Value for money in transport infrastructure investment: An enhanced model for better procurement decisions

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ABSTRACT

This paper addresses the nebulous value for money (V/M) concept and its widely-criticised use in justifying the adoption of Public-Private Partnerships (PPPs) for transport infrastructure projects. It draws on the theories of value and identifies that value is generated in the interaction of the supply side (i.e., governments - as project sponsors and part of infrastructure delivery partnerships) and the demand side (i.e., end-users). In this sense, ‘public’ participation in transport is highlighted in the proposed framework to demonstrate that it is the combination of ‘traditional’ and ‘public’ V/M that together create a more meaningful V/M concept. To underpin the application of the framework, a dynamic V/M assessment process is developed that can facilitate the appropriate selection of a procurement method and assess its V/M throughout the project lifecycle. Unlike current examples, the framework is designed for both PPPs and their alternatives (e.g., conventional public sector procurement) and aligns ex-ante and ex-post V/M assessment. The enhanced model creates an opportunity for governments to recognise public V/M in transport interventions, shift their mindset from singular to multi-dimensional evaluation, and start to actually accumulate and exploit experience from past projects. As such, the contribution of this paper is twofold: (1) drawing upon theories of value, it depicts the ontology of V/M and addresses a missing ingredient in V/M assessment; and (2) it develops a holistic framework for the public sector to re-calibrate their V/M assessment policy when procuring transport projects.

“The chief value for money lies in the fact that one lives in a world in which money is overestimated.” –Henry Louis Mencken

1. Introduction

Transport infrastructure forms the backbone of an economy’s socio-economic development and growth (Maciulis et al., 2009). With this in mind, governments around the world are attempting to deliver quality transport services to meet their people’s demands. An example is the United Kingdom (UK)’s £88.4 billion investment plan in transport pipeline by 2020–21 to boost the economy and connect communities. According to the Global Infrastructure Hub’s estimate (2017, p3), “global infrastructure investment needs to be $94 trillion between 2016 and 2040. This is 19 percent higher than would be delivered under current trends, and is an average of $3.7 trillion per year”. However, for large-scale transport projects (> $300 million) and in the face of fiscal constraints, the public sector is increasingly engaging the private sector in the delivery of their transport assets using a Public-Private Partnership (PPP) approach (Carpintero and Petersen, 2015). This is particularly the case when Covid-19 is inflicting critical challenges on budgets and infrastructure delivery (Love et al., 2020). An example can be seen in the South African Transport Department’s unexpected payment of R24 million (≈ US$1.65 million) to the private sector on the Chapman’s Peak toll road as a result of the pandemic (National Treasury, 2021). Faced with this situation, it becomes even more important for governments to expend their budget effectively while satisfying taxpayers’ needs. PPPs are purported to be able to alleviate governments’ financial...
pressure by keeping associated spending off the balance sheet, and providing on-time and on-cost products through private-sector expertise and risk transfer (Kwak et al., 2009; Verweij, 2015). Put simply, proposals of this nature are justified by the assumption that PPPs can generate better value for money (VfM) than conventional public sector procurement (PSP) (Kweun et al., 2016). However, this assumption is sometimes debatable. A case in point is that the construction cost of road PPPs is 24% more expensive than conventional PSPs in the European Union (EU) (Blanc-Brude et al., 2009). Another point is that transport PPPs entail underlying transaction costs that, when taken into account, may cause the total costs to outweigh the benefits (Solino and de Santos, 2010). Hence, to determine an appropriate procurement method, governments have prioritised an assessment of VfM at the inception stage. Examples can be seen in both mature and emerging economies (e.g., UK, Australia and South Africa) where VfM assessment has become an indispensable component in the procurement process (The World Bank, 2013; European PPP Expertise Centre, 2015). However, current VfM assessment has a tendency to focus on cost savings while overlooks value per se (Opara, 2018; Zhao et al., 2021). For instance, Decora-Souze and Farajian (2017) contend that social benefits of transport projects are not captured in the typical assessment. Equally, as Zwalf et al. (2017) point out, a ‘touch’ on the discount rate used in calculating costs can skew the result, rendering its simple use to be ineffective and untenable.

Although the initial focus of this work is on the procurement decision stage, its outcomes have a wider relevance. We foresee VfM as a transferrable tool not only for making ex-ante decisions but also for monitoring and (ex-post) evaluation of projects in their operational phase. Although, in the ex-post evaluation, there is a need to consider any new issues that emerge throughout the project lifecycle, it remains important for the evaluation to reflect the criteria that were applied at its outset. Failure to do so, would, as Samset and Christensen (2017) argue, diminish the effectiveness of the evaluation and its role in improving subsequent decision-making.

