D expenditures in China during the period of reform and opening

	1987	1990	1995	2000
Domestic R&D expenditures in China	6.74	12.54	34.87	89.57
The ratio of corporate expenditures (%)	29.3	n.a.	43.7	60.0
The ratio of independent R&D institutes' expenditures (%)	54.7	n.a.	42.1	28.8
The ratio of colleges' expenditures (%)	15.9	n.a.	12.1	8.6

Source: Gu and Lundval (2006, p.16)

This situation was intensified as another motivation structure was strengthened due to the active promotion of development into an innovative country by the Chinese government. After China joined the WTO, Chinese companies faced competition in the international market and technological gaps between Chinese companies and companies in other countries were revealed. To unravel this situation, the Chinese leadership started in October 2005 that it would promote the "The National Medium- and Long-term Scientific and Technological Development Plan 2006~2020" and completed a plan containing concrete action plans in February 2006 through consultation with more than 2,000 experts in various industrial, academic, and research fields. The plan emphasized 'indigenous innovation' (*Zizhu Chuangxin*). China made a policy to increase the capacity of domestic R&D institutes and firsthand support their scientific and technological activities, believing that only through this policy can Chinese domestic companies secure their own core technologies and gain sufficient technological capabilities. The central government, which secured stable tax revenues after the tax reform in 1994 and the entry to the WTO, selected fields for government procurement and support with R&D expenses and promoted support through the 11th Five-Year Plan (2006~2010) and the 12th Five-Year Plan (2011~2015).

Figure 4: Central and local government expenditures in science and technology spending



Source: Ministry of Science and Technology of PRC, http://www.most.gov.cn/kjtj/

As Chinese local governments actively participated in the Chinese central leadership's plan as such, R & D and patent activities explosively increased in China. Gu, Serger and Lundval (2016) analyze that the Chinese innovation system is evolving with a characteristic of increases in R&D expenditures centered on local governments. This phenomenon becomes clearer in reviewing Figure 4. Local governments' science and technology spending increased more rapidly than central governments' science and technology spending. Local governments' science and technology spending in 2017 was 20 times that in 2001. The proportion of local governments' science and technology spending became clearly higher than that of central governments' science and technology spending since 2006 and became even higher in Xi Jinping's regime since 2013.

Along with the increase in local governments' R&D expenditures, the patent activities of local innovators surged. Among studies that well illustrate the mechanism in which the effort to create patents centered on local governments affected the motivation structure for innovators is a study conducted by Li (2012). Li (2012) argues that the phenomenon of increases in patent applications in China cannot be fully explained without considering changes in the institutional patent activity encouragement systems of

Chinese local governments such as R&D subsidies and tax cuts. He argues that most decisively, the causes of the sudden increase in patent applications to the US Patent Office (USPTO) and the EU Patent Office (EPO) by Chinese innovators, and the expansion of regional imbalances in patent applications, can be explained only through the factor of local government's patent activity incentive systems. The Shanghai local government prepared and began to operate a fund to subsidize costs necessary to apply, register, and maintain patents for the first time in 1999 and the Beijing, Guangdong, Tianjin, Jiangsu, and Chongqing local governments raised funds and began to operate similar systems in 2000.

Table 3: Provincial governments' operation of patent subsidy systems aggregated by 2008

Year	Local government	Accumulated Number
1999	Shanghai	1
2000	Beijing, Tianjin, Guangdong, Jiangsu, Chongqing	6
2001	Zhejiang, Heilongjiang, Guangxi, Hainan, Sichuan, Shanxi	12
2002	Fujian, Jiangxi, Henan, Guizhou, Neimenggu, Xinjiang	18
2003	Shanxi, Anhui, Shandong, Yunnan, Tibet	23
2004	Jilin, Hunan	25
2005	Hebei, Qinghai	27
2006	Liaoning	28
2007	Ningxia	29

Source: Li (2012, p. 248)

Although the sizes of funds and the levels of subsidies operated by individual provincial-level local governments depended on the availability of finances of the local governments, local governments began to competitively raise and operate such funds. For example, Shanghai operated a fund of RMB one million at the beginning, while Chongqing operated a fund of about RMB200,000. These funds subsidized companies located or

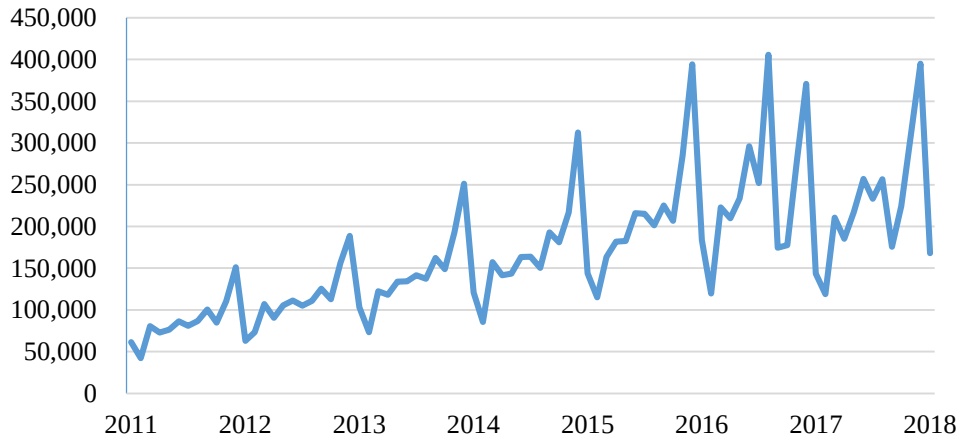
individuals residing in areas under the jurisdiction of the local governments without discriminating between companies and individuals. In addition, it is said that subsidies for overseas patent applications were commonly large. These subsidies were paid based on the number of cases regardless of technology areas. Therefore, the motives for the patent activities of innovators in China increased significantly. Once patent activities had begun, knowledge of patent applications and approval procedures was accumulated, and as this knowledge was diffused, and specialized, regional patent capacities were enhanced. According to Li (2012), the approval rate of overseas patent applications has increased since the changes in local governments' systems as such, and the quality of patents was improved.

There is a study, which indicated that there was political motivation mechanism for such local government-led patent activities based on the analysis. As examined earlier, local governments took the lead in increasing R&D expenditures and motivating patent activities to enhance the innovation capacity of innovators in areas under their jurisdiction. In the background of these efforts to improve the system was competition among local government leaders for political promotion. Lei, Sun and Wright (2014) analyze the motives as such thorough analysis of Chinese domestic patent application data from 1986 to 2007.

Fundamentally, it is said that political leaders in local Chinese governments have a tenure of three years and they have a motive to encourage patent activities because the innovation performance of areas under their jurisdiction in the tenure may be reflected on their individual evaluation indexes. Although no clear document on the evaluation criteria for Chinese political leaders has been secured, the foregoing can be confirmed through various pieces of anecdotal evidence such as public notices advertising that a yearly quota of patent applications was achieved earlier posted by some administrative units or disclosed documents delivering evaluation policies from some administrative units to cities under their jurisdiction for example. Lei, Sun and Wright (2014) indicate based on analysis that such pieces of news are mainly published in the online news sections of local governments and since they are usually good pieces of news, quotas and goals regarding patent applications implicitly existed in China.

Lei, Sun and Wright (2014) also suggest seasonal trends of patent applications as a basis of the analysis as such. The data from 1986 to 2007 after the enactment of the Chinese patent law in 1985 showed a phenomenon in which the number of patent applications in December was consistently larger than that in other months. This is attributed to the fact that the patent applications allocated to local governments in China are evaluated in January. Indeed, a document of Guangxi Zhuang Autonomous Region dated November 25, 2011, was delivering a policy to evaluate the situations of patent applications of cities under the jurisdiction of the regional government in January. Lei, Sun and Wright (2014) reported that for this reason, situations, where existing patents were divided into 'small' patent applications or patents, are quantitatively increased in the form of co-applicant patents by linking with patent inventors in other areas in order to fill the quotas and exceed their targets were observed from innovators in December. Although patents in December do show a tendency to be qualitatively low because the number of citations of patents in December is not smaller than that of patents in other months, the analysis indicates that more characteristic increases in the number of patents are observed in December for the above-written reason. Since the analysis by Lei, Sun and Wright (2014) was conducted with data until 2007, recent trends were analyzed, and the results were similar as can be seen in Figure 5.

Figure 5: Monthly numbers of applications for domestic patents of invention in China



Source: CNIPA Data Center

Patent applications showed a pattern of consistent increases in December and decreases in January. This pattern appeared identically over many recent years, except for August 2016. In 2016, since the number of patent applications in August was relatively large, the numbers of patent applications in other months, especially in January were small. Patent applications in 2018 and 2019 were not included in the analysis, considering the possibility of high ratios of patents not yet published after filing. Chinese patents can be published when one year and six months has passed after filing. The trend shows that patent applications are increasing and it can be regarded that the motivation mechanism for Chinese innovators has not yet been changed very much.

Local governments can inject funds into related local banks or state-owned enterprises with tax revenues secured through real estate development, etc. and the relevant local banks or state-owned enterprises became to have motives to allocate resources more intensively to those enterprises and industries that can play roles in the management of allocated goals of local governments such as the number of patent applications. Universities and research institutes also become to have motives for active development of patent activities to receive benefits from R&D project funds operated by local governments. Through this mechanism, local governments induce innovators in areas under their jurisdiction to strengthen their capacity for innovation through patent creation.

4. Amendment of Chinese patent law and patent activities of FIEs/Chinese firms

Based on the analysis, existing studies indicate that behind the phenomenon of increases in domestic patent applications in China are increases in the patent activities of the foreign-invested enterprise (FIE) following the increase in FDI and the patent activities of domestic firms in China intended to compete with the FIEs. Motohashi (2008) states that in the early 2000s, non-residents' patent applications by Japanese companies accounted for a large proportion of domestic patent applications in China. Hu and Jefferson (2009) explain that patent applications increased thanks to the revision of the patent system and that in relation to the foregoing, the patent activities of enterprises with foreign capitals, which have implemented FDI, account for a large portion. Zhang (2010) also indicates that the second revision of the

patent law made in 2000 and the patent activities of FIEs thanks to the inflow of FDI are the cause of the increase in patent applications in China.

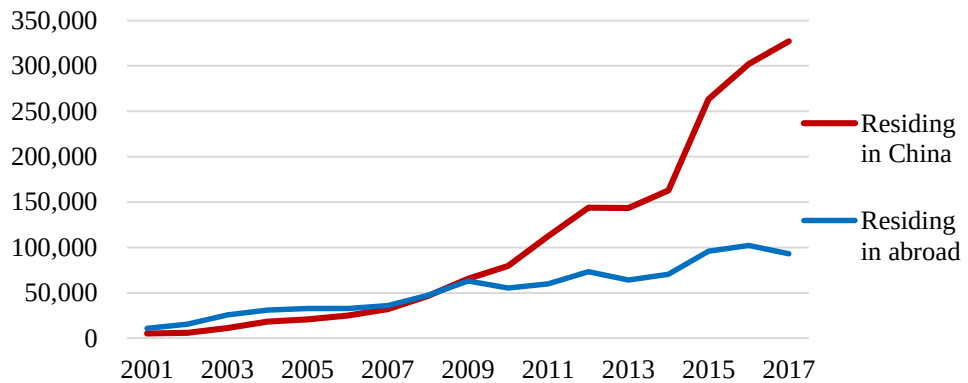
In particular, the second revision of the Chinese patent law made in 2000 is very important. Eun (2004) well outlined the meaning of the second revision of the Chinese patent law, indicating that before joining the WTO, China was requested to have an intellectual property system coincides with the Agreement on Trade-Related Aspects of Intellectual Property Rights (TRIPs) and enforced the revision of the Chinese patent law from July 2000. Importantly, the revision raised the level of protection of patents by stipulating not only the sale of patent-related products but also the act of offering of sales without the patent holder's permission as acts of infringing patents. In addition, the revision stipulated that compensation for patent infringement should be calculated by multiplying the comprehensive amount including not only the loss of profits of the patent holder but also the gains illegally obtained by the infringer and the royalties under the contract license. In addition, the revision enabled preliminary injunctions against potential acts of infringing patents by court order before the action against infringement of the patent by the patent holder. Furthermore, the revision restricts the compulsory licensing of dependent patents to a stricter situation than before. As the Chinese patent law promised to protect and enforce patents at the international level, it became easier for FIEs that implement FDIs in the Chinese market to exclusively possess technologies through the patents.

In addition, the patent law revised in 2000 simplified the procedure for patent applications by FIEs and Chinese firms located in foreign countries. When innovators located in foreign countries apply for Chinese patents, they were not required to submit documents or investigation reports obtained during patent examination in third countries. In addition, the provision that required Chinese innovators to get the permission of the relevant authorities when they for foreign patents was deleted. These measures lowered the threshold for patent applications so that innovators can more freely engage in patent activities and helped the Chinese innovation system evolve into a system where knowledge flows faster and more efficiently through open information.

Thanks to the background as such, Chinese patent applications by FIEs increased sharply from the early 2000s after China entered into the WTO. Through empirical analysis, Hu and Jefferson (2009) found that the patent activities of FIEs showed a tendency to significantly increase since 1999. Interestingly, in this analysis, the correlation between R&D activities and patent activities was not high in the case of FIEs while being very high in the case of Chinese firms. It can be judged that in the case of FIEs, innovation outcomes obtained in the countries where the head offices are located were introduced into China or the results of localization through application and development were utilized in patent activities in China. FIEs, that is, the China branches of multinational corporations played a role of applying and using head offices' patents in China.

Therefore, in the early days, the correlation between R&D and patent applications of FIEs was lower than that of Chinese firms that directly connected R&D activities to patent applications. As can be seen in Figure 6, among the patents approved in China from the early to the mid-2000s, the number of those that were applied by foreign innovators was larger than the number of those applied by Chinese innovators. In 2002, 5,868 patents were granted to applicants who reside in China and 15,389 patents, which are more than two times of the foregoing, were granted to applicants residing in abroad. For this reason, most research papers that analyzed innovation in China in the early 2000s evaluate that most of the important innovations in China were made by FIEs, and take notice of the fact that the ratio of applied research and development research in China was high.

