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Study of Sanitation Infrastructure Operations (Case Study: Wastewater Infrastructure in Ciamis Regency)

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Abstract *– Sanitation infrastructure is intended to complement the needs of people who do not yet have access to wastewater infrasctucture include bathing, washing and toilet. Inadequate sanitation infrastructure in an area can cause problems of decreasing environmental quality in residential areas. One of the problems in Ciamis Regency due to population growth is sanitation problems in the form of waste water treatment including the availability of infrastructure for bathing, washing and toilet facilities or Mandi, Cuci, Kakus (MCK). Ciamis Regency has a total of 63 MCKs that have been built in the 2010-2022 period, spread across 19 sub-districts and 62 villages with 63 MCK units. This research uses a quantitative descriptive approach to explain and analyze the existing conditions of all MCK facilities that have been built in Ciamis Regency through field survey data collection. Indicators for assessing the functioning of MCK facilities refer to SNI (Indonesian National Standard) SNI 03-2399-2002 concerning General Procedures for Planning MCK Buildings. The results of the assessment of the functioning of the MCK infrastructure in Ciamis Regency show that 37 MCK units are in prime condition, 23 MCK units are damaged but can still function properly, 3 MCKs units where users are hesitant to use the MCK. Efforts need to be made to repair damaged and/or non-functioning MCKs by increasing participation from the user community in the form of contributions to MCK managers. This aims to encourage people to use and care for toilets as a form of sense of ownership and shared responsibility.*

Keywords*: Infrastructure Sanitation; Toilets; Wastewater*

I. INTRODUCTION

In the planning stage, in order to improve the development of sanitation infrastructure, an integrated planning document is needed that refers to national policies and takes into account potential problems that exist in each region. One of Indonesia's current development goals and targets with reference to the Sustainable Development Goals (SDGs). The targets of the Sustainable Development Goals (SDGs) and their indicators have become an integral part of Indonesia's 7 development agendas for the future. One of the goals in Sustainable Development is "Realizing Safe and Sustainable Access to Drinking Water and Sanitation for All" with a target of 90% access to decent sanitation (including 15% safe) and 0% open defecation or *Buang Air Besar Sembarangan* (BABS) by 2024. According to the Regulation of the Minister of Public Works and Public Housing Number 4 of 2017 concerning the Implementation of Domestic Wastewater Management Systems has states that the definition of domestic wastewater is wastewater derived from businesses and/or residential activities, restaurants, offices, businesses, apartments, and dormitories. Domestic wastewater consists of black water and gray water.

Sanitation problems in cities/regencies in Indonesia are bathing and washing into rivers, waste that is discharged directly into water bodies from households and commercial areas, open defecation, poor quality toilet; and illegal fecal sludge disposal. All these sanitation problems have the potential to cause water pollution and health problems. The need for proper and safe sanitation for health is a basic need that is shared by every layer of society. Basically, domestic wastewater is generated from daily activities through the use of 100 liters of water per day per person for drinking,

