



The Infrastructure Governance Incubator

Background paper

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University of Sydney

Infrastructure Governance Incubator

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The production of this report and the research within it has taken place upon the lands of the Traditional Owners of Country throughout Australia and beyond. The core work that has gone into this research has been produced upon the Gadigal lands of the Eora Nation, and the lands of the Wurundjeri people of the Kulin Nation. We pay our respects to Elders past, present and emerging, and recognise that Indigenous sovereignty was never ceded.

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Cover images: [Left] New bike lanes built during the 2020 pandemic in Sydney (photo by author), [Top-right] The Djab Wurrung sacred 'Directions tree' cut down by the Victorian government (Perkins, 2020), [Bottom-right] A rail line in Tokyo [photo by author].



The Henry Halloran Trust at the University of Sydney



Planning Institute of Australia (PIA), NSW & Victoria

Executive summary

In response to the ongoing challenges of infrastructure planning and delivery, and in a time of unprecedented social, environmental, economic, and public health challenges facing Australian cities, the Infrastructure Governance Incubator sets a timely research agenda. It aims to develop an integrated infrastructure governance framework for Australian contexts, seeking better alignment between strategic planning and project delivery - in terms of visioning and policy formulation, funding, and public legitimacy - to create more inclusive and deliberative processes and frameworks enabling advocacy for, and delivery of, fairer, more just and sustainable cities and regions.

The task begins with foregrounding that infrastructure governance in Australian cities is taking place on unceded First Nations land. The Incubator sees this as a critical starting point from which to understand the wider dimensions of the infrastructure gaps, and question whether strategic infrastructure development is, or could be, formulated in a just manner through this specific political context. In doing so, we argue that simply reconnecting strategic planning and infrastructure delivery will not be sufficient to address the deep urban challenges and crises facing our cities, as no meaningful resolution is possible unless delocalisation of strategic planning and infrastructure within the settler-colonial state takes the centre stage. Decolonisation is of course not a simplistic end, but a long-term and highly political process of transformative change centred on "the repatriation of Indigenous land and life" (Tuck & Yang, 2012, p. 1). Decolonisation can therefore be used as one key critical lens to help uncover the injustices of contemporary infrastructure governance and shed light on the system's existing values and priorities, and what capacities it possesses to be transformed: to reshape and respond to the ongoing crises of our times. Decolonial infrastructure governance then involves systemic and structural transformation of governance that is not only capable of offering effective integrated planning across infrastructure and governance sectors, but also requires dismantling the principles underpinning its relations, decision-making knowledge and processes, power structures, politics, and future visioning. This critical perspective will inform all the Incubator's focuses, from infrastructure planning, funding, and social legitimacy.

This background paper has been prepared as part of the Year 1 milestones set for the Infrastructure Governance Incubator. In accordance with the key research questions at the core of the Infrastructure Governance Incubator, it offers a literature review of the broad topic of infrastructure governance and covers topics of infrastructure governance on unceded land, infrastructure governance ownership models, infrastructure governance in times of crisis, infrastructure planning, infrastructure funding, and the social legitimacy of infrastructure governance. The paper concludes by identifying five major gaps in the literature, and puts forward the case study research which be the immediate focus of the Incubator in the next step.

Preface: Evidence base for infrastructure governance in times of crisis

Infrastructure ought to nurture places and support the betterment of cities and people. However, three decades of neoliberal orthodoxy alongside the misalignment of projects to strategic plans, as identified across numerous academic and independent assessments (Audit Office of New South Wales, 2014), suggests there is little clarity surrounding for whom and to what ends infrastructure is serving. It is evident that infrastructure governance in Australia struggles with a lack of social legitimacy or mandate as public outrage continues over numerous flagship infrastructure projects (Haughton & McManus, 2019; Searle & Legacy, 2021). Such struggles are now given greater urgency as Australian state and Commonwealth governments look to increase infrastructure provision in the years following the COVID recession. As additional infrastructure is put on the national agenda, optimists will focus on the promises of more jobs, economic productivity and growth. Others, who may look to the years following the Global Financial Crisis as a period of lost opportunity for 'big thinking' and transformative infrastructure projects, are perhaps more cautious. The cautious minds among us raise serious concerns over the promises of infrastructure and the shortcomings of infrastructure governance in times of crisis.

The unprecedented social, environmental, economic, and public health challenges facing Australian cities have raised the stakes for infrastructure planning, and the planning profession more broadly. In responding to the spotlight being cast onto infrastructure, the Infrastructure Governance Incubator – funded by the Henry Halloran Trust – sets a timely research agenda to take a comprehensive approach to interrogating the current approaches to infrastructure governance in Australia. Informed by international best practices, the Incubator aims to develop an integrated infrastructure governance framework for Australian contexts, seeking better alignment between strategic planning and project delivery in terms of visioning and policy formulation, funding, and public legitimacy. The Incubator builds on this extraordinary moment in our history to create more inclusive and deliberative infrastructure governance processes and frameworks enabling advocacy for, and delivery of, fairer, more just and more sustainable cities and regions.

The notion of unfolding infrastructure governance in times of crisis – at the core of Incubator's mission – is informed by a broad understanding of 'crisis', acknowledging both the sudden social and economic shocks such as a global health crisis, but also that urban and regional communities must at the same time increasingly engage with the "new normal" of multiple ongoing crises, such as the unfolding global climate crisis, and the increasing levels of inequities and inequalities (Adkins, Cooper, & Konings, 2021; Furceri, Loungani, Ostry, & Pizzuto, 2020; Oke et al., 2021). Crisis therefore is becoming a more prominent, complex, and arguably influential factor in infrastructure discourse, decision-making and delivery, with different interpretations and often unequal implications across communities, sectors and stakeholder groups.

As such, the Incubator's research agenda is guided by a conceptual framework that focuses on three interconnected areas of infrastructure governance, namely infrastructure planning, infrastructure funding, and the social legitimacy of infrastructure. This focus is underpinned by decolonial questions across all aspects. For us, the task begins with foregrounding that infrastructure governance in Australian cities is taking place on unceded First Nations land. This is a critical starting point for understanding the context of infrastructure development within settler-colonial places like Australia, and a key foundation for the necessary questions guiding our urban and regional futures. The Incubator's tentative conceptual framework can be seen below (Figure 1).

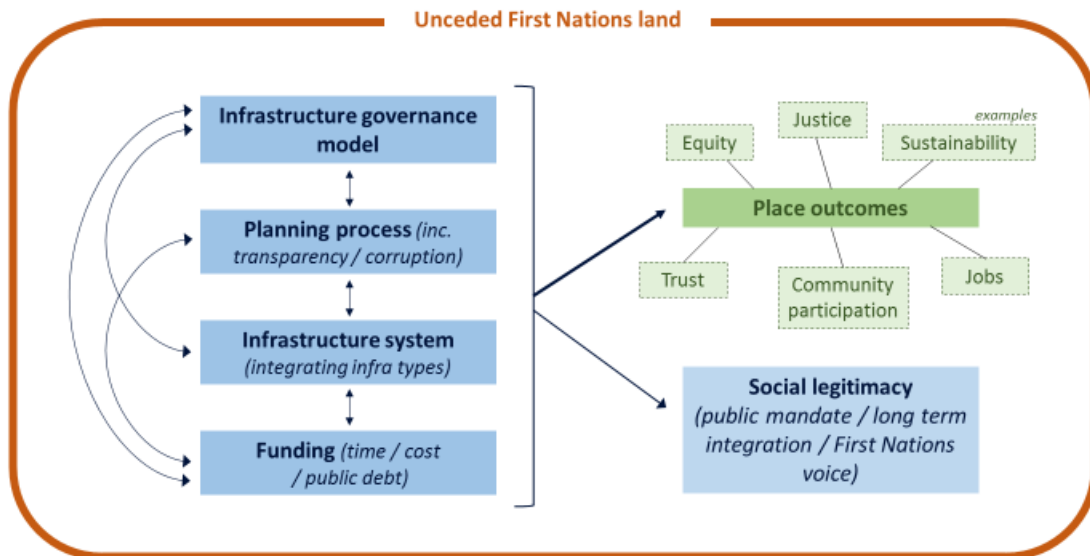


Figure 1 The tentative conceptual framework of the Incubator's research agenda.