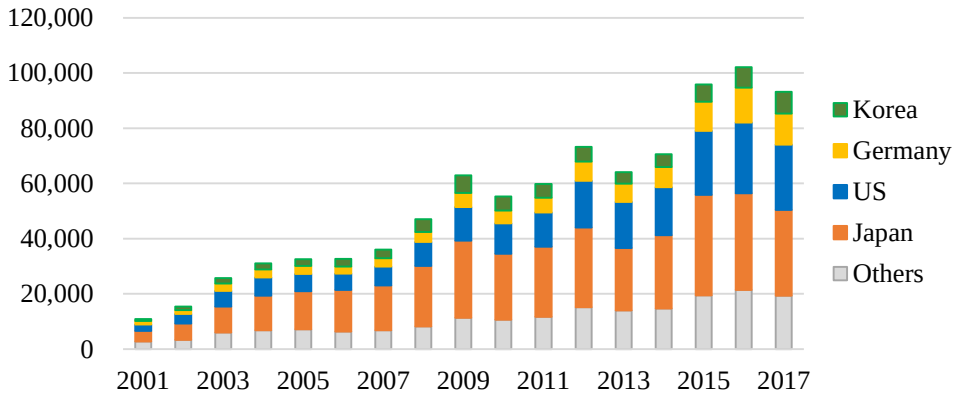
Figure 6: The number of patents approved in China divided by the patent applicants



Source: WIPO Data Center

Among FIEs, especially Japanese enterprises filed many patents. Japan was equipped with an advanced intellectual property right system early on and innovators accustomed to exclusive possession of technologies through patents have been developing in Japan (Motohashi, 2008). In the Chinese market, which was opened due to the entry into the WTO, too, the foregoing Japanese innovators began the effort to hold a dominant position in competition by preoccupying patents early on. As can be seen in Figure 7, even until recently, among applicants residing in foreign countries that filed patents in China, those located in Japan accounted for the largest part of patent activities. Innovators residing in Japan have occupied more than 30% of patents granted to applicants residing in foreign countries and occupied 46.69% in 2008 followed by innovators residing in the US and Germany. Innovators located in South Korea also received many patents in China utilize the patents in China.

Figure 7: Ratios of major countries in patents filed by innovators granted by China



Source: WIPO Data Center

In the early-mid 2000s, patent activities in China were mainly conducted by innovators located in abroad, especially by FIEs, but according to analysis in studies, such patent activities diffused innovation and promoted Chinese innovators' patent activities. According to an analysis by Hu and Jefferson (2009), patent applications tended to increase more in industries with higher ratios of FIEs. It means that Chinese innovators could not but actively conduct patent activities to compete with FIEs. In addition, technologies were diffused while FIEs were cooperating with Chinese companies to enter the Chinese market, and the outcomes appeared as patents.

The industrial fields where FIEs enter the Chinese market are those in which market demand grows rapidly in China and, naturally, patent activities are actively conducted in such fields. However, many studies still point out that such increases in Chinese patent activities did not imply the capacity building of Chinese innovators (Shao, 2011).

Recently, however, opinions that the capacity for innovation of Chinese innovator should be reevaluated have been increasing (Atkinson and Foote, 2019). As mentioned earlier, competition for innovation in the Chinese market has been intensified through the 2006 indigenous innovation strategy and the 2008 global financial crisis and the result appeared as increases in the patent activities of Chinese innovators as shown in Figure 6. As of 2001, the number of patents granted to innovators located in China and the number of patents granted to innovators located in foreign countries was 5,395 vs. 10,901. Therefore, the innovation capacity of overseas innovators was clearly superior, and this was the case with for the qualitative aspect too. However, in 2017, this trend reversed drastically, and the number of patents granted to innovators located in China was 326,970, which was more than three times the number of patents granted to innovators located foreign countries at 93,174. The strengthening of the innovation capacity of Chinese innovators appearing as patent activities are worth noticing.

In the background of this phenomenon was institutional support that helped domestic innovators secure the capacity for innovation. The third revision of the patent law in 2008 also a great effect. According to Eun (2012), whereas the primary purpose of the second revision of the patent law in 2000 was to protect the patent rights of FIEs, the primary aim of the third revision of the patent law in 2008 was to strengthen patent protection and the capacity for innovation of Chinese domestic innovators. An important fact in this regard is that the revision strengthened the novelty requirements so that overseas innovators release higher-level technologies in China first and forces that patents for inventions completed in China should be filed in China first to enhance the overall technological level of the Chinese market and strengthen the capacity for innovation of Chinese innovators. Instead, the patent law was revised to clarify the right to share patents and make a system that facilitates the transfer of patents thereby strengthening patent protection and enhancing the motives of innovators for patent activities.

Meanwhile, to strengthen the competitiveness of Chinese firms, systems to restrict the access of enterprises with foreign capital to the Chinese market access were also established. For instance, the Chinese government procurement law, which had been drafted since 2007, states that products ordered by the Chinese government with government procurement funds must include at least a certain percentage of 'indigenous innovation' products and that if not, the approval of the fund will be cancelled. That is, the law made purchases from domestic companies in China mandatory. In addition, the system that requires FIEs to disclose their technologies as a condition for them to access the Chinese market has been organized from this time. For instance, according to the bill for revision of the Chinese patent law, which was drafted in 2009, enterprises with foreign capital had to disclose the contents of technologies obligatorily for the technologies to become standard technologies of China. This system was driven more strongly in the IT industry. Only Chinese citizens or corporations can enter the markets of national security-related information infrastructure-related products and in the case of such products, technical information had to be disclosed in the process of China Compulsory Certification (Ernst, 2011). The enforcement of such a system has the effect of promoting the transfer and diffusion of foreign technologies into China. FIEs had to calculate the profits and risks of entering the Chinese market and technology disclosure.

Whereas the motives for patent activities of FIEs were daunted as their access to the Chinese market was restricted, the patent activities of Chinese innovators became more active as their capacity for innovation was strengthened. In particular, the strengthening of the capacity for innovation of Chinese firms was outstanding and the reasons can be illuminated from various angles. First, Chinese firms have expanded their cooperation with FIEs to cultivate their own technological capabilities. Most notably, Gao (2014) concretely describes the process through which Chinese firms secure their independent capacity for innovation through cooperation with FIEs. A state-owned company Datang signed an agreement with Siemens in 2001 and began joint development of TD-SCDMA technology, the third-generation mobile communications standard. Among FIEs, only Siemens was interested in TD-SCDMA and another team of China was developing WCDMA technology jointly with Ericsson.

However, since securing independent communication standard technologies can technology monopoly and high-price policies in the Chinese market of FIEs and reduce royalty expenditures, Datang concentrated on the technology in which FIEs were not much interested so that Chinese mobile communication firms organized a consortium and jointly developed technical standards. Through joint development, Siemens owned 21.6% and 21.2% of patents related to TDD and SCDMA technology in 2006, respectively, while Datang secured 12.2% and 15.2%, respectively. In this process, however, Datang acquired know-how in the application and acquisition of standard patents, and this capacity for innovation was exerted completely in the development of 4G and 5G communication technology standards thereafter. Huawei has also participated in the TDS-CDMA technology development network since 2003 and signed a contract with Siemens to carry out joint research. In this process, Huawei secured a lot of know-how. That is, technologies were transferred and diffused. Knowledge is created not in the simple process of citation of patents but in the process of in-depth joint development and as a result, innovators in late coming countries can obtain the know-how of developed countries. As the Chinese market expanded, the foregoing occurred in many industries. In industries such as high-speed railway and power generation facilities, Chinese companies have collaborated with FIEs to produce patents and secure the capacity for innovation capacity thereby rising to world-class levels.

Second, Chinese firms secured patent rights and technologies through active mergers and acquisitions of foreign companies. As the Western economy lost its growth engine during the time of the global financial crisis, China's share in the global economy has expanded dramatically. China has been able to secure a large number of foreign exchange reserves by maintaining solid growth even in the financial crisis through trade surpluses and managed such foreign exchange reserves strategically. Representatively, the Chinese government actively encouraged institutionally, companies to invest in foreign companies that would enable them to enhance their capacity for innovation, which is called ‘going global’ (Zǒu chūqù). ‘going global’ was mainly composed of strategic investments to secure resources as an axis, and there were many cases of mergers and acquisitions of overseas brands, but the ratio of investments to secure technologies was also high.

As a representative example, in 2010, Geely Automobile Holdings Limited of China got loans from the Bank of China and the Export-Import Bank of China to acquire Volvo, Sweden thereby upgrade its technological capabilities one level further. In 2015, when the enthusiasm for mergers and acquisitions was the highest, Sany Heavy Industries got loans from CITIC Bank to acquire Putzmeister in Germany. That is, it was a strategic step supported by the government. In 2017, a Chinese state-owned chemical company, ChemChina completed the acquisition of the Swiss seed company Syngenta to secure the ownership of seed and pesticide technologies. Syngenta is a company that has massive grain genetic information and plant variety protection rights (patent rights) in the world. Through mergers and acquisitions of enterprises, China is securing the time to advance innovation and building the capacity to produce new patents.

Table 4: Recent trend of overseas mergers and acquisitions of China

	2014	2015	2016	2017	2018
Overseas M&A(100 million dollars)	521	574	2,105	1,224	941
The ratio of overseas M&A FDI(%)	42.3	39.4	107.3	77.3	72.5

Source: China Specialist Forum https://csf.kiep.go.kr/home/M000000000/index.do

In this background, the situation where innovation in China had been led by FIEs was completely changed into a situation where innovation was led by Chinese domestic firms. As the capacity for R&D of enterprises that have been leading the world begins to be exerted in response to the demands of Chinese innovators, the capacity for innovation of Chinese innovators is being strengthened. The market share and competitiveness of Chinese innovators in individual industrial fields are strengthened.

5. Summary and Concluding Remark

Although it is difficult to demonstrate the direct correlation between patent activity and innovation capacity for several reasons, the following conclusions can be drawn up. First of all, the increase in patent applications in China is taking place faster than the growth in innovation capacity of Chinese innovators.

Local governments have a micro-motivation to encourage patent activities by innovators residing in their regions. Such patent activities are showing a trend of growing beyond the pace of China's growth in the international market. Secondly, the Chinese central government's institutions and policies have led to a greater incentive for domestic innovators to engage in patent activities than foreign-invested firms. Because of this, patents are increasing faster than Chinese firms' innovative competitiveness in foreign-invested firms in the Chinese market. Chinese innovators have collaborated with foreign-invested firms to produce knowledge through joint research and development, and more recently, mergers and acquisitions of foreign firms have been carried out aggressively to secure patents and knowledge in a short period of time.

In China, the improvement of innovation capabilities is unevenly achieved in certain industries and the diffusion effect of technology is limited. However, it is certainly observable that the increasing innovation capacity of Chinese firms in several industries is being enhanced. According to Atkinson and Foote (2019), China is on a level where it can create its own innovative performance and lead the global market beyond the steps of introducing foreign technologies through FDI and licensing and spreading them to other industries. For example, the three Chinese smartphone makers, Huawei, Xiaomi and Oppo, account for 32 percent of the global market, which was tallied from the fourth quarter of 2009 to the fourth quarter of 2018. BOE's Hefei LCD plant runs a highly automated plant, producing 10.5G world's largest standard LCD products. COMAC, a state-owned company in China, succeeded in a test flight of the 190-seat C919 and is beginning production. The plane will be delivered in 2021 and put on the official route. DJI is the world's largest producer of drones and has the largest share in the global market. Accordingly, it is expected that patent activities of Chinese innovators, especially firms, will become more active in the future. In particular, in the case of the ICT industry, both patent activities and innovation capacity of Chinese firms are rapidly increasing.

However, efforts by Chinese innovators, especially firms, to enhance their innovative capabilities are likely to face difficulties in the future. The U.S., Europe, Japan and other Western countries are nervous about the rise of China's innovators and are keeping China in check through various measures. In particular, the U.S. is blocking firms such as Huawei and DJI

from entering the U.S. market for their own security, and also restricts U.S. firms from cooperating with these firms. Germany has also lowered the criteria for government review when they receive overseas investment, prompting the government to impose restrictions on Chinese firms from increasing overseas mergers and acquisitions for their technology firms. In line with this global trend, Chinese innovators have become increasingly dependent on their own capabilities to continue their innovation. In particular, if the U.S.-China conflict is not resolved smoothly, China will face the problem of reducing direct foreign investment due to tariff barriers and securing foreign currency reserves to stabilize the yuan. Failure to solve this problem will damage the mechanism of capacity development of Chinese innovators discussed in this paper. In addition, if local governments fail to upgrade their industrial structure, they will face a vicious cycle of worsening financial difficulties and weakening innovative competitiveness.

Thus, it is necessary to take a close look at the Chinese central government's innovation strategy. The Chinese government avoids friction with foreign countries and innovates through internal institutional improvements. In relation to patent activities and innovation capabilities, the Chinese patent trading market system is being improved. This is aimed at enhancing the utilization of patents produced so that they can be linked to industrial innovation and contribute to enhancing national competitiveness. China is pushing for reform of the system bypassing the fourth revision of the Patent Law, which began in earnest in 2014, at the National People's Congress in December 2018. It established and operated a court specializing in intellectual property rights, and established a system to better protect intellectual property rights by reorganizing the organization of the State Intellectual Property Bureau. It is also pushing for a punitive compensation system for infringement of intellectual property rights. The technology trading market is also continuing to expand its size. The Foreign Investment Law, which will go into effect in 2020, also emphasizes the protection of intellectual property in foreign-invested firms to encourage foreign-invested firms to introduce high-level technologies in the Chinese market.

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Regional Integration and Its Impact on Tourism Industry: with special reference to Indonesia

Hashan Wijesinghe[1]

Abstract

Regional integration has been identified as one of the main strategies which are often used to solve common political, economic, scientific and socio-cultural issues faced by countries in a particular geographical area. Regional economic cooperation occurs in various forms and degrees and is in general aimed at increasing cross border linkages and deepening interpenetration of economic activity for the mutual benefit of economies within a geographic region. Looking at the world tourism industry, according to the World Tourism Organization, 2016 was a momentous year for tourism where international tourist arrivals continued their upward trajectory in their seventh straight year of above-average growth. Against this backdrop, the main objective of the study would be to understand the relationship and impact of regional integration on the tourism industry of a given state with special reference to Indonesia. Here the study has focused on the progress and status of intra-regional tourism in ASEAN and its impact on Indonesia. This study is an exploratory case study of Indonesia's tourism sector. The data is collected through secondary sources including annual reports, magazines, journal articles etc. The study has found, over the last 5-10 years the tourism industry in Indonesia has shown an upward trend and that continued success was mainly due to tourist arrivals from the ASEAN region. Intra-regional tourism has made a significant contribution to the tourism sector of Indonesia. Strengthened regional ties have given Indonesia the advantage of diversifying its tourism industry as well. The study finds an interdependent relationship between regionalism and tourism sector.

Keywords: *ASEAN, Indonesia, regional integration, tourism*

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1. Introduction and Research Problem

Regional cooperation and integration have occupied greater prominence in contemporary world politics. Especially since 1945, the number of regional groupings or organizations grew significantly. During the cold war period, most of the regional groupings were formed as security or defense alliances, but with the passage of time, particularly during the post-cold war period, economic interests began to define the scope and direction of these regional groupings. According to the United Nations Development Programme (UNDP), the term "integration" signals a process that is considerably broader than simply eliminating barriers to trade in goods and services between countries. Integration can also encompass harmonizing standards and regulatory frameworks; reducing restrictions on financial capital and labour mobility; adopting common approaches to fiscal and monetary policy; promoting peace and conflict prevention; and pooling investment in cross border infrastructure for transport, power and communication (UNDP, 2011, p.09). Regional cooperation has been identified as one of the main strategies which have been often used to solve common political, economic, and socio-cultural issues faced by countries in a particular geographical area. According to Chowdhury & Mamta (2005, p.24) cooperation among neighbours not only strengthen the economic and financial sectors via optimal utilization of natural and human resources but also enhances greater political stability and social-cultural cooperation between member nations.

