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STRATEGIC VALUE CREATION IN INFRASTRUCTURE PROJECTS: DECISION- MAKERS' PERSPECTIVES ON URBAN TRANSPORTATION DEVELOPMENTS

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ABSTRACT

Long term, strategic value creation from transport infrastructure projects remains a challenge in the current setting for decision-making, planning and project delivery. In part, this is shaped by uncertainty about the eventual impacts of improved transport services for end-users and urban systems. Drawing from a thick narrative analysis of discussions with senior decision-makers in the specific policy context of Greater London, this exploratory study develops a decision-making framework to both aid and support improved long-term value creation from urban transport infrastructure. The framework articulates five pillars of strategic value creation: growth, community value, process, behaviour and user experience. This framework articulates diverse sources of value creation, attributing the source, scale, beneficiaries, and value creation mechanism for each. Front-end planning and strategic management may benefit significantly from such a framework to support project selection and development. As a sparse boundary object, this tool can improve cross-disciplinary decision-making and deliberation. Further development to test and refine the five pillars can improve the robustness of the framework for application in different contexts. This framework provides a conceptual tool to address the challenge of long term value creation. The exploratory study shows the value of thick narratives and project studies, as infrastructure value is under-represented in existing discourses around infrastructure decision-making and delivery across the project life cycle.

KEYWORDS: Infrastructure, transport, value creation, project life cycle, impacts

INTRODUCTION

Building upon the systems lifecycle view (Morris *et al.* 2012, Artto *et al.* 2016), recent work on project organizing has put forward the argument that whilst projects create value in their front-end and execution, this value is captured beyond the project and into the operations phase of the systems lifecycle. This situation creates a challenge for the traditional project delivery alliance as they participate in the value chain for a limited period of time and move on to deliver other projects as soon as they complete the current one. This, in turn, means that the project delivery team is not able to operate on the basis of familiarity with the long-term benefits realization

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arising from the project, but is rather firmly confined within project boundaries seeking to deliver the project's outputs to the best of their ability.

The value capture issues and challenge becomes evident only after project delivery, when the project is not delivering benefits as it should, or even worse – it is misaligned with the strategic brief of the client and/or sponsor. Unfortunately, at that stage of operation it is too late to easily remedy such a situation, as the project team has moved on with resources having been redeployed for other purposes. Project value creation is a challenge because it is not always possible to understand the precise outcome-based expectations for the project at the outset. This holds true in a business or corporate setting (Young *et al.* 2012), but even more so in the domain of large-scale infrastructure projects (Flyvbjerg 2009), which are often complex and multifaceted in terms of functions they perform for the society. An attempt to address this disconnect in the value chain for infrastructure service provision lies at the heart of the rationale advocating public-private partnership (PPP) approaches. PPP projects seek to offset high capital expenditures through a long-term stream of revenue for the private builders and operators. Although it can be argued that a PPP approach resolves some of the challenges of value chain disintegration by offering a possibility to take into consideration a long-term investment approach in the delivery of infrastructure projects (Monk *et al.* 2017), we are arguing that often this is still not enough to remedy the fundamental problem of the lack of understanding of where and why the project should create value for those that instruct it, pay for it, use it, or in other ways derive benefits from it. This creates a host of pathological phenomena, well known to both project practitioners and policy makers: either strategically misaligned project decisions are made – if they are made at all, leading to projects creating 'white elephant' assets with little or no use value whatsoever (Zerjav, forthcoming), or where the project's execution is fraught with delays and cost overruns

To alleviate the impact of these pathological (but unfortunately routinely encountered) practices in project delivery, in this paper we argue that there is a need for a broader understanding of project value creation phenomena – especially as applied in the domain of infrastructure. We propose that having such an understanding will be beneficial for the project team as well as the client/sponsor in that they would be able to seek financial and performance solutions for the delivery of infrastructure projects when their purpose for the client and users is better understood. Moreover, this would enable the client bodies to assemble the strategic case for the project on a broader basis, going beyond the imperative for short-term commercial performance. Infrastructure projects are delivered to support a broad base of more local users (unlike in a purely commercial setting where customers are found on the open market), thus, projects require a very strong alignment between user needs and the strategic case.

We therefore ask:

If project investment and delivery precede the future value capture through operations and infrastructure, how can we ensure that the project brief contains a comprehensive and realistic outline of beneficial use-outcomes expressed as various forms of value that the project will be expected to create for its users?

In what follows, we present an initial set of results from a 3-year interdisciplinary study on understanding the delivery challenge in infrastructure projects. This study broadly follows guidelines on engaged scholarship (Van de Ven 2007) in an attempt to closely engage with senior policy and project practitioners and co-create knowledge that has primarily practice and decision-making use. To this end, we first

developed a hypothetical framework for understanding delivery challenges and value creation in infrastructure as a result of a broad range of various depth interactions with over 100 senior project and policy practitioners principally in the domain of infrastructure in the UK policy setting. The informants come from a variety of infrastructure sectors and span both public and private actors. Examples of interactions include in-depth individual and group interviews, interactive workshops, validation sessions, and project specific consultancy work.

The paper then further refines the hypothetical framework by engaging with a small sample of selected key informant/practitioners at the interface of policy and project governance. The aim of this effort is to conduct a qualitative phenomenological inquiry on the decision makers' perspectives on strategic value creation in infrastructure projects. This effort took place in the context of urban transportation development projects in the UK. In so doing, the paper seeks to contribute to project studies with a more nuanced understanding of different areas of value, which are strategically important to consider in the delivery of the projects.