Foregrounding the unceded First Nations land in the Incubator's conceptual framework is a step towards unpacking colonial legacies and supporting alternative governance formations based on Indigenous sovereignty (Porter, 2018). It also appropriately coincides with the rising consciousness among the profession that within settler-colonial cities such as those in Australia, infrastructure governance carries a responsibility to recognise its role in reproducing colonial power relations, and working to transform them (Porter, 2018; Temper, 2019). The recent example of community resistance to the Victorian state government's road building project on Djab Wurrung Country demonstrates vast gaps in infrastructure planning's claims to social legitimacy, and highlights the ways in which infrastructure planning is intertwined with assumptions and processes that prioritise what is valued, what knowledge counts, and who decides.

With this conceptual framework, we argue that simply reconnecting strategic planning and infrastructure delivery will not be sufficient to address the deep urban challenges and crises facing our cities. It is time to acknowledge that the misalignment between strategic planning and infrastructure delivery, in the context of Australian cities, is happening on the unceded First Nations land. So, no meaningful resolution is possible unless delocalisation of strategic planning and infrastructure within the settler-colonial state takes the centre stage. Decolonisation is of course not a simplistic end, but a long-term and highly political process of transformative change centred on "the repatriation of Indigenous land and life" (Tuck & Yang, 2012, p. 1). Exploring what this could involve for infrastructure governance within an Australian context must necessarily involve deep and sustained reflection for stakeholders, and continually renewed commitments from decision-makers. Decolonisation can therefore be used as one key critical lens to question whether strategic planning and infrastructure development are formulated in a just manner within a specific political context, and can help shed light on the system's existing values, and its capacity for reflexive transformation: to reshape and respond to the ongoing crises of our times. This involves the systemic and structural transformation of governance that is not only capable of offering effective integrated planning across infrastructure and governance sectors, but also requires deep reflection on the principles underpinning its relations, decision-making knowledge and processes, power structures, politics, and future visioning. This critical perspective will inform all the Incubator's focuses, from infrastructure planning, funding, and social legitimacy.

Key Research Questions

As part of this research agenda, the Incubator focuses on a set of key research questions aimed at interrogating the above critical tensions in infrastructure governance in the Australian context:

Research question 1: To what extent do strategic planning for infrastructure align with the actual project planning and delivery on the unceded First Nations land - especially at times of crisis when short term imperatives may need to take priority over longer term strategic actions?

1. To what extent do infrastructure strategic planning and project planning processes and rationales align?
2. To what extent do original funding and the final actual cost align?
3. To what extent do public engagements at strategic and project level align?
4. In what ways is decolonisation of infrastructure governance understood, enacted, or resisted?

Research question 2: Informed by research question 1, how can strategic planning for infrastructure be better aligned with project delivery on the unceded First Nations land - especially at times of crisis – for enhanced place outcome?

1. How to assess the impacts of infrastructure projects on place outcomes on the unceded First Nations land?
2. How to align infrastructure strategic and project planning processes and rationales?
3. How to align infrastructure funding plans and actual delivery cost?
4. How to enhance and align public engagement in infrastructure strategic and project planning for enhanced social legitimacy?

Evidence base: Multi-tiered systematic literature review

In the first step towards unpacking the above key research questions at the core of the Infrastructure Governance Incubator, a systematic literature review has been conducted. The aim of this systematic literature review is to:

- Develop a **systematic overview of key literature** concerned with infrastructure governance
- Interrogate a broad cross-section of diverse literature on the topic of infrastructure governance, and case studies **across infrastructure typologies, to understand trends, common lessons, and research gaps**
- Build a **substantial research evidence base** to justify and guide the Incubator project's future research, and ongoing foci
- To seek **emerging best practice governance models and lessons**, such as approaches particularly suited to guiding post-COVID cities struggling with fragmented governance regimes

The overall review synthesizes two major tiers of analysis (see Figure 3), and develops both broad and more in-depth perspectives on the state of the infrastructure governance literature - with specific focus on the key research questions at the core of the Incubator.

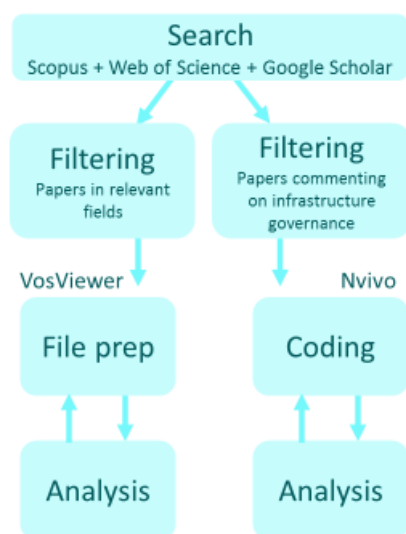


Figure 2 A diagram of the general review protocol, from search to analysis.

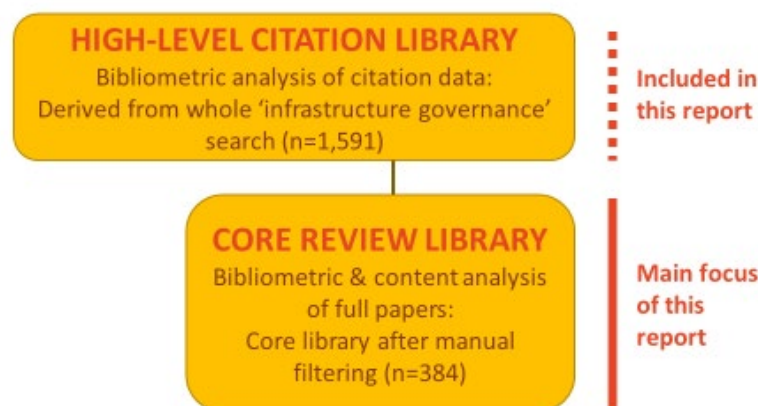


Figure 3 Two major tiers of analysis, involving both bibliometric and thematic and content analysis.

The initial citation search of Scopus, Web of Science, and Google Scholar databases delivered a total of 2,745 papers (after removing duplicates) before filtering (Figure 2). These diverse texts include reports, books, book chapters, theses, and conference proceedings, but are mostly comprised of journal articles. For ease of description, the word 'papers' will hereafter be used to describe all the texts in the library across these formats.

From the initial search, two different processes of filtering and analysis led to distinct but overlapping collections of literature (Figure 2 and Figure 3). Firstly, a larger "**high-level citation library**" of infrastructure governance literature citations (n=1,576) was constructed from citation data (Google Scholar citations were omitted due to non-conductive formatting), and bibliographic analysis was performed using VosViewer software to develop understandings of major themes within the literature, key authors, countries of publication, and interlinkages across the field. Only Scopus and Web of Science databases were sourced for this library (n=1,576) due to the data limitations of the software.

