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Letter from the Editor-in-Chief

Myanmar and Korea have many similarities and are complementary relationship. Therefore, we believe that research exchange will expand mutual understanding between Myanmar and Korea, and will be the cornerstone for mutual development.

KOMYRA and YUE have co-published The Myanmar Journal since August 2014. So far, many scholars have published numerous papers through the journal, and We are sure that this journal has helped many people understand Myanmar and Korea more clearly and closely.

The Myanmar Journal covers various issues in Myanmar and Korea. It covers various topics that can promote bilateral development and mutual understanding, not limited to specific topics such as economy, industry, society, education, welfare, culture, energy, engineering, healthcare, and agriculture.

We hope that this journal will continue to promote understanding of the current status and potential capabilities of Myanmar and South Korea and promote in-depth international exchange and cooperation.

We would like to express our deepest gratitude to the editorial board and YUE and KOMYRA for their valuable support in The Myanmar Journal publication.

February 28, 2022

Youngjun Choi *yj choi*

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The Myanmar Journal (ISSN 2383-6563) is the official international journal co-published by Yangon University of Economics (YUE) and Korea Myanmar Research Institute (KOMYRA).

This journal aims to promote the mutual cooperation and development of Myanmar and Korea through intensive researches in the entire field of society, economy, culture, and industry.

It will cover all general academic and industrial issues, and share ideas, problems and solution for development of Myanmar.

Articles for publication will be on-line released twice a year at the end of February and August every year on the Myanmar Journal webpage (http://www.komyra.com/bbs/board.php?bo_table=articles).

A Cluster Analysis of Households' Sanitation Facilities in Sagaing Region, Myanmar

Cho Cho Win

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ABSTRACT : This study aims to investigate access to sanitation facilities of households at district level in Sagaing Region. Secondary data from the table for proportion of households by types of sanitation facilities based on the 2019 Inter-censal Survey in Myanmar was studied. The types of sanitation facilities were grouped into improved sanitation facilities and unimproved sanitation facilities. It was found that 91.4 percent of households have access to an improved sanitation facility in Myanmar, but 8.6 percent of households used an unimproved sanitation facility. Cluster analysis was performed to explore existing disparities in sanitation facilities of households at the district levels in Sagaing Region. Sagaing district and Kalay district are most similar situation in accessibility of sanitation facilities among 11 districts. This study specified two clusters: one cluster combines Shwebo, Hkamti and Yinmarpin districts, and another cluster combining Sagaing, Monywa, Katha, Kawlin, Kalay, Tamu, Mawlaik, and Kambalu districts. The study recommended that accessibility of sanitation facilities of household in second cluster is better than that of first cluster. Therefore, households in Shwebo, Hkamti and Yinmarpin districts need to use more improved sanitation facilities than households in other districts.

Key words : *Households' Sanitation Facilities, Cluster Analysis*

I. Introduction

Sanitation is important for all, providing to maintain health and increase life-spans. Sanitation is a vital subject of health and development around the world.

Limited access to sanitation has become such a worldwide problem. Proper sanitation facilities promote health. The health of women and children, particularly pregnant women and young children is directly linked to the access of sanitation facility.

People's access to quality water and sanitation resources significantly improves their health (Agbadi et al., 2019). Water and sanitation are fundamental to human development and well-being. Access to safe water and sanitation is also a human right, as recognized in 2010 by the United Nations General Assembly (WHO/UNICEF Joint Water Supply and Sanitation Monitoring Programme et al., 2015).

Water and sanitation improvements, in association with hygiene behavior change, can have significant effects on population and health by reducing a variety of disease conditions such as diarrhea, intestinal helminths, guinea worm, and skin diseases. These improvements in health lead to reduced morbidity and mortality and improved nutritional status (Billig et al., 1999).

Sanitation is a public health issue and also contributes to social injustice and poverty. It is common for societies to use access to safe sanitation facilities as a measure for progress to develop. Access to safe sanitation is essential for better health, welfare and productivity. It is recognized as a human right.