In traditional value management theory, VfM is considered to be an integration of cost and function (Palmer et al., 1996). This is supported by HM Treasury’s (2006) definition of VfM as ‘the optimum combination of whole-of-life costs and quality (or fitness for purpose) of the good or service to meet the user’s requirement’. Furthermore, Broadbent and Laughlin (2004) have argued through a longitudinal analysis of the UK’s Private Finance Initiative (PFI) that VfM in essence is about whether improved public service can be derived. Yet, public-sector clients worldwide rely heavily, if not wholly, on the lowest-price bidder for transport infrastructure projects. For example, results from 305 US design-build highway projects showed that 80% of them were awarded to the lowest bidder (Calahorra-Jimenez et al., 2020). According to McKevitt (2015) and Calahorra-Jimenez et al. (2020), this occurs due to a lack of what constitutes VfM, and in particular, an understanding of what taxpayers perceive as a VfM transport service. Despite its significance, there is a paucity of theoretical studies investigating this missing but important link in VfM assessment. To fill this void, this paper addresses the following research question: ‘How can the VfM of transport projects be more realistically assessed, and what are the implications for theories of value?’ Accordingly, the contribution of this paper is twofold: (1) drawing upon theories of value, it depicts the ontology of VfM and addresses a missing ingredient in VfM assessment; and (2) it develops a holistic framework for the public sectors to re-calibrate their VfM assessment when procuring transport projects.

The remainder of this paper is structured as follows. It commences by presenting the landscape (status quo and challenges) of current transport procurement. Next, a theoretical framework underpinned by theories of value is proposed and explained. Then, a dynamic lifecycle process is developed and relevant implications for procurement are discussed. We conclude this paper by summarising its achievements and future directions in the final section.

### 2. PPPs and VfM assessment

#### 2.1. Definitions and history

Although existing literature is replete with studies on their pros and cons, there is no consensus on the definition of PPPs (The World Bank, 2017). This is exemplified in some international organisations and economies’ guidelines on PPPs as shown in Table 1. Governments’ various intentions and arrangements over private participation in infrastructure may go some way in explaining the inconsistency in defining PPPs (Nathan Associates, 2017; p.11). For example, the UK explicitly requires that private sector organisations assume responsibilities (e.g., design, build, finance and operation) that used to be performed by the government; whilst Australia puts more stress on service provision.

Nevertheless, some common characteristics of PPPs can be seen, including: (1) long-term partnership; (2) risk-sharing; (3) value realisation; and (4) innovation (Akinola et al., 2003; Garvin, 2010; Chen et al., 2011).

| Organisations and economies | Definitions | Reference |
|----------------------------|-------------|----------|
| The World Bank | A long-term contract between a private party and a government entity, for providing a public asset or service, in which the private party bears significant risk and management responsibility, and remuneration is linked to performance. | The World Bank-PPP Knowledge Lab (2020) |
| European Investment Bank (EIB) | An arrangement between a public authority and a private partner designed to deliver a public infrastructure project and service under a long-term contract. | European PPP Expertise Centre, (2022) |
| The UK | Long-term contracts where the private sector designs, builds, finances and operates an infrastructure project. | UK Government (2020) |
| Australia | A service contract between the public and private sectors where the Australian Government pays the private sector (typically a consortium) to deliver infrastructure and related services over the long term. | Department of Infrastructure, Transport, Regional Development and Communications (2018) |
| Canada | A cooperative venture between the public and private sectors, built on the expertise of each partner, that best meets clearly defined public needs through the appropriate allocation of resources, risks and rewards. | The Canadian Council for Public-Private Partnerships (2020) |
| The United States (U.S) | Contractual agreements between a public agency and a private entity that allow for greater private participation in the delivery of projects. | Department of Transportation (2019) |
| South Africa | A contract between a public-sector institution and a private sector, where the private sector performs a function that is usually provided by the public sector and/or uses state property in terms of the PPP agreement. | National Treasury (2021) |
et al., 2015; Hodge and Greve, 2016). With these core elements, variants of PPPs have materialised over recent decades. The World Bank (2020) has grouped them into: (1) utility restructuring, corporatization and decentralization; (2) civil works and service contracts; (3) management and operating agreements; (4) leases/affermage; (5) concessions, build-operate-transfer (BOT), design-build-operate (DBO); (6) joint ventures and partial divestiture of public assets; (7) full divestiture; and (8) contract plans and performance contracts. In the case of transport projects, they are often procured via concessions in the form of BOT, DBFM (Design-Build-Finance-Maintain), DBFMO (Design-Build-Finance-Maintain-Operate) etc. (Verweij, 2015; Zhang et al., 2018; Yescombe and Farquharson, 2018). The latest data have indicated that transport remains the largest PPP sector in both value and numbers in the EU, with the UK accounting for the highest value (European PPP Expertise Centre, 2022).