On the other hand, over the years, the tourism industry has grown in an unprecedented manner.

According to the World Tourism Organization, in 2016 international tourist arrivals grew for the seventh consecutive year to reach 1.2 billion, a sequence of uninterrupted growth not recorded since the 1960s (UNWTO, 2016, p.11). Association of Southeast Asian Nations (ASEAN) created initially for security (Guan, 2004, p.04), is arguably the most durable and successful regional association in the developing world (Hill & Mennon, 2010, p. 01). Looking at the current status of ASEAN, it is obvious that it has come a long way since its inception in 1967. Today, ASEAN has become a powerhouse in world politics.

From an economic perspective, the rapid growth of regionalism has paved way for improved intra-regional trade, investment and tourism. When it comes to travel and tourism, regionalism encourages people to travel more to their neighbouring countries.

As far as Southeast is concerned, Southeast Asia has a rich and diverse set of natural and tangible and intangible cultural tourism resources located in both rural and urban areas under the ASEAN Economic community pillar, tourism is one of the priority sectors for integration (ASEAN, 2015, p.01). Looking at Indonesia in ASEAN, it is generally accepted as the de facto leader of ASEAN regardless of where the chairmanship may lie (Haan, 2017). Given its geographical location and size and economic strength, Indonesia, since the inception of ASEAN, continued to play a vital role in promoting regional cooperation and integration.

Despite a large number of studies undertaken on regional cooperation and tourism industry, not much research has been done with regard to understanding the impact of regional integration on the tourism industry. Thus, this research attempts to contribute to filling this vacuum. Given the inadequacy of research on importance of regional integration in promoting tourism industry for a country, this particular study shall attempt to figure out how important regional integration is in promoting the tourism industry of a country, with special reference to Indonesia. The main rationale behind choosing Indonesia is multidimensional. First, as foretold, Indonesia, being one of the founding fathers of ASEAN, has been playing an important role within the ASEAN since its inception. Secondly, the tourism industry remains one of the main contributors to the national economy of Indonesia, and finally, Indonesia gives so much importance to promoting intra-regional tourism.

1.1 Objectives of the study

The main objective of this study is to examine the role of regional integration in promoting the tourism industry, with special reference to Indonesia. Apart from this, the study also has two sub-themes given as follows.

- Understand the nature and scope of Tourism in Indonesia.
- To evaluate the importance of promoting intra-regional tourism.

1.2 Scope and Significance of the Study

As explained earlier, despite the overwhelming success countries have able to achieve through regional cooperation and looking at the progress world tourism industry has able to achieve, there is a clear inadequacy in research on the significance of intra-regional tourism. Taking as a whole, while, so much of studies have been carried out on regional integration, most of those studies have focused on intra-regional trade and investment. However, tourism certainly plays a vital role in almost all economies. Thus, it is so important to study this aspect of regional cooperation. This particular study focuses on ASEAN integration and how integration affects the tourism industry of Indonesia. What ASEAN has achieved so far is a very good example to show what regionalism can do for the developing world. As noted before, today ASEAN remains the most successful regional grouping in the developing world. Looking at some statistics, the volume of intra-regional trade as a percentage of total trade in Southeast Asia in 2017 stood 22.92%, while intra-ASEAN investments in the same year achieved a staggering number of US$ 26,975 million (ASEAN Secretariat,2017). Moreover, ASEAN has already launched several programmes to promote tourism in Southeast Asia. Against this backdrop, this study looks into the impact of the growing level of regionalism on the tourism industry of Indonesia. As explained earlier, given Indonesia's role in ASEAN, and importance given by the country in promoting its tourism industry, a case study of Indonesia would better capture the impact of regional cooperation and integration intra-regional tourism. The study will focus on the nature of tourist arrivals to Indonesia, the importance of intra-regional tourism to Indonesia and how Indonesia accommodate intra-regional tourism in their tourism industry.

2. Literature Review

Today regional cooperation is no longer a new phenomenon. While forms of the regional theory were already in existence, a specific study of the phenomenon began with a focus on Europe in the early 1950s, shortly after the end of the World War 2 (Kolovos, 2001, p.03). During the post Second World War era, countries began to comprehend the importance of regionalism and began to work collectively as a region. This gave birth to several regional organizations, which includes the European Union, ASEAN,

South Asian Association for Regional Cooperation (SAARC), African Union etc. According to the UNDP, the process of regional economic integration can have significant effects on human development (UNDP, 2011, p.09). The term "integration" signals a process that is considerably broader than simply eliminating barriers to trade in goods and services between countries. Integration can also encompass harmonizing standards and regulatory frameworks; reducing restrictions on financial capital and labour mobility; adopting common approaches to fiscal and monetary policy; promoting peace and conflict prevention; and pooling investment in cross border infrastructure for transport, power and communication (ibid). As far as ASEAN is concerned, ASEAN's creation was initially for security (Guan, 2004, p.70). In a region that had been plagued by conflict and divided by a diverse colonial past, ASEAN has first and foremost forged diplomatic cohesion among its population (Hill & Menon, 2010, p.01). With regard to Indonesia's role in ASEAN's formation, there are contradictions in the literature. According to Guan (2004), ASEAN was formed to constraint Indonesia. As *Konfrontasi* (confrontation) was a clear indication of Indonesia's powerful military might that stands to destabilize the region, the establishment of ASEAN was a direct response to the intra-regional stimulus of Sukarno's Konfrontasi. However, as Smith (1999) notes, Indonesia took a leading role in the composition of the organization at its inception. As he noted, Indonesia's original motivation to establish a regional organization with its immediate neighbours was characterized by three main reasons as; (1) Desire for normalcy in its relations with the non-communist nations of Southeast Asia, (2) the need for domestic stability and (3) less reliance on external powers for regional security. He further noted that Indonesia has been committed to the expansion of ASEAN to include the entire region of Southeast Asia since ASEAN's inception (ibid). Considering the modern role of Indonesia within ASEAN, according to Haan (2017), while Indonesia is generally accepted as the de-facto leader of ASEAN regardless of where the chairmanship may lie, Indonesia has yet to completely embrace that role. When it comes to the relationship between regionalism and tourism industry, according to Chheang (2013, p.44) cross-border cooperation can promote tourist destinations and travel corridors with complementary locations. As he notes tourism is part of the regional integration process in Southeast Asia (ibid, p. 47).

3. Research Methodology

This particular study is exploratory. Exploratory studies are particularly useful when not enough information is known or even available (Valente, 2016,p.86). This study looks into and critically evaluates the impact of regionalism on the tourism industry of Indonesia. Thus this case study of Indonesian will look into its role in the regional integration process of ASEAN and how its tourism industry has been influenced by the enhanced regional cooperation. With regard to the data collection technique, it would be mainly through secondary sources including annual reports, magazines, journal reports etc.

4. Results and Discussion

Considering where Southeast Asia was and what it has able to achieve today, the progress is impressive. Both as individual states, as well as a regional grouping, today ASEAN has a strong say in the international affairs. Looking at the trade, during the period 1993-2003, intra-ASEAN trade increased at an average annual rate of 10.5% compared with overall ASEAN trade at 9.2% and ASEAN's trade with non-ASEAN countries at 8.9% (Pangestu & Ing, 2017, p.02). Table 01 gives a clear indication of how success ASEAN has been in promoting regional cooperation and integration.

Table 01: Intra-ASEAN Trade in goods, FDI inward inflows and visitor Arrivals

	Intra-ASEAN Trade in Goods (US$ million) [% total ASEAN trade]	Intra-ASEAN FDI inward flows (US$ million)	Intra-ASEAN visitor arrivals (in thousands)
2012	605,640 [24.4%]	23,391.3	39,845.5
2013	617,752 [24.28%]	18,483.6	46,154.4
2014	608,114 [23.98%]	22,343.6	49,223.0
2015	535,380 [23.55%]	20,819.9	45,991.8
2016	516,575 [23.07%]	25,891.7	46,570.2
2017	590,225 [22.92%]	26,975.0	48,492.8

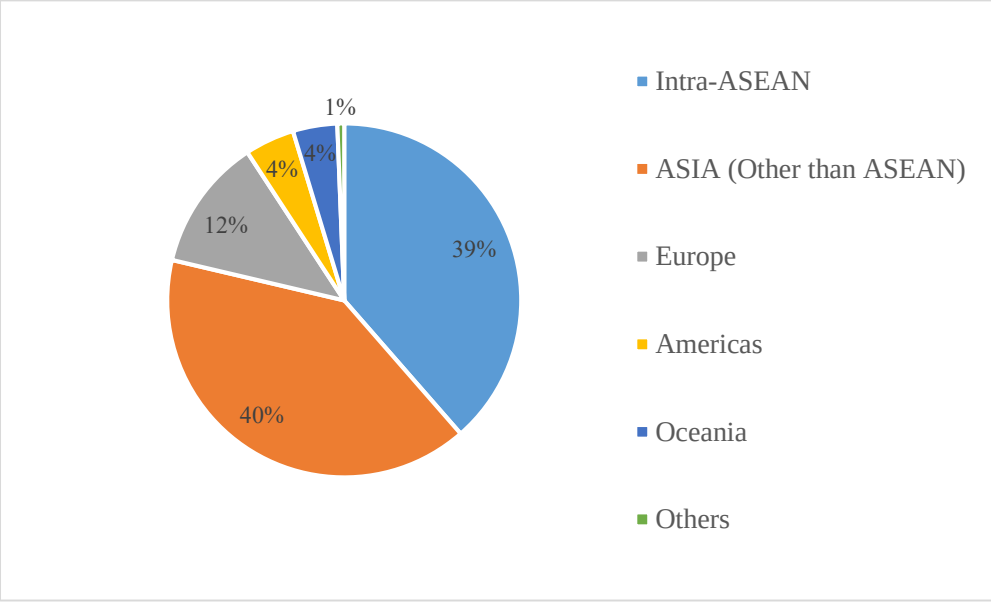
Source: Asean Statistical Yearbook 2019 (Rep.).

The level of intra-regional tourism, trade and investments are some of the key indicators among many to understand the success of regional

cooperation and integration. Looking at ASEAN, as given in Table 01, while intra-regional investments and tourism have shown significant growth, intra-regional trade too has shown steady progress. When it comes to tourism, ASEAN has given greater priority in promoting ASEAN region in other parts of the world while encouraging intra-regional tourism. Looking at the total number of international tourist arrivals to ASEAN, it has increased from 39,845,500 in 2012 to 48,492,800 in 2017 (Table 01).

Here the most important fact in Intra-ASEAN tourism is out of the total tourist arrivals to ASEAN countries, 39% has been intra-regional (Figure 01). This is a classic example to indicate the importance and impact of regional cooperation on tourism.

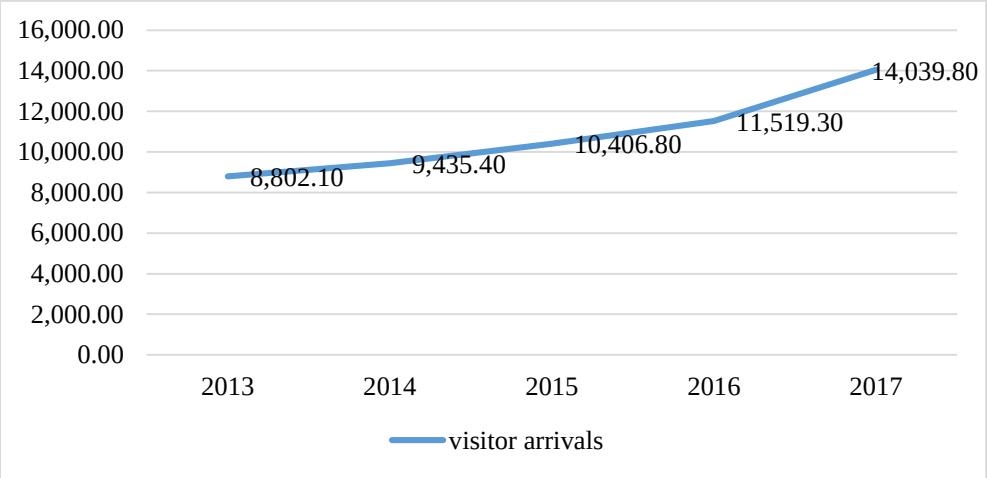
Figure 01: Share of International Visitor Arrivals to Southeast Asia (2017)



Source: ASEAN Statistical Yearbook 2019 (Rep.).

As far as Indonesia is considered, it is certainly a well-known tourist destination across the world. Huge increase in the number of tourist arrivals to Indonesia indicates the popularity it has able to occupy among international tourists. As given in Figure 02, in 2017, the country was successful in attracting more than 14 million tourists from all around the world.

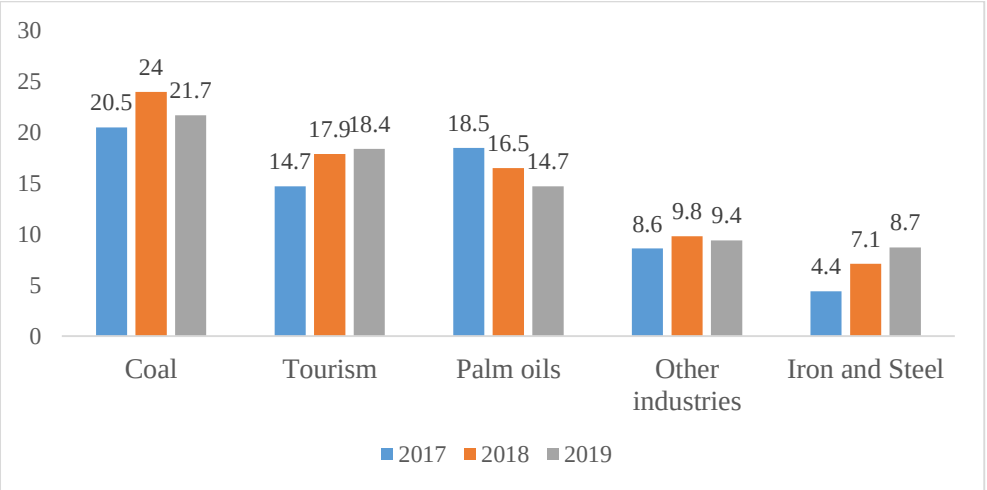
Figure 02: Visitor arrivals to Indonesia (2013-2017) (thousand)



Source: ASEAN Statistical Yearbook 2019 (Rep.).

Tourism plays a significant role in Indonesia's economic growth. It is one of the highest contributors to foreign currency earnings (Figure 03).

