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QUALIFYING AND QUANTIFYING THE INTANGIBLE FACTORS THAT ENHANCE IN INFRASTRUCTURE ASSET VALUATION

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Abstract

Infrastructure asset are included as a special property when one is conducting a valuation. The uniqueness of an infrastructure asset due to its specific functions and operations that are differ from other infrastructure asset. Thus, the tangible and intangible factors included for valuation are also difference and specialize according to each infrastructure asset. The issues of intangible factors that enhance in infrastructure asset valuation are arisen since the investor and stakeholders are concern in getting to know how much the asset are generating a profit compare to its expenses in operating the asset especially a public asset. This research aims to evaluate the application of intangible factors in infrastructure asset valuation. As intangible factors are unforeseen factors, thus this research elaborates on detailed intangible factors and how to identify the factors that influence to the value. The methodology adopted in this research is based on qualitative analysis by in depth interview with the experts that specialized in special property valuation. The research findings are derived from the content analysis. Based on the interview expert's session, this paper has also benefit in the form of knowledge and to the practitioner in implementing the intangible factors in infrastructure asset valuation.

Keywords: Intangible factors, special property valuation, infrastructure asset valuation, CIQ Complex, Malaysia

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INTRODUCTION

According to Nur Farah Hanna et. al. (2021), infrastructure assets involve mutually infrastructure and assets that operates and functions by completing each other and are commonly used to benefit to the society. Thus, in contributing to the society, the infrastructure assets operate with optimum functionality but with minimum income generation as the infrastructure assets are public assets. Referring to Asset Management Manual in World Road Association (PIARC), infrastructure asset valuation is highlighted because it considers the long-term financial planning and budgeting that influence to investment decision making. Weldemicael et al. (2017) added that asset valuation is the process of conveying monetary value to an asset. Infrastructure asset valuation is vital factor in the strategy planning for asset long term preservation, maintenance, restoration and replacement.

Thus, the issues of valuing infrastructure assets are highlighted because the infrastructure assets owner are categorised either government or private sector. The results from valuation with specific methods chosen as a tool will affect the owner in terms of the final value reach from the calculation of either in market value, rental or rating purposes. Hence, it is very essential for the valuer to well understand in order to implement the most suitable method in infrastructure assets valuation. By associating infrastructure asset as a special property, various valuation methods are adopted to value such kind of property. It is based on the special property types, functions and factors that affect the value. In some cases, the element of intangible value is highlighted because it does contribute to the final value of the special property.

International Valuation Standard (IVS, 2013) address only real property interest, infrastructure asset and plan equipment can be described as specialized public service assets. Infrastructure asset is known with their specialized features by design, specification or location that reliable comparisons can rarely be made with the prices of similar asset in the market. Generally, the infrastructure asset or other special property are best valued by using depreciated replacement cost method (DRC) (Ivannikov and Dollery, 2018; Molland, 2008). MVS (2019) supported that the current best practice to value a specialised property is by using DRC basis. DRC refers to the present cost of substituting an asset with a new equivalent asset less deductions for physical deterioration, functional obsolescence and economic obsolescence. It can be concluded as the replacement cost to the new asset and considering the deductions due to the obsolescence of the physical, functional and economic aspects. DRC calculation is based on the land value, building or construction cost and deduct with the depreciation. Thus, the calculation is based on the physicality of the infrastructure asset. However, there is another issue in the long-term run if the valuation is considering other elements such as concessions period, operation cost, income flow, holding cost, discounted cash flow and payback period. Then, discounted cash flow analysis

(DCF) is another approach that was highlighted to counter this problem. DCF includes all the costs and expenses by considering a specific time frame with further calculation of internal rate of return (IRR).

In contrast, there is also another aspect of intangible and social benefits that need to be measured in determining the value of infrastructure asset. This paper fills the gap in terms of the intangible elements that are unseen but actually influence to the value. Thus, this research is conducted because rather than highlighting on the tangible asset included in the calculation, there are actually other factors in the form of intangible factors that influence the functions and operations of the infrastructure asset. Indirectly, the intangible factors are influencing to the value. Thus, this research aims to evaluate the application of intangible factors in infrastructure asset valuation.

HOW TO VALUE INFRASTRUCTURE ASSET?

Special property valuation is a property with specialised nature or functions and it is rarely transacted (Malaysian Valuation Standards, 2019). Infrastructure asset is included as one of a special property. This is due to special or specific construction, arrangement, size or location involved for the specific property. Thus, due to the specialised property condition, then the valuation procedure are different from another special property. It is highly depending on the functions and operations of the special property.