There is an increasing uptake of PPP forms of contract for public services provision. This is because PPPs are expected to bring forward better risk management (Grimsey and Lewis, 2002), reduced project costs (Chou and Pramudawardhani, 2015), economic development (Cherkos and Jha, 2021) and sustainability (Hueskes et al., 2017) through a bundled ‘construction and operation’ contract (Chan et al., 2009). However, empirical evidence on whether these advantages are realistic remains contested and anecdotal (Hodge and Greve, 2016). For example, Soomro and Zhang (2015) examined 35 failed transport PPPs and found both governments and taxpayers suffered substantially from the unachieved V/M. In a similar vein, Medda et al. (2013) and Roumboutsos and Pantelias (2014) identified that risks in real-world transport PPPs are not optimally allocated and these projects often cost more and are delayed. As a consequence, the UK has scrapped its use of Private Finance 2 (PF2) in 2018 (UK Government, 2018). The UK is widely considered to be the cradle of PPPs. PFI was first introduced there in 1992 followed by a revised version - PF2 - in 2012 (Broadbent and Lauglin, 2004; UK Government, 2018). The withdrawal of PF2 due to unsatisfactory performance has again put V/M under the spotlight and triggered wider reflection on how to improve the procurement decision-making process for future PPPs (National Audit Office - NAO, 2018).

2.2. PPPs and transport procurement

Transport projects have been traditionally procured via PSP in which governments delegate construction and operation to separate contractors but remain responsible for their commissioning and finance. During the procurement process, a cost-benefit analysis is conducted to make the ‘go or no-go’ investment decision. Different procurement methods are then evaluated against a set of criteria including time to completion, quality, risk allocation, and availability of price competition (Naoum and Egbu, 2016; Pu et al., 2020). Although transparency and fairness are stressed, surveys by Love et al. (2008) and Burger and Hawkesworth (2011) have shown that clients had an intrinsic preference for PSP as they are more familiar with it. However, according to Medda (2007) and Jin and Zhang (2011), this situation is offset by the aforementioned advantages PPPs can potentially offer and by the presumption that the private consortia are more capable of managing the complexities (e.g., large-scale investment and uncertainties) embedded in transport infrastructure. Since the 1990s, more than 60 transport projects with a total capital value of £7.8 billion have been procured through PFI in the UK alone (HM Treasury, 2019). This momentum has made PPP forms of procurement become what Reeves (2011) has called ‘the only game in town’ as the V/M assessment that rationalised its implementation is manipulated. In reality, rather than provide better V/M, the driving forces behind the commitment to PPPs are that they, inter alia can keep the public debt off the balance sheet and leverage up governments’ limited budget (Chan et al., 2009; European PPP Expertise Centre, 2022; NAO, 2018). The private sector, because PPPs are potentially profitable, advocates their adoption. This is what Edgar et al. (2018) refer to as ‘impression reinforcement’ to consolidate the underlying public policy tendency. It should be noted, however, that results from a sample of 258 transport projects investigated by Flyvbjerg et al. (2004) indicate that the claim that the private sector can better manage cost than the public sector is exaggerated. Leigland (2018) has argued that some previous proponents of PPPs have been persuaded against them because of compelling evidence that some PPPs are not successful. Evidently, the ‘mechanisms’ that are in place to facilitate the decision whether to adopt PPPs or its counterpart, the PSP, are subject to controversy. Therefore, it is important that the current methods of assessment should be improved if the true transport V/M is to prevail, regardless of procurement method.

2.3. V/M assessment to date

V/M assessment, similar to project evaluation, can be divided into ex-ante and ex-post assessment (Harlen and James, 2006). For the latter, copious studies have been undertaken to investigate whether the expected output is delivered at the operation stage (Yuan et al., 2009; Henjewele et al., 2014; Liu et al., 2015). For instance, as revealed by Liu et al. (2018), traditional TCQ (time, cost and quality) criteria continue to be the main factors in the ex-post assessment of PPP performance. Against these criteria, Edwards et al. (2004) state that V/M was not achieved in the first eight UK PFI road projects as a staggering £100 million could have been saved using a different approach. Additionally, systematic reviews conducted by Wang et al. (2017) and Cui et al. (2018) confirm that these performance management-related studies have formed a major research theme in the field of PPPs. By contrast, taking a simulation perspective, in ex ante V/M assessment it is common practice to compare the net present value (NPV) of a PPP option with that of a public sector comparator (PSC). However, such comparisons are subjected to criticism. An example is that cost at the inception stage can be underestimated. Sometimes, according to Flyvbjerg (2007), this appears to be the result of deliberate ‘strategic misrepresentation’. Moreover, the PSC method itself is open to criticisms, such as asymmetric comparison, a contentious discount rate, and subjective assumptions (Yescombe and Farquharson, 2018, p. 87–90). A pertinent case that undermines the rigour of PSC was the appraisal of PPP for the capital investment, management and maintenance of the London Underground in which Shaoul (2002) in her study, concluded that the methodology for assessment of V/M was unsound.