INFRASTRUCTURE AND VALUE CREATION IN PROJECTS

Infrastructure has become one of the principal topics *du jour* for policymakers, practitioners and academics around the world. There is no agreed definition of what infrastructure is, but for the purposes of this paper it can be broadly defined as the technological systems that provide essential services, normally, but not exclusively to the public. This loose definition requires clarity of the scope and context it is being used in. Some of the traditional forms of infrastructure have been defined as transportation systems, power/energy, and water and waste, Information and Communication technologies (OECD 2007, IPA 2016), however this definition can go further to encompass the classes of 'social' infrastructure such as healthcare, housing and education. A common feature of these essential infrastructural services is their tendency for market failure and/or natural monopoly. As a result, infrastructure tends to be provided within government-regulated settings rather than the notional open capitalist market (ICIF 2017). The nature of the essential services provided by infrastructure is such that they now comprise the very fabric of everyday social and economic life. This reliance can and does lead to the condition of "taken-for-grantedness", quickly rendering the services invisible and largely unappreciated until they fail or become unreliable. As a result of this taken-for-grantedness, infrastructure assumes qualities of a kind of societal institution (Scott 2013), 'blackboxed' when operating (Latour 2005) and only visible in exceptional circumstances.

The first of such circumstances is when infrastructure fails to deliver its services to the users. The failure of infrastructure has significant impacts on individuals, communities, and even entire societies who are unable to enact their day-to-day routines and activities, often causing extreme frustration and substantial social and economic costs. The second circumstance when infrastructure becomes visible is through the projects that provide the service. Such projects are often of large or even monumental scale and complexity. They are very visible to the public eye and significant to the public purse – with strong implications for political legitimacy. Project delivery is therefore fraught with challenges across different levels ranging from political, legal and financial through to the technical and operational. This situation puts such projects in a peculiar setting when it comes to justifying the project business case and its delivery. The combination of the above factors is what distinguishes infrastructure projects from other kinds of projects.

Specificities of infrastructure as a distinct project delivery domain have been recognized in policy and project studies (Pitsis *et al.* 2003, Davies *et al.* 2009, Gil *et al.* 2012, Whyte *et al.* 2016, Winch and Leiringer 2016). The purpose of infrastructure is to generate first assets and asset-base, which will provide essential services to the public over potentially long periods of time. The one-off projects that are an important part of enabling this provision have received a lot of attention recently, especially driven by the need to achieve successful delivery spanning over public and private parties. We have therefore seen the emergence of PPPs designed and implemented to integrate the capital expenditures driven project provision with the long term generation of revenue streams coming from the operations and use of the asset. Nonetheless, experience also shows that infrastructure projects continue to fail to provide expected outcomes, frequently delivering outside the anticipated cost plan and scheduled timeframe. Moreover, it is not uncommon for projects to also fail to realize the long term benefits assumed in the key business case (Flyvbjerg 2014). Projects are only fully successful if they create value for their stakeholders - through a process that occurs through the co-creation of project outcomes in multi-organisational settings (Morris 2013). Recent project studies have taken up the notion of value creation as an important cornerstone of theorizing (Wikström *et al.* 2010, Matinheikki *et al.* 2016) arguing that in order to move beyond the often-misleading time-cost-quality criteria familiarly referred to as the 'iron triangle', we need to look into benefit realisation and value creation aspects of projects (Morris 2013). Previous work has also argued that value creation in a project occurs through interactions between multiple organisations participating in project. Mutual alignment and integration between multiple organisations has therefore been broadly accepted as the main value creation principle in projects. This has been investigated both in the project *front-end* where the strategic decisions take place (Edkins *et al.* 2013, Matinheikki *et al.* 2016) as well as during the operations phase of the systems lifecycle where long-term benefits are being realized (Artto *et al.* 2016).

Although research has looked into front-end value creation in the earliest stages of the project and back-end value capture through the systems lifecycle view, little is known about what happens to the value that has supposedly been created through the project interaction processes outlined above. In other words, the question becomes the relationship between *value delivered* by the project coalition and *value captured* by end users and operators of infrastructure. We use this cue as the motivation to conceptualize infrastructure projects from a value creation perspective (Morris 2013, Artto *et al.* 2016) to address the delivery challenge from an end-user perspective. The basic premise for this rationale is that any successful infrastructure project will enable users to capture value from its delivery. To meet this challenge, policy needs an evidence-based rationale to inform business case evaluation and funding decisions.

To progress this reasoning, we present findings of an exploratory study conducted in the UK policy context, specifically in the domain of urban transport infrastructure development projects. Findings of the study suggest multiple areas of strategic value creation, which we believe is a useful emerging cognitive model to understand the complex and multifaceted phenomenon of long term benefit realization that infrastructure should provide to its users and operators.

RESEARCH DESIGN

This research methodology comprises two parts. The first is an ongoing engaged scholarship (Van de Ven 2007) effort over a period of 3 years, whereby we both have been and are participating in a broader research stream on *Innovative Delivery and*

Business Models for infrastructure provision. As part of this engagement, we individually and collectively held a broad range of semi-structured face-to-face interactions with relevant practitioners in the sphere of economic infrastructure in the UK. This approach can be seen as long-term alignment between the researchers and representatives of various policy related bodies (*Infrastructure and Projects Authority, National Infrastructure Commission, Infrastructure UK*), major infrastructure clients (*Heathrow Airport, Transport for London (TfL), Anglian Water*), design and construction firms (*Arup, Balfour Beatty, CH2M, Mace*), and representatives of the financing landscape for infrastructure (*KPMG, European Investment Bank*). Over a period of three years, the researchers have thus been able to familiarize themselves with the dominant discourses on the delivery challenges and value in infrastructure projects. We are estimating that during this period, we have interacted directly with more than a 100 senior decision-making individuals from policy, project governance, delivery, advising and finance for infrastructure projects. The semi-structured and often serendipitous interactions with practitioners allowed co-creation of ideas, which led to emergent insights and the development of a hypothetical framework for understanding delivery challenges and value creation in infrastructure. The emerging findings were continually validated and discussed within a consistent group of researchers, meeting regularly for the ‘innovative delivery and business models’ stream of work. These views were then verified through presentation and discussion with both the research governance board comprising senior infrastructure practitioners and policy-makers and through various academic and practitioner conferences and similar. The resultant hypothetical framework indicates that infrastructure projects create benefits and value for a host of beneficiaries: individuals, user groups, local communities, and the wider society. Understanding the mechanisms in which the value is created for each of the beneficiaries was our next research challenge leading to the second part of the research methodology.