Customs, Immigration and Quarantine Complex (CIQ Complex) as an example of infrastructure asset, this asset functions as the main checkpoint at the cross border of Malaysia-Singapore. Thus, in conducting a valuation, first step is to identify the asset functions and operations that must meet on subsection of specialised property definition in MVS (2019). Further details on the construction, arrangement, size and specification of the property proves that there is no market for those unique buildings. Other than that, due to the operational and business reasons of CIQ Complex that leads to no market for such buildings there. After analysing the items or factors that influence to the value of the special property, then decision can be made in using the right method of valuation.

In the case of CIQ Complex, this infrastructure asset belongs to the government, the land value and building cost invested are very costly. However, in the perspectives of investor, they want to know whether the investment will benefit to the society. Then, the intangible benefit to the society will added value to their investment and to the value of the infrastructure asset. How this new project development will save people time in crossing the Malaysia-Singapore boarder with less hassle, effective screening process, save people's money and save fuel due to less time stuck within the boarder. These are the intangible benefits from the project development and it will encourage more people to use the infrastructure asset specifically the CIQ Complex in this case study. Thus,

this research elaborates the valuation approaches for infrastructure asset by considering both tangible and intangible factors that influence to the valuation.

INTANGIBLE ASSET VALUATION APPROACH

Based on the previous research, there are methods of valuation for intangible assets. This is due to the generic intention of getting to know on how to translate the value of the intangible asset. As supported by RICS Valuation, Global Standards referring to VPGA 6, valuation of intangible assets under Part 5 of Valuation Application, intangible asset valuation requires a valuer to have a comprehensive information and thoughtful on such issues such as the owner's rights to the asset; what happen in the past and the current activities conducted within the asset; and the state of subject industry including the economic and political factors. Based on previous research, there are three main methods of valuation adopted for intangible assets. The approach are cost approach, income approach and market approach (Souza, 2017; Reily, 2019; Visconti, 2020; Chartered Global Management Accountant (CGMA), 2012; Junainah and Suriatini, 2019 and Parrington, 2016). Thus, the intangible asset valuation approach applied in various countries has been critically reviewed and the findings on intangible asset valuation approach are summarised in Table 1.

Table 1: Summary Review of Intangible Asset Valuation Approach

No.	Intangible Asset Valuation Approach	Details	References
1.	The cost approach	• Replacement cost new less depreciation method • Reproduction cost new less depreciation method	CGMA (2012); Paneth (2016); Reilly (2019); Visconti (2020).
2.	The income approach	• Profit split method • Incremental income method • Residual income method • Multiperiod excess earnings method	CGMA (2012); Paneth (2016); Reilly (2019); Visconti (2020).
3.	The market approach	• Relief from royalty method • Comparable uncontrolled transactions (sales) method • Comparable profit margin method	CGMA (2012); Paneth (2016); Reilly (2019): Visconti (2020).

Based on Table 1., the methods for intangible asset valuation are summarised consist of the cost approach by considering replacement cost and reproduction cost. As for income approach, the recognized methods are profit split method, incremental income method, residual income method and multiperiod excess earnings method. Finally, the market approach is detailed through relief from royalty method, comparable uncontrolled transactions method and comparable profit margin method. Trough analysing the intangible asset valuation approach, the next subtopic elaborates the tangible and intangible factors that enhance to infrastructure asset valuation in the case of CIQ Complex.

SUMMARY OF THE FINDINGS FROM PREVIOUS RESEARCH

According to the previous research (Nur Farah Hanna et. al., 2021), the valid items for tangible and intangible factors are detailed as in Table 2. Thus, these items have gone through a process of qualifying the right factors that influence to the value in infrastructure asset valuation. The next phase is to quantify the items for tangible and intangible factors and working on translating the items to value.

Table 2: Summary of Previous 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)
5.	Social value		
6.	Environmental quality		
7.	Intellectual property		
8.	Image/ goodwill		
9.	Legal ownership		

Source: Nur Farah Hanna et. al. (2021)

Based on Table 2., the early research hypothesis of tangible and intangible factors are recognised through critical literature review from previous

research. The recognised factors then are investigated through in-depth interview with the experts to get their visions and remarks regarding the factors that influence to infrastructure asset valuation. The detailed tangible factors are listed in Table 3. Next, the detailed intangible factors are listed in Table 4.

