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TANGIBLE AND INTANGIBLE FACTORS INCORPORATED FOR INFRASTRUCTURE ASSET VALUATION

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Abstract

Infrastructure asset requires high building capacity for its operations. Its functions are also linked to other infrastructures. In this light, an asset's uniqueness in its design, operations, stakeholders' interest, and business growth affects its overall value. Therefore, valuation is a critical component of infrastructure assets. This is because specific components incorporate the approaches for valuing assets. This paper highlights the valuation method for infrastructure assets and identifies the tangible and intangible perspectives incorporated in infrastructure asset valuation. Thus, each tangible and intangible perspective were investigated and critically detailed in this paper. Identifying the tangible and intangible components in an asset is essential because it will affect the valuation methods that will be used to value the asset. Then, it will also be affected on the final value of the asset. The research findings are derived from a critical review of literature on tangible and intangible assets. This study adopted the qualitative approach, where a series of in-depth interviews were conducted with experts to get an insight into how these tangible and intangible perspectives influence asset valuation. This paper will enrich the current body of knowledge and benefit practitioners who could apply the study's output to real practice.

Keywords: Tangible assets, intangible assets, infrastructure asset valuation, property valuation, Malaysia

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INTRODUCTION

Infrastructure refers to the physical, interrelated systems and components that provide essential commodities and services to enhance a society's living sustainability (Fulmer, 2009). Infrastructures include roads, bridges, water supply, sewers, electrical grids, telecommunication, and transportation. According to Government Asset Management Policy (2009), assets are categorised into four categories: movable assets, immovable assets, live assets, and intellectual assets. In this light, infrastructure assets comprise both infrastructure and assets supporting each other commonly used by members of the society. The main goal of infrastructure management is to optimise the lifecycle value of infrastructure for its users, owners and other stakeholders.

In recent years, the concept of infrastructure assets valuation has been expanding as the infrastructure industry shifts into a performance-based decision-making paradigm and the innovation of smarter infrastructure. Subsequently, the intentions in intangible assets, including information and communication technology, continue to rise in their shares in advanced economics. The expansion of the intangible's economy reflects the importance of expanding asset valuation methods to capture tangible and intangible more explicitly in the future. On the other hand, the international valuation standard (2013) stated that only real property interests, infrastructure assets and plant equipment could be described as specialised public service assets as infrastructure assets possess specialised features by design, specification or location, reliable comparisons can rarely be made with the prices of similar assets in the market. Therefore, choosing the right method for infrastructure asset valuation has become the responsibility of real estate professionals. This has caused several problems to arise, particularly about the design of the building, the function, operation, and business growth within the assets, making it more challenging to determine the suitable valuation approaches to value an infrastructure asset. Therefore, the valuation of infrastructure assets should come under scrutiny. Valuers need to understand and adopt the right and most suitable approach in valuing infrastructure assets. Consequently, it is important to choose an approach that aligns with the goals and objectives for managing the infrastructure and reflects the true value of the asset. Junainah and Suriatini (2019) supported that the goal of the valuation process is to estimate the best possible value for a specific property. For this reason, an asset valuation methodology is needed to quantify the value of infrastructure assets by considering the tangibles asset and the intangible elements, including overall asset use.

LITERATURE REVIEW

Valuation of Special Property

The Malaysian Valuation Standards (MVS) 2019 defined specialised property as a property with a specialised nature. These properties are rarely transacted to continue their existing use, except as part of a business sale in occupation. The property is categorised as a 'special' due to the construction, arrangement, size or location of the property, or a combination of these factors, or maybe due to the nature of the plant, machinery and equipment provided in the buildings. Thus, a special property valuation is required by using specific valuation methods based on the property's specific functions, operations, and the purpose of valuation. Moreover, MVS (2019) asserted that specialised properties are usually valued based on the Depreciated Replacement Cost (DRC). As mentioned in MVS (2019), DRC is defined as the current cost of replacing an asset with a modern equivalent asset with fewer deductions for physical deterioration, functional obsolescence and economic obsolescence. Therefore, it is subject to the cost of replacing the new asset by considering the physical, functional and economic obsolescence. Thus, this research further discusses the current valuation practice for infrastructure assets and how intangible elements are considered in conducting a valuation. In this light, the most suitable valuation method could be determined based on data derived from published reading materials (Abdul Halim, 2008).