In order to validate, refine, and further develop the hypothetical preliminary framework, we conducted an exploratory study targeting a specific setting and using a highly selective sample of key respondents. In doing so, our intention was to adopt an ideographic approach (Robinson 2014) – with the tendency to specify features of a broad discourse around strategic domains of value creation in projects, which is sometimes discussed in economic and policy terms, but not in project studies.

We therefore chose a purposive sampling strategy whereby we wanted to recruit:

- A small group of senior decision-makers: In line with guidelines on idiographic research (Robinson 2014) we sought to study the thick narratives given by relevant decision-makers in a way that gives individuality and voice to each of the respondents, as opposed to treating them as anonymous accounts - as would be the case in nomothetic research aiming to generalize.
- A relatively homogeneous group of informants who share a strategic discourse and perceptions on value creation in infrastructure projects. Nonetheless, we did not want the informants to self-select, but we rather chose to approach them based on the researchers’ awareness and knowledge of their relevance for the research question. In our case, this meant significant senior management experience with major urban transportation developments for projects in the London policy setting.

The final (and perhaps most difficult) decision to be made was on the size of the sample. Our approach to the sample size is clarified in terms of research validity and rigor. The rule of thumb for ‘hitting the point of theoretical saturation’ in qualitative studies is generally reported to result in 20 to 30 interviews (Marshall *et al.* 2013),

with the current standard of mainstream management journals being greater than this average, by a factor of 5-10 - ostensibly driven by ideas from quantitative inquiry suggesting that larger numbers imply greater rigor and validity of the findings.

By contrast, there is a growing debate amongst qualitative researchers as to the appropriate sample size for reaching the ever-elusive 'theoretical saturation point', originally suggested by Glaser and Strauss (1999) in early literature on grounded theory building. Recent debates on that subject converge to a broad consensus that there is no one-size-fits all for the sample size and, in fact, that the 'theoretical saturation point' is often arbitrary and is not necessarily a reliable justification for the sample size (Marshall *et al.* 2013, O'Reilly and Parker 2013, Morse 2015). In addition to that, there is ample evidence that with a careful sampling strategy, the marginal benefit of every additional interview diminishes. In fact, in research on saturation and variation in qualitative inquiry, Guest *et al.* (2006) have shown that as much as 71% of the total number of codes was generated on the sample size of 6 and that 89% of the total number of codes is generated on a sample size of 12 interviews. The same stream of work gives guidance about the sample size of 12 being sufficient for any qualitative study into shared perceptions about a relatively clear phenomenon amongst a heterogeneous group of informants. Similarly, a sample size of 6 is suggested as sufficient for an analysis of the generic meta-themes which describe the phenomenon in question in a similar setting of informants (Guest *et al.* 2006, Robinson 2014).

As our goal was to undertake a phenomenological inquiry into domains of strategic value creation for urban infrastructure projects, we followed advice by Guest *et al.* (2006) and approached 8 highly knowledgeable and experienced informants for this research. In the purposive sampling strategy, all the informants possess experience in infrastructure delivery at a senior management or leadership level on projects over £1 billion capital cost, and depth of experience in the London policy setting. In such a way, the group of informants was intended to bring together experience across a diverse range of projects over the past two decades. Informants had experience in senior management or leadership spanning across the following projects: King's Cross Central Redevelopment, St. Pancras International Station, London Road Modernisation Plan, London Olympic Games 2012, Crossrail, Crossrail 2, Thameslink 2000, High Speed 2, Jubilee Line Extension. When combined, the total capital value of this bundle of London-centric projects and programs would run into the many tens of billions of GB pounds.

At this stage, informants were not aware of our attempt to validate and refine the hypothetical value creation framework – thus greatly reducing researcher bias (Morse 2015). Interviews were framed around generic decision-making challenges in urban infrastructure development. To ensure internal validity of data collection, the first two authors of the paper attended all the interviews to emphasize reflection in real time and support each other with additional questions if a new avenue of interest would open up. All interviews were audio recorded and transcribed subsequently. Combined, the 8 informants capture over 200 years of strategic management experience, being involved in strategic roles for an average of 27 years each.

Informant	Experience in relevant strategic roles	Area of expertise + years of strategic experience	Date of interview	Duration of interview
11	23 years	Civil engineering for urban redevelopment and transport	1 June 2016	01:09:26
12	30 years	Large scale urban infrastructure design	2 June 2016	00:48:54
13	29 years	Urban transport operations	6 June 2016	01:00:49
14	17 years	Urban planning and regeneration	5 July 2016	00:50:11
15	32 years	Smart cities and transport innovation	13 July 2016	01:19:59
16	38 years	Construction and engineering	14 July 2016	00:49:07
17		Project and program management	7 August 2016	00:50:03
18	30 years	Science and engineering policy	7 Oct 2016	01:14:05

All of the informants hold very senior roles, which allowed us to use a small N sample size of interviews to achieve sufficient validity for a concept that is relatively simple (value domains for transportation infrastructure projects) but we know virtually nothing about it in project studies. As a result, we wanted to compile a set of meta-themes hinging upon the hypothetical ideas on multilevel value-creation refined and expanded through interviews. To this end, we performed axial coding (Strauss and Corbin 1998) seeking evidence for the hypothetical multi-level delivery challenge framework in interview accounts.