A second, more focused "**core review library**" (n=384) was constructed from manual filtering of the original citations found. Abstracts and titles were reviewed to including papers that appeared to make substantial commentary on the topic of infrastructure governance (and the research questions of the project); less relevant papers (such as those more narrowly focused on infrastructure technicalities or analytical tools) were excluded from the final sample. This *core review library* (n=384) has been analysed using NVivo 12 Plus software.

Methods of analysis

The *core review library* (n=384) has been analysed in NVivo 12 Plus software using several approaches to identify three major characteristics:

Themes: *Thematic coding* has been performed across the entire literature identifying instances of selected *themes* (such as "sustainability", "integration", or "politics") related to infrastructure governance and the research questions of the project.

This process involved large-scale text searches using collections of key terms and phrases in order to seek all the instances of a theme throughout the literature. Each instance of thematic code includes the searched term as well as its surrounding paragraph for context, allowing for reasonable cross-tabulation of different codes. The full list of search terms used are available in Appendix A.

Thematic associations: *Matrix coding analysis* allows for cross-tabulation of different codes. This form of analysis essentially reveals every instance where two different themes (such as "mega-projects" and "social legitimacy") appear

within the same paragraph together (*associations*). Using this method, the entire literature was able to be analysed for common *associations* between themes; where they are commonly or rarely discussed together (or not at all). Any associations of interest were then explored in detail, reviewing the relevant sections of texts together, and if necessary, reviewing the paper for further context.

Word clusters: Another form of analysis used was *word tree analysis*. This allows each instance of a word or phrase throughout the entire literature to be displayed together with its surrounding context (typically several words either side of the word or phrase). This analysis reveals the most common phrases associated with that term (*word clusters*), and these can be further reviewed in the context of their papers. For example, the most common word cluster in the "crisis" word tree is "financial crisis" (see Appendix B).

Two methods to analyse themes: Themes in this research are analysed and reported in two main ways:

- **By file:** This shows how many papers throughout the core review library (n=384) contain any coded instance (one or more) of a particular theme. For example, Figure 10 shows that the 'sustainability' theme features in 335 papers (out of a total of 384). This is useful for understanding how many papers include a particular topic, however it doesn't differentiate between a paper that contains one or a hundred references to a particular theme.
- **By references:** This shows the total number of individual instances of a theme coded (referenced) throughout the entire core review library. For example, Figure 11 shows that there are a total of 7218 references to the 'sustainability' theme. This is useful for understanding how much the entire literature (the core review library) reference a particular theme, however it may be a small number of papers that contain many references to a theme, elevating the overall figure.

Each method has its own advantages depending on the context. Because of the noted limitations of each method, it is sometimes most useful to view them together.

Limitations

There are some key limitations regarding interpretation of the results of the systematic literature review approach used. The particular libraries of citations and papers used in the analyses are derived from the specific search protocols used. While the resulting collection of literature was considered suitable as a sample of urban and regional infrastructure literature (particularly research that identifies *itself* as related to infrastructure governance), it is not fully comprehensive given the potential breadth of the subject as overlapping with urban governance and planning more generally, and because of its highly interdisciplinary character. Other search approaches are likely to produce different results, particularly via different compositions of literature from various disciplines, or infrastructure sectors. The boundaries of how to define and consider what counts and does not count as relevant literature for understanding infrastructure governance approaches are fuzzy. The approach in this systematic literature review was guided by the Incubator's research questions. The nature of many of the analytic tools used in NVivo 12 Plus means that small changes to the body of literature used may impact some of the results. This dynamic requires some caution when attempting to generalise results beyond the literature used in this research.

Structure of the background paper

This report is organised in accordance with the key research questions at the core of the research project. After describing the context and methodology of the systematic literature review, the first chapter will give an overview of the composition of the infrastructure governance literature from the perspectives of both the "high-level citation" (n=1591) and "core review" (n=384) libraries.

Chapters two to seven will each offer a literature review of the research project's key topics of infrastructure governance on unceded land, infrastructure governance ownership models, infrastructure governance in times of crisis, infrastructure planning, infrastructure funding, and the social legitimacy of infrastructure governance. Each chapter

begins with the key points and highlights of that particular chapter, and then includes insights into how the literature engages with that topic, the diversity of understandings and critiques, as well as examples and case study findings when relevant.

The report concludes by summarising the major identified gaps in the literature, and then puts forward the case study research which be the immediate focus of the Incubator in the next step. One of the Incubator's case study subjects, Western Sydney Parklands City, is introduced, and contextualised within the Incubator's research interests.

Chapter 1. An overview of the infrastructure governance literature

Key points:

- Literature on the topic of infrastructure governance falls across a **highly fragmented and multidisciplinary** literature.
- The four main distinctive sub-groupings of literature appear to be **urban planning, green infrastructure, water governance, and transport and land use planning**. While transport infrastructure topics seem to be well integrated with land-use and urban planning already, green infrastructure appears to be rising in prominence and interconnectivity with urban planning fields.
- **Water and transport infrastructure** governance are the most represented sectors in the core review library.
- **Some sectors such as community infrastructure are poorly represented and poorly connected** to the broader literature on the subject. For example, while housing as an infrastructure is present within this infrastructure governance literature, there is a substantial broader realm of housing literature that is not represented here.
- Infrastructure governance as a distinctive field **appears to be a growing topic**, particularly since the early 2010s, and with a larger increase from 2017.
- **Sustainability** (or more broadly environmental issues in the context of the climate crisis) stands out across every analysis as **the most common theme** throughout the infrastructure governance literature. The other major stand-out themes are **politics, integration, power**, and infrastructure delivery/implementation, decision-making, funding and community participation.

This first chapter provides an overview of the composition of the infrastructure governance literature. This includes insights from both the bibliographic analysis of the high-level citation library (n=1,591), and bibliographic and content analysis of the core review library (n=384). The former describes analysis of citation data performed using VosViewer software, and the latter describes analysis of full texts predominantly using NVivo 12 Plus software to code themes and target information across the library for closer review. More details are available in the Methods of analysis section.

An overview of the high-level citation library

While much this report draws predominantly on analysis of the core review library (n=384), this section offers summary results of the bibliographic analysis of the high-level citation library (n=1,591). More detail about the analytical parameters used to derive each figure is included in Appendix E.

The infrastructure governance literature (when analysed by keywords) appears to be largely comprised of four major interconnected sub-groups of literature; urban planning, green infrastructure, water governance, and transport and land use planning (Figure 4). "Urban planning" and "green infrastructure" are the most highly used keywords, followed by "sustainability", "sustainable development", "governance", "ecosystem services", "infrastructure planning", and "climate change".

While it is likely that their prominence in part reflects a greater proclivity for these particular infrastructure sectors to identify with "infrastructure" terms in general, it is notable how prominent and distinct the green and blue (water) governance sectors appear to be. Transport appears to be the sector most integrated with the topic of urban planning generally. The more recently emerging topics since 2017 include green infrastructure, resilience, and smart cities (Figure 5). This possibly reflects a greater prominence for thinking about green infrastructure within urban settings, and the interest of cities in addressing green infrastructure shortfalls in the face of climate emergency adaptation and mitigation. The emergence of smart city topics is unsurprising given that it is a relatively recent field.

literature only includes English-language texts, and the most significant research in many countries is published in their own languages.