bathing, washing and toilet needs so that the water that is thrown away becomes around 85 liters of wastewater per day (Elysia, 2018 : 157). According to the American Association for the Advancement of Science (Xu Wang, Glen Daigger, 2018) The potential of wastewater resource infrastructure for effective coupling with natural ecosystems should be explored by considering both the emissions and their covered products. A holistic methodology to study the coupling of technical and ecological systems is needed to advance our understanding and methods of creating truly sustainable wastewater management protocols. Concern for environmental conditions is related to the conditions of knowledge and attitudes which are manifested in daily behavior (Ramadhani et al., 2019). Basically, sanitation infrastructure is very important to prevent the emergence of various diseases by creating good residential environmental conditions so as to break the chain of disease transmission (Rahmawati et al., 2018). According to (Sandy, 2020), health development, in this case sanitation development, is a combination of construction and non-construction development or infrastructure development and human development. The identification results show that actors implementing sanitation development need to involve internal government actors, community actors and private actors. According to Sa'ban et. al. (2021) that in increasing community knowledge in improving environmental sanitation, the process of increasing community knowledge in improving environmental sanitation is carried out through three approaches, namely socialization, assistance and planning for making toilets. Based on an analysis of existing conditions, the waste water sanitation infrastructure used by Low Income Communities and non-Low Income Communities in Muara Lawai Village was found to be still adequate and safe, where efforts need to be made to provide adequate and safe sanitation infrastructure through residential waste water management. in the form of a waste water treatment plant (Prasetyo et. al., 2020). According to (Setyoadi, 2011) weak support for the utilization of sanitation infrastructure can be caused by the distance between septic tanks and groundwater sources that do not meet safety standards, leaking wastewater pipes, or household wastewater not being treated before being released into the environment and the source of underground water is not completely safe and there is the possibility of contamination of clean water by household waste water.

Based on the 2022 Annual Report by the Ministry of Health, only 7.25% of households in Indonesia have access to safe sanitation rates. The government targets 15% access to safe sanitation rate by 2024, while 5.56% of households in Indonesia have shared access to decent sanitation such as bathing, washing and toilet bathing facilities or Mandi, Cuci, Toilet (MCK) facilities which means that these households have shared toilets, whether connected to waste water treatment facilities.

According to (Kasey M. et al, 2015) the lack of published literature focused on underground infrastructure in shrinking cities and the underutilization of infrastructure in general makes it difficult to synthesize information.

According to (Hari R, Asori, Hilmi I. F, Nanang, 2021) that there are several relationships between sanitation access factors and optimization related to the use of MCK facilities. Sanitation access factors can include behavior, community participation, technical aspects and can also be institutional at the community level and even the lowest government head of the sub-district head. Technical factors are the capacity to meet the level of demand and provide the desired services, technical skills to operate and maintain the system, availability of accessibility and cost of spare parts total operational and maintenance costs for the MCK facilities in the family/community in this areas. in this case the quality of water sources, adequate protection of water, water quantity and continuity of supply, the impact of development/waste on the environment. With the existence of several factors, this can be useful for increasing the community/population using MCK facilities and reducing the population who is still defecate and improving the quality of life that is clean and healthy optimally.

According to (Denisa S.P. et. al, 2011) in determining priorities for improving sanitation quality, technical aspect criteria are more important than non-technical aspects. Especially for the sub-criteria of structural durability, possibility of replication, and availability of spare parts. From the results of data processing using the Analytical Hierarchy Process (AHP), the alternative of making communal septic tanks is a top priority which must be followed by socialization so that there is community readiness for the construction of existing sanitation facilities so that they have awareness and a sense of ownership of the selected sanitation, management and maintenance of sanitation. structured, and monitoring from various parties including the government for continuity in improving the quality of adequate sanitation for households.

According to the American Public Works Association (Stone, 1974 in Kodoatie, R.J., 2005) infrastructure is physical facilities developed or needed by public agencies for government functions in the provision of water, electricity, waste disposal, transportation and similar services to facilitate social and economic purposes. Based on the definition of infrastructure, infrastructure is a physical system needed to meet basic human needs in the social and economic sphere. Currently there is the Regulation of Minister of Public Works and Housing Number 4 of 2017 concerning the Implementation of Domestic Waste Water Management Systems which is a priority and is related to the urgency in this study. Domestic wastewater is wastewater that comes from residential businesses and/or activities, restaurants, offices, businesses, apartments, and dormitories. Domestic wastewater consists of toilet wastewater (*black water*) and non-toilet wastewater (*grey water*). Daily human activities produce wastewater, such as washing, bathing, or from toilet, so planning wastewater infrastructure is needed. Domestic wastewater management requires adequate facilities and infrastructure for distribution and treatment of wastewater where the Domestic Wastewater Management System can be distinguished through an *onsite* system or through an *offsite* system. MCK or bathing, washing and toilet bathing facilities is one of the public facilities shared by several families for bathing, washing and urinating in certain residential locations that are considered to be densely