The first two authors discussed and compared interview notes across the accounts and agreed on the strongest emergent themes. These findings were then reviewed by the third author and refined to develop the propositional framework, which we present next. The propositional framework has subsequently been validated through three additional interviews with decision-makers, at a similar level of seniority as the group initially sampled. Moreover, the propositional framework is validated in a group setting outside the UK context where it was developed. This was done independently through engagement with three distinct groups in Australia and New Zealand. This comprised a presentation hosted by the Victoria branch of the *Australian Institute of Project Management* where preliminary findings were presented and commented on. The second was an interactive workshop with infrastructure professionals primarily focused on the New South Wales area of Australia. Finally, the findings were presented and comments sought from a national level infrastructure seminar for senior practitioners in Auckland, New Zealand. Validation is also taking place through a number of informal interactions that all three authors are having with relevant infrastructure project practitioners in the UK and in the US State of California. This ongoing validation effort, although not conducted in a formal setting of a prescribed research method, nonetheless seeks to both refine and add credibility to the conceptual ideas developed in this research.

FINDINGS

We next present the evolution of the findings for this study. These were derived by applying concepts from literature on projects as value creation instruments and combined with the principal interview accounts. All the informants are based in London, where the delivery of infrastructure rests largely with the private sector and special-purpose vehicles (SPVs) for delivery of megaprojects.

Qualitative interviews facilitated discussion to explore the ‘thick narratives’ (Eisenhardt and Graebner 2007) expressed in accounts by each informant. Particular

attention is given to the conceptualization of urban transport within broader urban systems, and thinking around value delivery within and across stages of the project life cycle. We next present the emerging meta-themes from this idiographic inquiry (Robinson 2014). They broadly refer to: economic growth, community value, process optimization, user behaviors and travel experience.

SUPPORTING GROWTH

A distinct form of value creation derives from expanding provision of accessibility (also known as connectivity). Transport investment is typically predicated on meeting greater travel demand generated by anticipated urban population growth and expansion of economic activity. Improvements to accessibility can be delineated into different forms. Local labour markets rely on transport infrastructure to support commuter flows, while residents require access to local goods, services, and recreational activities. Regional transport nodes such as air and sea ports also require transport accessibility. The Thameslink 2000 upgrade of the north-south rail line exemplifies the different types of accessibility - *'it was predicted against population growth, which has almost happened by now, and the growth in traffic movements to [Gatwick and Luton] airports, and commuting flows into London, along the way'*. Supporting urban growth, with the demand for different types of accessibility, brings inherent tensions between different spatial scales. The objectives for the Thameslink 2000 upgrade showed the imperative to meet different needs with a single investment: *'It provided three different objectives simultaneously – two airport-city links, commuter traffic, and in the centre, a north-south rail service... so those three objectives were somewhat in tension with each other, with regard to some of the parameters for which the engineered system was thought about.'* The potential for transport projects to address multiple objectives is influenced by investment appraisal and front-end planning phases. Meeting travel demand across these scales not only influenced the physical configuration and distribution of transport services for Thameslink, but was in further tension with the financial model for the project: *'The business model relied on carrying a certain number of passengers during peak hour in Central London, to get the revenue to justify the investment in signaling systems that provide high throughput, low dwell time, and modernized rolling stock. That business model – because that's where the money came from – dominated the way in which it was thought about.'* Therefore the value of supporting growth is the aggregate benefit across multiple forms of accessibility: labour market accessibility for commuter flows, local accessibility for residents to access goods and services, and regional accessibility for specific nodes such as airports and international terminals. While the demand for these three forms of accessibility grows with increases in London's population, unequal provision can limit the value generated through transport. An example is given through the refranchising of London Overground lines by Transport for London (TfL): *'When all those railway lines were run by Network Rail, who didn't have the same vision and priorities for London travel, they were interested in commuting traffic into London, as opposed to travel within London. At the moment it became the Overground [line], it completely changed journey travel around West to North London, to East London. I remember when nobody rode on it, it was once every 45 minutes with a crap train – it was empty'*. On the basis of regional accessibility, the level and type of service was different to that required for local accessibility. Upgrading stations, rolling stock, and improving the capacity and frequency on these lines substantially improved intra-metropolitan connectivity, which was formerly of a poor standard.

Elaborating further on transport's value to support growth, informants expressed their concern over the rigid forms of investment appraisal and planning, against the fundamentally speculative and uncertain nature future growth: *'You can't make a business case "fact-driven". The problem is, if we do it on business case, you've already manifested a problem you're now solving – as opposed to anticipating a problem and living in hope that something will happen... we have a government policy now for evidence-based decisions. [But] your transit stuff, by and large, it isn't evidence based – it's self-fulfilling scenario based'*. Growth projections are future extrapolations of current or past trends, and therefore the models employed to anticipate future travel demand have little sensitivity to unforeseen shifts in economic activity, migration or environmental conditions. This introduces uncertainty around the actual future value of urban transport services: *'I'll take the traffic model, the population growth, the demographic mix with different habits, I'll take the average income and income distribution and project them all forward ten years and I've no idea what's going to happen. Any of these could be off by 20% and change the answer'*. In the perspective of informants, this uncertainty suggests that more intentional, scenario-based planning can better support value creation from transport infrastructure, with reference to the London Docklands regeneration and Jubilee Line Extension – *'where they have got a vision, it's worked'*.

The political context of large-scale projects introduces an additional challenge for long term value creation, as projects mobilized as part of an agenda for politicians could compromise long term value creation – *'As the magnitude of the project increases, the size of it and the impacts, the costs and its photogeneity increase, then the capability of the modeling decreases, and the rationality of the decision-making process becomes increasingly more like – what will win me votes, will I look good in my high-vis and hard hat... that in many ways is where our country loses out, because we don't take sensible decisions for the big stuff'*.