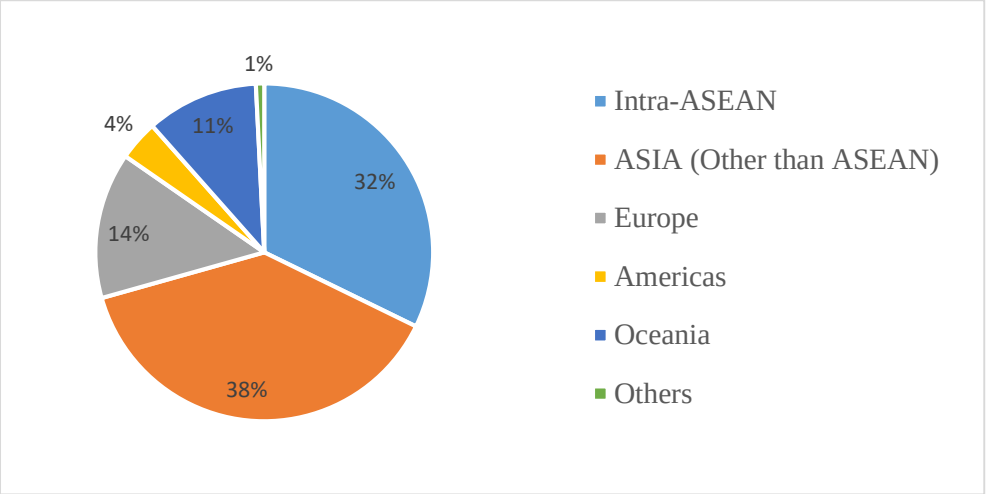
Figure 03: Highest contributors to foreign currency earnings by commodities (US$ Billion)



Source: Bank Indonesia. (2019). 2019 Economic Report On Indonesia (Rep.). Bank of Indonesia.

As given in Figure 03, after coal, the tourism industry remains the highest contributor foreign currency earning.

Figure 04: Visitor Arrivals to Indonesia-Region wise 2017



Source: Created by Author based on ASEAN Statistical Yearbook 2019 (Rep.).

Looking at the composition of tourist arrivals to Indonesia in 2017, 32% has been intra-ASEAN. Looking at the numbers, there has been a steady increase in the number of tourist arrivals to Indonesia from the ASEAN region (Table 02)

Table 02: Visitor arrivals to Indonesia-Region wise (In Thousand)

Region of origin	2013	2014	2015	2016	2017
Intra-ASEAN	**3,516.1**	**3,683.8**	**3,860.7**	**3,817.5**	**4,524.6**
ASIA (Other than ASEAN)	2,580.7	2,782.6	3,224.7	3,791.6	5,392.8
Europe	1,243.0	1,332.6	1,462.4	1,767.1	1,965.9
Americas	333.2	358.7	411.6	476.0	537.0
Oceania	1,071.8	1212.7	1377.4	1571.9	1507.9
Others	57.5	65.0	69.9	95.1	111.5
Total	8,802.1	9,435.4	10,406.8	11,519.3	14,039.8

Source: ASEAN Statistical Yearbook 2019 (Rep.).

Looking at the average expenditure of the tourists from Southeast Asian countries a significant increase can be observed (Table 03).

Table 03: Average expenditure of international visitor per visit by country of residence (US$)

Country of Residence	Average Expenditure of International Visitor per Visit by Country of Residence (US $)	
	2018	2016
Brunei Darussalam	1 059,37	986,05
Malaysia	843,34	719,69
The Philippines	1 164,65	766,79
Singapore	1 049,22	588,53
Thailand	1 490,58	910,19

Source: Statistics of Indonesia

This Intra-ASEAN tourism has strengthened Indonesia's tourism industry significantly. In 2017, the tourism's total contribution to Indonesia's economy stood at US$58.9 Billion which is far above the region's average. Moreover, in 2017, the travel and tourism sector attracted investments worth of US$ 12 billion which is far above both Southeast Asia and world average.

Table 05: Contribution of the tourism sector to the national economy

Travel and Tourism's direct contribution to GDP		2017(US$ Billion)
22	**Indonesia**	**19.4**
	World Average	21.5
	Southeast Asia Average	13.6
Travel and Tourism's total contribution to GDP		2017 (US$ Billion)
23	**Indonesia**	**58.9**
	World Average	62.9
	Southeast Asia Average	33.0
Travel and tourism investments		2017 (US$ Billion)
16	**Indonesia**	**12.0**
	Southeast Asia average	4.9
	World average	4.8

Source: Travel and Tourism Economic Impact 2018-Indonesia (World Travel and Tourism Council)

Here, intra-regional tourism brings many benefits to a country which goes beyond the mere number of tourist arrivals. The most important aspect of this study is to examine the nature of the relationship between regional integration and the tourism industry. Looking at the findings it is clear that there is an interdependent relationship between regional integration and the tourism industry. On one hand, a country's tourism industry can be greatly benefitted by strong and visionary regional cooperation and on the other hand regional integration too would be strengthened by travel and tourism. In Indonesia's case, regionalism has helped Indonesia boost its tourism industry and at the same time travel and tourism has also enhanced regional integration in Southeast Asia. Intra-regional tourism provides a country's tourism industry with great stability. In 2002, Indonesia became a victim of brutal terrorism, when one of its major tourist destinations. Bali was attacked by a group of terrorists. Even today, this attack is considered as the deadliest terrorist attack in the history of Indonesia. Bali is renowned as a major tourist attraction in the world.

Bali island attracted approximately 2.5 million tourists in 2001 and generated US$ 1.4 billion of Indonesia's total tourism revenue of US$ 5.4 billion (The Straits Times, 2002, cited in Henderson, 2003). The tourism industry in Indonesia was adversely affected by this terrorist attack in an unprecedented manner. Both the number of international tourist arrivals (Table 06) as well as revenue from the tourism industry (Figure 05) dropped significantly.

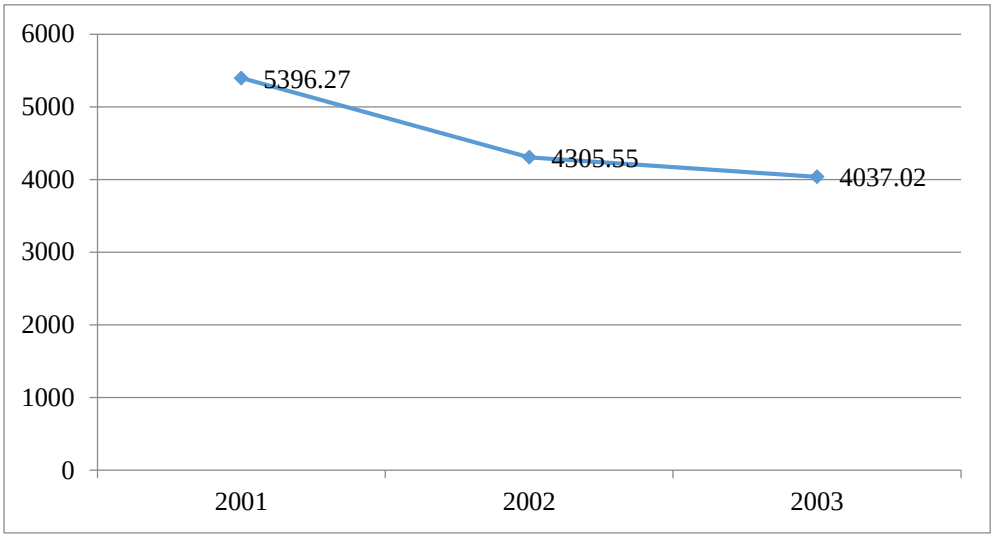
Table 06: Number of Foreign Visitor Arrivals to Indonesia 2002-2003 (Region wise)

Region	**2002**	**2003**	**Change (%)**
Total America	222 052	175 546	-20.9
Total Europe	833 004	605 904	-27.2
Africa	36 503	30 244	-17.1
Middle East	37 987	31 371	-17.4
Total ASEAN*	2 085 736	2 083 320	-0.1
Total Asia Pacific	1 818 118	1 540 636	-15.2
Total	5 033 400	4 467 021	-11.2

*Visitors from Vietnam not available

Source: Statistics of Indonesia

Figure 04: Revenue from International visitor arrivals (2001-2004) (US$ million)



Source: Created by the author based on Statistics Indonesia

Table 06 indicates the drop in international tourist arrivals from 2002 to 2003. Looking at the Table, the visitor arrivals from the Americas dropped by 20.9%, Europe by 27.2% while the total number of tourist arrivals dropped by over 11%. However, while international tourist arrivals to Indonesia from various regions dropped by a significant percentage; the drop in the arrivals from the ASEAN region was less than 1%. This reflects the significance of regionalism and intra-regional tourism. During the hardest times, regionalism has made it possible for Indonesia to keep its tourism industry stable. In this case, intra-regional tourism has given the rest of the world with an assurance to visit Indonesia.

5. Conclusion

As a regional organization, what ASEAN has able to achieve so far is impressive and exceptional. Greater regional cooperation and desire to work on a common platform have made ASEAN a true example of regionalism. ASEAN has able to bring together Countries which were at a different level of economic strength, power capabilities and contradictory political ideologies. The achievements made by ASEAN as a regional grouping have paved the way for individual states to achieve unprecedented economic growth, political stability and social integrity.

Looking at tourism, both as individual countries and also as a region, ASEAN is successful in promoting the tourism industry in the region. Intra-regional tourism has given countries not only the increased number in the tourist arrivals but also the stability and diversity to the tourism industry of the country. In the case of Indonesia, intra-regional tourism has given the Indonesian tourism industry an extra boost. Most importantly, while regionalism strengthens tourism industry, tourism industry fortifies regionalism. In this sense, ASEAN is a great example to show this interdependence.

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Modelling and Forecasting the Usage of Cellular and Landline Phones in Sri Lanka: Univariate Time Series Approach

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Abstract

Phones have become a mandatory commodity in human life. Nowadays, there is a very strong increase in the cellular phone market, so we tend to forget landline phone services. According to statistics, cellular phones and landline phones usage up to December 2018 is 32,528,104 and 2,484, 616 respectively. That is, the teledensity (per 100 inhabitants) is 150 for cellular phones and 11.5 for landline phones. Due to the increment of the cellular phones and decrement of the landline phones, it is vitally important to study their behaviour. Therefore, the objective of this paper is to model and forecast the usage of cellular and landline phones in Sri Lanka. The model was developed using 80% of the data and validated with 20%. The usage was modelled with Autoregressive Integrated Moving Average (ARIMA) technique. Several models were fitted and based on the lowest Akaike's Information Criteria (AIC), ARIMA (1,2,1) and ARIMA (2,2,1) were identified as the best-fitted models with forecasting accuracy measured by Mean Absolute Percentage Error (MAPE) values 1.403 and 0.976 for cellular and landline phones usage respectively, concluding that two ARIMA models have a strong potential for forecasting the usage of cellular and landline phones. This model would be important to those who are with the telecoms market to achieve their business goals.

Keywords: *AIC, ARIMA, MAPE, ACF, PACF*

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1. Introduction

Among all the essential modern telecommunication equipment, telephones are at the forefront. Phones have become an absolutely necessary commodity in human life. Today the world has become a village which has no boundaries to communicate between countries and people. There are two major categories of phones namely cellular phones and landline phones. Landline phones can be classified into another two subcategories as fixed wire landline phones and fixed wireless landline phones. In this study, the total usage of those two categories has considered as the landline phone usage.

Considering the evolution of the telephones, the modern telephone is the result of work of many people. Alexander Graham Bell was awarded the first U.S. patent for the invention of the telephone in 1876. Many people have contributed to the development of the telephone. So gradually the telephone has become incredibly advanced. The innovation of cellular phones in 1973 was a turning point in the history of telephone invention. Currently, the cellular phones have become tinier and lighter including many more features such as touch screen, camera, fingerprint sensor, internet connectivity, long-lasting battery, GPS, Bluetooth etc. So, with these features, cellular phones have converted into a wonderful innovation which is called a smartphone. Therefore, the usage of mobile phones has rapidly increased as a result of the invention of these smartphones. This makes our lives much easier and more convenient because they provide us with a lot of services such as online shopping, e-banking, e-mailing, taking photographs, accessing the internet, entertaining with games, music, movies etc. That is, comparing to landline phones, mobile phones are multitasking and super easy. Therefore, there can be seen a significant decline in landline phones market. In our opinion, the main reason for this decline is the immobility of these landlines and also lacks of technology, more expensive, no visual communication tools etc. But compared over cell phones, the biggest advantage of landline phones is the consistency of the telephone signals.

The objective of this study is to model and forecast the usage of cellular and landline phones in Sri Lanka using Autoregressive Integrated Moving Average (ARIMA) models and to use the best-fitted models to predict the usage of the cellular and landline phones in future years more accurately. Our study will be helpful to the people those who are with the telecoms market to achieve their business goals by considering the usage of consumers. Also, it will be much easier in decision making by analysing the variations of usage and to get an idea about the gross income of a county from telephones market.

This manuscript is collated as follows: In section II the literature reviews are presented. Section III is used to present the methodology of this study. In section IV and V results, conclusion and future work of the study are pointed out.

2. Literature Review

Yuan et al. (2004) have presented a paper based on the results they have gained through a survey on cell phones. They have conducted their survey for US households because in the last five years the usage of the cellular phone has strongly increased. The survey results showed that, in general, more efforts were required to get a complete interview from people with both telephone services than from people with only a cell phone. McBurney, Parsons, & Green (2002) presented an introductory paper on forecasting market demand for new telecommunications services. There they have given a brief introduction about marketing theory and then talks about how to identify the key stakeholders in the forecasting process in a new telecommunication company. Throughout the study, they have portrayed the main forecasting techniques and highlighted some of the conceptual and practical challenges involved in forecasting the demand for new telecommunication services.

Aker & Mbiti (2010) presented a study on mobile phones and economic development in Africa. They have shown that the mobile phone subscriptions have increased by 49 precent annually between the year 2002 and the year 2007 as compared with the past decade. They have shown that the growth of the mobile phone coverage across Africa has shown strong positive growth with population density as well as other factors. Thanh et al. (2005) have described that mobile phones will continue to increase in

numbers and many more people will have mobile phones in future. They are predicting that in future the mobile phones will have more and more functions such as personal data storage, Personal Information Manager (PIM), MP3 player, camera portable storage etc. They have written and published this paper in 2005. It has completely proven that they were successful in doing predictions about mobile phones since all the smartphones in the market today have almost all the features they have mentioned in their paper.

Rashid & Elder (2009) have presented a paper to emphasize the connection between mobile phones and the development of a country. They have stated that in most of the developing countries have skipped fixed-line telephones and leapfrogged directly into the mobile phones. One of their key findings in this paper is that mobile phones are increasingly accessible to lower-income groups in developing countries. Nawaz (2012) has carried out statistical analysis to find the impact of mobile phones on students' life in India. This paper reviews the impact of the mobile phone on youth peer relationships, on family relationships and the institution in both positive and negative ways. For this purpose, a survey has been conducted by taking five well-known colleges of Gujarat city.

Zajdel, Śmigielski, & Nowak (2013) have published a paper to evaluate the influence of the sound of a ringing mobile phone on the complex reaction time score in a healthy person and to check if there are any differences in reaction time when a landline phone and mobile phone ring. This study concludes that the relationship between a person and their private phone can significantly obstruct their attention and thus affect the attention-demanding activities. Another survey has been conducted by Priya & Jeevitha (2017) in India to analyse mobile phone usage and the academic performance of college students. 200 college students were selected for this survey who are using mobile phones. The collected data has been analysed using a chi-square test. The study concluded that there is a significant relationship between mobile phone users and their academic performance.