Table 3: Detailed Tangible Factors

No.	Tangible Factors	Details	Authors
1	Land	Vacant land value	Chen et. al. (2005); Roubi (2004)
2	Buildings	Central office	Lutzkendorf and Lorenz (2011); Roubi (2004)
3	Plant and machinery	Equipment fittings, installations, apparatus and tools	Olawore (2011); Mohd Nasir et. al. (2012); Roubi (2004)
4	Infrastructures	Pavement, bridges and drainage structures	Alyami (2017)

Source: Researcher's Fieldwork (2020)

Table 4: Detailed Intangible Factors

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 Prena Singh (2018).
2	Mobility	Congestion mitigation, close distance to transit and traffic efficiency	Amekudzi-Kennedy et. al. (2019); Dojutrek and Labi (2012); Juan Diego et. al. (2015) and Prena Singh (2018).
3	Economic and Social Value	Demand drivers and service contributed to the community	Amekudzi-Kennedy et. al. (2019); Dojutrek and Labi (2012); Frischmann (2012); Juan Diego et. al. (2015) and Prena Singh (2018).
4	Sustainability (Environmental Quality)	Energy efficiency, functionality, serviceability, durability, indoor air quality, health friendliness, recyclability and Positive externalities, environmental risk	Amekudzi-Kennedy et. al. (2019); Lutzkendorf and Lorenz (2011); Dojutrek and Labi (2012); Frischmann (2012)

Source: Researcher's Fieldwork (2020)

As the result, from 8 identified tangible factors in the early stage of research, there are 4 tangible factors that really influence to infrastructure asset valuation. This is because, smart technology, utilities, weight scales and traffic management system are actually fall under plant, machinery and equipment (PME). It is supported by MVS (2019) where the definition of PME also mentioning regarding items that are assemble in the form as part of utilities, installations of building services, or systems related to machines or technology that installed for specific purposes. As for intangible factors, there are 9 identified factors at the early stage of this research. Through in-depth interview with the experts, it results in only 4 verified intangible factors that influence to the value. 2 of the early hypothesised factors are merge with other factors as there are inter-related. The factor of social value is combined with economic value. Same goes to another factor that is environmental quality and image/goodwill that actually result in as part of sustainability factor. The other factor that is intellectual property was withdrawn from the list due to its factor that is not really influence to the infrastructure asset valuation. After qualifying the items for tangible and intangible factors, this paper is focusing on quantifying the detailed intangible factors. It means that, this research will further investigate how to translate the intangible factors and turn it to value.

RESEARCH METHODOLOGY

Research methodology is very significant in achieving the aims of the research. The research methodology stage develops systematic research design and techniques to be implement in the research. The study is conducted and analysed based on qualitative analysis. In-depth interview with the experts specialized in intangible asset valuation, green building, registered valuer, cost-benefit analysis experts, person that managing the operational and functional of CIQ Complex and valuer specialize in special property are the target group of experts for interview session. Overall, ten experts are chosen and interviewed. The experts are chosen according to their great experience with the range of experience between 8 to 25 years. The in-depth interview is conducted on face-to-face with the experts and some of the experts are being interview online basis through Webex platform. All of the experts successfully sharing their opinions and comments on the tangible and intangible factors of CIQ Complex and explain the details regarding the factors that effect to the value. The questions to the experts are related to the expert's background as in Section A. The details of years of working experience and their expertise type were asked in the early part. On the next part of Section B, it is regarding the weaknesses of the valuation method for infrastructure asset valuation. Next, the detailed list of tangible and intangible factors is listed in the questions and the experts need to respond to each factor. The experts will answer either they are agree or disagree that the factors listed

will influence to the infrastructure asset valuation. Thus, the agreed factors will remain and will proceed with further analysis. However, based on the discussions with the experts, some factors that are not accepted are merged with other factors. Based on further discussions with the experts, the research result in either accepting or rejecting the factors that influence to infrastructure asset valuation. Thus, the results are not suitable to be presented in percentage form.

FINDINGS AND DISCUSSIONS

The findings of this research contribute to the knowledge of how to qualify and quantify the factors that influence to the infrastructure asset valuation. Based on the results, all of the experts opined that the favoured valuation method for infrastructure asset valuation is cost method. This is due to cost method that is appropriate to use to value a public infrastructure asset. Through cost method, the land value are considered through comparison method to get the land value per square feet. Other than that, is to get the building cost, plant, machinery and equipment cost and considering the depreciation for each cost item. Thus, further analysis is done to quantify the factors into value. According to the data analysis, Table 5 is the final findings of the research. The table illustrates the verified factors and how to identify these factors in translating it to value.