COMMUNITY VALUE

In addition to the economic value created by enabling growth, transport infrastructure creates direct social value for urban communities by enhancing accessibility for residents, and stimulating housing development. Appraisal of transport investment derives from appraisal of economic benefits and viability based on users' willingness to pay – also known as farebox modelling. Informants readily acknowledged that transport infrastructure generates wide social and environmental value, and broader benefits beyond those reflected in users' willingness-to-pay for transport services. In the context of regeneration projects in London – *'there is much greater acceptance now that the wider economic benefit analysis needs to accompany the kind of core, farebox modelling'*. Farebox models look to the viability of transport services based on users' willingness to pay – however, the external benefits of urban transport investment suggest that these models may underestimate the full value potential of a project.

In London, the strong influence of transport infrastructure upgrades on land development shows the potential to create social value in boosting housing supply and sustainable land use patterns. The value of transport infrastructure to communities is therefore instrumental in increasing London's housing supply: *'Transport plays a key enabler in terms of allowing a lot of development work to take place, and now you need to flip the thinking to a degree... social sustainability will become really important over the next 10-15 years, part of it driven by the real challenge that*

London is facing in housing accommodation, and the ability to find affordable places for people... It's a slight change in thinking, it's no longer that the potential is there around transport nodes, we have to create those links and nodes to enable developments to function properly'. Rather than expanding transport services in response to demand, the emerging view contends that transport be used to proactively target growth areas. This highlights that transport can be instrumentalized to leverage housing supply, as a stimulant for redevelopment. The uneven distribution of transport accessibility across the Greater London region highlighted potential areas for intensification or redevelopment. Shifting the conceptualization of transport to a potential stimulant for development, there are new opportunities to make a case for improved service provision – 'I'm working in an area in London – on the map it looks like a highly connected place... but then you realize that the station has one train an hour at peak times, possibly two. It's one of the most deprived places in Britain – the reason it can be is that the service is operated on a farebox basis, it's bringing in passengers from commuter towns... there's no reason for the rail company to stop in this area because no one there can pay a fare – but it won't ever be regenerated if that train doesn't stop there either. This reflects the limitations on transport service provision imposed by direct farebox considerations, which restrict transport infrastructure's value generating potential as a stimulant for urban development, and broader benefits of improving accessibility across the London metropolitan area.

The 2012 Olympic Games were provided as a prime example of a regeneration-led transport investment programme. The exceptional nature of the international sporting event, with very high political support and public interest, drove the imperative for infrastructure investments to deliver benefits beyond the scope of the Olympics events: *'The Olympics always started right from the premise that it was a regeneration project first and foremost... it was planned in from the start that as much as we could spend would go towards a longer term outcome. It's a good case study in how to start with the right message and then plough that message literally into the way in which the project is planned, and then deliver an outcome.'* However even in the case of the London 2012 Olympics, the distribution of social value is uneven and comprises localized accessibility benefits, alongside indirect societal benefits: *'at the heart of the conundrum, the reason you're doing this scheme isn't just for locals who live on the line of the route, it's the wider societal benefits, exogenous benefits to do with pollution... a dispersed raft of benefits to society at large, against some micro-benefits for local residents.'*

PROCESS DESIGN OF TRANSPORT PROVISION

Transport infrastructure creates value by adopting a 'process design' perspective on providing accessibility. Value is derived by individuals as they make journeys, as a sequence of trips and activities across different modes, spatial scales and times. The need for integrated planning and delivery of transport services was described by one informant as a kind of process design – *'the point is you're making a process design of transportation – classically, we don't think about transport as a process, and certainly not an end-to-end process. We think about it as a series of bits of physical interventions, it's asset-based – so we'll have a bike station, bike racks, a railway line – not actually, how do you make the whole thing work and how does that work differently under new technologies'*. Identifying trips as an end-to-end process is essential for this form of value creation. A process perspective on transport brings greater clarity on how to deliver on the fundamental purpose of transport: *'It is rarely possible that a government has been able to articulate with any real clarity the long-*

term purpose of the asset. Traditionally it has been improving journey time – and the cost value of time equation was the simple driver. But it's not journey time, it's also reliability – accessibility in predictable time – acknowledging that the dis-incentive curve of extra journey time is not linear'. This gives clear direction on the value of urban transport: a composite of accessibility and reliability, with a non-linear utility function for users.

Critically, a focus on accessibility and reliability goes beyond traditional framing of transport's value as a function of reducing travel times: *'A lot of our business case is determined by the value of time, on the assumption that if you get people there quicker, it delivers more value'. The process view is more holistic than journey time savings alone, as it factors in reliability and the level of congestion on services, to better reflect the nature of individual travel decisions. Taking forward this concept, various issues around the wider forms of value creation were raised. Firstly, the potential health benefits of encouraging active travel are significant, but 'the classical method of evaluation is journey time savings and congestion relief... at the moment, your cost-benefit ratio often doesn't stack up if you add walking to the journey times, but all you do is [allow for the benefits of active travel] and it actually saves the National Health Service money over the long term'. Current appraisal methods discourage investments that enable walking. Shifting away from the dominance of travel-time savings for the value of transport opens up new opportunities for realizing wider value for public health and wellbeing.*