In Myanmar, 91.4 percent of households have access to an improved sanitation facility (97.9% of urban households and 88.9% of rural households). However, only 26.1 percent of households have a flush toilet linked to a sewer system or septic tank. On the other hand, 8.6 percent of households used an unimproved sanitation facility (2.1% of urban households and 11.1% of rural households). About 5 percent of all households still practiced open defecation (dispose of faeces in fields, forests, bushes, open bodies of water, beaches or other open spaces), with higher proportion in the rural areas (6.5%) (The 2019 Inter-Censal Survey The Union Report, 2020).

Access to improved sanitation facilities is a key to the socioeconomic wellbeing and sustainable development of any household. This study examines accessibility of sanitation facilities in Sagaing Region. This study utilizes secondary data from the 2019 Inter-censal Survey, and employs descriptive and cluster analysis.

1. Objectives

The main objective of this study is to analyze existing disparities in sanitation facilities at the district levels in Sagaing Region. The specific objectives are:

- (i) to describe the proportion of households by types of sanitation facilities used in Sagaing Region, and
- (ii) to cluster districts according to the proportion of households by sanitation facilities used in Sagaing Region.

2. Method and Limitations

In this study, sanitation facilities of households used in Sagaing Region is explored by cluster analysis. Secondary data from the 2019 Inter-censal Survey was used to analyze existing disparities in sanitation facilities of households at the district levels in Sagaing Region. Data were analyzed with RStudio. The analysis has been used secondary data from the 2019 Inter-censal Survey published by the Department of Population under the Ministry of Labor, Immigration and Population of the Republic of the Union of Myanmar. The required data for this study were extracted from the number of households by toilet facility and State/Region, Urban/Rural, District. Various kinds of toilet facility used by households at the district levels in Sagaing Region are studied.

II. LITERATURE REVIEW

Sanitation is defined as a system that promotes proper disposal of human and animal waste for improving and protecting public and environmental health. Many studies on household access to different types of sanitation facilities and factors that influence facility access have been conducted in some developing countries. According to the United Nations, the Coronavirus Disease 2019 (COVID-19) pandemic has demonstrated the critical importance of sanitation, hygiene and adequate access to clean water for preventing and containing diseases. According to the World Health Organization, poor sanitation is believed to be the main cause in some 432,000 of these deaths. Poor sanitation also reduces human well-being, social and economic development due to impacts such as anxiety, risk of sexual assault, and lost educational opportunities. In 2017, 45% of the global population (3.4 billion people) used a safely managed sanitation service. There were about 2.0 billion people still do not have basic sanitation facilities such as toilets or latrines.

1. Sanitation Facilities

Sanitation as one of the basic needs of human beings has a direct relationship with health, nutrition and social wellbeing. Without sanitation or with poor sanitation, people' life will be clutched with fatal diseases and will create a havoc situation. Therefore, access to sanitation is crucial for human survival. The Joint Monitoring Programme for Water Supply and Sanitation which monitors progress toward targets

defines "improved sanitation" in terms of service levels. This includes a private flush or pour-flush toilet or latrine connected to a piped sewer system or septic system, a simple pit latrine with a slab, a ventilated improved pit latrine or composting toilet. Pour-flush latrine or any other flush, an open pit latrine, bucket latrine, a hanging latrine or open defecation is "unimproved" (Ahmed, 2015).

Without basic sanitation, ill-health dominates a life without dignity. Simply having access to and using sanitation facilities increases health, well-being and economic productivity. Inadequate sanitation has a negative impact on individuals, households, communities and countries. Lack of sanitation has profound effects on the health of the world's people (WHO/UNICEF Joint Water Supply and Sanitation Monitoring Programme, 2005).

Households with access to piped water, boreholes or tube wells, protected dug wells, protected springs, and packaged or delivered water sources were categorized as having 'Improved' drinking water. 'Unimproved' drinking water was indicated by households that accessed water from unprotected sources (dug well or spring) and surface water (directly from a river, dam, lake, pond, stream, canal or irrigation canal). Having a handwashing facility, regardless of soap and/or water availability was categorized as 'Facility', whilst the absence of such facilities was categorized as 'No facility' (Nyambe et al., 2020).