Table 5: Final Findings of the Research

No.	Research Findings	How to Quantify the Factor that Influence to the Value	Value
	Tangible factors:		
1.	Land	Depreciated replacement cost method	Economic (monetary)
2.	Buildings	Depreciated replacement cost method	Economic (monetary)
3.	Plant and machinery	Depreciated replacement cost method	Economic (monetary)
4.	Infrastructures	Depreciated replacement cost method	Economic (monetary)
	Intangible factors:		
1.	Safety	Cost approach or market approach	Economic (monetary)
2.	Mobility	Cost approach or market approach	Economic (monetary)
3.	Economic and Social value	Social benefit	Social (benefit)

4.	Sustainability (Environmental quality)	Cost approach or income approach	Environmental Quality (monetary)

Source: Researcher's Fieldwork (2020)

According to Table 5., the identified factors are categorized to the best approach in quantifying the factors that influence to the value. Overall, for tangible factors, it results in depreciated replacement cost method as the best approach to quantify the factors and translate it to the value. While for intangible factors, the findings are different and there are options of either to conduct cost approach or market approach to translate the intangible factors to value. However, as for economic and social value factor, the approach to translate to value is by referring to social benefit. Thus, these three approaches are deemed applicable to intangible asset valuation, that are cost approach, market approach and income approach.

Apart from that, the approach in translating the intangible factors to value can be divided to three elements, that are in terms of economic, social benefit and environmental quality. This concept is related to the cost-benefit analysis (CBA). CBA includes an organised classification of impacts that are benefits (pros) and costs (cons), and the value can be monetarised in specific currency value. A CBA is included as a subjective calculation tool. This is because the data added from cost and benefits considerations are influence by the choice of suitable data to support and estimate in the calculation. Through this concept, the economic and environmental quality element can be monetarised. Meanwhile, the element of social is referring to the benefit of the social and cannot be translated to value.

The costs involved in CBA include direct costs (workers involved in manufacturing, manufacturing expenses, raw materials or inventory); indirect costs (electricity, overhead costs from management, rent, utilities); intangible costs of a decision (impact on customers, employees or delivery times); opportunity costs (alternative investments or buying a plant or building); and cost of potential risks (regulatory risks, competition and environmental impacts). Besides, as for revenue, it might include revenue and sales increases from increased production or new product; intangible benefits (improved employee safety and morale, customer satisfaction or fast delivery); and competitive advantage (market share gained). Thus, according to the research findings, there are 4 identified intangible factors for CIQ Complex valuation as agreed by all experts. Each of the intangible factors is detailed in terms of the specific items referring to the factor and was derived by how to translate the items to value.

Due to infrastructure asset as part of special property, thus it is rarely transacted and it is hard to find the comparable data. This is supported by all of the experts during the interview. In terms of intangible elements being included

in infrastructure asset valuation, all of the experts agreed that the cost method that they adopted did not include the intangible elements. However, experts 3 and 8 added that the intangible elements are already included in the price per square feet for the built-up area of the infrastructure asset. Thus, they opined that the intangible elements are already influence to the value by considering the building materials attached to the infrastructure asset. This leads to disagreement of experts 3 and 8 towards the statement of that the results from valuation findings did not picture the real value of the asset. This is because, the price per square feet for the built-up area of the infrastructure asset already include the element of building materials which also influence to intangible factors that are environmental quality and sustainability. It is applicable especially for green building where they have all the criteria that relate to the sustainability in terms of energy saving and indoor air quality. Thus, the overall findings of the research result in the verified tangible and intangible factors incorporated in infrastructure asset valuation.

CONCLUSION

As a conclusion, the main research objectives are achieved where the best practice of valuation method is identified. Besides, the identified tangible and intangible factors of infrastructure asset valuation are investigated through in-depth interview with the experts. It has result in the most significant factor that influence to infrastructure asset valuation. Four tangible that are land, buildings, plant and machinery and infrastructures are the results for tangible factors that influence to infrastructure asset valuation. Another four intangible factors are the result of this research. The intangible factors are safety, mobility, economic and social value and sustainability (environmental quality). Other than qualifying the factor, this paper has also identified the suitable methods to quantify the tangible factors which by using depreciated replacement cost method as agreed by all experts. However, as an added value in this research, further investigation is done to quantify the intangible factors that influence to infrastructure asset valuation. The results are also presented of either the factors can be monetorised or it will benefit to the society. This research has contributed to the body of knowledge as well as practitioner can apply the output to the real practice.

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