Additionally, the contribution of transport to the quality of the urban realm has strongly influenced street design in London. Redevelopment of Trafalgar Square, Parliament Square and Whitehall as part of the World Squares for All project were transformational, landmark projects: *'The methodology, in terms of the cost-benefit ratio, doesn't really adequately reflect some of the liveability aspects – projects that have been transformational for London... wouldn't have had a positive business case because the road journey time disbenefits would have more than outweighed the benefits, and I feel that when we come to the liveability, health and ambience benefits, they are undervalued against public expectations'. The value of these redeveloped public spaces, with more balanced allocation of space for walking and cycling, is recognized as a more holistic approach to transport: 'If you have a value proposition for what you're trying to do, which is reasonably cohesive – for example, it's not about the bus service, it's about how I make Oxford Street successful – that's a different question, drawing it back to look at the ends, not the means... It used to be that traffic signals were designed for vehicles, with pedestrian crossings – at Oxford Street, we designed a crossing system for pedestrians, with vehicles – a fantastically different application of the same technology, because the value proposition changed'.*

The process view operates with a more sophisticated value proposition for transport provision

This crucial shift to focus on the ends of transport provision opens new opportunities to use alternative interventions to create greater value from existing assets, including policy measures and sector-specific travel management. Signaling technologies on rail networks are a prime example: *'If I can get 20-30% more from an existing railway system through the application of new signaling technologies, why are we not doing that – why are we looking toward building new lines? What then is the implication when you have autonomous vehicles, and why would you not also consider policy or land use interventions? There's not enough holistic decision-making to ask those questions upfront.'* This call for holistic decision-making to consider different forms of intervention for increasing capacity, and therefore

accessibility, and avoid unnecessary capital investments. Specific interventions to improve efficiency for freight travel and the ‘gray fleet’⁴ are also targeted in London to manage traffic congestion: *‘freight now forms a large part of the traffic in central London, it’s needed, we know it has to be there to service the shops and things we need, but we can look at consolidation, putting it into larger vehicles, or retiming of freight deliveries. These are not infrastructure-faced problems, but they will help tackle some of the congestion and air quality issues we’re looking at’*. Traffic management for specific sectors or travel activities can be particularly cost-effective interventions to leverage the value of the transport network, with minimal capital requirements. This approach to managing travel demand is particularly valuable in the London context, where a large proportion of vehicles using the city’s road network are freight deliveries or employees using their own cars for work purposes.

SHAPING USER BEHAVIOR TO ENHANCE VALUE CREATION

The influence of user behaviour on transport demand and the efficiency of transport networks was universally recognized by informants. Intentional planning and allocation of service provision across modes, to shape travel behaviour, is an important element of value creation – *‘What has been missing from many situations is a vision statement for how you want your city to behave... London’s big success story has been the congestion charge, it did involve some infrastructure but it was basically a behavioural macro-tool to tackle it, with low-emissions zones’*. The congestion charge is the most prominent example of travel demand management in London, with a marked impact on congestion levels in the central city. The value created through this mechanism lies in the behavioural response of individuals to reprioritize trips in a specific area, either shifting to an alternative mode, re-routing, or travelling at a different time. Incentivisation not to travel in very busy areas allows more valuable trips to have priority, as they are more likely to be willing to pay the congestion charge.

Informants identified the unique, adaptive nature of travel behavior – ‘transport’s interesting in that it’s not a precise science – if you kick over an ant hill, for half an hour or so the ants are all over the place, but over a period of time they’ll gradually transform their movements, readjust and life carries on as normal – and you see the same in London’. The response of travel demand to the level and types of provision shows how induced demand can rapidly dissipate the value created through capacity upgrades, and therefore a more sophisticated approach to use multiple interventions to improve accessibility while actively managing demand. This also brings opportunities to shape behavior with the physical allocation of space in line with the desired travel outcomes: ‘If you move the kerb, you change the priorities. If you change the bus lanes, you change the priorities. If you put in a tram, you’ve change the priorities... you are implicitly making value judgements of balance every time you put in transit or a motorway or a traffic light or a pedestrian crossing.

These findings show a distinct shift away from deterministic modes of transport modeling toward a more intentional mode of provision to create diverse forms of value through transport investment. Incorporating non-capital interventions is an important element of this approach: *‘The best infrastructures are those that have associated policy changes. Often we use policies instead of infrastructure – quite often, as individuals we think the solution must be to build something... the reality is*

⁴ ‘Gray fleet’ refers to employees using their own vehicles for work purposes

that probably we're better to actually try and avoid doing it in the first place, or use new technology to avoid doing it. One of the challenges for the industry going forward is how you blend policy, infrastructure interventions and new technology to get higher value solution sets – rather than always thinking that banging in a new railway must be the solution'. These 'higher value solution sets' show the shift to holistic decision-making, and strategic, long term value creation in urban transport. Combining relevant capacity upgrades or accessibility improvements with mechanisms to manage behaviours, or enable prioritization of specific travel activities or modes, leverage the value of existing and new assets and shape sustainable travel patterns.

TRAVEL EXPERIENCE

The final element of transport infrastructure's value was identified as the experiential dimension of urban travel. This recognizes that the value of transport is not only about movement, but includes the use value of time and everyday experience for urban residents. The reliability, comfort and convenience of transport services therefore have direct impacts on quality of life and wellbeing. *'We break it down, appreciating that some people experience the transport system as a bus passenger, some as a pedestrian, some as a cyclist – moving away from just seeing the road network as something to move vehicles around, and seeing it as a more holistic transport network'. This therefore implies that user experience varies across different travel modes, and front-end planning and public consultation should consider the relative impacts on drivers, public transport users, cyclists and pedestrians.*

While there can be a dominant focus on travel times and speed as a measure of value, as explained in the previous section, the value of travel experience in TfL's Road Modernisation Plan can be enhanced by reducing speed: *'Some of our schemes, in order to provide better liveability, actually slow people down – and as soon as you start slowing it down, the number of people and the value that's placed on their time usually far outweighs the safety, health, ambience and other benefits'. As highlighted in the previous section, this creates a challenge for investment appraisal, as slowing down journey times is typically viewed as being of negative value.*

Travel experience is distinct from a process view of transport, and mechanisms to influence behaviour: the difference is that this pillar directly addresses the experience of urban transport infrastructure. The integration or bundling of different capital, policy, and technology-based interventions for seamless delivery of transport services support a process view of transport, and leverages behavioral change. Experience looks instead to the immediate human perception and experiential value of the physical environments created by infrastructure. It introduces new adjectives for the user, as rather than 'fast' or 'quick' the vocabulary shifts to 'easy', 'intuitive', or at the opposite end – 'nightmare'.