populated and low levels of economic ability (Development of Rural Infrastructure (P2D), 2002). MCK facilities is a common means shared by several families to bathe, wash and defecate in a residential location with a moderate to high density (300 – 500 people/Ha) *(Pusat Penelitian dan Pengembangan Permukiman Kementerian PU*, 2001). Based on the Ciamis Regency Domestic Wastewater Masterplan (2022), the level of domestic wastewater coverage in Ciamis Regency has only reached 82.38% of the population. The number of domestic wastewater infrastructure for MCK facilities is 63 units throughout the Ciamis Regency area. This research aims to determine the functional components of existing MCK facilities. The function and condition of these MCK facilities need to be maintained in prime condition so that they can be used by the community to manage domestic wastewater that does not pollute the environment and nearby water bodies.

II. METHODS

The method used in this study is a descriptive method and a verification method with a quantitative approach. Using this method, a significant relationship between the variables studied will be known so that the conclusion will clarify the description of the object studied. According to (Sugiyono, 2013) descriptive method is a study conducted to describe independent variables, either only on one or more variables (stand-alone variables) without making comparisons and looking for those variables with other variables. Verificative method is defined as research conducted on a certain population or sample with the aim of testing the hypothesis that has been set (Sugiyono, 2013).

In this study, descriptive methods quantitative approach was used to explain and analyse the existing conditions of all MCK facilities that had been built in Ciamis Regency conducted a survey in 2022. The planning of MCK facilities and building construction with the parameters described above refers to several SNI (Indonesian National Standards) by SNI03-2399-2002 on General MCK Building Planning Procedures. Other normative references that form the basis for making SNI 03-2399-2002 include SNI 03-2399-1991 on General MCK Building Planning Procedures, SNI 03-6481-2000 on Plumbing Systems, SNI S-04-1989-F, Building Material Specifications and SNI 01-0220-1987, Terms and Supervision of Drinking Water Quality. The SNI includes the implementation of piping for wastewater treatment plants, drainage, and other systems needed in the construction of MCK facilities.

The assessment of the functionality of MCK facilities is assessed based on 12 assessment parameters with the weight of each has been determined so that the overall final result is 100% functionality and is then assessed based on a score that will determine the final result of the condition of MCK facilities, namely score 0 (object facilities not functioning), 1 (object facilities in poor condition), 2 (object facilities is sufficient but users are hesitant to use the facility), 3 (object facilities is damaged but can still be functioned reasonably), 4 (object facilities is in excellent condition). The following is a table of assessment parameters used to assess the functionality of MCK facilities, shown in Table I and Table II.

Table I. MCK Functionality Assessment Paramater and Weight

No	Assessment Parameters
1	The Toilet is functioning properly
2	Tile Condition (bathroom floor and walls)
3	Safety Fence
4	Electrical Energy
5	Wastewater Drainage
6	Availability of Water
7	Building Condition
8	Water Reservoir
9	Septic Tank Condition
10	Building Construction
11	Doors Condition
12	Washing Place Condition

Table II. MCK Facility Functionality Assessment Category

Score	Description
Score 4	Infrastructure objects in excellent condition
Score 3	Infrastructure objects are damaged but can still be functioned reasonably
Score 2	Infrastructure objects are sufficient but users are hesitant to use the facilities
Score 1	Available, in poor condition
Score 0	Failed.

III. RESULTS AND DISCUSSION

Based on the analysis using the 12 MCK facilities assessment parameters above for the functioning of MCK facilities in Ciamis Regency that have been built, it can be explained in the description below.