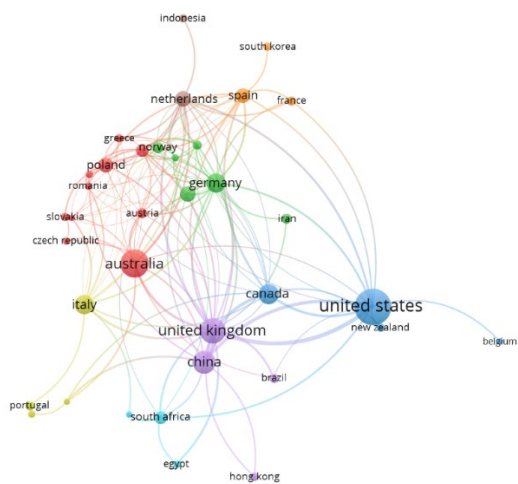


Figure 6 The Countries co-authorship network, showing which countries are most commonly represented in co-authoring relationships.

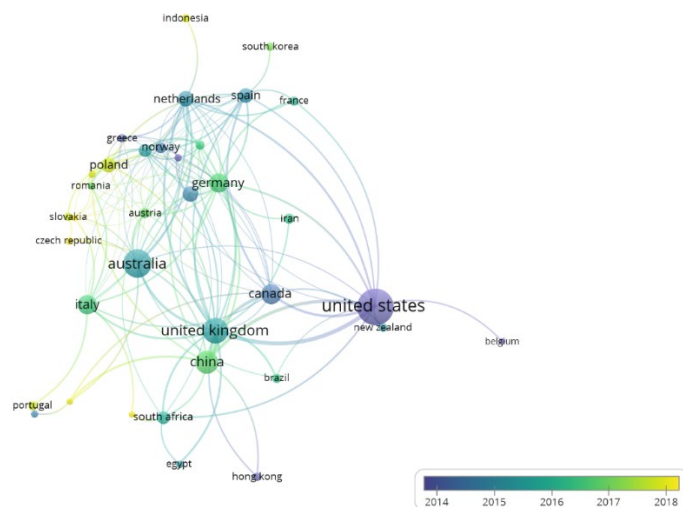


Figure 7 As the previous figure, with colours representing the timescale of co-authorship (more recent co-authorship connections between countries are represented in yellow).

The 1,591 research outputs were published in 794 different sources. A network visualization of these sources is provided in Figure 8, showing how closely the different sources are related to each other in terms of citations (e.g. how many times Journal A cites Journal B or vice-versa). The two most productive sources of infrastructure governance research are *Sustainability* (42 documents) and *Land Use Policy* (34 documents). These two sources also have the greatest influence in the field in terms of the total number of citations they received. *Cities* maintained its third position both in terms of the number of documents it produced (25) and the number of citations these documents received (247).

This analysis reveals that a high proportion of infrastructure governance literature is published in environmental sustainability and urban policy journals (Figure 8). This may reflect the growing prominence of green infrastructure and discussions of resilience. Nevertheless, again we can see that there is a strong representation within the literature of the connection between urban studies and sustainability. Given the political nature of infrastructure governance, there is also a notable lack among the most cited journals in terms of connections to political science and public administration literature, which may suggest a gap in socio-political contextualisation and political theorisation of infrastructure governance analysis.



Figure 8 The sources citation network, showing the most commonly cited sources/journals.

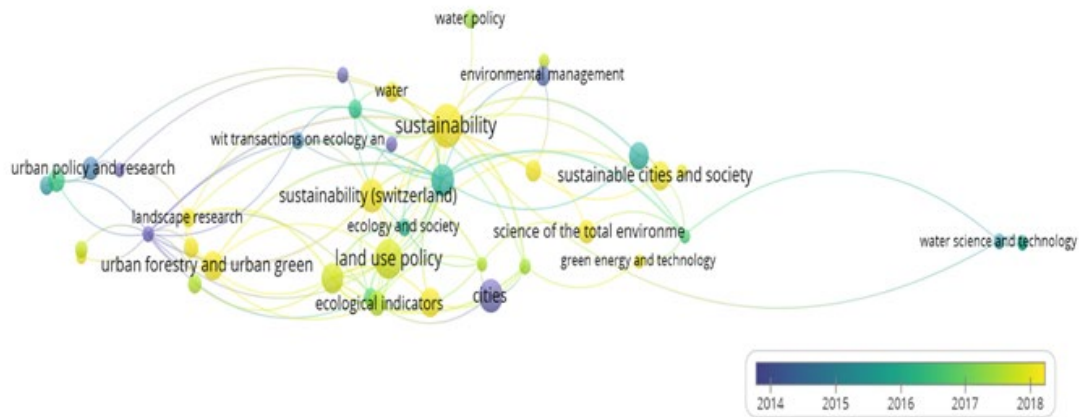


Figure 9 As the previous figure, with colours representing the timescale of citations (more recently cited journals are represented in yellow).

An overview of the core review library

This section provides an overview of the composition of the core review library (n=384). This more targeted sample of infrastructure governance literature was manually selected, appearing to have the highest relevance for commentary on infrastructure governance specifically. This literature was largely analysed in NVivo 12 Plus software, using methods described further in the *Methods of analysis* section. This overview covers the major themes within the literature, along with other topics such as time of publication, and the representation of select countries. More detail on the specific search terms used to derive the themes is available in Appendix A.

Figure 10 and Figure 11 show the frequency of all the identified themes coded throughout the core review library; respectively, by the papers that contain any reference to the theme, and by total unique references to the theme (see the *Methods of analysis* section for more information on these two forms of analysis). Both of these charts reveal that sustainability (or more broadly, environmental issues in the context of the climate crisis) stands out across every analysis as the most common theme throughout the infrastructure governance literature. The other major common themes are politics, integration, power, and infrastructure delivery/implementation, decision-making, funding and community participation. Knowledge and power have emerged as critical lenses in the last two decades following the influence of postmodern discourse theory.

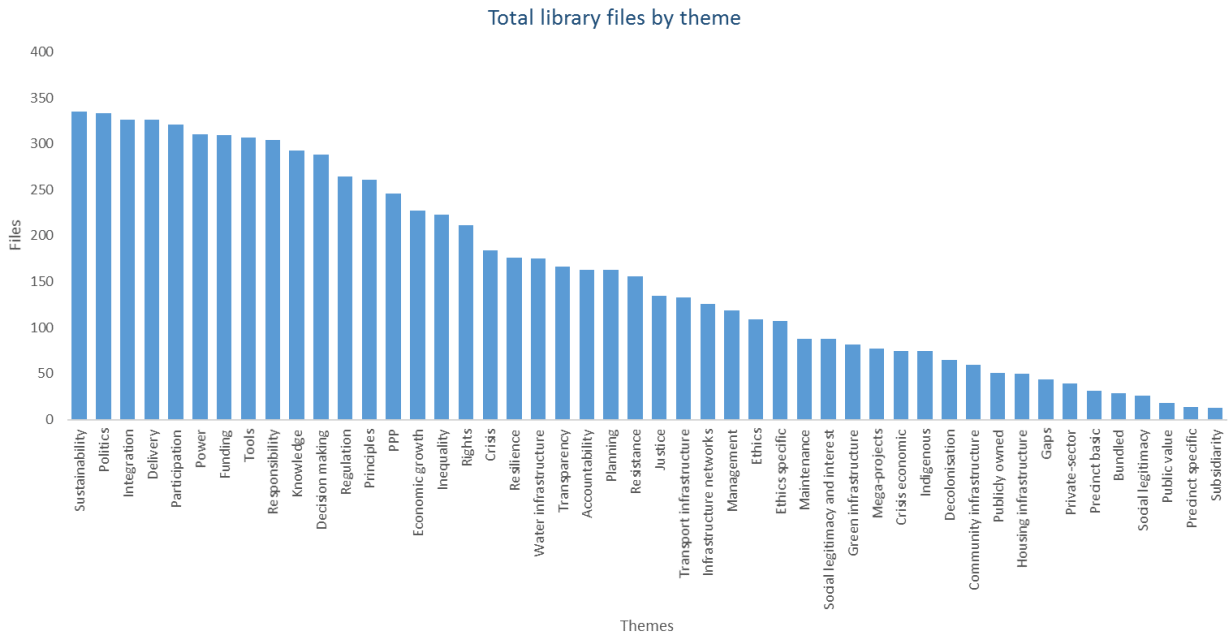


Figure 10 The themes coded across the core review library (n=384), by papers/files that contain any references to the themes.