2. Related Resources

Sanitation is a basic human need. Inadequate sanitation and poor hygienic practices lead to huge public health costs and diseases. Shukla, (2018) highlights the interregional and interstate disparity in the coverage of sanitation facility in India based on census data. Most of the states in India have inadequate toilet facilities. About 53 per cent of all Indians still do not have access to any type of toilet. The best sanitation facilities are available in all states of Northeast India where nearby 77 per cent households get the benefits of sanitation facility. The study reveals unsatisfactory condition of sanitation facility especially in rural areas. There is also a need to make constant effort to improve the performance of the programmes by making them more responsive to the local needs and aspirations.

Nyambe et al., (2020) used multivariate stepwise logistic regression to assess the factors associated with use of improved (toilet) and unimproved (chamber) sanitation facilities among peri-urban residents of Lusaka, Zambia. Findings revealed that having a regular income, private toilet facility, improved drinking water and handwashing facility were all positively correlated to having an improved toilet facility. To better access and increase peri-urban sanitation, this study recommends a separate sanitation ladder for high density areas which considers improved private and shared

facilities, toilet management and all-inclusive usage (cancelling unimproved alternatives). It further calls for financial plans supporting urban poor access to basic sanitation and increased education on toilet facility models, hygiene, management and risk to help with choice and proper facility use to maximize toilet use benefit.

Inadequate water and sanitation during childbirth are likely to lead to poor maternal and newborn outcomes. Benova et al., (2014) used existing data sources to assess the water and sanitation environment surrounding births in Tanzania in order to interrogate whether such estimates could be useful for guiding research, policy and monitoring initiatives. The main objective of this paper is to estimate the coverage of water and sanitation in the various birth environments. Existing data sources can be useful in national monitoring and prioritization of interventions to improve poor water and sanitation environments during childbirth. However, a better conceptual understanding of potentially harmful exposures and better data are needed in order to devise and apply more empirical definitions of water and sanitation safe environments, both at home and in facilities.

Sanitation is one of the most important aspects of community well-being because it protects human health, extends life spans, and is documented to provide benefits to the economy. Although sanitation infrastructure can be expensive, the return on investment and job creation is documented as being much greater. Also, the lack of sanitation is known to impart large costs and job losses to industrial, health, agricultural, and tourism sectors. Investing in sanitation not only has positive economic returns, creates jobs, and contributes to a vibrant economy but not investing in sanitation provision can have a highly negative impact on a nation's economy. Poor sanitation also leads to illness associated with work and school absenteeism and decreased productivity (Naughton & Mihelcic, 2019).

Andualem et al., (2021) studied to analyze household access to improved drinking water sources and sanitation facilities and their associated factors in Ethiopia. The study conducted an in-depth secondary data analysis of 2016 Ethiopian Demographic and Health Survey. Multilevel binary logistic regression analyses were performed to identify factors associated with access to an improved drinking water source and toilet facilities. A higher probability of having access to improved toilet facilities: households with heads who had attained higher education, households having better access to improved sources of drinking water and households with better wealth index. While the following households were less likely to have access to improved toilet facilities: households with heads were widowed, households with four to six members, rural households and region. The study found that the proportions of households' access to improved drinking water sources and toilet facilities in Ethiopia were relatively low, which demands the need to tailor strategies to increase the coverage of access to improved drinking water sources and toilet facilities.

Raj et al., (2019) said that hygienic sanitation facilities are crucial for public health. Investment on sanitation brings the single greatest return for any development intervention. Poor sanitation, open defecation and lack of awareness about hygiene have detrimental effect on the health of women and children living in slums. The objective of this study was to perceive the barriers to access of hygienic sanitary facilities for adolescent girls in an urban slum of Central India. Community-based cross-sectional study was designed to assess the barriers to the access of hygienic sanitary facilities for adolescent girls in an urban slum of Raipur city. The availability of sanitation facility and latrine utilization rate of the households were satisfactory. This study recommended that appropriate emphasis needs to be given to behavior change communication to create awareness among adolescents on the importance of hygienic and safe sanitation practices.

Abubakar, (2017) examined access to sanitation facilities in Nigeria and explores the socioeconomic and locational factors that influence the type of facility used by households. The study utilizes cross-sectional data from the 2013 Nigeria Demographic and Health Survey, and employs descriptive and inferential statistics for data analyses. Results from chi-square analysis and analysis of variance revealed significant statistical differences between the type of sanitation facility households used and their place of residence, geopolitical zone, ethnicity, educational attainment and wealth. Multivariate regression results indicated that the type of household sanitation facility is significantly associated with the mentioned factors as well as household size, gender of the head of the household, type of water sources, number of rooms and access to electricity. The study concludes by underscoring the implications of using unimproved sanitation facilities on human health and environmental sustainability.

