

Factor for Asset Valuation of Machinery and Equipment at Water Treatment Plant

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Abstract

Plant, Machinery and Equipment Assessment (PME) is now a very important assessment branch especially for companies or a large industrial company that involves the operating process and water treatment plant are one of the elements of PME that can be assessed for certain reasons. For this reason, this study will be conducted with the first objective of this study is to identify the factors that are taken into account in plant valuation. Further, for the second objective is to identify valuation methods for facility components in water treatment plants. The scope of this study involves all types of machinery components, equipment at the plant and involves several assessors in Malaysia. This study aims to identify the best valuation method to carry out plant machinery equipment valuation carried out by private appraisers as well as government appraisers. The findings for this study are based on a series of interviews conducted with four (4) respondents, from public assessment officers and private assessment officers.

1. Introduction

Plant, Machinery, and Equipment (PME) valuation is a fairly detailed assessment process and is not as straightforward as the typical real estate valuation processes such as for residential, agricultural, and vacant land properties. Generally, this occurs because the use of equipment such as machinery and PME is not a basic necessity for the general public and is usually only utilized by large manufacturing companies. Valuation of plants, machinery, and equipment is required for various purposes such as the following: Fire Insurance, Electrical Licensing, Rating, General Valuation, Purchase/Sale, Privatization, and Leasing/Renting. (JPPH,2019)

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Plant, Machinery, and Equipment (PME) valuation is a fairly detailed assessment process and is not as straightforward as the typical real estate valuation processes such as for residential, agricultural, and vacant land properties. Generally, this occurs because the use of equipment such as machinery and PME is not a basic necessity for the general public and is usually only utilized by large manufacturing companies (Hishammuddin, 2005).

According to the Royal Institution of Chartered Surveyors (RICS, 2017), there is no clear and detailed information on how the valuation of Plant, Machinery, and Equipment (PME) is carried out, including the factors considered and the information required. To date, if we look more closely, reference sources for the valuation of Plant, Machinery, and Equipment, particularly machinery and equipment at water treatment plants, remain one of the PME elements that has limited information available for public knowledge.

This poses a challenge in important processes related to valuation and studies, as valuation is part of a professional field recognized in Malaysia. Therefore, by studying the factors related to the assets of machinery and equipment, the valuers can clearly identify relevant information for asset valuation.

Additionally, by examining the valuation methods used in asset valuation of machinery and equipment, it can inform future valuers about the methods and practices employed in carrying out valuations, particularly for machinery and equipment in water treatment plants.

This study focuses on the specifically on the factors and methods of machinery and equipment valuation. This limitation is important to ensure that the data collected is more accurate and facilitates the study process. The scope of this study will focus specifically on the machinery and equipment involved in the valuation methods of machinery and equipment owned by at the water treatment plant. This study will comprehensively examine the methods and approaches used in conducting the valuation. The study will also provide research questions for a number of respondents to be used. The scope of this study is based on the valuation methods for machinery and equipment assets to ensure the objectives of the study are achieved. The researcher conducts the study on the methods employed by valuers in conducting valuations for machinery and equipment assets to improve the effectiveness and efficiency of the valuation methods and to provide a positive impact on the level of valuation to be carried out in the future.

The importance of this study is to serve as a reference and assist valuers, particularly those involved in the valuation of machinery and equipment, especially for machinery and equipment at water treatment plants. This is because the knowledge and input gained from this study can help and become a reference source for valuers conducting valuations of machinery and equipment, considering that the scope of machinery and equipment valuation is not as extensive as other real estate assets such as residential properties. Furthermore, this study will assist future valuers, including students, as it will provide exposure to valuation methods, particularly in the field of machinery and equipment assets. Therefore, it will indirectly contribute to academic knowledge as well as provide a perspective on the role of valuers.

2. Literature Review

This study is a literature review aimed at discussing in more depth the theoretical framework for the valuation of machinery and equipment assets owned by a water treatment plant. This discussion covers the factors and valuation methods used in conducting the valuation of machinery and equipment assets at the water treatment plant.

2.1 Case Study

According to the Malaysian Valuation Standard 6th Edition (2019), Plant, Machinery, and Equipment (PME) is defined as tangible assets used in the production process, but not limited to manufacturing, construction, and transportation. Plant, Machinery, and Equipment (PME) is a branch of real estate, and all PME products can be valued like other real estate assets. However, Plant, Machinery, and Equipment does not include land or buildings, which are considered separate assets, and any assets that are leased or rented should be included in the valuation of Plant, Machinery, and Equipment.

2.2 Definition

2.2.1 Plant

According to Malaysian Valuation Standard 6th Edition (2019), the definition of plant refers to machines and equipment that are used in the manufacturing or production process. This also includes items such as assembly lines, conveyor belts, and specialized tools.

2.2.3 Machinery

According to the Malaysian Valuation Standard 6th Edition (2019), machinery refers to equipment used for specific purposes, such as construction machinery, printing machines, and mining equipment.

2.2.4 Equipment

Refers to assets used in the production process but not considered as machines or plants. This can include items such as computers, office furniture, and vehicles (Malaysian Valuation Standard 6th Edition, 2019).

2.3 Valuation of Machinery and Equipment

The valuation of machinery and equipment will be carried out by valuers who have experience and possess clear knowledge of the components of a particular machine or equipment. This type of machinery and equipment valuation is highly subjective. There is no fixed formula or equation to calculate the value of a specific machine or equipment; however, comparisons through previous market values are relevant (Kenny, 2018).