A previous study by Michelle (2012) adopted the depreciation replacement cost method in highway valuation. Other than that, Nick French (2004) investigated the profit method and depreciation replacement cost method for hotel valuation, where depreciation replacement cost was applied to leisure properties, public hospitals, and public churches. Meanwhile, in a study on transportation terminals, Ratmoko (1997) adopted the cost method and profit method for airport terminal valuation; and Gutek (1990) also adopted the cost method and profit method for terminal transit valuation. Besides, Hall (1990) used the cost method, comparison method and profit method for an automatic car wash centre, and Healy and Berquist (1994) adopted the comparison method for tin mining valuation. Based on the studies reviewed, the preferable valuation methods adopted are cost and profit-based methods. In general, all valuation methods adopted for special properties would identify and categorise a different component that could be taken out during the valuation of tangible and intangible assets.

This study embarked on a case study of the Sultan Iskandar Custom, Immigration and Quarantine Complex (CIQ Complex) in Johor. The CIQ complex is a transportation terminal in Johor Bahru built to solve the traffic congestion issue in the Johor-Singapore Causeway. This study focused on a 3-storey office building located within the CQI Complex with a total area of 353,082.43 square feet. The building is located adjacent to the complex's vehicle

deck of the complex. In this light, the vehicle decks in the complex are placed at different levels to isolate traffic flow. Heavy vehicles will use the outermost part, and the next level is for light vehicles such as cars and motorcycles, while the highest level is reserved for buses. The CIQ Complex also houses government offices. The development of the complex was listed under the National Key Target Level 1, which means that CIQ Complex is considered an essential infrastructure asset that serves an important function to the society and the relationship between Malaysia and foreign countries, specifically Singapore. Thus, in valuating this asset, all facilities and components of the building must be identified to ensure a comprehensive assessment that involves all facilities and components of the CIQ Complex. Issues related to intangible economic benefits also need to be highlighted as they also influence the infrastructure asset value.

Overview of Profit Method and Cost Method

The profit method is one of the five methods of valuation (Pagourtzi et al., 2003). It aims to provide a comprehensive valuation of any property (land and buildings), plant, equipment, machinery and movable asset. The profit method considers the specialised nature of the property and is based on the income and expenses relating to the business that includes tangible and intangible assets. It is important to note that this method is not a business valuation; it does share similarities to a discounted cash flow used to value a business and is based on the income and expenses of the business. However, at a certain point, the cash flow would be converted into a property rental split and capitalised after deducting property expenses to arrive at the property value.

Meanwhile, the cost method is used when the transaction data for the property is limited, or there is no transaction for the property. In theory, the cost method evaluates the property by dividing it into land and buildings. Based on A. F Millington (1975), the value of land should be added to the cost of the building to obtain the value of the property. For the first component, which is land, the value of this site will be determined by comparing the site's value against the value of other similar sites. If there is a difference between the comparison site and the valuation site, adjustments need to be made (Azhari Husin, 1996). On the other hand, to determine the second component, including building cost, estimates can be made by assuming the cost for rebuilding or refurbishing the building on the ground.

Tangible Factors of Infrastructure Asset Valuation

When the valuation is made, the asset components will be carefully considered to obtain the correct and accurate amount of value. The components of the asset will usually take into account the so-called tangible assets. Tangible assets are terms used in the valuation procedure for fixed assets, including machinery,

buildings and land, and current assets, such as inventory (Falls & Hosang, 2001). Other than identifying the methods adopted for infrastructure asset valuation, the use-value approach mentioned by Weldemicael (2017) could also be used to measure an asset's intangible economic benefits. Thus, the tangible factors that influence infrastructure asset valuation are discussed and summarised in Table 1.

The critical literature review found eight elements subject to tangible factors that influence asset valuation: smart technology, land, buildings, plant and machinery, infrastructures, utilities, weight scales, and traffic management system.

Table 1: Tangible factors that influence infrastructure asset valuation

No.	Tangible Factors	Details	Authors
1	Smart Technology	Cameras at guide rail and barrier wall, loop detectors, communication equipment.	Amekudzi-Kennedy et. al. (2019); Alyami (2017) and Mian (2019)
2	Land	Vacant land value	Chen et al. (2005); Reynold (1986); Sherif Roubi (2004)
3	Buildings	Central office	Lutzkendorf and Lorenz (2011); Reynold (1986); Sherif Roubi (2004)
4	Plant and machinery	Equipment fittings, installations, apparatus and tools	Olawore (2011); Yusof et al. (2012); Reynold (1986); Sherif Roubi (2004)
5	Infrastructures	Pavement, bridges and drainage structures	Alyami (2017)
6	Utilities	Cable, hydro, gas, phone and water	Alyami (2017)
7	Weight scales	Truck weight station, batching machines and constant feeding belt scale.	Alyami (2017)
8	Traffic Management System	Route suggestion, accessibility network, data acquisition equipment	Souza et al. (2017); Shen and Chen (2012)