Faced with the ongoing criticisms of its PSC, the UK suspended this quantitative assessment and emphasised the qualitative benefits that a project can engender (NAO, 2013). However, based on the latest Green Book, the PSC continues to play a pivotal role in PPP evaluations in conjunction with qualitative assessment (HM Treasury, 2020). This suggests that the aforementioned problems may persist. More importantly, a problematic issue is that the qualitative assessment is only applied to PPP forms of procurement, while neglecting similar consideration of the PSP (HM Treasury, 2006; HM Treasury, 2020).

1 According to The World Bank (2020), leases and affermage contracts are generally public-private sector arrangements under which the private operator is responsible for operating and maintaining the utility but not for financing the investment. In affermages, the operator is assured of its fee and the authority shoulders the risk of collecting receipts from customers to cover its investment commitments.

2 A PSC is the estimated cost of providing the specified service under PSP. It assumes the same time frame (i.e., start and finish date) and standards as a PPP although these standards may not be achieved by past public provision (See Grimsey and Lewis, 2005 for more details).

3 In the UK, the Green Book (HM Treasury, 2020) is a guidance on how to appraise policies, programmes and projects. It is for all public servants concerned with proposals for the use of public resources, not just for analysts.
Nevertheless, efforts have been made by scholars to improve VfM assessment. For example, Cui et al. (2019) identified 19 VfM drivers and explored their interrelationships in contributing to VfM. This is similar to previous studies where Cheung et al. (2009) and Ng et al. (2012) highlight some critical factors that should be accentuated to achieve VfM. More recently, Cherkos and Jha (2021) proposed nine factors that can drive the decision to adopt PPPs in the road sector. However, it should be noted that these researchers tend to categorise VfM elements without a theoretical underpinning and thus their concept of VfM remains nebulous (McKevitt and Dave, 2016). Equally, a roadmap guiding how VfM should be consistently and dynamically assessed throughout a transport project lifecycle is still lacking.

3. Setting the framework

3.1. Theoretical base

As previously noted, defining VfM is challenging, as different stakeholders may perceive project success differently (Wang et al., 2017). However, VfM assessment is carried out by public clients who are obliged to ensure that public spending is economical, effective and efficient (Grimsey and Lewis, 2005). In this sense, the UK’s definition combining whole-of-life cost and quality is widely shared (Morallos and Ameudizi, 2008). Although we acknowledge the merit of this view, it is possible that the commonly-applied term ‘fitness for purpose’ is partly conceived-of as the wages paid to the labour so that they can survive at subsistence level (Henry, 2000). This would support the approach to the selection of procurement where the lowest NPV of an option, be it the PSP or PPP (given that both can provide a baseline service), is preferred. However, similar to the general critique, as outlined by Bellofiore (1989), that the labour theory of value is not sufficient to explain a product’s long-term price. Thus, the current practice in assessing VfM fails to consider a project’s lifecycle performance. A case in point is that the UK’s PFI projects were said to be cheaper at first sight but experienced cost and time overruns over the long term (Pollock et al., 2007; Bain, 2010). By contrast, in neoclassical economists’ view (i.e., the marginal theory of value), Kauder (1965) indicated that this kind of price (i.e., cost) should be consistent with the equilibrium price that satisfies both the demand (i.e., taxpayers) and supply (i.e., government) side. That is, end-users’ perceived service should equate to the expected service. Akin to this, a balanced view is the philosophical perspective that value judgement is about evaluating what is ‘goodness’ (and what is not) which in Schroeder (2012) is termed ‘agent-relative value’.

Applying this to infrastructure delivery means that what is ‘good’ (e.g., simply a lower cost) for the government does not mean the decision is sensible as it can still short-change taxpayers if the perceived service fails short of the expected service. This accords with Vining and Boardman’s (2015) contention that the self-interest of governments opposes the society. This highlights a principle that value and VfM are relative concepts and depend upon who the value is for.

With the idea of relativity in mind, Seth et al. (1991) initiated the consumption theory of value and asserts, from the perspective of consumers (i.e., demand side), that the consumer choice behaviour is a function of multiple consumption values, comprising functional, emotional, social, epistemic and conditional elements. The focus on the impact of a mixture of values on the choice decision making reflects a shift from ‘price’ to a wider realm. It demonstrates that customers value not only ‘affordability’ but an improved service (Raval and Gronroos, 1996). For example, Arvidsson (2009) illustrated that the emerging social production requires that value takes in the form of ‘intangible’ items, such as knowledge, brand and flexibility rather than just market price. To emphasise the importance of intangibles, Lange et al. (2018) estimated that they represent an ‘unexplained residual’ that accounts for around 70% of global wealth. Despite the fact that governments are not the direct consumer in terms of infrastructure delivery, the implication is that cost should not be the single benchmark when assessing VfM and the real customers’ value (i.e., taxpayers) should be considered.