2.3.1 Purpose and Basis of Valuation

The purpose and basis of valuation are the factors or reasons why a particular machine or equipment undergoes the valuation process. The valuation of machinery and equipment is an extraordinary and highly complex process. Therefore, only reasonable and relevant reasons make it possible for a machinery and equipment valuation to be conducted for a company.

(a) General Valuation

This valuation is carried out for various purposes, such as obtaining quotations. General valuation is conducted by registered valuers recognized by the machinery and equipment classification bodies. The general rating is based on several factors, including the age of the machinery or equipment, physical condition, machinery and equipment classification, and current market prices. The machinery and equipment valuer will conduct a visual inspection of the machinery and equipment to gather data on the condition of the structure, machinery, machinery systems, and other equipment. This data is then analyzed to determine the market value of the machinery and equipment. (JPPH, 2023)

2.4 Machinery and Equipment Used at the Water Treatment Plant

2.4.1 Raw Water Source: Submersible Pumps

In this process, the machinery used consists of four submersible pumps. Water from the river is pumped using four submersible pumps, each with a capacity of 1,110 m³ per hour. This water will undergo several stages of treatment before being supplied to consumers. In brief, the machinery and equipment used in the water treatment process at this plant are as shown in the diagram above. (Perak Water Board, 2023)

2.4.2 Screening: Intake Screens

The intake screen is a machine that serves as a barrier to prevent debris from entering the raw water pumps. There are two types of screens: coarse screens and fine screens, which trap large and small debris. The main purpose is to ensure that no damage occurs to the pumps. (Perak Water Board, 2023)

2.4.3 Aeration: Cascade Aerator

The machinery used is the Multiple Cascade and Aeration Tank (cascade aerator). The function of these machines is to add dissolved oxygen (DO) to the water to remove odor and taste. It also removes some of the iron (Fe) and manganese (Mn) that cause discoloration in the water. This process can also oxidize dissolved iron and manganese into an undissolved form, causing them to precipitate. (Perak Water Board, 2023)

2.4.4 Coagulation: Flocculation Tank Machines

Next, the water flows into three flocculation tanks of the mechanical flocculator type, each with a capacity of 183 m³. Chemical reactions cause fine particles to clump together, forming larger and heavier flocs. The flow in the coagulation tank is controlled to achieve optimal coagulation. The formed flocs will trap bacteria and color present in the water. The dose of alum used must be precise to form good flocs and facilitate the sedimentation process. (Perak Water Board, 2023)

2.4.5 Sedimentation: Flocculation Tank Machines

At this stage, the process is sedimentation. Three horizontal flow tanks, each with a capacity of 792 m³, are involved in the sedimentation process. The larger and heavier flocs will settle to the bottom of the sedimentation tank, resulting in clear water. (Perak Water Board, 2023)

2.4.6 Filtration: Filtration Tank Machines

In the filtration process, the water flows into three rapid gravity sand filter tanks, each with a capacity of 230 m³, using river sand as the filtering material. This process is aimed at filtering and separating fine sediment (floc). The water passes through the filter sand, where the fine flocs are trapped in the sand. The pipes beneath the sand filter will collect the filtered clear water. To ensure water quality, the sand filters are cleaned at regular intervals. The backwash process for the filters at the plant is operated automatically. (Perak Water Board, 2023)

2.4.7 Clean Water Tank and Machines at the Pump House

The process of dosing lime for the pH adjustment of clean water is carried out here, which involves lime machines. The tank has a capacity of 1,500 m³ with a normal level between 2.0-3.0 meters and a critical level at 0.7 meters. From the clean water tank, the water is pumped using machines into the balancing tank (with a capacity of 7 million liters) through a 600mm pipeline over a distance of 4 kilometers.

2.5 Factors Considered in the Evaluation of Machinery and Equipment

Factors considered are essentially elements that are taken into account and highlighted to determine the value. These factors are typically not fixed and depend on the condition of the asset during the evaluation process. The factors considered also vary according to the type of asset. For example, the valuation factors for the evaluation of plants, machinery, and equipment differ from those for other types of real estate assets such as residential properties (Lamprakis, 2023).

2.5.1 Machine Capacity

Machine capacity is significant as it reflects a high level of importance for each factor analyzed. The most influential factors in the valuation of plants and machinery are the machine's motor power and capacity, as each of these has a specific value in terms of machine capacity. The capacity and motor power are the most influential valuation factors because differences in these two factors will affect output, required labor, and working time requirements for producing a product (Hishamuddin Mohd Ali, 2005). Machine capacity helps to determine the strength of the machine.

2.5.2 Physical Size

The factors influencing the valuation of machinery and equipment include the physical characteristics of the machine. Machinery and equipment have brands, countries of origin, manufacturing years, materials used, technology, space requirements, and operating systems. (Arif, 2020). Physical size refers to understanding the machine's dimensions, such as its length or width (Hanif Abbas, 2016).

2.5.3 Machine Condition

According to MITI Malaysia, factors determining the valuation of machinery and equipment include the condition of the machine, such as its usable age. For instance, asset usage expectations, physical wear and tear expectations, technical or commercial obsolescence, and legal or usage limits related to the asset, such as expiration dates, are considered. The condition of the machine is also crucial in assessing its value. The age of the machinery also plays a role in determining its valuation. A well-maintained machine can enhance its value (Hanif Abbas, 2016).

2.5.4 Model Number

The model number of a machine or equipment allow for comparison between machines. It may be similar to used machines currently for sale in the market (Hanif Abbas, 2016). This can assist in the machinery and equipment evaluation process. The serial number is also important to ensure the machine is legitimate and not counterfeit. With the serial or model number, we can determine when the machine was made, its capacity, size, and the manufacturer of the machinery and equipment (Hanif Abbas, 2016).