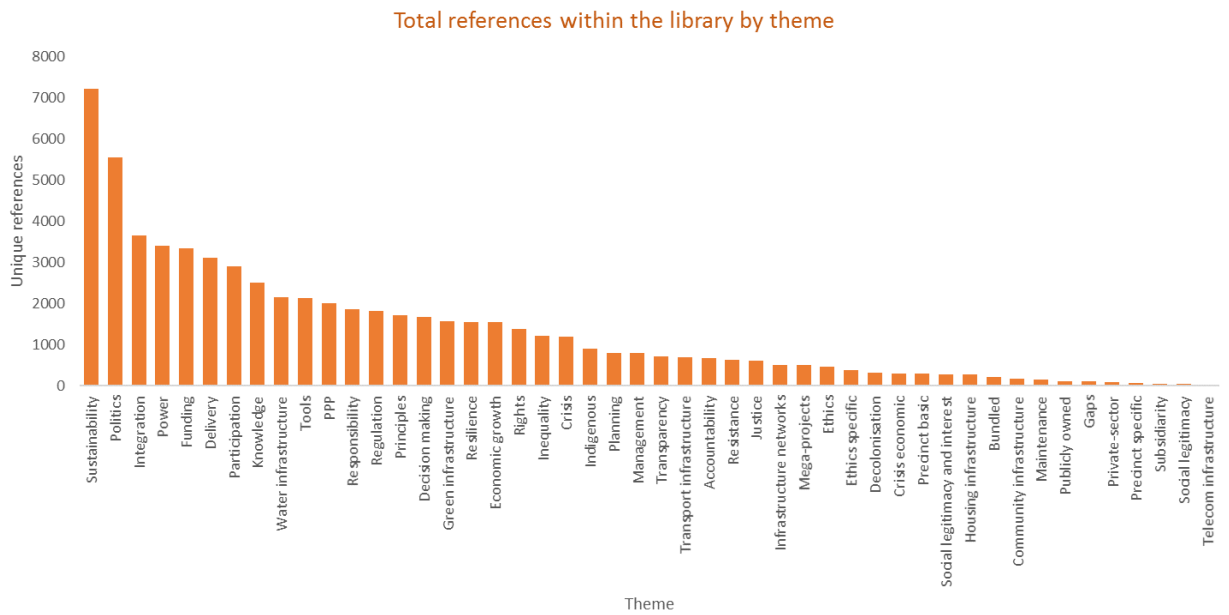


Figure 11 The coded themes across the core review library (n=384), by total unique references to the themes throughout the literature.

Looking at the year of publication, most of the reviewed literature on infrastructure governance was published from the early 2010s, with a notably larger wave of literature from 2017. While of course infrastructure governance in a broad sense has a long history within research, often implicit within fields such as urban planning and policy (Dodson, 2017), this analysis shows that more explicit references to infrastructure governance as a distinct idea are a relatively recent phenomenon of the past two decades, and growing. Additionally, a large range of countries are represented throughout the literature. Figure 13 shows only a select number of countries, but it suggests that Australia is reasonably well represented within the papers.

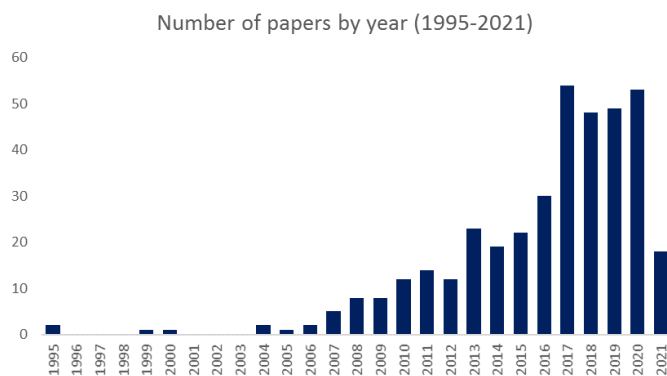


Figure 12 The number of papers within the core review library (n=384) by publication year.

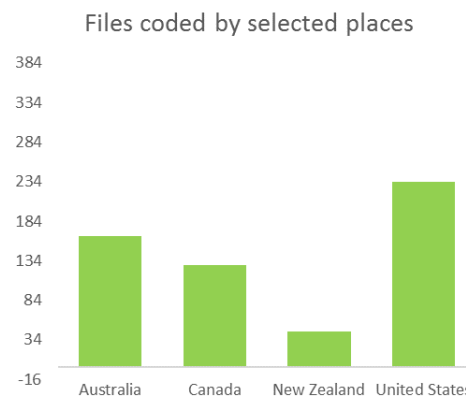


Figure 13 The number of papers that contain references to a selection of four countries.

In terms of the types of texts represented within the core view library, 70% are journal articles, with the other 30% comprising others such as books, book chapters, conference papers, and others (Figure 14). The top keywords of the core review library can be seen in Figure 15 and contrasted with those in the high-level library (Figure 4). There is similarly a high prevalence for keywords related to governance, climate change and sustainability, green infrastructure, urban planning and cities, and water governance. Notably different is the prevalence of public-private partnerships, and mega-projects, which will be explored further in *Chapter 3: Infrastructure governance ownership models*. This analysis only reflects 63% of the total core review library (due to the fact that 37% of the texts, such as books, book chapters, reports, and many of the journal articles published prior to 2010 do not contain official keywords), but 82% of the journal articles.

CORE REVIEW LIBRARY TEXTS BY TYPE

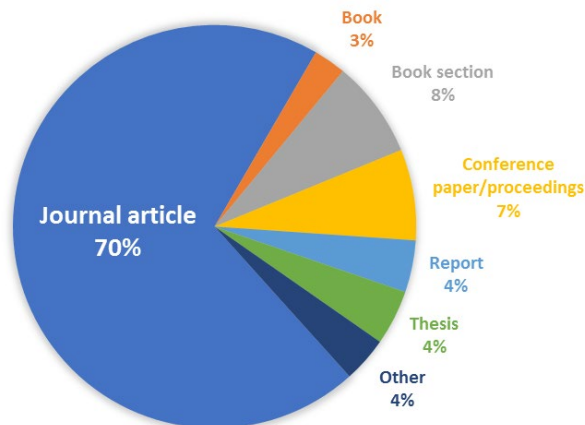


Figure 14 The proportions of journal articles and other types of papers within the core review library. 'Other' includes electronic and magazine articles, government documents, serials, and unpublished works.