The condition of learners' sanitation facilities reflect the image of a school and have an influence on their hygiene practices and health. It is in view of this that the study was carried out to gather information from respondents regarding the influence of type, number and maintenance of sanitation facilities on implementation of hygiene practices in secondary schools in Machakos County. After studying the research findings, it emerged evident that toilets have a positive significant influence on implementation of hygiene practices. However, adequacy of toilets is the most important indicator followed by type and maintenance (Mbula et al., 2014).

Current challenges for the water and sanitation sector require an increase in sustainable access to water and sanitation services in residential areas, where natural hazards pose the greatest risk. Sanitation includes safe excreta disposal, drainage of wastewater and rainwater, solid waste disposal and vector control (Hlavinek et al., 2009).

Water and sanitation-related improvements are crucial in meeting the Global

Sustainable Development Goals. Nyanza et al., (2018) conducted to determine the access, utilization and determinants of access to sanitation facilities among pastoral communities in rural areas of northern Tanzania. The multivariate analysis identified that the key determinants to access a sanitation facility at a household were socio-economic status, family size, presence of under-five years of age in the household, history of diarrhoeal diseases, having ever received education on sanitation and motivation for improvement in defecation place. Individual and community factors are key determinants for a household to own a sanitation facility. Findings from this study indicate a need for interventions to improve access to water, and sanitation facilities in the area.

Higashikata, (2019) summarized how Indonesia has improved access to sanitation services and drinking water through household survey data and community-level census data from 1999 to 2017. This study checks the relationship between urbanization and the share of households with better access to safe drinking water, basic sanitation, and garbage pickup services using district level information. The study examines the progress using the dataset from large sized household surveys and community level census data. The share of households with safe drinking water has grown from 1999 to 2017 not only in urban regions but also in rural districts.

Sanitation affects the health, nutrition, education and economic status of the population of a country. Mwambuli, (2015) presented that basic household sanitation coverage in Tanzania is high, with 70-90% of rural households having access to some sort of latrine. However, only about 14% of the rural population has access to an improved sanitation facility. The low quality of most sanitation facilities in rural Tanzania combined with open defecation, and unsafe disposal of children's stools are holding many communities back from realizing the health and economic benefits of sanitation.

The human right to water and to sanitation constitutes the right of every individual, without discrimination, to sufficient, safe, acceptable, accessible and affordable water and sanitation for personal use. The seriousness and scope of the health risks associated with unsafe water and inadequate sanitation make action on these issues a leading priority for child survival and development. In every country, governments have the leading role in seeking to make these goals a reality, in building consensus and political will, mobilizing support and creating an enabling environment for the provision of a minimum core level of access to water and sanitation for all with equity (Noorani, 2014).

Water and sanitation-related programs include improvements in facilities as well as hygiene education for behavior change. It is well-documented that such programs can bring about decreases in the rate of diarrheal disease on the order of 25%. A sanitation facility is defined as a functioning excreta disposal facility, typically a toilet

or latrine. The toilet or latrine is inspected for maintenance and evidence of use, such as a well-worn path between the house and sanitation facility, signs of wear on the seat, absence of storage materials, door in good repair, absence of spider webs, etc. Improvements in sanitation have been shown consistently to result in better health, as measured by less diarrhea, reductions in parasitic infections, increased child growth, and lower morbidity and mortality (Billig et al., 1999).

III. METHODOLOGY

1. Cluster Analysis

Cluster analysis is a well-developed branch of applied statistics that attempts to identify groups in data such that objects within groups are as similar as possible although the differences between groups are maximized. Although classification of similar objects was a prominent task of many fields (e.g., classification of animals and plants, of stars, and of chemical compounds) in the 19th century, the development of statistical techniques to uncover "known underlying dimensions" received major interest in psychology since the 1950s and 1960s (Ahlquist & Breunig, 2012).