2.5.5 Other Factors

According to Barbara Anderson, other factors in the valuation of machinery and equipment include the expected lifespan of the plant or machinery, which is also important to consider. If the plant or machinery is expected to have a longer service life than anticipated, its valuation may be higher. Another factor to consider is the current market value of the plant or machinery. This can be determined by looking at current sales in the market. If the market value is lower than the cost of the machine itself, the machine's value will decrease.

2.6 Machinery and Equipment Valuation Method

The machinery valuation study is conducted to determine the value of all machinery and equipment in the company's assets. The generally accepted valuation methods are used in this study. The objective of the machinery valuation study is to provide information that will enable parties to make informed decisions in the development of strategies that concern the company's future. The key point emphasized here is accurately determining the market price of the machinery without bias and based on available information.

2.6.1 Valuation Methods

The machinery valuation method is generally used in real estate valuation. In this context, the method commonly used is the cost method. (EuroLab, 2019). One of the preferred valuation methods in this case is the comparative method and the cost method. When using the machinery valuation method, assumptions relevant to the structure of the machinery and equipment and the purpose of the valuation are considered. Some examples of these assumptions include the condition of the company in which the machinery and equipment are still in use, the level of compliance of these assets with other assets, whether the entity will continue its activities, the business's consideration of retaining these assets, the installation and commissioning costs of these assets, and lastly, factors such as legal restrictions and environmental regulations. (EuroLab, 2019)

2.6.2 Source Acquisition Methods

To obtain relevant information for the valuation, the appraiser must conduct a survey at the location where the valuation is to be carried out. Additionally, the appraiser should have information related to inventory preparation, including macro and micro identities for all machinery or equipment that will be evaluated. (Amish Suryakant Patel, 2013).

2.6.3 Key Components

The main components that need to be prepared before the land valuation work is conducted are maps, plans, details of land ownership, comparative data, along with the tools and support required in the process of collecting data and measurement information for the subject land, such as cameras, measuring tapes, compasses, stationery, paper, and so on. (Mohd Farid Sa'ad, 2021)

2.6.4 Component Value

The component value for a machinery and equipment plant in property, plant, and equipment items consists of

the purchase price, including import duties and non-refundable purchase taxes, after deducting trade discounts and rebates. Any direct costs incurred to bring the asset to the location and condition that allows it to operate in the manner required by management. (MPSAS, 2013).

2.6.5 Depreciation of Machinery and Equipment

Alico (1989) states that depreciation occurs as a result of damage and obsolescence of the physical structure of plants and machinery. This depreciation reflects a state of wear and tear that can be visibly seen as a result of the operation of the plant and machinery exposed to elements such as weather, placement, surrounding conditions, and others, which will cause the physical condition of the plant and machinery to become obsolete. However, physical depreciation usually does not have a significant effect on the depreciation of the plant and machinery because they are typically made of durable metal materials that do not deteriorate quickly.

3. Research Methodology

This study This section of the study consists of three methodological stages. The first stage involves background research, obtaining information from respondents with experience in machinery and equipment valuation. The second stage focuses on the valuation factors involved in machinery and equipment assessment. The third stage concentrates on the valuation methods used in machinery and equipment assessments.

3.1 Research Design

The structure of this study's stages shows an organized and systematic approach, allowing for more efficient achievement of the study's objectives. In Stage I, the researcher will determine the study title, identify the issues and problems to be examined, and establish the objectives and scope of the study. In Stage II, the researcher will conduct a review and analysis of the literature related to the study topic. In Stage III, the researcher will gather the data and information needed to answer the research questions. Stage IV involves the analysis of data and study findings, while Stage V is the conclusion and recommendation stage.

3.2 Research Methodology

Based on the objectives of this study, the methods used for the first and second objectives are qualitative methods. This is because these methods are considered more transparent and accurate in obtaining information about the factors considered in machinery and equipment valuation and the methods used in such valuations. Through this method, relevant information can be obtained more accurately.

3.2.1 Primary Sources

In this study, interviews have been conducted to collect primary data. Primary data refers to data generated by the researcher, through observations, interviews, and specifically designed to solve the research problem. These interviews involve several valuation officers from both the government and private sectors.

(a) Data Collection through Interviews

In this study, the researcher will prepare interview questions for valuation officers in both the government and private valuation sectors. The interview questions will address factors considered in machinery and equipment valuation. Additionally, the questions will inquire about the methods used in machinery and equipment valuation.

(b) Formation of Interview Questions

Interviews are used to gather all necessary information and primary data. These questions focus on the aspects the research aims to achieve, and the questions provided are semi-structured and not too difficult. The interview questions were designed based on the literature review and research objectives to obtain data from the respondents. Specific research questions were formulated by the researcher. All related data is collected during the study process. The interview questions for this study are divided into three sections to make them easier for respondents to understand during the interview session. Section A contains questions related to the respondent's background. Section B focuses on the factors considered in machinery and equipment valuation. Section C, the final section, focuses on the methods used in machinery and equipment valuation.

3.3 Data Analysis

The data collected through the qualitative method, i.e., the interview method, was gathered from government sector valuation offices and private sector valuation offices. In this study, the researcher chose to use content analysis for both objectives.

3.3.1 Content Analysis Method

Content analysis is an important element in collecting research findings. For questions that are open-ended for respondents, the analysis method used is Content Analysis. Qualitative content analysis focuses on text for internal and subjective interpretation of meaning.

4. Results and Discussion

In this study, A total of four valuation officers were involved in this interview. Therefore, four interviews were conducted with valuation officers from both the government and private sectors, who have relevant experience related to this study.