3.1 The toilet is functioning properly

Domestic wastewater management is still limited to awareness of healthy living by building toilet and using the toilet themselves. The level of public awareness to use household toilet and public toilet is still quite good as seen from the score of 3 has a percentage of 49% with a total MCK facilities of 31 units and followed by a score of 4 of 29% with a total MCK facilities of 18 units. There are 4 units of MCK facilities that have a score of 1, with the condition of the building still exists but the toilet is damaged and not functioning in Ciamis District (Imbanagara Village), Cijeungjing District (Karanganyar Village), Banjarsari District (Ciulu Village) and Sindangkasih District (Sindangkasih Village), shown in Figure 1.

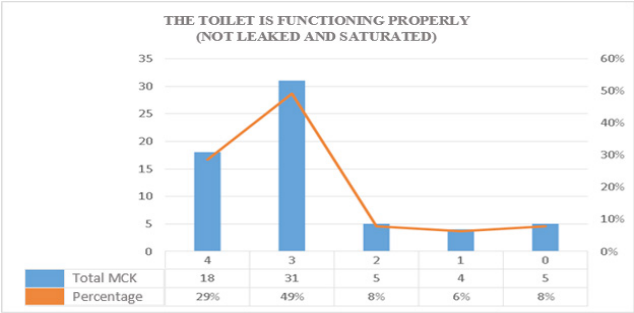

Figure 1. Parameter of Functioning Toilet Assessment (Not Leaking and Compounding)

3.2 Tile Condition (Bathroom Floor and Wall)

Maintenance of toilet, according to (Ratma, 2018) good toilet maintenance by means of the toilet floor should always be dry and clean. There is no puddle on the toilet floor, the toilet floor is made of waterproof material, it is not slippery and has a channel for wastewater disposal to the Wastewater Treatment Infrastructure. If the floor and even the walls of the bathroom/tub are damaged, the use of MCK facilities will no longer be maximal. Judging from the assessment of tile condition parameters (bathroom floor and wall) in the overall MCK facilities in Ciamis Regency is in good condition and suitable for use with a score of 3 by 46% or as many as 29 units, and 35% or 22 units that have very good condition with a score of 4, shown in Figure 2.

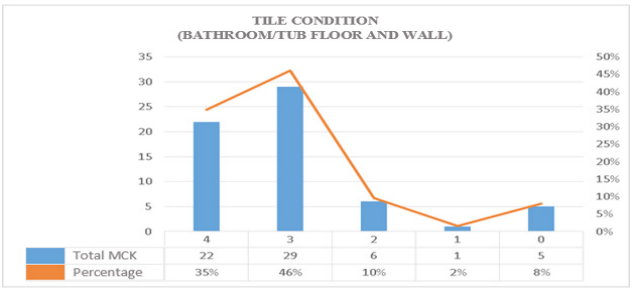

Figure 2. Parameter of Tiles Condition Assessment (Bathroom Floor and Wall)

3.3 Safety Fence

Based on the data from the survey of the use of safety fences at MCK facilities in Ciamis Regency (Domestic Wastewater Management Master Plan of Ciamis Regency, 2022) using wall or wall and iron fences. The wall fence is used for security and comfort in the community that uses the MCK facilities. Seen in the assessment of guardrail parameters that are in poor condition or not functioning properly (score 0) with a percentage of 35% or 22 units of MCK facilities. The location of MCK with a non-functioning safety fence is in Ciamis District (Ciamis Village, Imbanagara Village, Imbanagara Village, Panyingkiran Village, Cisadap Village, Benteng Village, Kertasari Village), Cijeungjing District (Karanganyar Village, Utama Village, Kertaharja Village), Sadananya District (Mekarjadi Village), Rancah District (Dadiharja Village), Cidolog District (Jelegong Village), Cimaragas District (Jayaraksa Village) and Cisaga District (Cisaga Village) shown in Figure 3.