The user experience of streets, as part of the urban realm, extends into their potential as public space – 'It's partly, how pleasant is this area to pass through, in terms of ease of movement or clutter, easy road crossings, less noise, better air quality – and then there's a further question, is this space so nice that I actually want to stop here and absorb it and sit on this bench... spaces do perform a really important function, they're almost an extension of the parks'. The experiential quality of transport infrastructure is a distinctly human experience, including the sensory experience, potential exposure to air and noise pollution, easily navigable spaces and safe travel amongst vehicle traffic. As a parallel to the redevelopment of Trafalgar

Square, touched on in an earlier section, value is added by recognizing that transport is experienced more broadly than simply a form of movement. Conceptualisation of individual movement in public spaces challenges existing modes of planning and design: 'Architecture occupies space, in order to execute a design you have to destroy what is already there... to justify replacing it, it's got to be 'bettter' against some set of criteria for what 'better' means. Whereas in choreography or orchestration it stands alone, as a 'space of experience' - we think that fundamentally affects the way in which people think about the urban'. The metaphor of choreography, applied to engineering practices, illustrates the value of mobilities and activities enabled within infrastructural spaces. Distinguishing the 'space of experience' within the built environment suggests the need for decision-makers and the decision-making process to move from the rational and analytic world of data and facts, to the more subtle and psychological world of how people will feel about the infrastructure they have and may use.

Reliability of transport services is central to the value of the user experience, as it allows users to use transport to meet their needs, for individuals commuting or accessing local goods, services, or recreation, or alternatively for firms supplying local or export markets – *'it's not journey time, it's predictability, and that's true of all journeys'*.

DISCUSSION AND CONCLUSION: PILLARS OF STRATEGIC VALUE CREATION IN PROJECTS

Drawing upon the thick narratives that define value along lines of economic growth, community value, process optimization, user behaviors and travel experience we next derive a propositional framework for user value capture in urban transportation developments. This propositional framework posits that there are value creation processes in transportation infrastructure hinge upon five distinct pillars. The pillars that emerged as meta-themes from our findings are further elaborated in Table 1.

Table 1 – Pillars of strategic value creation in transportation infrastructure projects

Growth: Enabling expansion of economic activity in the local economy		
Scale	How?	Example:
Metropolitan	Expanding accessibility for local labour market, goods and services providers	Crossrail increases the population of potential employees within a given travel time for central London

Community: Servicing housing stock with accessibility to employment, education, local services		
Scale	How?	Example:
Local community	Leveraging effective housing supply through improved accessibility to employment and local services.	Co-ordinated expansion of residential housing along new or upgraded transport routes expands the supply of housing in proximity to employment and local services

Process: Enhancing value by aligning infrastructure services with linked activities		
Scale	How?	Example:
Individuals, firms	Automation and integration of transport service provision	Integrated ticketing and trip planning across public transport, active and rideshare modes

Behaviour: Enhancing value through shaping user behaviour		
Scale	How?	Example:
Individuals, firms	Enhancing value generation by shaping user behavior	Congestion charging improved traffic flow in central London by disincentivising peak-our trips that could be avoided, re-routed or rescheduled

Experience: Enhancing value of the user experience of transport		
Scale	How?	Example:
Individuals	Enhancing the user experience for different urban transport modes	Designing traffic junctions from the perspective of different users: drivers, pedestrians, cyclists and public transport users

Each pillar can be defined according to its source, scale, beneficiaries of value created, and mechanisms for value creation. In such a way, the propositional framework build upon the ideas on infrastructure’s multi-dimensional use value, as a “shared means to many ends” (Frischmann 2012). Most importantly, by defining user experience, behaviors, processes, community and growth as strategic value areas in transportation infrastructure, this framework expands the understanding on performance of projects in the transportation sector. Namely, recent debates around innovative delivery and business models for the provision of infrastructure projects have been advocating the use of PPPs, as delivery vehicles which achieve efficiencies by (1) optimizing the total expenditures along the entire life cycle of projects and (2)

allocating risks along the value chain that is advantageous for the entire project coalition.

The five pillars of strategic value creation framework can be a valuable input for sponsors and clients (mainly a public transportation agency) to define the strategic project brief by working out either the specific or range of outcomes that the project should help generate. In such a way, the propositional framework can be seen as a valuable decision making tool for front-end project considerations (Edkins *et al.* 2013) integrating various long-term benefit realization and outcome areas. The framework considers the integration of practices at the project, program, and strategic level. This approach avoids a linear, solely business-driven idea of the value chain, which centres on utility maximization principles and underplays positive and negative externalities generated by the economic activity of businesses (Porter 2001).

The utility of the framework for decision-making is greatest in the very earliest stages of project feasibility studies, where different options are put on the table and the best project for the society needs to be chosen. We argue that having an integrated decision-making framework - such as the five pillars for value creation, proposed in Table 1 – would help first shape the problem-space more richly and then assist in the selection and development of the best projects by avoiding the challenges of mono-disciplinary silo thinking (Tett 2015) and, even worse, deliberate deception by project promoters (Flyvbjerg 2009). Although we contend that issues and challenges of urban transportation development decision-making are complex, a balance should be found between an incoherent (and indeed often incomprehensible bricolage) of expert studies on the one hand, and the soundbite value propositions – such as ‘connectivity leads to productivity’ – that politicians may well be inclined to make in order to obtain public support for the project.