4.1 Demography of Respondent

Table 1: *Background of Respondent*

Respondent	Position	Department	Service Place	Service Duration
R1	Bekas Pegawai Penilai	Jabatan Penilaian dan Perkhidmatan Harta (JPPH)	Johor.	13 Years
R2	Pegawai Penilai	IPC Island Property Consultants SDN BHD	Johor Bahru	8 Years
R3	Penolong Pegawai Penilai	Jabatan Penilaian dan Perkhidmatan Harta (JPPH)	Kluang, Johor	21 Years
R4	Pegawai Pengurus Ibu Pejabat	IM Global Property Consultant Sdn Bhd	Kuala Lumpur	13 Years

4.2 Analysis of the First Objective: Factors Considered in Machinery and Equipment Valuation.

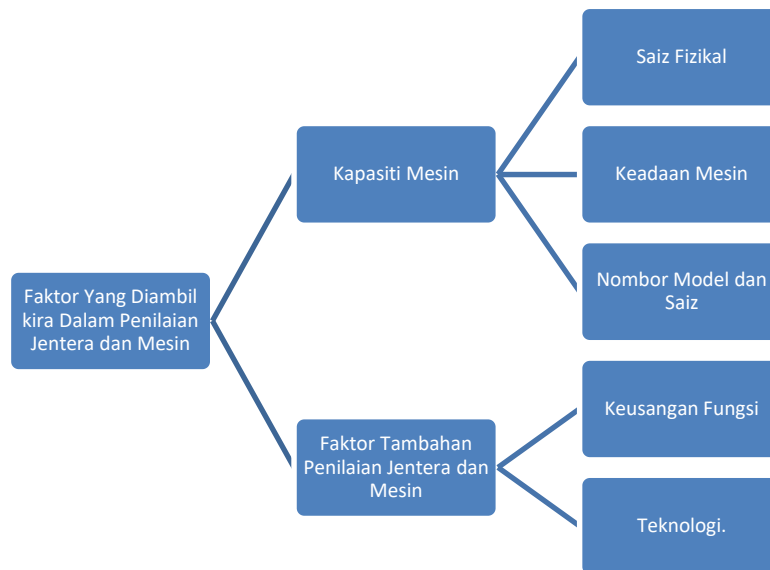


Figure 1: Factors Considered in Machinery and Equipment Valuation

4.2.1 Machine Capacity

Table 2: Analysis of Machine Capacity Factor

Respondent	Validation	Explanation
R1	Agree	The machine capacity becomes one of the factors for evaluating machinery and equipment when all the respondents involved are confirmed through the interview sessions that were conducted.
R2	Agree	
R3	Agree	
R4	Agree	

According to Table 2, all respondents confirmed that the machine capacity is a factor considered in the valuation of machinery and equipment. According to the respondents, the valuation session will be conducted by the valuer responsible for the specific machinery and equipment. The determination of the machine capacity is based on the final output of the machinery, which also reflects the capability of the machinery to function. The capacity of the machinery and equipment is determined during the valuation process.

"Of course, each machine has a different capacity; some may be able to process, for example, if the machinery and equipment used by the SAJ company, the cubic meter of its usage depends on which part it is used. Therefore, it is true that the machine capacity should definitely be considered, such as the machine's capacity, which manufacturer, which country it was made in, and most importantly, when the machinery and equipment were installed and made." (Interview, 2024)

4.2.2 Physical Size

Table 3: Analysis of Physical Size Factor

Respondent	Validation	Explanation
R1	Agree	The physical size of the machinery and equipment is a factor considered in the evaluation of machinery and equipment, as there is support for this statement from 2 out of 4 respondents who confirmed this factor.
R2	Agree	
R3	Disagree	
R4	Disagree	

According to Table 3, two respondents confirmed that physical size is a factor considered in the valuation of machinery and equipment, while two respondents disagreed that physical size is considered as a factor in the valuation. According to the respondents, physical size depends on the type and function of the machinery. Information regarding the physical size of the machinery and equipment is obtained from the company requesting the valuation and the identity documents for the machinery and equipment. Depending on the type of machinery and its function, physical size is a factor that influences the valuation of the machinery, and it also depends on the purpose of the valuation. According to the respondents who disagreed, the physical size factor is usually considered along with the condition of the machinery.

"In our opinion, the physical size of the machinery can be considered the same as smaller components that will also be evaluated. However, it also depends on the purpose of the valuation. Nevertheless, if the machinery is a primary piece of equipment to be used, then the physical size of the machinery will definitely be considered during the machinery valuation process." (Interview, 2024)

4.2.3 Machine Condition

Table 4: Analysis of Machine Condition Factor

Respondent	Validation	Explanation
R1	Agree	The condition of the machinery and equipment is one of the factors considered in the evaluation of machinery and equipment, as all respondents have confirmed their agreement with this factor.
R2	Agree	
R3	Disagree	
R4	Agree	

Based on Table 4, all respondents with experience in machinery and equipment valuation confirmed that the condition of the machinery and equipment is considered during the valuation process. According to all respondents, the condition of the machinery and equipment is another key factor in determining its value. A piece of machinery that is well-maintained and regularly serviced according to the correct maintenance schedule will generally be valued higher than machinery that is poorly maintained or lacks proper monitoring.