Hitherto, the selected infrastructure procurement approach is providing prima facie VfM when in fact, according to Chan et al. (2009) and McQuaid and Scherrer (2010), the driving forces behind value are that PPPs can save cost, keep the associated spending off the balance sheet and thus leverage up the budgetary arrangement. A concomitant of analysing theories of value, as shown above, is that VfM: (1) should represent the interests of the government (supplier) and the end-users (consumer) that pay for the service; and (2) should not only consider the quantitative value but also embody the socially recognised value. Hereby, drawing on these principles, we propose a framework that addresses VfM and its assessment in transport procurement.

3.2. Framework for VfM assessment of transport projects

3.2.1. Traditional VfM

The theoretical base reveals that the supply-side value is not flawless. Empirical evidence provided by Edwards et al. (2004) and Blanc-Brude et al. (2009) also corroborates this theory by confirming that governments’ existing VfM assessment does not guarantee PPPs’ success. We argue, however, that their measures for VfM (i.e., traditional VfM: TCQ) are significant and continue to be an ingredient in our proposed value chain (Fig. 1). Support for this view is to be found in Locatelli’s (2020) rebuttal illustrating that ‘megaprojects (e.g., transport infrastructure) that are delivered late and over budget aren’t necessarily failures’. This does not mean that ‘cost’ and ‘time’ are no longer elements of project success. Rather that they remain important but as part of a wider
picture. In other words, we proffer that it is by means of collaboration between the supply side and the demand side that co-creates VfM.

Governments are responsible for delivering infrastructure assets and providing public services, such as construction and maintenance of highways, railways and ports. In doing so, they usually outsource parts or all of the work to the private sector to capitalise on its expertise and capabilities (Torres and Pina, 2002). While the role of government may vary in different delivery models, its responsibilities for prudent spending and project success remain. As Birmingham and Stankevich (2005) point out, it is patently clear that an unsuccessful project (e.g., poorly maintained roads) represent a waste of resources and does not generate value. This explains the large number of studies that aim to define project success and develop countermeasures to prevent project failures (see, for example, de Wit, 1988; McLeod et al., 2012; Viswanathan et al., 2020). However, what constitutes project success and thus, encompasses value is an enduring debate. A growing consensus is that it should be (1) multi-dimensional (Shimhu et al., 1997); (2) in the context of project, portfolio, and programme (Ika, 2009); and (3) dependent on different stakeholders (Davis, 2017). Hence, we adopt the position of the supplier (stakeholder perspective) to examine the traditional VfM (dimension perspective) that materialise over a project’s future lifecycle (future-proof perspective). It should be noted that the scope of this paper is not in defining project success, but the value that is associated with projects.

Typically, TCQ, heralded as the ‘iron triangle’, is adopted to measure project success in the construction sector (Atkinson, 1999). In PPP-related studies, although results differ, time and cost are the most common constructs in measuring performance (i.e., to judge if VfM is delivered). Many commentators, including Raisbeck et al. (2010) in related studies, although results differ, time and cost are the most project success in the construction sector (Atkinson, 1999). In PPP-projects.

Increased time and cost performance. Assessment of quality, on the other hand tends to be based upon the prediction and post-inspection of defects of a project (Ma et al., 2021). In major transport infrastructure this preoccupation with non-conformance to standards and requirements has, according to Love et al. (2020), impeded the realisation of true benefits and value. Measurable specifications (e.g., quality metrics) have become a convenient (but insufficient) benchmark of PPP performance, representing a retreat to the traditional concept of VfM, based simply on TCQ (Doloi, 2012). Although many studies of PPP critical success factors and performance measurement have taken a broader lens, this traditional VfM is still most prevalent. For instance, Eadie et al. (2013) and Cui et al. (2019) confirmed that cost-effectiveness is the most critical factor in manifesting best project value.

3.2.2. Public VfM

On the premise that public sectors represent their taxpayers’ interests, the literature routinely delves into the relationship between governments and private sectors to ensure PPPs’ success. However, it is increasingly recognised that there is a discrepancy between the public sector and the general public (e.g., taxpayers, citizens, community, end-users) in perceiving value. Hodge and Greve (2010), for example, have identified how, in the context of PPPs, the interests of governments and private sectors are more dominant than those of the public. A conspicuous example is the UK’s high speed 2 (HS2) rail project where the government advocates regional economic stimulus whilst the public is protesting against its damage to the environment. The strength of public concern about HS2 is noted by Taylor (2021), who cites an environmental activist: “there are countless people I know who will do what it takes to stop HS2”. Accepting, as Crompton (2015) has shown, that public participation does feature in policy decision making and recognising the role of demand-side value in co-creating project VfM (Fig. 1), we propose public VfM in VfM assessment brought by ‘public’ participation in transport to form a two-wheel system, as outlined in Fig. 2. This concurs with Barber (2017), that achieving public VfM (i.e., service, environment, distribution, resilience, and social inclusion in our context) requires a shift from inputs to outputs (what will be delivered for transport end-users). It should be pointed out that the five dimensions under the public VfM shown in Fig. 2 are in the context of transport infrastructure, and thus may not be universally applicable. For example, Historic England (2014), in the field of heritage, emphasises its value in knowledge and sense of identity in addition to economic value. However, to the best of our knowledge, these five have emerged as the themes that best reflect public (transport) VfM based on the theories of value and the existing body of literature.