Source: Research Fieldwork (2020)

Intangible Factors of Infrastructure Asset Valuation

Apart from considering tangible assets in the calculation, intangibles assets are also an important aspect that needs to be studied and considered to evaluate a property. While intangibles assets are often overlooked, and their existence is rarely considered, they can influence the value in determining the more accurate value of an assessment conducted. Intangible assets comprise nonphysical assets,

and the intangible asset components will vary across the properties being assessed. Intangible assets are also monetary assets that manifest themselves according to their economic properties. It does not have physical substances but grants rights and economic benefits to its owner (Malaysian Valuation Standard, 2019). These assets derive their value from the rights inherent in their ownership. In this sense, these assets are considered intangibles because they cannot be seen or touched, yet they have the potential to possess value.

Table 2 list the intangibles factors incorporated in the infrastructure asset valuation. There are nine intangible elements, including safety, mobility, economic advancement, sustainability, social value, environmental quality, intellectual property, image/ goodwill and legal ownership.

Table 2: Intangible factors that influence infrastructure asset valuation

No.	Intangible Factors	Details	Authors
1	Safety	Resilience and Risk mitigation	Amekudzi-Kennedy et al. (2019); Dojutrek and Labi (2012); Weldemicael (2017); Juan Diego et al. (2015) and Prerna Singh (2018).
2	Mobility	Congestion mitigation, short distance to transit and traffic efficiency	Amekudzi-Kennedy et. al. (2019); Dojutrek and Labi (2012); Juan Diego et. al. (2015) and Prerna Singh (2018).
3	Economic Advancement	Demand drivers	Amekudzi-Kennedy et. al. (2019); Dojutrek and Labi (2012); Frischmann (2012); Juan Diego et. al. (2015) and Prerna Singh (2018).
4	Sustainability	Energy efficiency, functionality, serviceability, durability, indoor air quality, health friendliness and recyclability	Amekudzi-Kennedy et. al. (2019); Solikin et. al. (2019); Lutzkendorf and Lorenz (2011)
5	Social value	Service contributed to the community	Dojutrek and Labi (2012); Frischmann (2012)
6	Environmental Quality	Positive externalities, environmental risk	Dojutrek and Labi (2012); Lutzkendorf and Lorenz (2011); Frischmann (2012) and Solikin et. al. (2019)

7	Intellectual property	Software, guidelines, methods, procedures and data.	Alyami (2017); Frischmann (2012)
8	Image/ Goodwill	Brand identity, brand meaning, brand responses and brand relationships	Alyami (2017)
9	Legal ownership	Patent, trademarks, copyrights, registered designs, brands, computer software	Frischmann (2012)

Source: Research Fieldwork (2020)

The purpose of a valuation also influences the forms of value factors (tangible and intangible) included in the valuation. Furthermore, aspects such as uncertainty and how one addresses it when valuing assets could influence the valuation results. Amekudzi (2019) addressed that not all types of value can be quantified. However, failure to quantify the various types of value does not invalidate their existence. To date, infrastructure asset valuation has largely been based on the infrastructure's physical condition. Along similar lines, assets may be valued for their contribution to mobility, resulting in mobility-based value. Assets may also be valued based on their safety, economic and environmental benefits. These assets might not have any physical substances, but they possess economic benefits to their owner. Hence, they could be considered as adding to the assets' value during valuation. Moreover, as different valuation methods are intended for different purposes and consider different components of tangible and intangibles assets, the inclusion of these assets may produce different results in the end.