"Respondent 4 also agrees that the condition of the machinery is a factor in machinery and equipment valuation. The condition of the machinery actually plays a very important role. This is because a new machine, compared to one that is 10 years old, or 30 or 40 years old, plays a major role in the valuation process. However, it depends on the maintenance schedule." (Interview, 2024)

4.2.4 Model Number

Table 5: Analysis of Model Number Factor

Respondent	Validation	Explanation
R1	Agree	The model number are among the factors considered in the evaluation of machinery and equipment, as the majority of respondents have confirmed their agreement with this factor.
R2	Agree	
R3	Disagree	
R4	Agree	



Figure 2: Number Model of Machinery

According to the findings from the respondents in Table 5, the model number affect the valuation of machinery and equipment. However, it is important to consider the type of machinery, and the machinery must be in the location where it needs to be evaluated, not elsewhere. The model number influence the valuation factor because machinery and equipment vary in size, even if they serve the same function. Information related to the serial number or size of the machinery is typically obtained from ownership documents issued by the manufacturing company. The model number and size are considered in the valuation factor due to the majority confirmation from the respondents.

"It is true that the model number or serial number of the machinery and equipment is indeed taken into account, and it must be. This is to ensure that the correct machinery is being valued, and if a valuation is to be made, the serial number, name, and location of the machinery must be provided to the valuer." (Interview, 2024)

4.2.5 Additional Factors from Respondents

There are two additional factors obtained as considerations in the valuation of machinery and equipment. The respondents stated that:

(a) Functional Obsolescence

"Functional obsolescence is considered in the valuation of machinery and equipment. This factor involves machinery that has become outdated. Typically, the valuation of machinery plants is not solely focused on large machines, but sometimes computers can also be included in the valuation of machinery and equipment. Therefore, sometimes there are functions that have become outdated. As a result, functional obsolescence is taken into account in the valuation of machinery and equipment." (Interview, 2024)

Functional obsolescence is another factor considered in the valuation because not all machinery and

equipment being evaluated are in new condition; some have been in use for a long time and have become obsolete. Therefore, functional obsolescence is considered in the valuation of machinery and equipment, which is part of the machinery and equipment plant valuation.

(b) Technological Factors

“Another factor is technology, which is included in the machinery and equipment valuation. The technology factor is also one of the important factors that need to be considered in machinery and equipment valuation. This is because more advanced technology affects the condition of the machinery and its ability to perform its main functions. The value increases if more advanced technology is applied.” (Interview, 2024)

The technological factor is also considered when making machinery and equipment valuations. Essentially, the technology of modern machinery today is much more advanced, in line with current trends, and holds a higher value compared to outdated machinery. Furthermore, machinery that is in operation generates profits from its operation and production, such as machinery in a water plant. Therefore, if the technology used in production and operation is more advanced, the value of the machinery and equipment is likely to be higher.

4.3 Analysis of the Second Objective: Identifying the Valuation Methods Used for Machinery and Equipment Valuation

4.3.1 Valuation Method

Table 6: Analysis of Valuation Method

Respondent	Evaluation Method Used	Explanation
R1	Comparison Method & Cost Method	The majority of respondents stated that the evaluation methods used are both the comparison method and the cost method.
R2	Comparison Method & Cost Method	
R3	Comparison Method	
R4	Comparison Method & Cost Method	

According to Table 6, most of the respondents interviewed confirmed that the best methods used in machinery and equipment valuation are the comparison method and the cost method. According to the respondents, companies usually want to know the value of a machine after 20 years or after several years of use. For the comparison method, the valuer will compare the existing machinery and equipment and make comparisons with other machinery and equipment. Therefore, the valuer will assess the machinery and equipment with transaction details from the inventory provided to the valuer.

“The comparison method is the one we always use and consider the best. As far as I understand, the comparison method is used. To assess machinery or equipment, the valuation of several other machines is used for comparison, based on the price and features of similar machines. We will ask for a list of machinery and equipment to be valued and use the comparison method in this machinery and equipment valuation.” (Interview, 2024)

4.3.2 Method of Obtaining Information

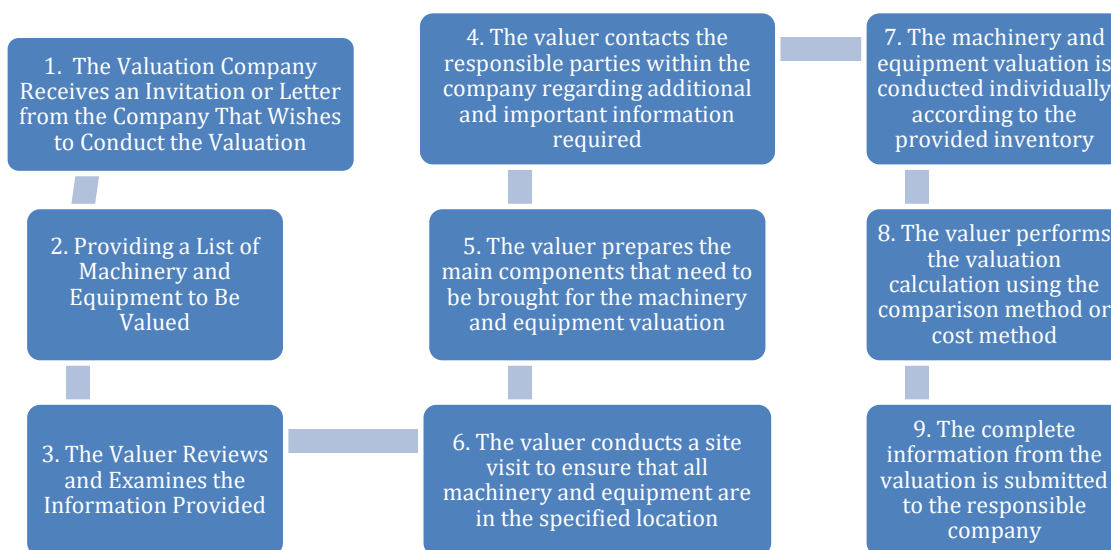


Figure 3 : Process of Obtaining Information

According to all the respondents interviewed, the method of obtaining sources before conducting the valuation is the process by which the valuer acquires data or receives a request from the company wishing to have their machinery and equipment valued. Subsequently, it is the role of the valuers to collect information before making the valuation based on the provided list. This is because data sources are limited and not centralized, and it is necessary to gather some relevant information for the intended valuation. The data acquisition process can take a long time due to the lengthy procedures involved, and at the same time, the data sources are not limited to just one but are quite numerous, such as information from the owning company, the manufacturing company, or data related to the machinery or equipment valuation process.