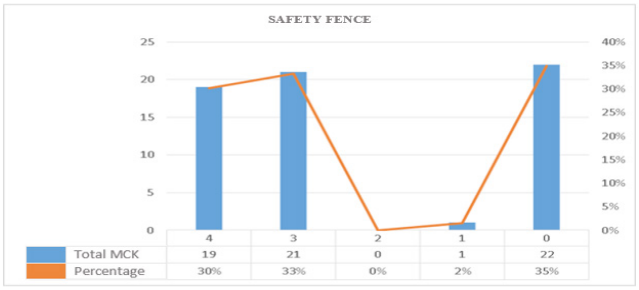

Figure 3. Parameter of Safety Fence Assessment

3.4 Electrical energy

In the Construction-Sanitation Instruction Pocket Book (Ministry of Public Works and Housing, 2022), one of the MCK facilities and building standards and requirements, among others, natural lighting is sought optimally so that during the day MCK users do not need to turn on electric lighting. Electrical energy of MCK complementary utilities for lighting and electric pump needs. Based on this, electricity or lighting is needed for community activities at MCK facilities either at night or during the day. Currently, most MCKs have electricity, however, in some units it is not accompanied by lights as a means of lighting. The lighting or power grid at MCK facilities in Ciamis Regency is mostly paid for and funded by the community using donations. 48% or 30 units of MCK facilities have good electricity flow with a parameter value of 3 and are still suitable for use, followed by 25% or 16 units of MCK facilities have much better electricity flow conditions with a parameter value of 4. As for MCK facilities in Cijeungjing District (Karanganyar Village), there is no electricity at all for MCK facilities lighting. This makes MCK facilities less functional and has a parameter value of 1, shown in Figure 4.

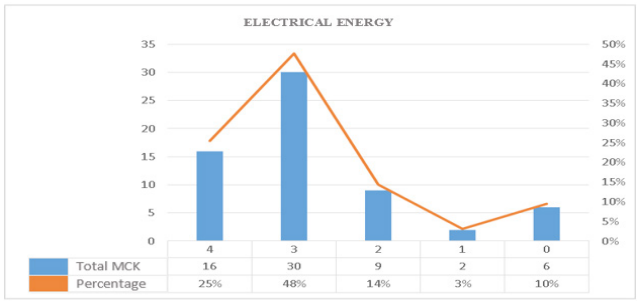

Figure 4. Parameter of Electrical energy Assessment

3.5 Wastewater Drainage

It is mandatory to have wastewater drainage from MCK facilities for more directed disposal and not to pollute water bodies. The standards and health requirements of toilet buildings according to Ministry of Health (2014) are that waste will enter the septic tank, solid and liquid waste from the toilet that enters every day and will absorb the waste liquid into the soil by not polluting groundwater, while the solid part of the waste will be biologically decomposed. In the graph of the results of the parameter assessment below, it can be seen that there is 1 unit with a score of 1 which means that it is not feasible and does not function properly. The unit is located in Ciamis District (Imbanagara Village). The assessment is given because the flow of wastewater from MCK facilities through piping is no longer functioning by looking at the pipe that drains the damaged wastewater. However, most MCK facilities still have very good and good

wastewater flow, such as parameter value 3 of 35 units or 56% still dominates in Ciamis Regency, shown in Figure 5.