In transport projects, uncertainty of demand risk is recognised to be the critical success factor as low uptake of the service will result in financial unviability, particularly for user-pays mode services (Boeing Singh and Kalidindi, 2006; Siemiarycki and Friedman, 2012). Germane examples are Australia’s Cross City Tunnel project entering into administration due to the severe demand risk (Johnston and Gudergan, 2007) and India’s Delhi Airport Metro Express, where the passenger uptake was approximately 30,000 per day less than expected in (Love et al., 2020). In addition to the overoptimistic forecast (i.e., optimism

![Fig. 1. Theoretical VfM.](image)

![Fig. 2. Conceptual framework for VfM assessment of transport infrastructure.](image)
bias) at play (Flyvbjerg, 2007), another point, raised by Burke and Demirag (2015), is the provision of affordable and quality service to its end-users so that the traffic level is at its optimal level. Supporting this is the empirical evidence of Gordon et al. (2013), who find that not only the physical quality can enhance transport projects’ competitiveness and engender a stable revenue, but also ‘soft’ services such as staff courtesy and cleanliness. However, Guirao et al. (2016) concede that there is usually a gap between the expected service (government perspective) and the actual service (customer perspective). Therefore, by engaging end-users’ perception of ‘what a good service is’, the demand risk can be mitigated, and the spill-over revenue can even compensate for the commonly overrun cost in transport infrastructure. For example, as reported by Zhao et al. (2021), the partnering parties in Australia’s Lane Cove Tunnel project can share the toll revenue that is beyond anticipated profits due to effective operation of the asset.

As stated above, in the UK’s HS2 project, communities’ concerns over environment issues appear to have been neglected in the government’s decision-making process. This is especially the case in emerging economies. Malvestio et al. (2018) illustrate that environmental issues are secondary to political and economic interests in their transport policy, plan and programme, which jeopardises sustainable development. However, transport projects are attested to be having a huge impact on the environment. Taking the UK as an example, the transport sector is the main source of air and noise pollution and accounts for 34% of its carbon dioxide emissions, which contribute to underlying health problems (Department for Business, Energy & Industrial Strategy, 2020). Consequently, it is self-evident that such aspects of public VfM (e.g., environment and health) should be addressed in transport interventions. Indeed, a series of policies have instilled environmental considerations in PPPs (The World Bank, 2017). More recently, a number of countries have set their zero-carbon goals with the transport sector spearheading these. The UK, aspiring to achieve ‘net zero’ transport emissions by 2050, has launched a package of programmes to decarbonise transport, including, for example, thousands of millions of investments in upgrading all transport types (Department for Transport, 2020). Yet, despite such policy developments, technology innovations, and risk analyses, prevalence of environmental considerations in transport PPPs appears to have progressed little over the last decade (see, e.g., Grasman et al., 2014; Khan et al., 2020). The ‘barrier’ arguably lies in the extent of the public’s participation in transport decisions to articulate what they value about the environment.

In Fig. 2, ‘distributional impact’ comprises intergenerational distribution (temporal effect) and regional distribution (spatial effect). This aims to resolve any transport inequity among the population, such as who cannot enjoy the benefits of transport but bear its externalities. However, distributional impact, according to Markovich and Lucas (2011), is only considered after economic and environmental appraisal. The limited attention paid to this key element has prompted appeals for a change in governments’ decision making. For instance, from a fairness point of view, an intergenerational redistributive effects model is proposed by Penyalver et al. (2019) to measure the extent to which transport projects entail bills for successive generations. Haddad et al. (2019), on the other hand, apply a spatial computable general equilibrium model to show how policies on transport can improve accessibility, in turn mitigating, and the spill-over revenue can even compensate for the commonly overrun cost in transport infrastructure. For example, as reported by Zhao et al. (2021), the partnering parties in Australia’s Lane Cove Tunnel project can share the toll revenue that is beyond anticipated profits due to effective operation of the asset.