4.3.3 Main Component

“The main components usually include bringing important inventory to identify the serial number, brand, themachinery and equipment’s capacity, and assessing the current condition of the machinery and equipment. If we are able to make trials on the machinery and equipment, we will try and observe its output. We also bring the usual equipment for the valuation, such as a flashlight, ruler, pen, marker pen, notebook, camera, and other essential components for the valuation.” (Interview, 2024)

Overall, the study shows that the main components that need to be brought during machinery and equipment valuation are essential writing materials and equipment. For example, pen, pencil, paper, camera for taking reference photos or evidence, ruler or tape measure, flashlight to assess narrow or dark areas in the machinery and equipment. Additionally, the most important items are the documents or inventory provided by the company wishing to have its machinery and equipment valued, or flowcharts and processes involved in the production of machinery and equipment at the water treatment plant.

4.3.4 Component Value

“The value of a piece of machinery and equipment is a nominal price. For machinery and equipment that are approaching 40 years or more, it will be considered scrap value. The value of a piece of machinery and equipment is a significant one. Its value can reach tens of millions for a single piece of machinery and equipment, depending on its capacity and capabilities.” (Interview, 2024).

The findings from the respondents interviewed indicate an optimistic view regarding the value of components for a piece of machinery and equipment. The value of a piece of machinery and equipment increases with its production capacity. The more production processes it performs, the higher its value. Overall, the positive view of the value of machinery and equipment is supported by an understanding of the valuation process conducted by the valuer. Even the smallest value will be taken into account in the valuation. The value of a piece of machinery and equipment is high, and respondents indicated that it can reach millions of ringgit for each piece of machinery and equipment.

4.3.5 Depreciation

According to all four respondents, depreciation is a key factor in the valuation of machinery and equipment. Depreciation occurs for machinery and equipment, whether it has been used for a short or long period. The depreciation rate is at least 10% and can reach up to 90%, depending on the lifespan of the machinery or equipment. It also takes into account factors such as the country of manufacture, the year of use, and the frequency of maintenance for the machinery and equipment. The value of a piece of machinery and equipment starts from tens of thousands of ringgit and can reach millions of ringgit for each item of machinery and equipment.

$$\text{Annual Depreciation} = \frac{\text{Original Cost} - \text{Scrap Value}}{\text{Number of years of Asset Usage}}$$

"Going back to the lifespan of the machinery and equipment, once we know the lifespan, we refer to the machinery, when it was made, how often the maintenance was carried out, and then we can determine the depreciation of the machinery and equipment at the water treatment plant. If the machinery and equipment are old, it will be considered as 'scrap value.'" (Interview, 2024)

5. Conclusion

The model number and size are among the factors considered in the evaluation of machinery and equipment, as the majority of respondents have confirmed their agreement with this factor. The findings of this study reveal several factors considered and methods applied in the valuation of machinery and equipment. The interviews with four respondents have helped the researcher achieve both objectives of the study and simultaneously answered several research questions. All the factors and methods explored in previous studies have been validated through the interview sessions with the respondents, and they remain essential components in the machinery and equipment valuation process. The limitation of study is to collecting and analyzing qualitative data usually takes longer than quantitative data. The need for in-depth interviews or careful text analysis can make this study more time-consuming and labor-intensive. Other than that, the limited reference sources in the valuation of machinery and equipment plants (LJP) pose a challenge since it is a complex valuation that does not occur as frequently as real estate. Therefore, the sources of reference are also limited and require extensive searches to obtain relevant information on LJP. However, the supervisor was very helpful, which allowed everything to be resolved.

Suggestions for future research are to identify other factors that can be considered in the valuation of machinery and equipment plants and identify the significance of conducting property valuations such as for machinery and equipment plants.

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Conflict of Interest

Authors declare that there is no conflict of interests regarding the publication of the paper.

Authors Contribution

*The authors confirm contribution to the paper as follows: **study conception and design:** Musliha binti Mahmud, Abdul Jalil bin Omar; **data collection:** Musliha binti Mahmud ; **analysis and interpretation of results** Musliha binti Mahmud; **draft manuscript preparation:** Musliha binti Mahmud, Abdul Jalil bin Omar. All authors reviewed the results and approved the final version of the manuscript.*

APPENDIX 1

LAMPIRAN A

LAMPIRAN 1: SOALAN TEMU BUAL



**FAKULTI PENGURUSAN TEKNOLOGI DAN PERNIAGAAN
UNIVERSITI TUN HUSSEIN ONN MALAYSIA (UTHM)**

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TAJUK KAJIAN

FAKTOR PENILAIAN ASET JENTERA DAN MESIN DI LOJI PEMROSESAN AIR.