Fowdur, Hurbungs, & Beeharry (2016) have objected to do a statistical analysis of the energy consumption of mobile phones for web-based applications in Mauritius. They have concerned the two most common types of mobile phones namely, Android OS-based phones and Nokia phones with

Symbian OS. They have concluded that the average energy consumption over a month for running the web-based applications on mobile phones was estimated to be 16.76 MWh for Mauritius.

3. Research Methodology

The data required for this study were collected from the Central Bank of Sri Lanka. The data set contains quarterly data from the year 2000 quarter 1 to the year 2018 quarter 2.

Stationarity

A stationary time series can be identified as a time series whose statistical properties, mainly mean and variance are constant over time. Graphical methods and statistical tests are commonly used to identify whether a time series is stationary or not. The most accurate way is to use statistical tests and in this study, Kwiatkowski-Phillips-Schmidt-Shin (KPSS), Augmented Dickey-Fuller (ADF) and Phillips Perron (PP) tests were used to check the stationarity of the time series.

i. Kwiatkowski-Phillips-Schmidt-Shin (KPSS) Test

The corresponding hypothesis is,

H_0: *the series is stationary*

H_1: *the series is not stationary*

ii. Augmented Dickey-Fuller (ADF) Test

The corresponding hypothesis is,

H_0: the series is not stationary

H_1: the series is stationary

iii. Phillips Perron (PP) Test

The corresponding hypothesis is,

H_0: the series is not stationary

H_1: the series is stationary

Time Series Forecasting Methods

A time series is a collection of observations where they are indexed in time order. There can be numerous time series where the sequence of observations is varied depending on the frequency like weekly, monthly, quarterly or annually etc. The ultimate goal of time series analysis is to derive the future behaviour of the time series considering the past behaviour. Time series forecasting is tremendously used in many sectors such as finance, agriculture, health, education etc. In this study, a univariate time series approach has been used in forecasting the corresponding data set.

Univariate Time Series Approach: ARIMA Model

If the previous values of a time series are used to predict its future values, it is called a 'Univariate Time Series Forecasting'. ARIMA modelling is a particular type in univariate time series forecasting.

ARIMA short for 'Auto-Regressive Integrated Moving Average'. This can be used to forecast future values using its own lags and the lagged forecasting errors. ARIMA models are applied when the data shows evidence of non-stationarity such as trend, random errors etc. In ARIMA models, differencing steps (corresponding to the "integrated" part of the model) are applied to eliminate the non-stationarity. The differencing steps can be further applied for one or more times.

$$ARIMA(p, d, q) \quad (1)$$

where, p: autoregressive order

d: degree of differencing

q: moving average order

$$\hat{y}_t = c + \emptyset_1 \hat{y}_{t-1} + \emptyset_2 \hat{y}_{t-2} + \cdots + \emptyset_p \hat{y}_{t-p} + z_t + \theta_1 \hat{z}_{t-1} + \theta_2 \hat{z}_{t-2} + \cdots + \theta_q \hat{z}_{t-q} \quad (2)$$

where, $\hat{y}_t$ is the differed series.

c is a constant

$\emptyset_1, \emptyset_2, \ldots, \emptyset_p$ are autoregressive parameters

$\theta_1, \theta_2, \ldots, \theta_p$ are moving average parameters

z_t is the White Noise term

The autoregressive order can be identified using the PACF (Partial Autocorrelation Function) plot and the moving average order can be identified using ACF (Autocorrelation Function) plot. ARIMA modelling has four major steps as model building, identification, estimation, diagnostics and forecasting. In this study, the model is developed using 80% of the data and validated with 20%.

Trend Elimination Methods

There are mainly four trend elimination methods namely Transformations, smoothing with Moving Average Filter, Exponential Smoothing and Differencing. Transformation methods estimate and eliminate the trend component. There are several transformation methods such as logarithmic transformations, Box-Cox transformations etc.

Smoothing with Moving Average filter is a nonparametric method that is used to estimate the trend component.

Let q be a nonnegative integer and consider the two-sided moving average.

$$W_t = \frac{1}{2q+1}\sum_{j=-q}^{q} X_{t-j} \quad (3)$$

Trend estimates $\hat{m}_t = W_t$. But in this method choosing the value of q is a hard task.

Exponential Smoothing is based on a moving average of past values only. This is often used for forecasting, the smoothed value at present being used as the forecast of the next value. And exponential smoothing uses weighted averages of the past data.

Differencing the data apply the difference operator to the original time series to obtain a new time series.

Backward shift operator : $BX_t = X_{t-1}$ (4)

Lag-1 difference operator : $X_t = X_t - X_{t-1}$ (5)

Correlogram

Correlograms are plots of autocorrelations and partial autocorrelations associated with time-series data. Correlograms show the relationship between autocorrelation coefficients against increasing time lags and they are useful in visualizing the correlation structure in time-series data.

Model Adequacy Checking

Model adequacy checking is used to check the validity of a model. In this study heteroscedasticity and serial correlation, tests were drawn to check whether the model is adequate.

Heteroscedasticity Test

When the variances of errors are constant, we call it homoscedasticity. Concerning real-world scenarios, a non-constant error variance can be observed frequently. The violation of constant error variance is called as heteroscedasticity.

There are several reasons for heteroscedasticity such as, usual variation structures that occur due to natural factors, omitting important variables from the model, incorrect data transformations etc.

There are several tests to check heteroscedasticity, such as ARCH test, Park test, White's general heteroscedasticity test, Goldfeld-Quaindt test etc. Among them, we have used the ARCH test in this study.

The corresponding hypothesis for the heteroscedasticity test is,

$H_0: No\ presence\ of\ ARCH\ effect$

$H_1: Presence\ of\ ARCH\ effect$

Serial Correlation Test

Serial correlation occurs when the error terms in a time series transfer from one period to another period. That means the error for one time period is correlated with the error for a subsequent time period. Serial correlation can happen in the excluded variable case, incorrect functional form, inertia (sluggishness) etc. To check the serial correlation, we can use several tests such as Runs test, Durbin-Watson test, Ljung-Box Q test etc.

Here we have used Durbin-Watson test and the test statistic is given below,

$$d = \frac{\sum_{t=2}^{n}(\hat{\varepsilon}_t - \hat{\varepsilon}_{t-1})^2}{\sum_{t=1}^{n}\hat{\varepsilon}_t{}^2} \quad (6)$$

where, d is the Durbin Watson statistic

$\hat{\varepsilon}_t, \hat{\varepsilon}_{t-1}$ are the error terms

The corresponding hypothesis for the serial correlation test is,

H_0: *No presence Serial Correlation*

H_1: *Presence of Serial Correlation*

Forecasting Accuracy

To know whether how well the model has been performed it is needed to consider the difference between actual and the forecasted values. It is essential to minimize the difference between actual and forecasted values because the model performance relies on that. That is the smaller the difference, the better the model is. Mean Absolute Percentage Error (MAPE) value has been used to assure the forecasting accuracy.

$$\text{MAPE} = \frac{1}{n}\sum_{i=1}^{n}\frac{|y_i - \hat{y}_i|}{y_i} \times 100\% \quad (7)$$

where, y_i = the actual value

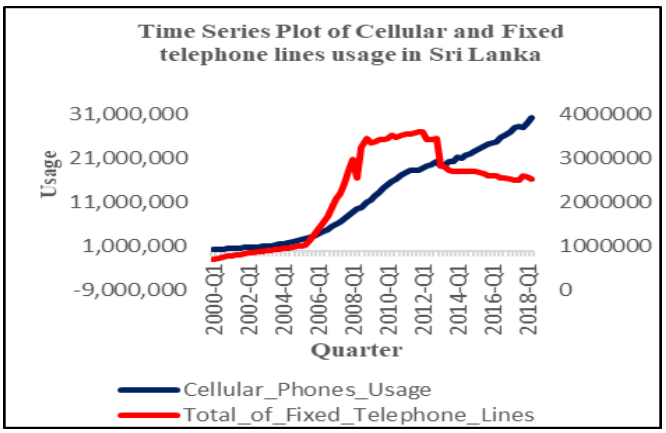
$\hat{y}_i$ = the fitted value

n = number of observations

4. Results & Interpretation

In our study, we have analysed the increment and the decrement of cellular and landline phones usage in Sri Lanka and it is illustrated in the below Figure 1.

Figure 1: Time Series plot of cellular and landline telephone lines usage in Sri Lanka



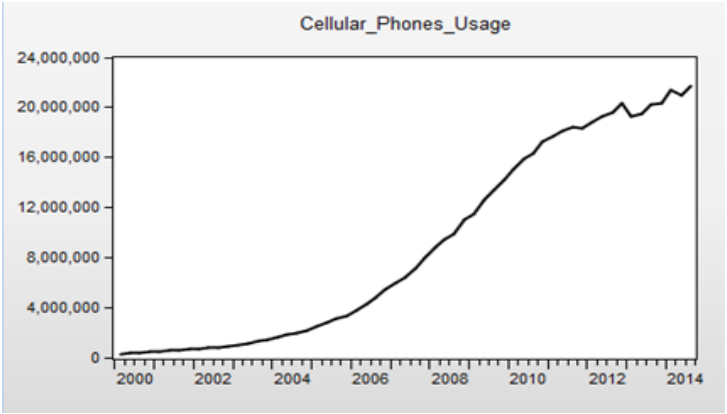
Source: Central bank of Sri Lanka (2018)

According to Figure 1, in the year 2000, the consumption of fixed telephone lines is higher than the consumption of cellular phones by 403,100. And it is clearly visualized that the fixed telephones consumption has phased out by the year 2018.

Time Series Plots

For model building, we have used 80% of the total dataset and it contains the quarterly data starting from the year 2000 quarter 1 to the year 2014 quarter 3. The rest of the 20% of data starting from the year 2014 quarter 4 to the year 2018 quarter 2 were used to validate our results.

Figure 2: Time Series plot of quarterly cellular phones usage

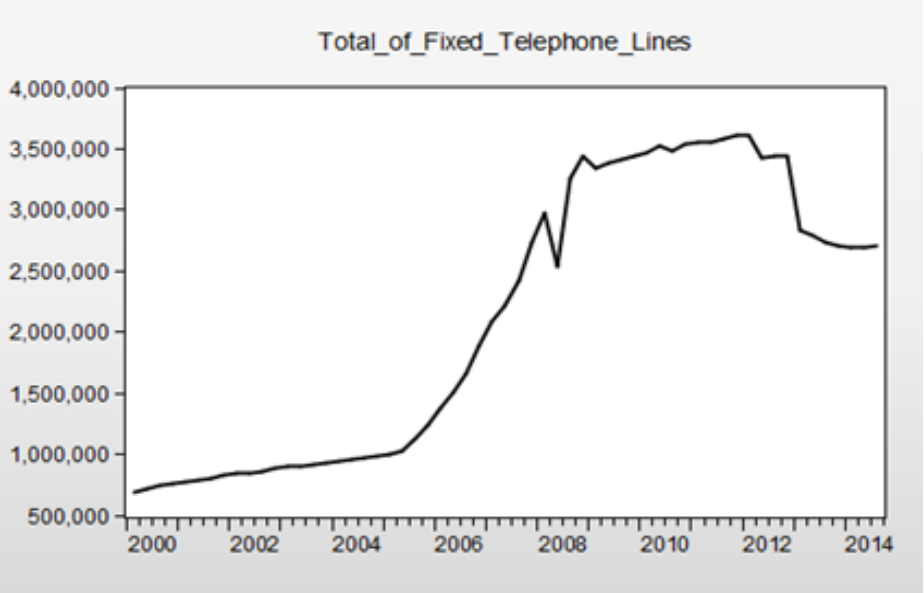


Source: Eviews Output (2020)

Figure 2 implies the variation of the quarterly cellular phones' usage in Sri Lanka. There can be observed consequent upward nonlinear trend implying the series is non-stationary. In the year 2000 quarter 1 the cell phones usage is 293,120 and in the year 2014 quarter 3, it has become 21,727,589. The difference between the usage in 2000 quarter 1 to 2014 quarter 3 is more than 21.4 million. This huge difference proves that within the past 14 years the cellular phones have become an absolutely necessary commodity in day to day life.

Figure 3 implies the variation of the quarterly fixed telephone lines usage in Sri Lanka. It can be observed an upward nonlinear trend up to the year 2012 quarter 3 and then from the year 2013 quarter 1 the usage of the fixed telephone starts to decrease gradually. Therefore, this series seems to be non-stationary.

Figure 3: Time Series plot of quarterly fixed telephone lines usage



Source: Eviews Output (2020)

In the year 2000 quarter 1 the usage of the fixed telephone is 696,220 and in the year 2014 quarter 3 that has become 2,711,717. The difference between the year 2000 quarter 1 to 2014 quarter 3 is more than 2 million. Compared to the year 2000, in the year 2014, 19 million people have to get used to cellular phones more than using landline phones in Sri Lanka. From these two graphs, it can be observed that both series are non-stationary. To confirm these result stationarity tests were performed.

Checking Stationarity

For KPSS test the hypothesis is given below,

$$H_0: the\ series\ is\ stationary$$

$$H_1: the\ series\ is\ not\ stationary$$

For ADF and PP tests the hypothesis is given below,

$$H_0: the\ series\ is\ not\ stationary$$

$$H_1: the\ series\ is\ \ stationary$$

Table 1: Stationarity test for the original data set

Stationary Test	Test statistic	For cellular phones usage	For fixed telephone lines usage	Result
KPSS Test	LM stat	0.9075	0.7929	Non-stationary
ADF Test	Prob	0.7661	0.6948	Non-stationary
PP test	Prob	0.9964	0.6873	Non-stationary

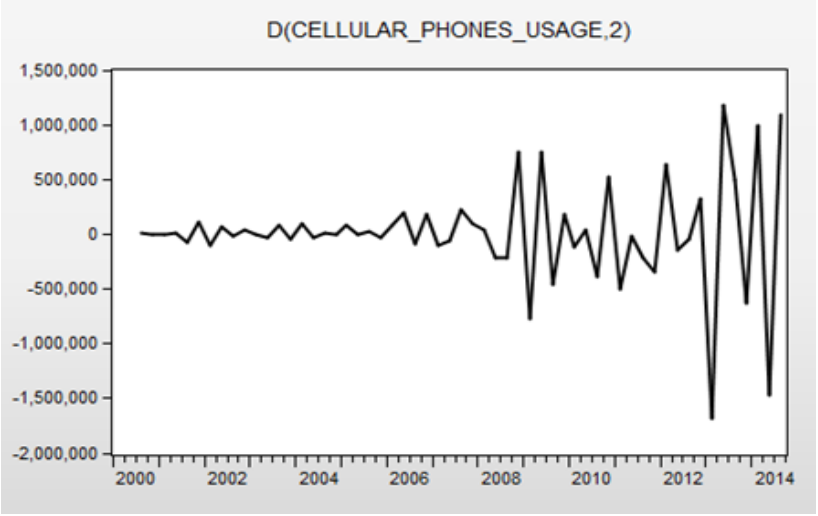
Source: Author Creations (2020)

Graphical and stationarity test results show that both series are not stationary. In order to convert these non-stationary series into stationary series, the differencing technique was applied. The first differencing has been performed and the results verified that the series is not stationary. So, the second differencing was further carried out.