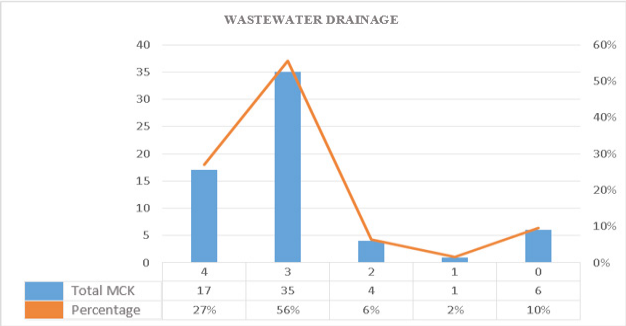

Figure 5. Parameters of Wastewater Drainage Assessment

3.6 Availability of Water

The availability of water in toilet is one of the good maintenance of toilet according to (Ratma, 2018). Water is the main component in the use of MCK facilities and its activities. The supply of water in Ciamis Regency, MCK facilities mostly uses ground water (bore wells), however, there are also those who use water from local water companies such as at the MCK facilities in Kawali District (Kawali Village). The availability of water in MCK facilities has a score of 4 which is quite high, namely 43% or 27 units that function very well, and a score of 3 as much as 37% or 23 units that function well. Although the availability of water is very necessary, some MCK facilities have inadequate availability of clean water with the value of water availability parameter 1 located in Ciamis District (Imbanagara Village), Sadananya District (Mekarjadi Village), and Sindangkasih District (Sindangkasih Village), shown in Figure 6.

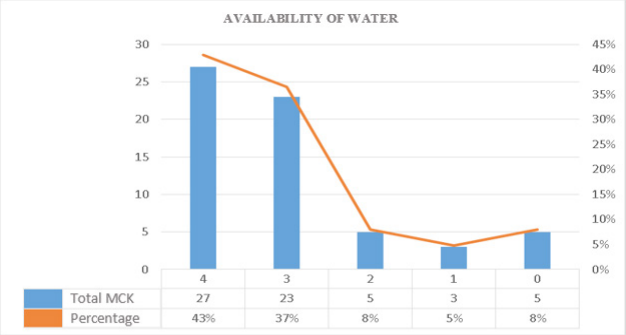

Figure 6. Parameter of Water Availability Assessment

3.7 Building Condition

According to the Construction-Sanitation Instruction Pocket Book (Ministry of Public Works and Housing, 2022), the Implementation of Development in MCK buildings is carried out by considering the habits and culture of the user community so that there is a need for deliberation. The condition of the MCK building in Ciamis Regency has followed this with the separation of male and female users and types of toilet and others. The condition of the MCK building that is currently standing can be seen as a whole with a score of 3 with a percentage of 51% or 32 units in good condition and suitable for use. The 2 units of MCK facilities that are no longer suitable for use and have a score of 1 are in Ciamis District (Imbanagara Village) and Sindangkasih District (Sindangkasih Village), shown in Figure 7.

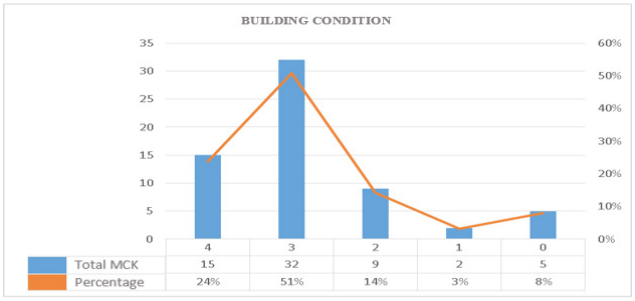

Figure 7. Parameters of Building Condition Assessment

3.8 Water Reservoir

Water reservoirs are used for MCK facilities where most of the MCK facilities in Ciamis Regency have used water reservoirs to store water. Water reservoirs can be used in household, commercial and industrial activities. The water reservoir in the use of MCK facilities functions very well can be seen in the parameter assessment which has a score of 4 by 48% or 30 units of MCK facilities from a total of 63 units of MCK facilities in Ciamis Regency. The 1 unit of MCK facilities with a parameter value of 1 or no longer usable is located in Ciamis District (Imbanagara Village), shown in Figure 8.