Temu bual ini dijalankan bagi mencapai objektif-objektif berikut :

- Untuk mengenal pasti faktor yang diambil kira dalam penilaian jentera dan mesin di loji pemprosesan air.
- Untuk mengenal pasti kaedah penilaian yang digunakan bagi penilaian jentera dan mesin di loji pemprosesan air.

Soalan-soalan dibawah ditujukan untuk menyiapkan kajian projek sarjana muda sahaja. Semua jawapan Tuan/Puan adalah rahsia untuk kegunaan akademik. Segala perhatian dan Kerjasama oleh Tuan/Puan amat dihargai. Sekian, terima kasih.

DISEDIAKAN OLEH:

NAMA: MUSLIHA BINTI MAHMUD

NO MATRIK: AP200350

KURSUS: IJAZAH SARJANA MUDA PENGURUSAN HARTA TANAH DENGAN KEPUJIAN

PENYELIA: PROF MADYA DR ABDUL JALIL BIN OMAR

BAHAGIAN A : MAKLUMAT DEMOGRAFI

1. NAMA:
2. UMUR:
3. NAMA ORGANISASI:
4. NO TELEFON:
5. PENGALAMAN KERJA(TAHUN):
6. TUGAS DAN TANGGUNGJAWAB:

BAHAGIAN B: FAKTOR YANG DIAMBIL KIRA DALAM PENILAIAN JENTERA DAN MESIN

B1. Kapasiti mesin

B1.1 Pada pandangan tuan/puan, bagaimanakah kapasiti jentera dan mesin menjadi salah satu faktor yang dominan untuk diambil kira dalam membuat penilaian?

B2. Saiz fizikalnya

B2.1 Bagaimanakah saiz fizikal bagi sesebuah jentera dan mesin merupakan faktor yang diambil kira dalam penilaian loji?

B3. Keadaan mesin

B3.1 Adakah keadaan bagi sesebuah jentera dan mesin menjadi salah satu faktor yang akan diambil kira semasa proses penilaian dijalankan?

B4. Nombor model dan saiz

B4.1 Pada pandangan tuan/puan, adakah nombor model dan saiz bagi sesebuah jentera dan mesin yang digunakan dalam loji menjadi faktor dalam membuat penilaian?

B5. Lain -lain faktor

BAHAGIAN C: KAEDAH MEMBUAT PENILAIAN JENTERA DAN MESIN

C1. Kaedah penilaian

C1.1 Pada pandangan tuan/puan, adakah kaedah penilaian yang digunakan dalam membuat penilaian jentera dan mesin?

C2. Kaedah mendapatkan sumber

C2.1 Bagaimanakah cara untuk mendapatkan sumber maklumat sebelum membuat penilaian jentera dan mesin?

C3. Komponen utama

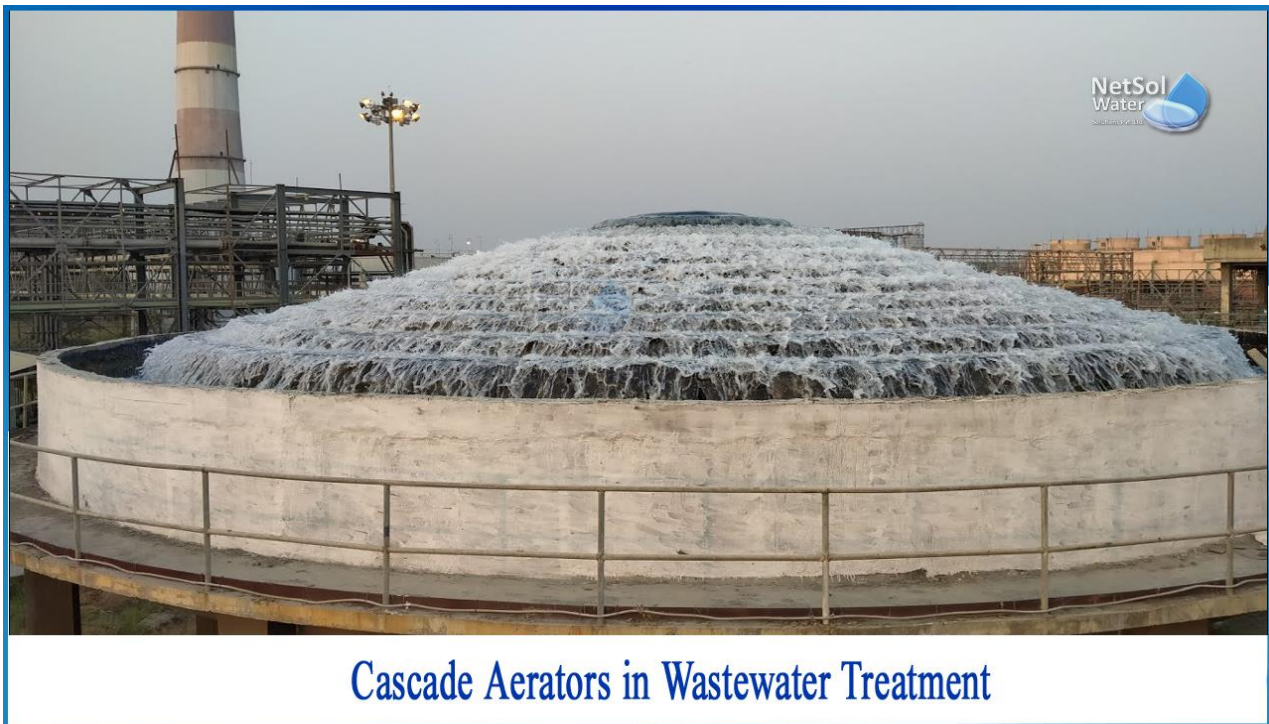
C3.1 Apakah salah satu komponen utama yang paling penting dalam membuat penilaian jentera dan mesin?