Graphical and Stationarity Test Results After Second Differencing

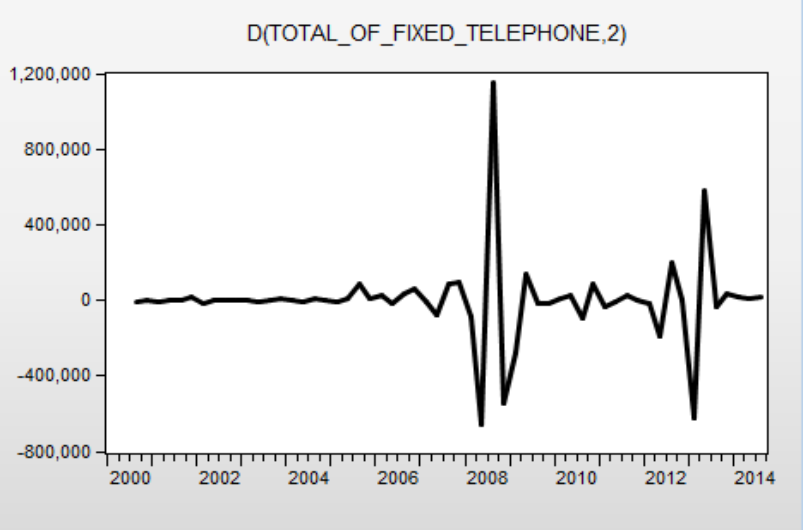
Figure 4 and 5 illustrates the graphical representation of the cellular and landline phones usage after applying the second differencing.

Figure 4: Time Series plot of quarterly cellular phones usage after taking the 2nd difference



Source: Eviews Output (2020)

Figure 5: Time Series plot of quarterly fixed telephone lines usage after taking the 2nd difference



Source: Eviews Output (2020)

Since there is no trend seems to be in the above Figure 4 and 5, they seem to be stationary.

The below Table 2 illustrates the stationarity test results after 2nd differencing.

Table 2: Stationarity test results after second differencing

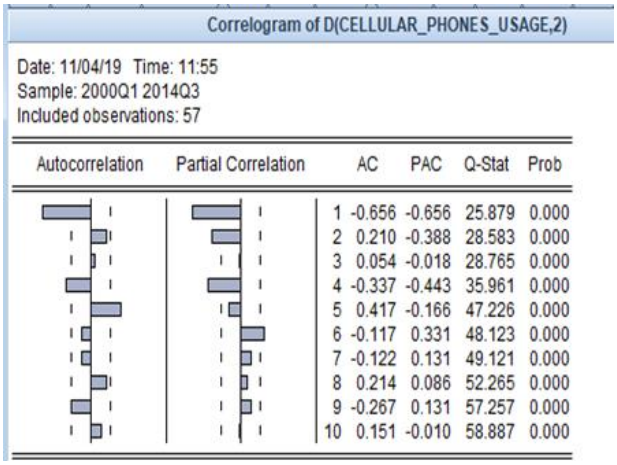
Stationary Test	Test statistic	Cellular phones usage	Fixed telephone lines usage	Result
KPSS Test	LM stat	0.0417	0.0448	Stationary
ADF Test	Prob	0.0000	0.0000	Stationary
PP test	Prob	0.0001	0.0001	Stationary

Source: Author Creations (2020)

Both graphical and stationary test results confirm that both series are stationary after taking the 2nd difference.

Correlogram

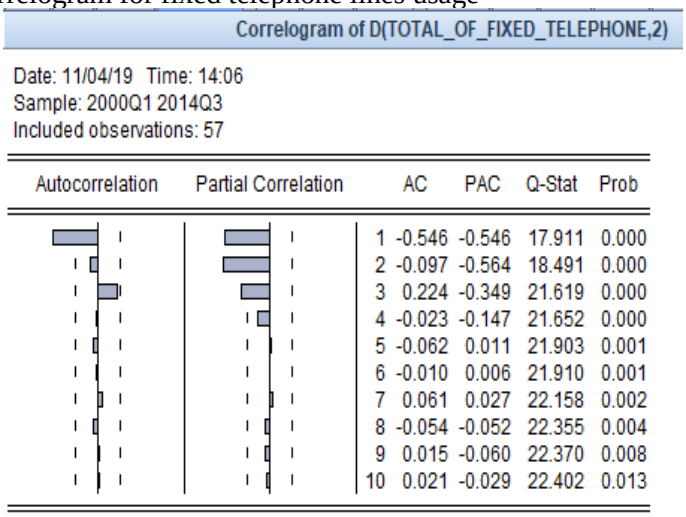
Figure 6: Correlogram for cellular phones usage



	AC	PAC	Q-Stat	Prob
1	-0.656	-0.656	25.879	0.000
2	0.210	-0.388	28.583	0.000
3	0.054	-0.018	28.765	0.000
4	-0.337	-0.443	35.961	0.000
5	0.417	-0.166	47.226	0.000
6	-0.117	0.331	48.123	0.000
7	-0.122	0.131	49.121	0.000
8	0.214	0.086	52.265	0.000
9	-0.267	0.131	57.257	0.000
10	0.151	-0.010	58.887	0.000

Source: Eviews Output (2020)

Figure 7: Correlogram for fixed telephone lines usage



	AC	PAC	Q-Stat	Prob
1	-0.546	-0.546	17.911	0.000
2	-0.097	-0.564	18.491	0.000
3	0.224	-0.349	21.619	0.000
4	-0.023	-0.147	21.652	0.000
5	-0.062	0.011	21.903	0.001
6	-0.010	0.006	21.910	0.001
7	0.061	0.027	22.158	0.002
8	-0.054	-0.052	22.355	0.004
9	0.015	-0.060	22.370	0.008
10	0.021	-0.029	22.402	0.013

Source: Eviews Output (2020)

In Figure 6, the significant cut-off lags of ACF and PACF plots are 1,4,5 and 1,2,4,6 respectively and in Figure 7, the significant cut-off lags of ACF and PACF plots are 1 and 1,2,3.

Since there is no seasonal pattern is visualized in above ACF and PACF plots, an ARIMA model was fitted instead of a Seasonal ARIMA model.

Model Fitting

The corresponding model fitting test results are shown in the below Figure 8 and 9.

Figure 8: ARIMA (1,2,1) model for cellular phones usage

Dependent Variable: D(CELLULAR_PHONES_USAGE,2)
Method: ARMA Maximum Likelihood (OPG - BHHH)
Date: 11/04/19 Time: 11:56
Sample: 2000Q3 2014Q3
Included observations: 57
Convergence achieved after 20 iterations
Coefficient covariance computed using outer product of gradients

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	5286.383	13921.40	0.379731	0.7057
AR(1)	-0.427722	0.117927	-3.627018	0.0006
MA(1)	-0.615109	0.092196	-6.671766	0.0000
SIGMASQ	9.72E+10	1.16E+10	8.388353	0.0000

R-squared	0.569705	Mean dependent var	11992.42
Adjusted R-squared	0.545349	S.D. dependent var	479460.7
S.E. of regression	323289.8	Akaike info criterion	28.29816
Sum squared resid	5.54E+12	Schwarz criterion	28.44153
Log likelihood	-802.4975	Hannan-Quinn criter.	28.35388
F-statistic	23.39048	Durbin-Watson stat	2.041512
Prob(F-statistic)	0.000000		

Source: Eviews Output (2020)

Figure 9: ARIMA (2,2,1) model for fixed telephone lines usage

Dependent Variable: D(TOTAL_OF_FIXED_TELEPHONE,2)
Method: ARMA Maximum Likelihood (OPG - BHHH)
Date: 11/04/19 Time: 14:08
Sample: 2000Q3 2014Q3
Included observations: 57
Convergence achieved after 36 iterations
Coefficient covariance computed using outer product of gradients

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	-781.6311	8641.572	-0.090450	0.9283
AR(1)	-0.525842	0.124134	-4.236098	0.0001
AR(2)	-0.386833	0.170329	-2.271098	0.0273
MA(1)	-0.544235	0.152297	-3.573504	0.0008
SIGMASQ	2.20E+10	3.57E+09	6.153672	0.0000

R-squared	0.584402	Mean dependent var	-176.7719
Adjusted R-squared	0.552433	S.D. dependent var	231941.2
S.E. of regression	155169.6	Akaike info criterion	26.85245
Sum squared resid	1.25E+12	Schwarz criterion	27.03167
Log likelihood	-760.2949	Hannan-Quinn criter.	26.92210
F-statistic	18.28026	Durbin-Watson stat	2.065050
Prob(F-statistic)	0.000000		

Source: Eviews Output (2020)

After considering all possible models, ARIMA (1,2,1) and ARIMA (2,2,1) models were identified as the best-fitted models with minimum AIC equals to 28.298 and 26.852 for forecasting the cellular phones usage and the fixed telephone lines usage respectively.

Model Adequacy Checking

This section outlines the results of model adequacy checking test results.

- *Heteroscedasticity Test*

$$H_0: No\ presence\ of\ ARCH\ effect$$

$$H_1: Presence\ of\ ARCH\ effect$$

According to heteroscedasticity test, the probability values 0.5349 and 0.1042 are greater than 0.05. Thus the null hypothesis is not rejected and therefore, there is no ARCH effect at 5% level of significance.

- *Serial Correlation Test*

$$H_0: No\ presence\ of\ Serial\ Correlation$$

$$H_1: Presence\ of\ Serial\ Correlation$$

Table 3: Durbin-Watson Test Results

	Durbin-Watson Statistic
For Cellular Phones	2.0415
For Landline Phones	2.0650

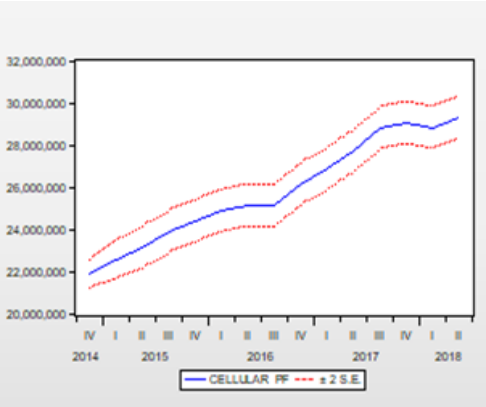
Source: Author Creations (2020)

In Table 3, Durbin-Watson Statistic values are 2.0415 and 2.0650. Since both values are closed to 2, it implies there is no serial correlation at 5% level of significance.

Forecasting

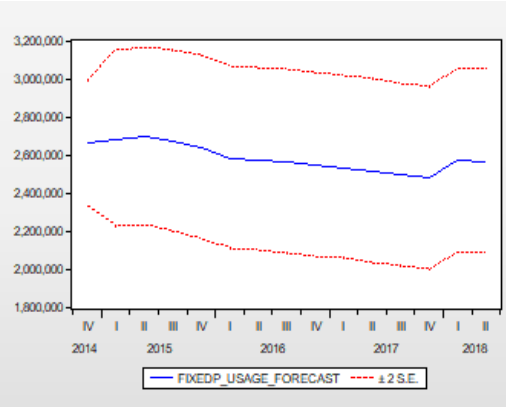
As mentioned in the previous section we have used 80% of data for model fitting and now we are moving to forecast our dataset using the remaining 20% of data.

Figure 10: Forecasting accuracy for ARIMA (1,2,1) model



Source: Eviews Output (2020)

Figure 11: Forecasting accuracy for ARIMA (2,2,1) model

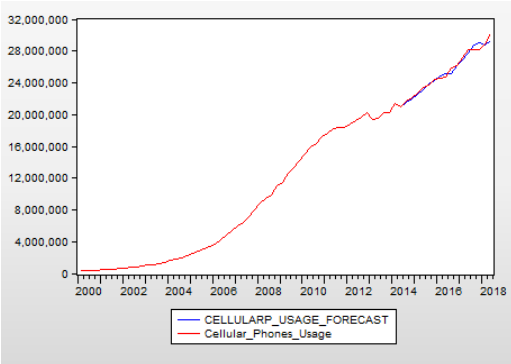


Source: Eviews Output (2020)

The measure the forecasting accuracy Mean Absolute Percentage Errors (MAPE) was used and the corresponding values are 1.403 and 0.976.

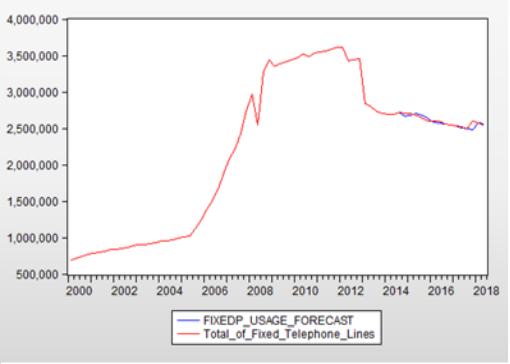
According to Figure 12 and 14, ARIMA (1,2,1) and ARIMA (2,2,1) models have a strong potential for forecasting the usage of cellular phones and landline phones respectively.

Figure 12: Forecasting with ARIMA (1,2,1) model



Source: Eviews Output (2020)

Figure 13: Forecasting with ARIMA (2,2,1) model



Source: Eviews Output (2020)

5. Conclusion and Future Work

This study mainly aims at modelling and forecasting the usage of cellular and landline phones in Sri Lanka. For this study, the quarterly phone's usage data were driven from the Central Bank of Sri Lanka. A univariate time series approach: ARIMA was used to analyse the data set. Here 80% of the data was used for modelling and 20% was used for forecasting. As the original data set of both of these series is not stationary, the differencing technique is used to make the series stationary. Here, the first differencing is also not stationary and so we have moved to second differencing. Second, differencing made both of our series stationary. Then observing the correlogram we have determined the corresponding cut-off lags and according to them AR and MA orders were decided. Then using these AR and MA orders we have tested for several ARIMA models. To finalize the best fitted ARIMA model, the minimum Akaike's Information Criteria (AIC) was used. The best-fitted models were ARIMA (1,2,1) and ARIMA (2,2,1) with minimum AIC 28.298 and 26.852 for modelling cellular and landline phones usage respectively.

Afterwards, we have checked for the assumptions of the constant variance (ARCH effect) and for the serial correlation. Since these assumptions were not violated by our models, they were used for forecasting purposes. The forecasting accuracy was measured by the mean absolute percentage error (MAPE).

The MAPE for cellular and landline phones are 1.403 and 0.976. This result clearly shows that the performance of both ARIMA models selected here is quite impressive and the actual and predicted values seem to be related to each other.

These models could guide the ones who are with the telecoms market to achieve their business goals. A further accurate forecast can be obtained if there were daily or weekly cellular and landline usage data records. And also, we can consider the factors such as the growth of the population, the price of the mobile and landline phones in the market, the tax by the government, monthly charges by corresponding service providers for a more accurate multivariate model. As a further study, machine learning techniques such as artificial neural network models are suggested to be used in achieving more accurate forecasting.