Cluster analysis is a very practical subject. Nowadays clustering methods are applied in many domains, including artificial intelligence and pattern recognition, chemometrics, ecology, economics, the geosciences, marketing, medical research, political science, psychometrics, and many more. This has led to a lot of different methods, and articles on clustering have appeared not only in statistical journals but also in periodicals of all these domains. Clustering is known under a variety of names, such as numerical taxonomy and automatic data classification. Kaufman & Rousseeuw, (2005) provided an accessible introduction to traditional cluster analysis, and several attempts have been made to catalogue the available measures of similarity and dissimilarity.

Cluster analysis has been employed as an effective tool in scientific inquiry. One of its most useful roles is to generate hypotheses about category structure. An algorithm can assemble observations into groups which prior misconceptions and ignorance would otherwise preclude. An algorithm can also apply a principle of grouping more consistently in a large problem than can a human (Anderberg, 1973).

Cluster analysis is the formal study of algorithms and methods for grouping, or classifying objects. Cluster analysis is another technique that has been used with success in the decision-making process. The premise in cluster analysis is: given a number of individuals, each of which is described by a set of numerical measures,

devise a classification scheme for grouping the objects into a number of classes such that the objects within classes are similar in some respect and unlike those from other classes. These deduced classes are the clusters (King, 2015).

2. Hierarchical Clustering

In a hierarchical classification the data are not partitioned into a particular number of classes or clusters at a single step. Instead the classification consists of a series of partitions, which may run from a single cluster containing all individuals, to n clusters each containing a single individual (Everitt et al., 2011).

Hierarchical clustering can be broken down into two major categories: agglomerative methods and divisive methods. A procedure for forming agglomerative hierarchical groups of mutually exclusive subsets was developed by Ward. The grouping technique is based on the premise that the greatest amount of information, as indicated by the objective function, is available when a set of n members is ungrouped. Some of the more common hierarchical techniques are the nearest neighbor (single linkage) method, the furthest neighbor (complete linkage) method, centroid method, and Ward's method (King, 2015).

3. Non-hierarchical Clustering

Non-hierarchical clustering analysis is used to generate groupings of a sample of elements by partitioning it and producing a smaller set of non-overlapping clusters with no hierarchical relationships between them. Non-hierarchical clustering has as start point the specification of the number of clusters. Once defined the number, the objects are assigned into clusters. It is a two-stage process. First, the cluster seed is specified. This is a start point that can be defined by the researcher or at a systematic or random selection. Then, observations are assigned according to its similarities to the pre-defined seed. The non-hierarchical group of algorithms is the k-means. The k-means works by separating the data into a pre-specified number and systematically assigning observations to the clusters. The k-means method is more suitable for large samples ($n > 1000$) since it does not compute the proximity matrix between all cases (Filho et al., 2014).

IV. SANITATION FACILITIES OF HOUSEHOLDS USED IN SAGAING REGION, MYANMAR

1. Accessibility of Sanitation Facilities in Myanmar

According to the 2019 Inter-censal Survey Union Report of Myanmar, an improved sanitation facility is defined as one that hygienically separates human excreta from human contact. Improved sanitation facilities include flush or pour flush to piped sewer systems, septic tanks or pit latrines, ventilated improved pit latrines, pit latrines with slabs and composting toilets. The Table 1 presents the proportion of households by type of sanitation facilities classified as improved or unimproved in Myanmar.

Table 1. Proportion of Households by Sanitation Facilities, Myanmar

	Improved sanitation facilities (%)	Unimproved sanitation facilities (%)
Union	91.4	8.6
Urban	97.9	2.1
Rural	88.9	11.1

Source: The 2019 Inter-censal Survey Union Report

It can be shown that 91.4 percent of households have access to an improved sanitation facility in Myanmar, while 8.6 percent of households used an unimproved sanitation facility. About 97.9 percent of urban households and 88.9 percent of rural households have access to an improved sanitation facility. However, 2.1 percent of urban households and 11.1 percent of rural households used an unimproved sanitation facility.

2. Accessibility of Sanitation Facilities in Sagaing Region

Sagaing Region constitutes 11 districts namely Sagaing, Shwebo, Monywa, Katha, Kawlin, Kalay, Tamu, Mawlaik, Hkamti, Yinmarpin, Kambalu. The Table 2 shows the proportion of households by type of sanitation facilities in Sagaing Region.