Top 13 keywords (everything over 7)	Frequency
Governance / Urban governance	50
Infrastructure	48
Climate change adaptation	22
Green infrastructure	21
Urban planning	16
Public-private partnerships	14
Sustainability	11
Cities	9
Water management	8
Local government	7
China	7
Mega-projects	7
Resilience	7

Figure 15 The top 13 keywords (all with frequencies over 7) within the core review library. Some similar words such as governance and urban governance have been combined.

Chapter 2: Infrastructure governance on unceded land

Key points:

- The systematic literature review finds **little literature that explicitly and robustly discusses Indigenous roles in infrastructure governance, or places urban infrastructure governance in particular within the context of decolonisation or settler-colonialism**. This is a notable gap, especially in settler-colonial contexts such as Australia, that future research in the field should work to acknowledge and give critical attention to.
- While there is a growing amount of literature (still relatively small compared to many other topics) discussing existing Indigenous infrastructure governance models and their relationships with colonial systems in the context of urban infrastructure and planning more generally, **much of this existing literature on alternatives is poorly connected to the core infrastructure governance literature**.
- **Examples of First Nations' governance models** include traditional and joint-planning initiatives, Indigenous owned and managed infrastructure networks, precinct-based planning and investment approaches, and land governing networks.
- **Conceptual frameworks such as the OCAP framework** have been developed by First Nations and applied to infrastructure governance to guide robust approaches to Indigenous infrastructure sovereignty.
- Drawing from wider literature such as Indigenous studies and critical geography, there are a **wide range of examples of First Nations-led infrastructure governance models** internationally that can be brought more into infrastructure governance research and policy discourses in order to better understand alternatives.
- Indigenous community enablement requires a **deep epistemological shift within infrastructure governance research and policy discourse**, including acknowledgement of unceded land and ongoing settler-colonial impacts, and commitments to exploring and enabling alternatives.
- Researchers call for more **rights-based approaches** to infrastructure governance.

Indigenous governance within settler-colonial contexts

It is important in settler-colonial places to give attention to the way First Nations issues and interests are currently acknowledged, represented and discussed within infrastructure governance research. In Australia, infrastructures are debated, planned and delivered on unceded Aboriginal land.

There are critical political implications for how infrastructure is considered in relation to Indigenous land, futures, political power, and value distribution. For example, Indigenous ownership and control are noted as "vital to self-determination and local community resilience" (Beaton, Burnard, Linden, & O'Donnell, 2015, p. 111), as well as the capacity to maintain infrastructure networks, and derive benefits such as community employment and revenue.



Figure 16 A word cloud showing the most frequent words within the "Indigenous" theme.

How is Indigenous governance represented within the literature?

Roughly 19% of papers in the core review library (n=384) reference Indigenous themes, though half of these are very brief (Figure 17). Put another way, this means that 81% of the papers represented in this analysis make no mention at all.

When compared across all the analysed themes within the literature, Indigenous and decolonisation themes are both revealed to be infrequently represented, particularly when analysed as unique references across the literature (Figure 18 and Figure 19). However, decolonisation is much less common.

TOTAL FILES WITH ANY REFERENCES TO INDIGENOUS CODING

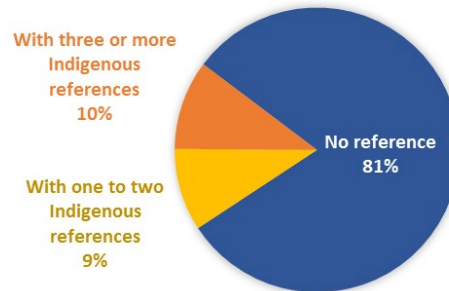


Figure 17 Papers with references to the Indigenous theme across the core review library.

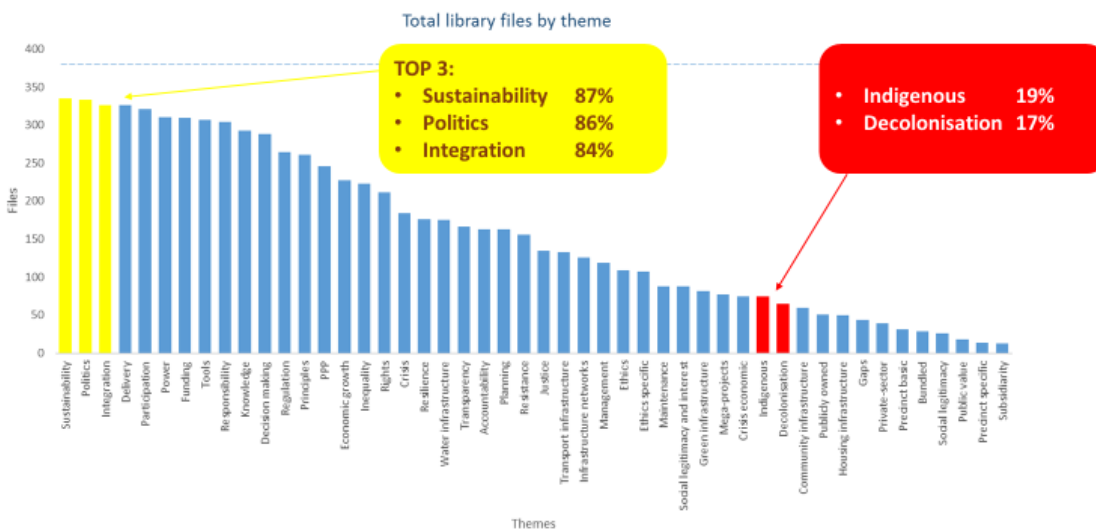


Figure 18 A graph showing the relative representation of the Indigenous and decolonisation codes within the core review library, going by unique files that involve the themes to some degree.

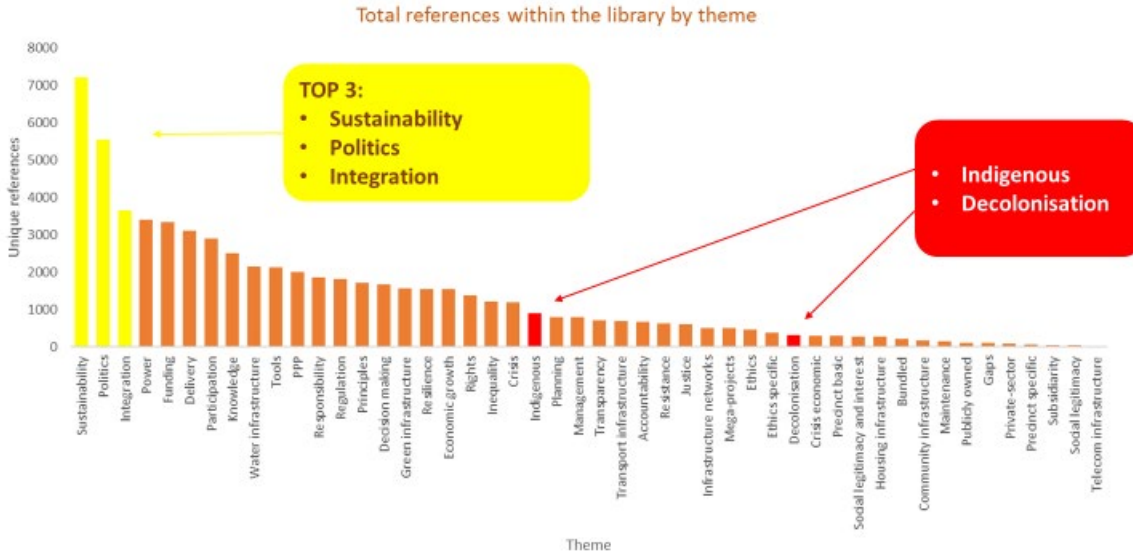


Figure 19 The relative representation of the Indigenous and decolonisation codes within the core review library, going by total references coded.