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A Study of Issues related to Empowerment of Female-Headed Households in Rural Areas in Sri Lanka

W.M.G.N. Panampitiya[1]

Abstract

Empowerment refers to the process of stimulation of potential powers, capabilities, abilities, and skills of individuals and communities. It plays a significant role to support active life through promoting the independent voice of disadvantaged and vulnerable communities. Hence, women empowerment enables women to identify their latent potentials and skills in decision making, active participation and implementation of policies and programmes. Women-Headed Households (WHHs) is a new form of the household and this new form of the household has become a significant phenomenon in both the global and national level. Although WHHs have occupied a prominent place in development discourse globally, very limited researches have been conducted regarding women empowerment related to WHHs in Sri Lanka. Accordingly, the main objective of this study was to identify the social issues related to empowerment of women heads in rural areas. This empirical research was conducted in five Grama Niladari divisions of Galgamuwa divisional secretariat division which conveyed a marked increase of WHHs in Sri Lanka. Data were collected from a hundred WHHs through purposive sampling method. Questionnaires and semi-structured interviews were used as primary data collection techniques. The research was conducted based on the survey method and case study method. Data were analysed based on thematic analysis and descriptive method. Power and authority are attributed in most patriarchal societies to women mainly due to the disappearing of the male person of the household. Thus, it could be identified that power and authority to make decisions in most cases of WHHs are not result of mobilization or empowerment but, women have no choice other than deciding on her household after assuming headship. Membership of community organizations illustrates a significant cross-cutting of the social profile of individuals. A majority (99%) of WHHs had

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obtained membership of death donation organization and Samurdhi organization (79%). But importantly, it could be identified that majority of WHHs (80%, 66%, and 55%) had not obtained memberships respectively of the women development organization, water organization, and farmers' organization. Only a few proportions of women heads (10%) had participated for self-employment training. Lack of motivation towards new trends of income-generating sources and unwillingness to change their familiar safe-zone had highly influenced the limited tendency to involve in activities related diversification of income-generating sources and livelihood of WHHs. Most of the current government programmes have related to the financial and physical allowances and has influenced to create a dependent mentality and to decrease the motivational factors among WHHs. As a result of that, a larger percentage of WHHs (75%) had requested more programmes on financial aids. Based on these findings it has been suggested to introduce integrated projects based on participatory development approach and methods of social inclusion to enhance opportunities to build self-esteem and self-confidence and to identify adaptation and mitigation actions to reduce hardships and issues through empowering latent potentials and skills of WHHs.

Keywords: *Female-Headed Households (WHHs), Empowerment, Women Empowerment, Decision- making, Authority*

1. Introduction

Women empowerment enables women to identify their latent potentials and skills in decision making, active participation and implementation of policies and programmes. According to that, the main feature of empowerment process is having the power to control materials, wealth, intellectual initiatives and ideologies and this process has related to welfare, upliftment, community participation and poverty alleviation (Batiwala, 1995). Female-Headed Households is a new structural form of household and this type of households have become a significant phenomenon in the last half of the 20th and 21st century (Baros, Fox & Mendonca, 1994). "Female-Headed Households are households where either no adult males are present, owing to divorce, separation, migration, non-marriage or widowhood, or were men, although present, do not contribute to the household income, because of illness or disability, old age, alcoholism or similar incapacity" (ABC of

women workers' rights and gender equality, 2007:81). It has demonstrated a very comprehensive idea of female headship. Thus, there are so many reasons for a woman being the head of the household. It can derive from being unmarried, separation, divorce, being widowed, and temporarily absentness and also no contribution to the household income due to serious illness, disability or similar causes. Recently, it can be identified as a marked increase of Female-Headed Households in Sri Lanka.

Table: 1 Demographic Characteristic of Total Households in Sri Lanka

Characteristics	**2009/2010**	**2012/2013**	**2016**
Number of Households	4.9 million	5.1 million	5.4 million
Male-Headed Households	3.8 million	3.9 million	4.0 million
Female-Headed Households	1.1 million	1.2 million	1.4 million
Percentage of WHHs	23.0%	23.5%	25.8%

Source: Household Income and Expenditure Survey (HIES) Final Report, 2009, 2012/2013 and 2016

According to the Household Income and Expenditure Survey (HIES) 2009/2010, out of 5.1 million in number of households, 1.2 million (23.0%) female-headed households were there in Sri Lanka (HIES Final Report, 2009/2010). HIES 2012/2013 final report has mentioned that, out of 5.1 million households, 23.5 percent of households were female-headed in Sri Lanka (HIES Final Report, 2012/2013). According to the most recent Household Income and Expenditure Survey 2016, out of 5.4 million households in Sri Lanka, 1.4 million households or 25.8 percent of the households were women-headed (HIES Final Report, 2016). In contrast, it can be identified that there are very limited researches have been conducted in Asia. In particular, review of the researches and library studies done in the field of issues related to empowerment of WHHs in Sri Lanka shows that there are inadequate sources to access issues descriptively related to WHHs. Even though many development projects and programmes including small, medium and large scale have been implemented in Sri Lanka, WHHs are out of the main development discourse. Therefore, our country has not yet been able to absorb the full potentials of the community sustainably and effectively.

1.1 Research Problem

The concept of women in development is not only concerning issues related to safety and protection of vulnerable groups but also, the importance of utilizing and improvement of experience, skills and capacities of women to strengthen them by prioritizing the actions and their perspectives in the development of social and economic fields (Centre for Social Development and Humanitarian Affairs, 1992). As well as, it seeks the empowerment of women through stimulating their latent potentials to improve the living standards of individuals. The absence of comprehensive attention, knowledge, regarding issues related to empowerment of WHHs has prevented women leadership and empowerment in the society in rural areas in particular. In accordance with the preceding context, "What are social issues related to empowerment of WHHs in rural areas in Sri Lanka?" was the research problem of this study.

1.2 Research Objectives

The main objective of this research was to identify the social issues related to empowerment of women heads in rural areas of Sri Lanka. Specific Objectives were to identify changes in authority and decision making after assuming the headship of the household, to study root causes and interrelationships among those issues related to empowerment of WHHs in rural areas and to identify issues related to programmes and projects which have implemented to empower WHHs.

2. Methodology

This research was conducted in five *Grama Niladari* divisions namely *Molewa, Kallanchiya, Koonwewa, Wadugama and Medawachchiya* in *Galgamuwa* Divisional Secretariat division which has situated in Kurunegala district, North-Western province. Survey and Case study methods were used to obtain a deep understanding of complex issues through both quantitative and qualitative manner. In sampling, purposive sampling method under non-probably sampling was used to select WHHs from other population in the area. Then, cluster sampling under the probability sampling method was used to select women from the list of WHHs in *Galgamuwa* division.

The researcher divided the population of WHHs in a *Grama Niladari* division into separate groups such as widows, separated women, divorced women, women heads who live with a disabled spouse and never-married women. Then a simple random sample of clusters was selected from the population, based on statistics of each *Grama Niladari* divisions. Data were collected from 100 WHHs through questionnaires and 10 case studies among 100 WHHs through semi-structured interviews to explore and get a thorough understanding of complexity and patterns of issues related to empowerments of WHHs. Besides, the observation was also used to obtain an acute insight into the research problem.

3. Results and Discussions

3.1. Changes in Authority and Decision-Making after Woman Assuming Headship of the Household

Generally, the head of the household has power and authority to apply control for family affairs and it has originated from moral conditions or legal obligations. According to Mencher, there are four elements of the concept of the head of household. They are Authority or Power, Economic Power, Decision-making and Rights to the Children (Rochelle, 2007). In traditional households, power, authority and responsibilities have attributed to the head of the household. Especially, in patrilineal societies male (farther, husband, elder brothers or sons) has the ownership to use power and authority of the household than female. According to the concept of head of household, in the situation of female headship, women should have the authority and power in the decision-making process and other affairs within the household. But there is a question whether there is the same extent or space of power and authority to make the decision and family affairs when women become head of the household.

When considering deeply, it is clear that power and authority are attributed in most patriarchal societies to women mainly due to disappearing of the male person of the household. Thus, this is not a result of mobilization or empowerment and women have no choice other than deciding on their own household after assuming the headship.

Box 1: Abstraction from the Case Study 1

Age: 54

Grama Niladari Division: Molewa

> "Now I am divorced for 30 years. I have no children. It was an arranged marriage. He came drunkenly in most situations. He quarrelled with me and assaulted me. One day, I could not tolerate it anymore, and I came to my parents' home. Thereafter, most decisions were taken by my father. But now they have died, and I have to make all decisions and responsibilities by myself."

Source: Filed Data, 2018

It could identify that there was also an attitudinal issue inside women. They identified authority and power to make decisions as a difficult responsibility rather than an opportunity.

Box 2: Abstraction from the Case Study 10

Age: 49

Grama Niladari Division: Molewa

> I do both paddy and Chena cultivation. And also, I work as an agricultural wage labour. One day, because of the personal crisis he went from home. Thereafter, he did not come home again. When he was at home, he made decisions on family affairs. Sometimes, we both discussed together. Thereafter he separated and he never looked after our family or even our children. I have to make all decisions and hold the responsibility of my family and children. Now, my children have got married and separated from the household. But, in most situations, before I make decisions I discuss with my elder son.

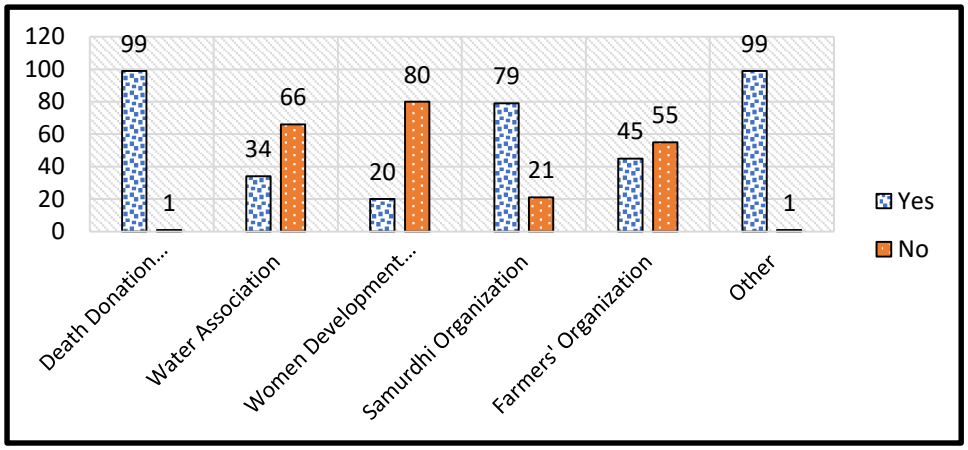
Source: Filed Data, 2018

Considering the above statements, it is evident that women have a little space for the power and authority of the household in traditional rural societies. Even after assuming the headship of the household, women have tended spontaneously to depend on others specially on a male figure as soon as possible. This is mainly a result of subordinate mentality which has created from childhood in male dominant societies through the socialization process.

3.2. Membership of Community Organizations and related Issues

Social capital is related to social supportive systems and social resources such as memberships of groups and associations, social networks and access to a wider institution of society (Tesfamariam, 2007). Social capital is significant to enhance opportunities to access social networks, sharing information, enabling social safeguard and protection, motivation and empowerment of women. Sense of connectivity and social relationships are also important indicators to measure the quality and well-being of individuals. Hence, membership of community organizations illustrates a significant cross-cutting of the social profile of individuals. According to research data of the study, status of membership of community organizations can be displayed as follows.

Figure 1: Percentage of WHHs by Status of Obtaining Membership



Source: Field Data, 2018

Above figure illustrates that a vast majority (99%) of WHHs had obtained membership of *Death Donation Organization* of the village and "other" category is related to *Dayaka Samithiya* of the temple. A considerable proportion of WHHs (79%) had been members of *the Samurdhi* organization. But importantly, it could be identified that majority of WHHs (80%, 66% and 55%) had not obtained memberships respectively of the women development organization, water organization and farmers' organization. According to the above data, it infers the idea that most of WHHs had obtained membership of community organization based on their benefits not because of any other motivational factors.

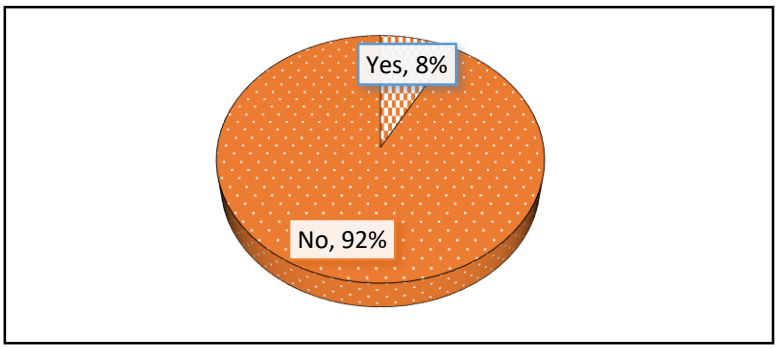
For instance, obtaining membership of *death donation organization* and *Dayaka Samithiya* considered as essential in a village community. As well as membership of the *Samurdhi* organization is essential for *Samurdhi* beneficiaries, farmers' organization's membership for farmers and membership of water organization underwater sources or drainage board. But when considering women development organization, they had not considered the importance of becoming members of women's organization. Personal development, women leadership or women empowerment had not been a significant or essential part of living of the majority of WHHs.

On the other hand, mainly women development organizations are empowered and authorized by the divisional secretariat in the area. Hence, it is illustrated the factor of lack of effectiveness of existing empowering methods in the community to stimulate women leadership, skills, latent potentials and to enhance involvement of decision making and improving infrastructures to enhance the stability of living standards of WHHs. Awareness of a programme for self-employment training and other capacity-building was raised through women development organizations of the village. Unfortunately, it had caused to decrease the participation, the fact that of the majority of WHHs (80%) had not become members of women organization in the village denying the objectives of leadership and skill development of women heads and ultimately to increase the low level of living standards among WHHs. Hence, it is illustrated the factor of lack of effectiveness of existing empowering methods in the community to stimulate women leadership, skills, latent potentials and to enhance involvement of decision making and improving infrastructures to enhance the stability of living standards of WHHs.

3.3. Status of Leadership of WHHs

Woman heads had reported that even if the male partner was present in the household, they had taken part in some community organizations. But the present issue is they have no enough time to participate for them actively with other responsibilities of children, and livelihood activities in the household. When considering deeply it could be easily noticed that economic burden had become a major barrier to participate actively in community organizations and to obtain a position in community organizations. Therefore, they have become only members of them namely.