Table 2. Proportion of Households by Sanitation Facilities, Sagaing Region

	Improved sanitation facilities (%)	Unimproved sanitation facilities (%)
Sagaing	94.5	5.5
Shwebo	88.7	11.3
Monywa	97.0	3.0
Katha	95.9	4.1
Kawlin	98.6	1.4
Kalay	94.4	5.6
Tamu	98.1	1.9
Mawlaik	98.4	1.6
Hkamti	86.5	13.5
Yinmarpin	88.2	11.8
Kambalu	98.7	1.3

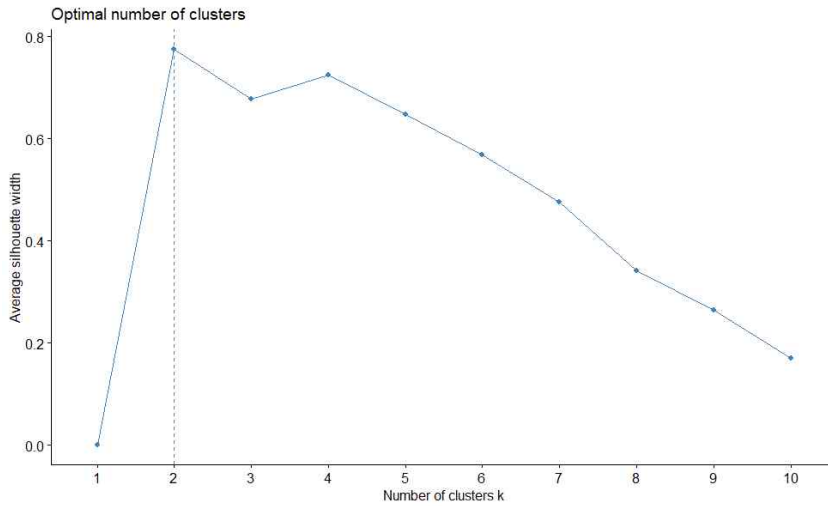
Source: The 2019 Inter-censal Survey Union Report

According to Table 4.2, 98.7 percent of households have access to an improved sanitation facility in Kambalu district, while 1.3 percent of households used an unimproved sanitation facility. About 98.6 percent of households in Kawlin district and 98.4 percent of households in Mawlaik district have access to an improved sanitation facility. It can be shown that 13.5 percent of households in Hkamti district and 11.8 percent of households in Yinmarpin district used an unimproved sanitation facility.

3. Clustering on Accessibility of Sanitation Facilities

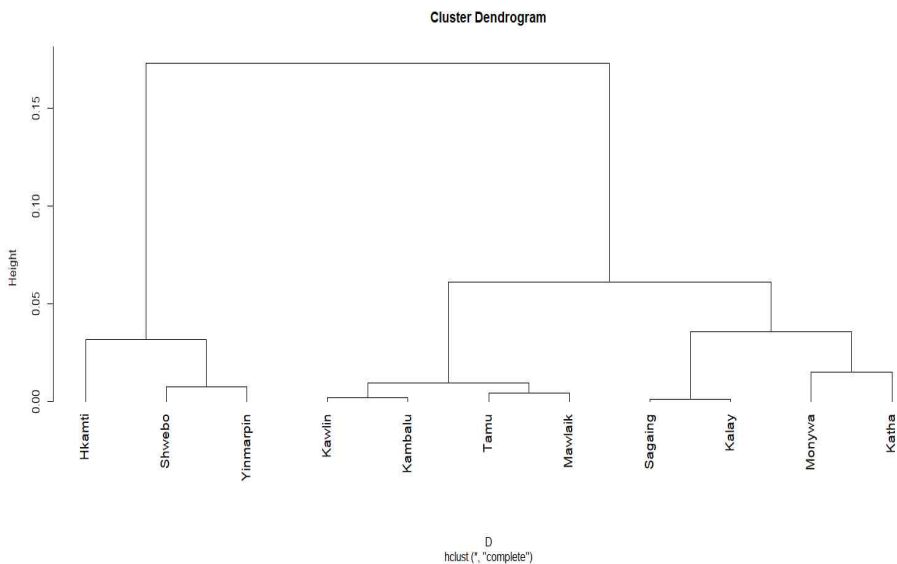
Cluster analysis was applied to provide the second objective of the study. The proportion of households by type of sanitation facilities in Sagaing Region by districts were used. The types of sanitation facilities were grouped into improved sanitation facilities and unimproved sanitation facilities based on the 2019 Inter-censal Survey Union Report of Myanmar. Firstly, average silhouette method was used to determine the optimal number of clusters. The method suggested that the optimal number of two clusters should be appropriated for the study. The plot for optimal number of clusters is presented in Figure 1.