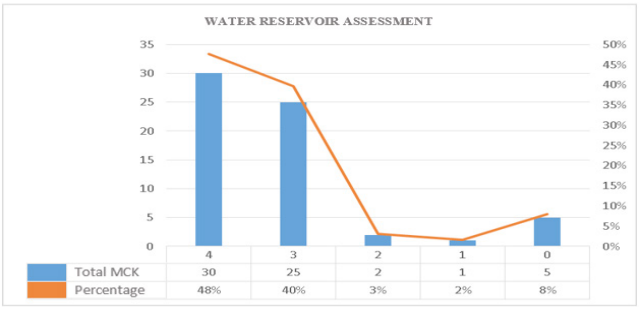

Figure 8. Parameter of Water Reservoir Assessment

3.9 Septic Tank Condition

Septic Tank is built based on SNI03-2398-2002 concerning Procedures for Planning Septic Tank with Infiltration System. The MCK facilities must be accompanied by a communal Wastewater Treatment Plant with provisions, among others. Suitable for high density areas, contamination of groundwater and water bodies can be avoided. The condition of the septic tank at the MCK facilities location mostly worked well, seeing a dominating score of 3 with a percentage of 52% or 33 units that had good wastewater treatment. There are only 2 units of MCK that have a parameter value of 1 in the sense that they are not suitable for use, located in Cijeungjing District (Utama Village) and Sindangkasih District (Sindangkasih Village), shown in Figure 9.

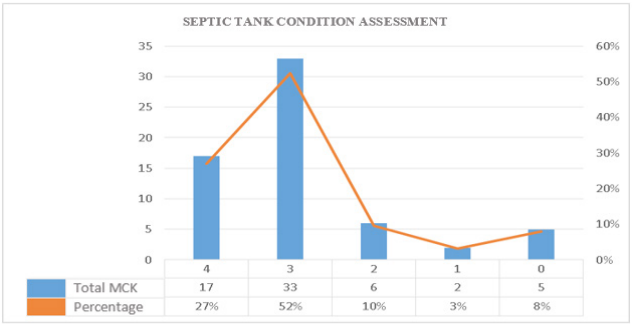

Figure 9. Parameter of Septic Tank Condition Assessment

3.10 Building Construction

The Construction-Sanitation Instruction Pocket Book (Ministry of Public Works and Housing, 2022) explains that each MCK facilities unit needs to be equipped with a water piping system, wastewater management, and drainage. The requirements for building materials that can be used are local building materials, ease of provision of building materials, easy to implement, and acceptable to the community. The existing MCK building can be maintained properly so that it can be used for a long period of time, but as for the construction of buildings that cannot last long due to inappropriate use or due to natural disasters. The assessment of MCK building construction parameters in Ciamis Regency was dominated by excellent building construction with about 54% or 34 units of the total 63 units of MCK facilities. There are only 2 units with a score of 1 that do not work, namely in the locations of Ciamis District (Imbanagara Village) and Sindangkasih District (Sindangkasih Village), shown in Figure 10.

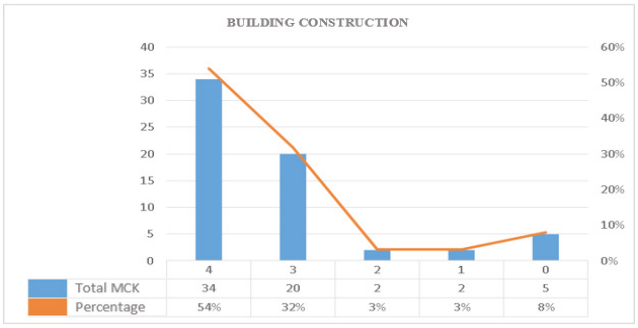

Figure 10. Building Construction Assessment Parameters

3.11 Doors Condition

The MCK facilities requirements standard in the Construction-Sanitation Instruction Pocket Book (Ministry of Public Works and Housing, 2022) explains that buildings must be equipped with doors that have a width of 0.6 – 0.8 m and a minimum height of 1.8 m, this has been stated in the MCK building requirements standard. The condition of the door in each room has various conditions such as damage to the door hinges, the door is loose and cannot be closed. Based on the assessment of the door condition parameters in the MCK facilities in Ciamis Regency, it can be seen on the graph which is dominated by a score of 3 of 55% or 34 units of MCK facilities that have good door conditions. Only 3 units with a score of 1 did not work, namely in the locations of Ciamis District (Imbanagara Village), Cijeungjing District (Karanganyar Village) and Sindangkasih District (Sindangkasih Village), shown in Figure 11.