Transport infrastructure is vulnerable to climate change and extreme weather. Cases can be seen worldwide whereby heavy downpours, snow, winds and heatwaves make transport systems dysfunctional (Markolf et al., 2019). The ramification is that people are unable to travel, which results in economic and social loss. As noted by Liu and Song (2020), this chain of effect also jeopardises the role transport plays in the critical infrastructure network to realise the resilient city. Naturally, resilience is brought to the frontline by scholars to study transport systems’ capacity to recover from a disruption or a disaster (Liu et al., 2019). Among them, one of the fundamental questions relating to resilience is ‘resilience for whom?’ (Vale, 2014). For end-users, Besominic (2020) believed that they would want to retain or regain uninterrupted access to, and benefits from their transport service, no matter what the situation. Put simply, the speed of recovery becomes a key indicator in reflecting public satisfaction. Compared with vulnerability analysis, which has become a mature field in resilience, Mattsson and Jenelius (2015) contend that aligning resilience with recovery is still an emerging one. According to the resilience curve proposed by Baroud et al. (2014), when confronted with stress (such as disruption caused by a natural hazard or security threat), the functionality of an infrastructure asset rapidly plummets to an undesired point, then gradually recovers to its normal state. To expedite the recovery process of transport networks for the end-users, a sense of resilience is indispensable in transport planning to improve their inherent ability to deal with aforementioned events (Chen and Miller-Hooks, 2012). By considering the resilience dimension, we address the concern raised by Kunreuther and Michael-Kerjan (2012), that the benefits of disaster risk reduction are largely overlooked in decision makings.

Hodgson and Turner (2003) have emphasised the inter-relationship of poverty, inadequate transport planning, and lack of access to key services in problems of ‘social exclusion’. Social exclusion, in the context of transport, means the lack of transport accessibility that prevents certain people (e.g., the low-income, elderly and disabled) from participating in society through education, employment, health, leisure and cultural activities (Kenyon et al., 2002). Those socially excluded are normally characterised by low employability, unstable work, identity loss, violence and poor food and living condition (Stanley and Lucas, 2008). With the growing awareness of social exclusion, the Social Exclusion Task Force of the UK Cabinet Office (formerly known as the Social Exclusion Unit, 2003) has pioneered studies on the status quo and underlying causes and proposed the ‘accessibility planning’ of its future transport schemes (see, e.g., Social Exclusion Unit, 2003). A longitudinal review of the ‘accessibility planning’ approach undertaken by Lucas (2012) confirmed its importance in tackling social exclusion but revealed that its adoption in local authorities was not popular and its practicality was questioned. Similarly, Young (2015) revealed that the Social Value Act 2012, in which the consideration of a procurement activity’s social impact (e.g., reducing anti-social behaviour or increasing employment) is assimilated, is only being applied selectively: the question of how and when to include it during the procurement process are vague. In response, we include the factor of social inclusion into the VfM assessment framework. This plants the idea that transport authorities should evaluate and compare whether a procurement approach for transport projects. Consequently, we
have introduced a holistic framework to support a dynamic life-cycle VfM assessment. This complements existing literature (e.g., Shaoul, 2002; Leigland, 2018) where evidence is provided to demonstrate that current VfM assessment is monochrome (i.e., purely cost-focused). However, our proposition is not simply a matter of abandoning the traditional view of VfM. On the contrary, studies addressing qualitative VfM assessment re-confirmed that cost is a driving force of VfM among others (Yuan et al., 2009; Cui et al., 2019). Despite some conformity (i.e., acknowledgement of traditional VfM), our framework differs from others in several ways. For example, instead of categorising measures based on judgement, we provided a theoretical predication and have elaborated on what VfM is. Complementing traditional VfM, our novel ‘public VfM’ (shown in Fig. 2) has incorporated ‘public’ participation in transport to provide a clearer and more comprehensive VfM concept. Moreover, current methods apply qualitative VfM assessment only to PPP forms of contracts (HM Treasury, 2006; Tsamboulas et al., 2013), while we contend that it is the assessment of both PPPs and the PSP that determines the VfM and the framework is specific to the transport sector. This is important, as project evaluation should not only be time-sensitive but also should consider variations between sectors (Liu et al., 2021).

In order to facilitate the applicability of the proposed framework, we provide, in Fig. 3, a dynamic VfM assessment process and its relevant implications. Public participation in government policy making is not new in an era of new governance where transparency and accountability prevail (Binham et al., 2005). In PPP forms of infrastructure development, scholars (e.g., Kuronen et al., 2010; Torvinen and Ulkuniemi, 2016; Yuan et al., 2019) are also calling for the consideration of public interests to create a ‘tripartite win’ between governments, private consortia and people. The benefit, according to Aaltonen and Kujala (2010), is that early engagement with all stakeholders, particularly those who are not bound by the contract (e.g., the public) can ensure project value realisation. As such, we revitalise ‘public (end-users’) participation in transport’ in VfM assessment. That is, demand-side value should be assessed from the viewpoint of end-users to realise public VfM. The life-cycle VfM assessment at the procurement stage commences with presenting and answering questions regarding the extent to which each procurement method (i.e., PPPs and PSPs) can deliver the traditional VfM and public VfM. By applying the same criteria to both options, we can potentially curb the bias towards PSPs (Burger and Hawkesworth, 2011) and PPPs (Bayliss and Van Waeyenberge, 2018). It is then multiplied by the weight of each attribute as we acknowledge there are regional differences. This is consistent with Kweun et al. (2018) suggesting that VfM assessment should be conducted on a project-by-project or case-by-case basis. In doing so, we avoid excessively complicated techniques and thus provide a pragmatic framework for policy-makers. However, it is noted that the result of each question may rely on individual contributions, such as an environmental impact assessment (see, e.g., Lidskog and Soneryd, 2000).