C2. Nilai komponen

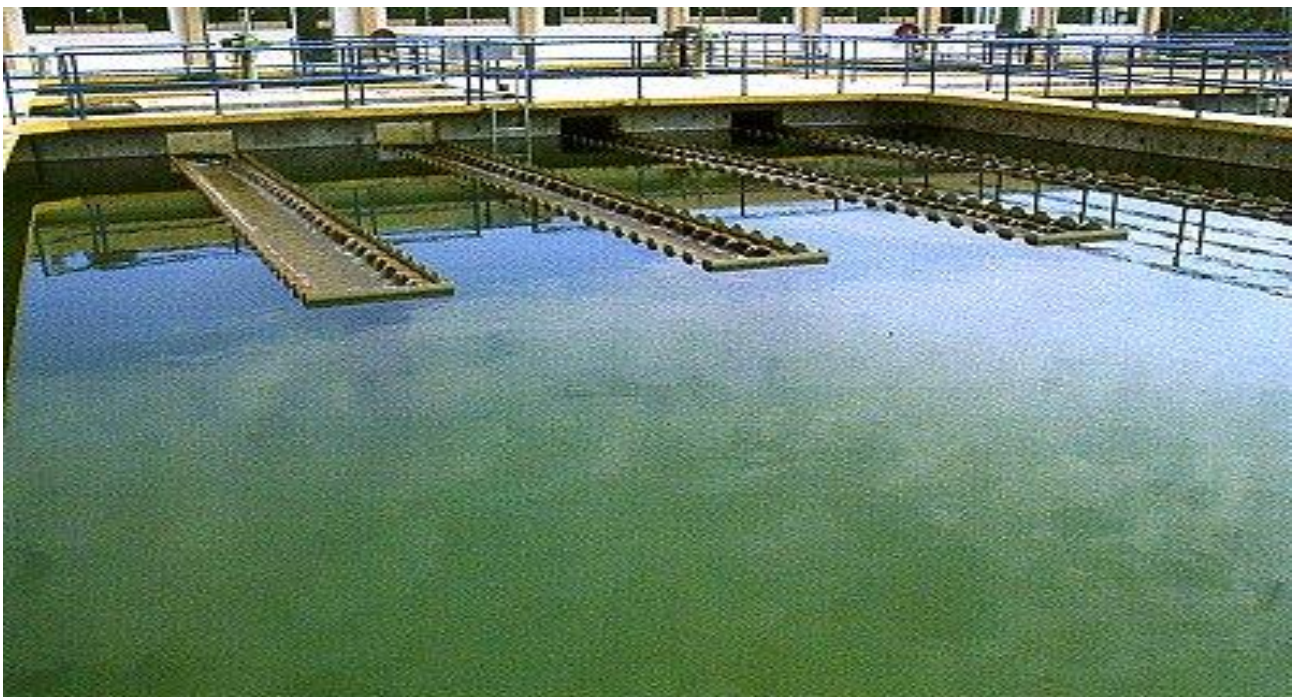
C2.1 Berapakah sekurang-kurangnya nilai bagi setiap komponen fasiliti di loji?

C4. Pada pandangan Tuan/Puan bagaimanakah cara untuk menentukan susut nilai bagi setiap jentera dan mesin di loji?

APPENDIX 2: Plant and Machinery in Water Treatment Plant



Cascade Aerators in Wastewater Treatment







APPENDIX 3: Respondent Analysis of Factors Considered in Valuation of Machinery and Equipment

Factors Considered	R1	R2	R3	R4	Score	Validation
Literature Review						
Machines Capacity	✓	✓	✓	✓	4/4	✓
Physical Size	✓	✓	X	X	2/4	✓
Machine Condition	✓	✓	✓	✓	4/4	✓
Model Number	✓	✓	X	✓	3/4	✓
New Information						
Functional Obsolescence	0	0	✓	0	Not Related	
Technology	0	0	0	✓		

APPENDIX 4: Calculation For Depreciation

The screenshot shows an Excel spreadsheet titled 'Copy of Copy of MICRO SEGAMAT POM training 9 mac 2023 (1) [Compatibility Mode] - Excel'. The spreadsheet is used for calculating depreciation for various machinery items. The columns are labeled as follows:

- Unit**: The unit of measurement for each item.
- Year**: The year of acquisition.
- Unit**: The quantity of units.
- Price / unit**: The original price per unit.
- Adjustment Factor**: The depreciation rate.
- Adjusted Price**: The price after depreciation.
- Hayat**: The useful life in years.
- Hayat Ekonomi**: The economic life in years.
- Susutnilai (Angkali)**: The depreciation amount.
- Adjusted Value**: The value after depreciation.
- Final Value**: The final value of the asset.

The data rows are as follows:

Unit	Year	Unit	Price / unit	Adjustment Factor	Adjusted Price	Hayat	Hayat Ekonomi	Susutnilai (Angkali)	Adjusted Value	Final Value
1. Muka Sauk										
10 tons weightbridge	1989	1	RM500,000	5%	RM0	24	25	rm25,000	RM0	RM475,000
"Neuro Power" Unit Power Supply cable and connection with pump										
2. Cascade Aerator										
Round size and concrete supports	1997	1	RM650,000	10%	RM0	28	40	65,000.00	RM0	RM585,000
Hydraulic Pump										
Connection with tank										
3. Horizontal Flow Tank										
3 unit	1995	3	RM890,000	9%	RM0	30	35	80,100.00	RM0	RM809,900

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