Figure 1. Optimal Number of Clusters



The district level data for the proportion of households by type of improved sanitation facilities and unimproved sanitation facilities are allocated to clusters by drawing a horizontal line through the dendrogram. It was created as an output from hierarchical clustering and showed the hierarchical relationship between districts. The Figure 2 explores the cluster dendrogram for this study.

Figure 2. Cluster Dendrogram of Districts



In Figure 2, it can be seen that Sagaing district and Kalay district are most similar, as the height of the link that joins them together is the smallest. The next two most similar districts are Kawlin and Kambalu. Moreover, Tamu district and Mawlaik district, Shwebo district and Yinmarpin district, Monywa district and Katha district are also similarly joined together.

The dendrogram explains that the big difference between clusters is between the cluster of Shwebo, Hkamti and Yinmarpin districts versus that of Sagaing, Monywa, Katha, Kawlin, Kalay, Tamu, Mawlaik, and Kambalu districts. Therefore, one cluster combines Shwebo, Hkamti and Yinmarpin districts, and a second cluster combining Sagaing, Monywa, Katha, Kawlin, Kalay, Tamu, Mawlaik, and Kambalu districts.

In addition, k-means cluster analysis is performed on the same data to represent districts and type of sanitation facilities. This study specified two clusters to conduct k-means. In this case, the districts have been randomly assigned to the two clusters by using hierarchical clustering.

For each cluster, the average value is computed for each of the variables improved sanitation facilities and unimproved sanitation facilities. The main output from k-means cluster analysis is a table showing the mean values of each cluster on the clustering variables. The table of cluster means produced from examining the data is summarized in Table 3.

Table 3. Mean Proportion of Households by Sanitation Facilities

	Improved sanitation facilities (%)	Unimproved sanitation facilities (%)
Cluster 1	87.8	12.2
Cluster 2	96.9	3.1

Table 3 indicates that 96.9 percent of households in cluster 2 achieved improved sanitation facilities

while 87.8 percent of households in cluster 1. On the other hand, 3.1 percent of households in cluster 2 used unimproved sanitation facilities but 12.2 percent of households in cluster 1. Therefore, it can be concluded that accessibility of sanitation facilities of household in cluster 2 is better than that of cluster 1.

V. CONCLUSION

1. Findings

The study found that the households in Hkamti district accessed improved sanitation facilities as the least proportion among the districts in Sagaing Region.

Furthermore, Hkamti district used unimproved sanitation facilities as the highest proportion among the districts. In Kambalu district, the largest percentage of households have accessed improved sanitation facilities while the lowest percentage of households used an unimproved sanitation facility in Sagaing Region. A dendrogram from hierarchical clustering showed the hierarchical relationship between districts. There was very big difference in accessibility of sanitation facilities between first cluster of Shwebo, Hkamti and Yinmarpin districts, and second cluster of Sagaing, Monywa, Katha, Kawlin, Kalay, Tamu, Mawlaik, and Kambalu districts.

Finally, it may be concluded that households in Shwebo, Hkamti and Yinmarpin districts of cluster 1 need to access more improved sanitation facilities than households in Sagaing, Monywa, Katha, Kawlin, Kalay, Tamu, Mawlaik, and Kambalu districts of cluster 2.

2. Suggestions for Further Studies

Base on the study of this dissertation, further studies is needed to measure many variables concerned with access to sanitation facilities of households. The findings and results will be more accurate and interested if primary survey is used. Household demographics, socio-economic determinants, characteristics and functionality of water, sanitation and hygiene facilities are also important objects to include in the analysis. If various considerations can be applied, the research will be more completed.

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