The second point of discussion relates to the interdependencies and trade-offs between kinds of value generated along the strategic areas of value defined in the framework. Different domains of value creation are inter-related through their physical networks, governance and institutional structures, operating models and funding mechanisms. This implies that there is likely to be a trade-off observed when value in one domain is maximized – which is then likely to be at the expense of other areas of value. For example, value creation through user experience ensures that transport infrastructure is usable for the widest possible proportion of the population. This pillar relates closely to, or interdependent on, the behavioural dimension of infrastructure value, as far as the value of user experiences eventually shapes travel behavior and individual preferences, as they optimize their own travel patterns according to the quality of experience.

This notion brings us to the third point - a discussion of costs. We argue that the strategic value creation framework can be advantageous for comparing not only the value achieved, but also the costs incurred with different delivery options across the proposed value domains. This provides a conceptual tool to consider some of the costs expressed as negative externalities that the project is likely to produce. Examples could be the impact on climate change (Morris *et al.*, forthcoming) or the social cost arising from the contribution from improved infrastructure to the inequality and ‘gentrification’ of an urban area, leaving members of the society affected exposed to the increasing unaffordability of the area leading to involuntary displacements of most vulnerable socioeconomic classes. Either way, the strategic

value creation framework can be beneficial to discuss costs as well as value of the project that can be translated from the outcome domain into the strategic project brief in terms of tangible outputs that the project should generate to enable these outcomes (Morgan *et al.* 2008). This rationale also offers a way to relate the front-end decision-making utility of the value creation framework to its delivery and execution utility.

In such a way, the propositional framework on strategic value creation makes an important theoretical contribution by cutting across the disciplines of transport planning, project delivery, and operations management of transport assets. On the one hand, transport-planning literature does not offer simple decision-making tools to articulate diverse sources and types of value. Transport investment appraisal methods often depend heavily on narrow measures of travel-time savings, with more recent additions of ‘wider economic benefits’ in the form of agglomeration economies and anticipated impacts on economic growth (Börjesson and Eliasson 2012, Laird and Venables 2017). This approach has limited ability to justify projects with long term strategic value, and often drives short-termism in transport investment decisions (Eliasson and Lundberg 2012). The empirical relationship between transport and investment and growth is inconsistent, reflecting that long term economic impacts of transport hinge on the quality of governance and decision-making on the type, location, and specific operating arrangements for transport infrastructure (Banister 2001, Crescenzi *et al.* 2017).

In a similar vein the value creation framework contributes to project studies, by starting to unravel some of the discourses that take place beyond the project execution frameworks. The importance of the sponsor role as well as the need to expand project studies onto the strategic phases of project decision-making and benefit realization in operations have been emphasized for a very long time (Morris 1994, Davies *et al.* 2006, Edkins *et al.* 2013, Artto *et al.* 2016). Regardless of this need, a lot of project scholarship has focused on the execution angle for the delivery as opposed to strategic delivery issues. This paper sets forth an early and emerging, yet potentially useful, decision-making tool that begins to chart the path towards understanding the temporary (project) organizational structures for delivering assets with long-term benefit realization across multiple levels.

Having extensively discussed the potential decision making utility of the strategic value creation framework, we turn to the limitations. The first lies in operationalizing the explanatory nature of the reasoning. We would argue that the next step for this stream of research is to expand the propositional framework and further operationalize it through proxy indicators for different kinds of value and costs in different domains. Upon critical evaluation of the framework, the main challenge to develop such key performance indicators (KPIs) will be to selecting appropriate language and definitions to quantify the different forms of value being generated. To better understand the complexity of interconnected urban systems, which are central in the value creation framework, applying improved modelling, potentially with the use of machine-learning techniques, as applied to publicly-available datasets would be a valuable and promising continuation of ideas presented in this paper, although this project did not set out to initiate a trajectory of big data research. As decisions in complex stakeholder settings are very rarely driven by instrumental rationality and more often are a product of politically-mediated negotiation processes that is based on

sound arguments, we propose the value creation framework as a sparse boundary object that helps different disciplinary communities find common ground in reaching a decision (Carlile 2002, Chang *et al.* 2013).

The second conceptual limitation is our empirical focus on the transportation infrastructure. We, indeed, acknowledge that one of the main challenges for policy makers in infrastructure is to transcend sector-specific recommendations and consider interdependencies and synergistic effects (ICIF 2017) between capital projects with sector-specific outputs. We take this on board and suggest a broad-brush system-of-systems perspective on infrastructure (Hughes 1987) in which transportation is only one component of the infrastructure fabric. Having said that, decisions on projects are, in fact, being made on a sector-by-sector basis so what can be seen as a theoretical limitation of our work can also be considered its main strength in a pragmatist sense. This is a strength as it facilitates a debate amongst stakeholders to discuss the trade-offs between the different kinds of benefits the project will create for the client, delivery partners, and last but not least for its users.

The final limitation to be discussed is the limited amount of thick narrative data used to derive the value creation framework. First of all, it must be said that the eight informants, which were specifically referred to and from which quotes have been drawn, are not the only source of data for this work. Indeed, the full genesis of this work has been the result of an ongoing enquiry that involved interaction and engagement with more than a 100 senior project and policy practitioners in the UK context. Secondly, and perhaps more importantly, the propositional framework has can be described in terms of developing a set of meta-themes (Robinson 2014) rather than a more detailed coding effort, which would have resulted in a set of qualitative categories in a grounded theory building fashion (Strauss and Corbin 1998). Although the framework is subject to ongoing validation, a follow up study should be conducted as a comprehensive validation effort for the framework. However, this was not the goal of this study – it was, by contrast, to present an idea, which is simple yet underrepresented in the delivery discourses around infrastructure projects.

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