Fig. 3 is based upon the use of the process at the initial procurement stage. At the construction and operation phase, the original ‘questions’ on traditional VfM and public VfM would evolve into ‘principles’ to monitor and evaluate the progression of the transport project. Put

![Fig. 3. Life-cycle VfM assessment process.](image-url)
simply, the same criteria can be used to track if the expected project VJM materialises under the selected procurement method. This adheres to Smset and Christensen (2015) who indicate that use of the same criteria in ex-ante and ex-post evaluation increases the likelihood of project success. The straightforward idea is that at these two stages the focus is on ensuring the project does not deviate from the VJM goal no matter which procurement approach. Thus, it is envisaged that the ex-ante VJM assessment helps determine a procurement approach and the ex-post VJM assessment evaluates the investment decision, thereby closing the loop. Accordingly, we propose the ‘feeding and retrospection’ mechanism to safeguard the VJM assessment process. It requires information to be passed down to the next stage as the reference and reflects on the life-cycle VJM assessment at ex-post stage so that more informed decisions can be made for future projects. It makes sense as one cannot know ‘what will happen’ without pondering ‘what transpired in the past’ (Veick et al., 2005). With that being said, the framework certainly produces an opportunity for governments to collaborate with the ‘public’ to co-create their traditional VJM and public VJM, and start to actually accumulate experiences from past projects.

5. Conclusions

Transport infrastructure forms the backbone of an economy’s socio-economic development and growth. However, the inherent large-scale capital expenditure and uncertainties can sometimes overwhelm governments’ financial capacity. PPP forms of procurement that exploit the private sectors’ funds and ingenuity are, therefore, trending around the world. The overall rationale behind this movement is a VJM assessment containing the cost comparison of a PPP and an alternative PSP. Nevertheless, there is little evidence to show that PPVs outperform their counterpart, provoking persistent criticism of VJM assessment. To date, VJM remains a nebulous concept with a paucity of theoretical research to investigate how VJM can be comprehensively assessed. As Covid-19 is posing critical challenges on infrastructure delivery and straining governments’ nerve on public spending, it becomes imperative that a holistic and pragmatic VJM framework be put in place to assist informed government decisions. Against this contextual backdrop, we have examined the fundamental theories of value and dissected VJM itself. The conclusion is that value is generated in the marketplace (i.e., through supply and demand) and is relative. Acknowledging this epistemology, we have proposed that true VJM should consist of traditional VJM (government perspective) and public VJM (end-users perspective) (Fig. 1). However, this does not mean that traditional VJM and public VJM are mutually exclusive, as end-users expect projects to be delivered within time, cost-effectively, and at a quality standard as well. Based on which, we revitalise ‘public’ participation in transport and expect that this type of public VJM (i.e., service, environment, distribution, resilience, and social inclusion) should be assessed from the standpoint of end-users. Equally important, we maintain that traditional VJM (TCQ) should not pass into oblivion; quite the contrary. A framework consolidating two wheels of VJM (Fig. 2) and a practical process are then proposed (Fig. 3).

The intention of this paper is not to detail how each dimension can be assessed. That is beyond the scope of this paper and has been, in any case, studied in the literature already, albeit in a piecemeal manner. Rather, we uncover the VJM concept, develop a holistic framework in which a comprehensive transport VJM assessment can coalesce, and provide a practical approach to assess both PPVs and PSPs instead of serving only PPVs. In addition, we highlight the importance of having in place the ‘feeding and retrospection’ mechanism to facilitate a life-cycle process. By doing so, we apply the same criteria in ex-ante and ex-post VJM assessment to determine an appropriate procurement option for transport projects and ensure VJM is (or has been) delivered throughout their lifecycle. It creates an opportunity for governments to recognise public VJM in transport development, shift their mindset from singular to multi-dimensional evaluation, and start to actually accumulate and exploit experience from past projects. As such, the contribution of this paper is twofold: (1) drawing upon theories of value, it depicts the ontology of VJM and addresses public VJM in VJM assessment; and (2) it develops an integrated framework for the public sector to re-calibrate their VJM assessment practice when procuring transport projects. Although a practical pathway is provided, the framework is conceptual in nature. However, as a requisite model that concentrates on ‘form’ and ‘content’ (Phillips, 1984), this study serves the purpose as a guide to action and paves the way for policy makers to think more clearly about VJM when assessing it. Future studies can be conducted to empirically test the model and an empirical example demonstrating formations of the weight is needed. As this study is the first step of a research project, lines of inquiry in these respects are ongoing.

CRediT author statement

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