Decolonisation within the infrastructure governance literature

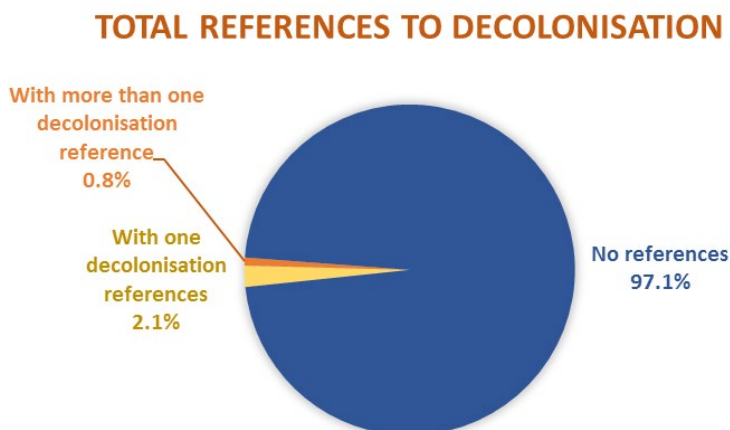


Figure 20 Files with references to the decolonisation theme across the core review library.

There are few papers in the core review library that make explicit reference to decolonisation (Figure 20). Of 11 total papers including the decolonisation theme, only three papers make more than one single reference.

Looking closely at these three papers that make more substantial references, they refer to decolonisation as a critical and future-oriented political project, calling for the decolonisation of existing systems, and furthering Indigenous rights and self-determination. Howard-Wagner (2018) emphasises the epistemological shifts to support Indigenous community enablement, acknowledging the colonising impacts of infrastructure approaches and instead decolonise the system. Gergan (2020) evokes decolonisation as a critique of Eurocentric and universalist approaches to infrastructure, instrumentalised as a regional strategy of geopolitical influence in India, revealing the displacement and intensified precarity of Indigenous communities. Hurl (2017) questions whether traditionally neoliberal mechanisms in infrastructure development might be co-opted to support Indigenous self-determination and alternative framings. In terms of strategies to enable decolonisation, these papers focus on:

- challenging and reframing notions of nation building, national interest and social citizenship to build a political commitment to Indigenous empowerment,
- working to rebuild the capacities (resources, funding, power) of local and community level governance, and
- more robust governance structures for forms of self-determination.

Aside from those three papers, several of the others that make brief references to decolonisation refer to it as a historical period, for example in post-colonial Africa (Larionova & Shelepov, 2016; Mhunduru, 2016; Otsuki, Read, & Zoomers, 2016).

There are no references to decolonisation (as a political project) within the core review library (n=384) texts identified within Australian contexts. There is certainly a rich and growing literature of case studies and theoretical work examining infrastructure governance through decolonial lenses in Australian scholarship, however this finding suggests that there is a poor engagement with this literature throughout Australian urban and regional infrastructure governance work to date. Similarly, this also suggests a major structural gap in the epistemologies of infrastructure governance discourses within settler-colonial states, failing to foreground the colonial contexts of infrastructures planned, debated, negotiated, developed and valued upon unceded First Nations land.

Examples of Indigenous-led infrastructure governance alternatives

When viewed in greater detail, most references to Indigenous and First Nations communities within the core review library are brief references without much substantial content, or discussions within contexts of activism and opposition against state-led infrastructure development. More substantial works include discussions of issues of housing tenure (Habibis, Phillips, Phibbs, & Verdouw, 2014), and other community development or policy reforms issues. In order to discuss Indigenous-led governance alternatives beyond inclusion or reform of existing systems, it is necessary to draw in literature from the broader research performed in the Incubator project, including literature from urban policy and Indigenous studies.

There are a range of examples both within Australia and internationally that demonstrate established and emerging ways First Nations peoples have gained forms of co-existing and sovereign authority, intersecting with state-led infrastructure governance and land-use planning. These forms go beyond inclusion within existing state-led processes, such as co-management agreements, infrastructure asset ownership, and sovereign planning approaches. These efforts are often marked by struggles and frustration against pervasive forms of resistance as formal settler-state systems may work to funnel demands for transformative recognition through procedural and consensus-based planning approaches (Porter & Barry, 2016).

First Nations-led and joint-planning initiatives

In Canada, the Tsleil-Waututh Nation use joint-planning initiatives and internal governance policies in metropolitan strategic land-use planning, and the Gitanyow Huwilp use their traditional planning approach to make plans for governing their lands (ibid).

Indigenous community owned and managed infrastructure

Indigenous communities have developed First Nations-owned and governed telecommunications infrastructure networks, such as Keewaytinook Mobile. This initiative directs benefits such as jobs and revenue back to local communities and develops community capacity through their governance sovereignty (Beaton et al., 2015).

Land governing networks

Infrastructure planning and development is intimately intertwined with colonial framings, understandings and legalities of land ownership and management – a core tension decolonisation works to unpack. McCreary and Turner (2018) describe the tensions over jurisdiction of land as central to infrastructure governance. In NSW, Australia, Aboriginal Land Councils (ALCs) comprise 120 legislated, self-funded governing bodies, managing portfolios of property and recovered lands. These ALCs pursue “priorities set by its members and reflecting local circumstances, capacity and resources [...] actively engaged in local development and planning, including in areas where significant public infrastructure projects are underway” (Norman, Apolonio, & Parker, 2021).

District-level housing approaches

District level housing approaches are emerging internationally that demonstrate ways First Nations epistemologies can underpin transformational forms of large-scale infrastructure delivery. For example, in Canada, a recent project (Señákw) is claimed to be the nation's largest First Nations economic housing development driven by First Nations communities as investors and partners (Ball, 2020). In Honolulu, Hawai'i, Indigenous principles such as aloha'āina, "a relationship of responsibility and respect between the land and its people" (Grandinetti, 2019, p. 1) are being used to demand regenerative approaches to public housing (Charles, 2020).

Indigenous infrastructure governance principles: The OCAP framework

Frameworks based on principles developed by First Nations people provide important guidance for how to consider the foundations of Indigenous community-centred infrastructure governance. The OCAP framework – based on the principles of ownership, control, access, and possession – is a theoretical framework developed by First Nations for application of self-determination to research (Schnarch, 2004) and later adopted nationally by Indigenous leaders in Canada (Beaton et al., 2015). While it was originally conceived by as a provocation related to research ethics, knowledge, and data (particularly in health disciplines), it has also been applied to Indigenous community-led infrastructure development, such as telecommunications and digital infrastructure (Beaton et al., 2015). These serve as broad ethical guidelines aimed at firmly establishing and recognising First Nations communities as sovereign, self-managed and principle actors in governance and knowledge, rather than as consulted subjects.