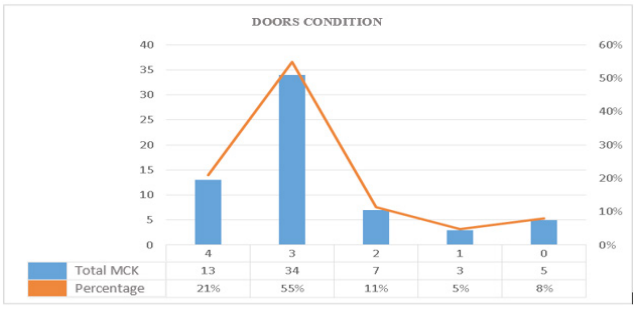

Figure 11. Parameter of Doors Condition Assessment

3.12 Washing Place Condition

The condition of the washing place in the MCK building in Ciamis Regency such as water faucets and sinks, most of which can still be used properly. This can be seen from the parameter assessment with a score of 3 which dominates by 54% or 34 units with good washing conditions. However, there are several locations with non-functioning washing place conditions with parameter value 1 such as in Sukamantri District (Sindanglaya Village) and Sindangkasih District (Sindangkasih Village), shown in Figure 12.

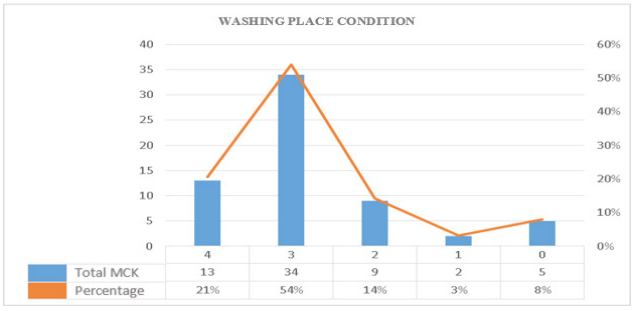

Figure 12. Parameters of the Washing Place Condition Assessment

IV. CONCLUSION

The results of this research show that the results of the assessment of the functioning of the MCK facilities in Ciamis Regency, most MCK facilities are in excellent condition based on the condition of the flow of wastewater as a result of piping activities that are a means of drainage are still well maintained, the condition of the availability of water which is the main component in MCK facilities flows well and is maintained in most locations, the condition of the building after the research is conducted looks quite good because the community as a user can still maintain the facility and the water reservoir parameters in this case are very necessary to accommodate water and anticipate water drought conditions. However, there are conditions of damage to MCK facilities such as the condition of the tiles (floors and bathroom walls), damage occurs due to the high intensity of use by the community using MCK and routine maintenance is not carried out, conditions where safety fences are not installed because most of the MCK facilities are located in community areas with limited land. and close to residents' houses, the condition of the doors of each counter is mostly damaged due to frequent MCK users opening and closing the doors so that the hinges and door handles are damaged (door handles are loose) and the condition of the washing area (sink and water faucet). The condition of the washing area is mostly damaged because of the water faucet. is the main means of use of MCK facilities by communities which are often vulnerable to destruction.

Therefore, the recommendation from this research is that there is a need for good maintenance and management of MCK facilities by involving all existing user communities to be able to pay management fees to MCK management institutions or non-governmental organizations. Another recommendation is that there needs to be an effort to repair damaged and non-functioning MCK facilities and infrastructure so that people want to use and maintain

existing MCK facilities as a form of a sense of ownership and shared responsibility for the creation of health and comfort. sanitation and environmental conditions

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