DATA COLLECTION AND DATA ANALYSIS

Research methodology is very important in developing systematic research and aligned in achieving the objectives of the research. The research methodology for this research consists of three phases, defining the research development, the procedure for data collection, data analysis, and results for discussion. The data were collected through a series of in-depth interviews with experts in fields related to special property valuation and intangible factors. These experts have more experience and knowledge in their field. For example, in analysing safety factors and risk mitigation, the head of a building's safety department will be able to provide the exact cost for a risk mitigation action plan and other plans. In all,

10 experts' valuation field, cost-benefit analysis and officers in charge of operations of the CIQ Complex were interviewed. The in-depth interviews with the experts were conducted on either a face-to-face basis or online interview via the Webex platform. All experts interviewed have successfully shared their thoughts and insights on the tangible and intangible factors of infrastructure asset valuation and how they influence the asset's value. The data analysis stage followed the data collection. Qualitative data analysis is the conceptual interpretation of the data set as a whole, using a specific analytic strategy to convert the raw data into a logical description and explanation of the phenomenon under study. This research adopted qualitative data analysis to analyse the data from the interview sessions with the experts.

RESEARCH FINDINGS AND DISCUSSIONS

Based on the research findings, there are two sections for the questions asked to the experts. The first section presents the expert's background and opinions on valuation methods adopted for infrastructure asset valuation. Based on the input from the in-depth interview, all experts agreed that the cost method is the preferred valuation method for infrastructure asset valuation. This is because the cost method is suitable for valuing a public infrastructure asset as it considers the land value by comparing the land value per square foot. Moreover, the method allows valuators to consider the depreciation for cost in determining the cost for building, plant, machinery and equipment.

The next part determined the most preferred methods for infrastructure asset valuation. This includes the tangible and intangible factors incorporated that enhance the infrastructure asset value. As infrastructure assets are considered special properties, they are rarely transacted. Hence, it is hard to find comparable data. All of the experts supported this notion during the interviews. In terms of intangible elements included in infrastructure asset valuation, all of the experts agreed that the cost method they adopted did not include the intangible elements. However, experts 3 and 8 opined that the intangible elements are already included in the price per square foot for the built-up area of the infrastructure asset. Thus, they opined that the intangible elements already influence the value by considering the building materials attached to the infrastructure asset. Two experts, experts 3 and 8, disagreed that the valuation findings did not picture the asset's real value. This is because the price per square feet for the built-up area of the infrastructure asset already includes the element of building materials, which also influences intangible factors that are environmental quality and sustainability. This is applicable especially for green buildings with sustainability features. The study found that the main concept to highlight in intangible asset valuation is an individual's willingness to pay (Solikin et al., 2019). The findings on tangible and intangible factors that should be incorporated into infrastructure asset valuation are shown in Table 3.

Table 3: Summary of Research Findings

No.	Early Research Hypothesis	No.	Research Findings
	Tangible factors:		**Tangible factors:**
1.	Smart technology	1.	Land
2.	Land	2.	Buildings
3.	Buildings	3.	Plant and machinery
4.	Plant and machinery	4.	Infrastructures
5.	Infrastructures		
6.	Utilities		
7.	Weight Scales		
8.	Traffic management system		
	Intangible factors:		**Intangible factors:**
1.	Safety	1.	Safety
2.	Mobility	2.	Mobility
3.	Economic advancement	3.	Economic and Social value
4.	Sustainability	4.	Sustainability (Environmental quality & image/goodwill)
5.	Social value		
6.	Environmental quality	5.	Intellectual property
7.	Intellectual property		
8.	Image/ goodwill		
9.	Legal ownership		

Source: Researcher (2020)

Table 3 lists all tangible and intangible factors identified during the critical literature review. The identified factors were verified through in-depth interviews with experts. Their insights and comments were derived regarding the tangible and intangible factors that influence infrastructure asset valuation. Out of the 8 tangible factors found from the literature, only 4 tangible factors actually influenced infrastructure asset valuation. In this regard, smart technology, utilities, weight scales and traffic management system could be categorised under plant, machinery and equipment (PME). This finding is in line with the MVS (2019) definition of PME, which includes any assembly of items that form part of utilities, building services installations, or a system configured of machines/ technology employed or installed for a specific process.

On the other hand, out of 9 intangible factors identified in the literature review, the experts only verified 5 intangible factors that actually influence infrastructure asset valuation. This is due to the merge factor of social value that is also related to the economic value. The same goes for environmental quality and image/goodwill, which are considered part of the sustainability factor. Another factor, legal ownership, was withdrawn from the list as it does not influence the infrastructure asset valuation result.

CONCLUSION

In conclusion, the main research objectives have been achieved by identifying the most suitable evaluation method. This study has identified and verified both tangible and intangible factors influencing infrastructure asset valuation through in-depth interviews with the experts and found the most significant factors influencing infrastructure asset valuation. This paper will enrich the current body of knowledge and benefit practitioners who could apply the study's output to real practice.

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