Figure 2: Percentage of WHHs by Status of Obtaining Positions of Community Organizations



Source: Field Data, 2018

Above pie chart illustrates that the vast majority of women heads (92%) had not obtained any kind of positions in community organizations. The least amount of WHHs (8%) had obtained different types of positions such as president, vice president, secretary, secretary, consultant etc. Most of them had positions, particularly in *Samurdhi* organization. Considering reasons for not obtaining positions in community organizations, unwillingness to take additional responsibilities, limited time for engaging in community activities, conflict of household responsibilities, lack of willpower to take leadership and to make decisions and lack of motivation could be identified through the research. Consequently, it had reduced opportunities to access leadership and decision making in the community. On the other hand, it had promoted the dependency, mentality and subordination among women heads.

3.4. Employment Status and Related Issues

Employment or livelihood activities are main factors which influence to decide living condition or status of an individual in society. On the other hand, employment status or livelihood strategies of individuals directly affect the level of income and economic stability of a household. According to the findings, the majority of employed WHHs have engaged in agriculture (45) and work as manual labours in the agriculture sector (28). A few numbers of women heads (2) employ in a brick-kiln and a tile mill as non-agricultural wage labours. This type of employment refers to hard physical activities for relatively low wages. Most often they are in the informal sector with a lack of job security and the risk of being expelled from work without prior notice.

In particular, those wage labourers are most vulnerable to health and physical risk. A few proportions of female heads (6) having engaged in self-employment. Considering agricultural labours, high risk of stability has been related to their employment because their employment has depended on agricultural process and production. Employment in the private sector refers mainly to women who are working in garment factories. A fewer number of WHHs (2) work as pre-school teachers and teaching assistants in pre-school. Thus, it infers that few of WHHs in the sample work in the formal sector. According to data, the percentage distribution of WHHs by occupation, the majority of WHHs (48) in the study area depends on agriculture, largely on paddy cultivation and crop cultivation (*Chena* cultivation). Some households combine both agriculture and off-farm activities; a small proportion does not have any connection with agriculture or farming.

Lack of water, inadequate labour and agriculture extension services are major factors to create issues related to livelihood activities, particularly in paddy and crop cultivation. Lack of rainfall and lack of capacity of irrigation systems to stock water for long term droughts have mainly influenced to create difficulties against livelihood activities in rural areas.

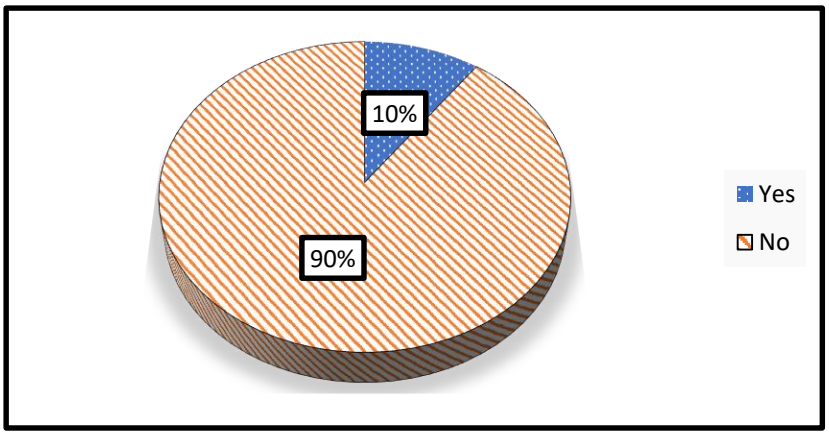
Physical subsidies such as seeds, fertilizers have distributed from government institutions. But lack of alternate supportive mechanisms of agricultural provisions, guidance, training and awareness programmes have influenced negatively on the sustainability of livelihood activities of WHHs. Because of the lack of awareness of climate-resilient agricultural methods, they have to mainly depend on traditional methods and have to struggle with climate challenges.

3.4.1. Lack of Confidence for Diversification of Livelihood Activities

Not only external socio-economic factors but also, internal factors have influenced to decide the condition of living of people. Some external social and economic impacts can reduce through relevant and sustainable actions and mechanisms. But internal crisis which bonded with attitudes of individuals is difficult to minimize and need a strong motivational process to reduce those. Although women heads are facing many difficulties and vulnerabilities in poverty due to lack of sustainable employment and livelihood activities, it is proved that they are reluctant to change their livelihood activities due to lack of confidence and motivation.

Although they confront many difficulties in agriculture and manual labour, they do not tend for diversification of livelihood activities because of familiarity with both paddy and dry farming and as well as manual labour works are easy to find. In one hand, they have limited in a demotivational attitudinal framework due to lack of choices, opportunities and educational and vocational qualifications. On the other hand, due to familiar daily livelihood activities, they do not much confidence about new income-generating sources such as self-employment or commercial activities.

Figure 3: Percentage of WHHs by Participation for Self-employment Training



Source: Field Data, 2018

Above figure shows that only a few proportions of women head (10%) had participated for self-employment training and a vast majority of women (90%) had not taken part in them. According to responded women, self-employment training on creating bags, boxes, purses and doormats, composing compost, making wicks and incense sticks had been conducted by Divisional Secretariat Office. Inadequate awareness of the advantages and opportunities of self-employment, lack of motivation towards new trends of income-generating sources and unwillingness to change their familiar safe zone had highly influenced the limited tendency to involve in activities related diversification of income-generating sources and livelihood of WHHs. It was identified that very few proportions of women heads (6) have engaged self-employment. Although they can engage in self-employment in addition to their primary occupation, the majority of women are reluctant to take challenges with new trends such as self-employment.

3.5. Community Development Project and Programmes Related to WHHs and Issues

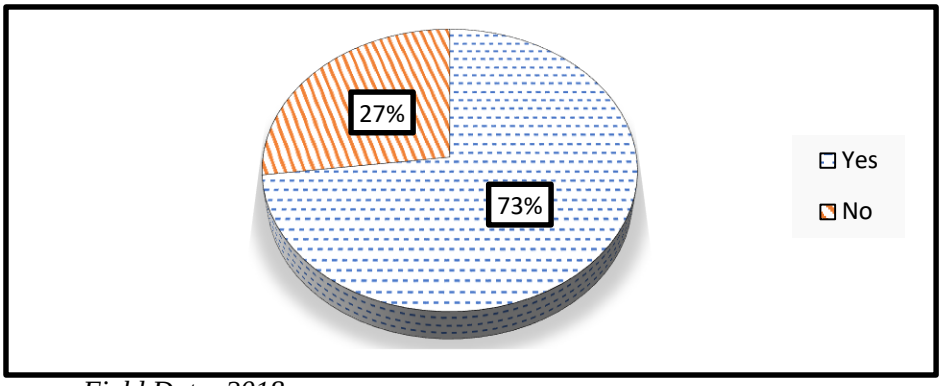
Community development seeks to empower individuals and groups of people with stimulating people's potential powers, capabilities, abilities and skills. Community development involves changing the relationships between ordinary people and people in positions of power so that everyone can take part in the issues that affect their lives. It starts from the principle that within any community there is a wealth of knowledge and experience which, if used in creative ways, can be channelled into collective action to achieve the communities' desired goals. Although the prevalence of many socio-economic difficulties and psychological issues negatively influenced livelihood and living conditions of WHHs, any kinds of Non-Governmental Organizations (NGOs) had not been working in the research area. It was a highlighted factor in this sector of the research conducted. Hence, government programmes had related to WHHs household in the sampled location. Monthly financial aids programmes such as "*Samurdhi*", allowances for disabled persons, and allowances for old aged poor people called "*Pinpadi"*, Distribution of books for poor children, drought subsidies, health clinics particularly for kidney disease, fertilizer subsidies, distribution of retail goods, self-employment training and low rate loan systems through women development organizations for self-employment had been identified as mainly highlighted programmes conducted under government intervention monitored by Galgamuwa Divisional Secretariat office.

3.5.1. Programmes for Monthly Financial Allowances

The figure 4 convinces that majority of WHHs in the sample (73%) had been benefitted by any kind of public financial source such as Samurdhi, allowances for disabled persons or "*Pin Padi*". In one hand, it has become a great contribution to their household income. On the other hand, it has influenced to create dependency mentality among most of the women as most of women heads had become suggestive of getting more financial or physical aids and subsidies from the government than believing their own potentials, strengths and skills.

Data related to WHHs receiving monthly financial allowances can be indicated as follows.

Figure 4: Distribution of WHHs who are Receiving Any Kinds of Public Financial Allowances

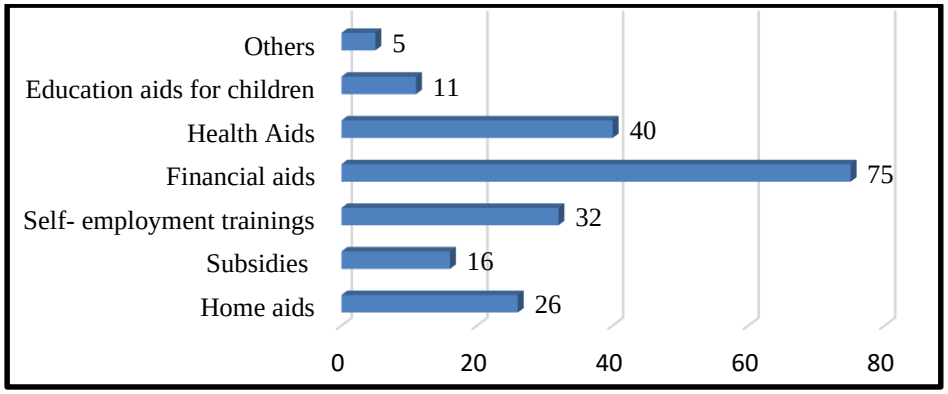


Source: Field Data, 2018

3.5.2. Promoting Dependency Mentality

In a deeper perspective, it could identify that most of the current government programmes had related to financial and physical allowances. It has influenced to diffuse dependency mentality and to decrease the motivational factors among people. WHHs' views on how to design future programmes and projects related to them can be illustrated as given below.

Figure 5: Percentage of WHHs by Requesting Types of Programmes



Source: Field Data, 2018

Above figure has convinced that a larger percentage of WHHs (75%) had requested more programmes on financial aids. Considerable percentages of WHHs (40% and 32%) had indicated that programmes based on health aids and self-employment training had been important respectively.

Home aids and subsidies for agriculture, animal husbandry and retails goods and educational aids for their children had been requested to some extent. "Other" category includes that requirements of programmes specially focused on social security regarding WHHs. Above data indicates that the majority of WHHs had limited awareness of community development projects and programmes implemented towards a constructive change in them. It infers that the low level of motivation and empowerment, inadequate awareness about skills and potentials of them and limited knowledge on true sense and importance of community development components had affected to create a negative impact within them.

3.5.3. Lack of Specific Programmes with Specific Reference to WHHs

Above mentioned projects and programmes are common for all people and specific programmes with specific reference to WHHs could not be identified in the research area during the study. As identified in this study the key issues to be addressed by those projects and programmes could be listed as follows: Lack of government, private or non-governmental programmes especially relevant to female-headed households, lack of effectiveness of those programmes and strength of existing empowering methods in the community to stimulate women leadership, skills and latent potentials and to enhance involvement of decision making and improving infrastructures to enhance the stability of living standards of female-headed households. Therefore, it is important to introduce integrated projects based on participatory development approach and methods of social inclusion to enhance opportunities to build self-esteem and self-confidence and to identify adaptation and mitigation actions for reducing hardships and issues through empowering latent potentials and skills of WHHs.

4. Conclusion and Suggestions

After considering all the above data and information, it is evident that the lack of confidence for diversification of livelihood activities is one of the key issues related to WHHs. Most women are reluctant to change their livelihood activities due to lack of confidence and motivation. Most women heads do not have economic stability due to their spouses or they have or had not engaged in the formal employment sector. The tendency of WHHs to obtain membership of community organization has mainly based on their individual benefits not because of motivational factors.

WHHs have obtained membership of community organization based on their benefits not because of motivational factors. Personal development, women leadership or women empowerment do not become a significant or essential part of living of the majority of WHHs in rural areas. This has caused to decrease the participation, leadership and skill development of women heads and ultimately has increased the low level of living standards among WHHs. Low rate of obtaining positions in community organizations has been caused by unwillingness to take additional responsibilities, limited time for engaging community activities, conflict of household responsibilities, lack of willpower to take leadership and to make the decision and lack of motivation.

Low level of participation for self-employment training programmes can be identified among WHHs and inadequate awareness of advantages and opportunities of self-employment, lack of motivation towards new trends of income-generating sources, unwillingness to change their familiar safe-zone have influenced to the limited tendency of diversification of income-generating sources and livelihood activities of WHHs. As identified in this study the key issues to be addressed by those projects and programmes could be listed as follows:

I. Lack of government, private or non-governmental programmes especially relevant to female-headed households,
II. lack of effectiveness of those programmes and strength of existing empowering methods in the community to stimulate women leadership, skills and latent potentials and to enhance involvement of decision making and improving infrastructures to enhance the stability of living standards of WHHs

Based on the findings of the study, suggestions to reduce issues related to WHHs and to enhance potential skills, capacities and strength of WHHs to sustain the living of WHHs can be illustrated as follows.

The current situation of WHHs is a prevalence of subordinate and dependency mentality in power, authority and decision-making process among most women heads. Even though they have attributed the headship of the household, women have tended spontaneously to depend on others especially on a male figure as soon as possible.

Therefore, it is important to introduce programmes to improve mobilization and empowerment of women heads to achieve skills and potentials in decision-making, women leadership and active social participation. In a context of most women heads have engaged in agricultural-related livelihood activities it is essential to have an alternative mechanism to support unexpectable but long-term challenges in agricultural societies. Hence, better adaptation and mitigation methods and climate-resilient actions such as disaster-resilient water systems and road systems, advanced technological agricultural methods, disaster-resilient genetically improved seeds, rain-water harvesting methods should be introduced to sustain the livelihood of WHHs by responsible government and non-governmental bodies. As well as enhancing capacities, awareness, skills and knowledge on sustainable livelihood activities are important than welfare mechanisms. Therefore, Agriculture extension services such as improving guidance, training and awareness programmes are crucial, parallel to distributing supportive physical materials in agriculture to improve the sustainability of livelihood of WHHs.

Improving access to the market, public transportation and infrastructure and low rate loan systems, updating reasonable rate of commodity price for products, increase motivational factors and empowerment are important to increase the tendency of diversified livelihood activities such as self-employment among WHHs.

Introducing government, private or non-governmental programmes with especially relevant to WHHs is significant to stimulate women leadership, skills, latent potentials and to enhance involvement of decision making and to the stability of living standards of female-headed households. And also, it is significant to introduce more effective community development programmes or project based on the bottom to top approach. Because community members are the core of community development and they are well-awarded and have numerous experiences on their own matters other than external bodies. Therefore, it is important to introduce integrated projects based on participatory development approach and methods of social inclusion to enhance opportunities to build self-esteem and self-confidence and to identify adaptation and mitigation actions to reduce hardships and issues through empowering latent potentials and skills of them.

Finally, this study signifies that typical rural development approaches mainly based on top-down supply had not responded adequately to the complexity of rural contexts in the past decades and suggests an approach to Participatory and Negotiated Territorial Development which offers concrete answers to the challenges of improving trust among female-headed households in the research area, strengthening social cohesion and promoting a systemic territorial development.

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