Indigenous rights and ethical frameworks

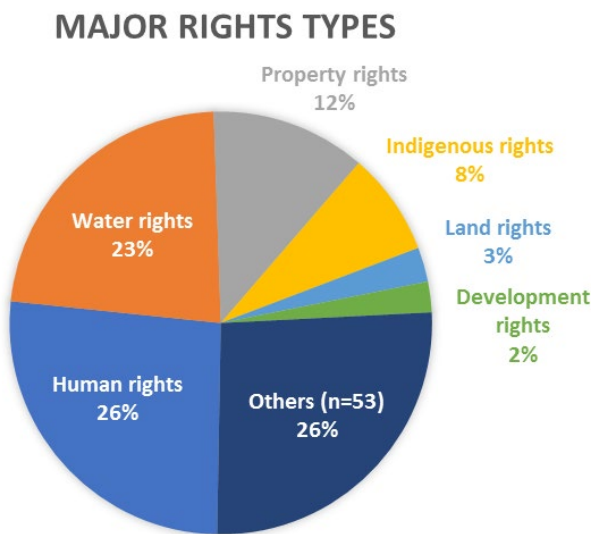


Figure 21 The major clusters of rights identified through NVivo Word Tree analysis of the word "rights". Of a total 2111 references, 1461 references were identified in clusters of 3 and above. Similar phrases were clustered together to produce this chart.

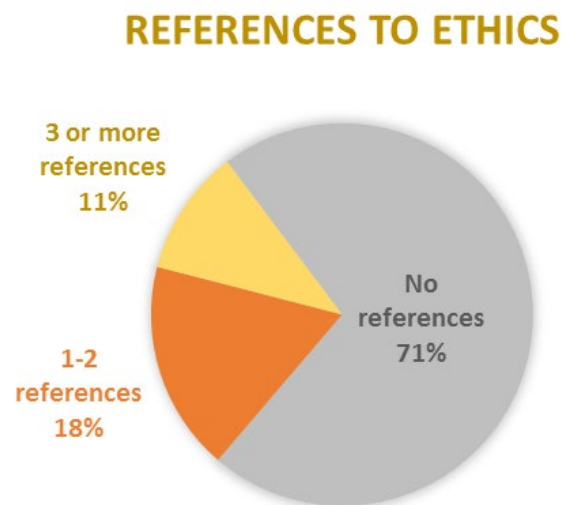


Figure 22 The proportion of papers that contain any reference to ethics.

In part due to the pervasive power imbalances in settler-colonial and colonial contexts, rights-based approaches to and conceptions of infrastructure governance have been identified as important in recognising and enabling more meaningful Indigenous participation and influence in infrastructure governance (Groenfeldt, 2013). Within the core review library, the two strongest thematic associations with the Indigenous theme are *politics* and *rights*. Broad references to rights are identified in some form across roughly half of the literature. Using word tree analysis, the most common references to

rights are in relation to human rights approaches, and water rights (both likely have some overlap with Indigenous rights) (Figure 21). Indigenous rights explicitly represent less than 10% of major references.

Similarly, references to ethical and moral themes in general are not strongly represented within the literature (Figure 22). Most of these references are brief, with the vast majority only representing one or two references within a given paper. Few papers deal with the topic substantially (Figure 23). However, the ethics and Indigenous themes are most strongly associated with each other.

Rights and ethics both arguably represent important gaps within infrastructure governance research and practice, neglecting more explicit and careful attention to the rights-basis and moral responsibilities of infrastructure mandates and planning. It is likely especially important that infrastructure fields and professions engage with moral frameworks and approaches as a way of prioritising decolonial approaches and strategies to infrastructure research and practice. Conversely, as First Nations' cultural frameworks tend to be strongly rooted in ethical relationship to land, ecology and people, greater priority and advancement of First Nations infrastructure governance approaches are likely to implicitly reinvigorate the ethical framings of infrastructure planning.



Figure 23 The number of references to ethics contained within the papers. By far, most papers only contain one reference.

Chapter 3: Infrastructure governance ownership models

Key points:

- **Public-private partnerships (PPPs) dominate discussions** within the literature, likely reflecting their international ubiquity as major infrastructure ownership models, as well as the tensions they raise as infrastructure approaches.
- **PPPs have strong associations with all infrastructure types** within the literature.
- **Alternative models of public ownership are much less represented**, including models of direct public provision and state-owned enterprises (SOEs).
- Critiques largely locate major urban and regional infrastructure failures within the **uneven relations between public and private sectors**, and more generally in **expanding private-sector influence** over, and privatisation of traditionally public assets and spaces
- **SOEs may represent a public alternative to PPPs.**

This chapter will focus on major infrastructure ownership models that dominate practice and academic discourse. In a highly multidisciplinary field with a "bewildering variety of institutional settings" (Cunningham & Kwakkel, 2009, p. 1) such as urban and regional infrastructure governance, it is challenging to be overly prescriptive about the distinctions between models and approaches. This chapter will focus on public-private partnerships (PPPs) in a broad sense as the most ubiquitous model of infrastructure ownership and procurement represented within the literature, contrasted with purely private or public models to provide some structure to discussions. While the OECD distinguishes between different forms of public models (such as pure public provision and public procurement) (OECD, 2015), this systematic review considers public provision broadly, in contrast to PPP arrangements.

Infrastructure ownership models and sectors

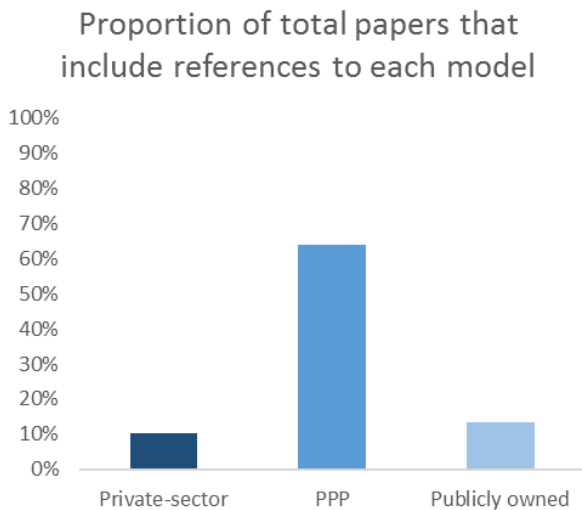


Figure 24 The proportion of all papers that include any reference to themes of infrastructure funding/ownership models.

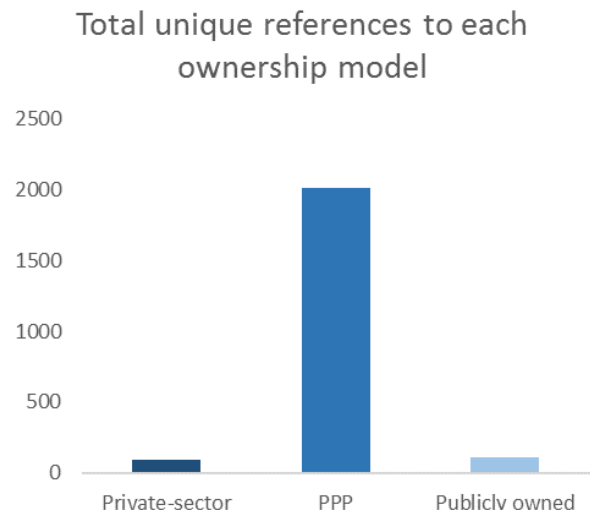


Figure 25 Themes of infrastructure funding/ownership models, by unique references to each theme across the literature.

Across the core review library (n=384), nearly 75% of the papers discuss public-private partnerships (PPPs), with both public and private-only models much less common (Figure 24). Looking at all unique references to the models, PPPs appear to dominate the literature even more (Figure 25). This is perhaps unsurprising given the ubiquity of PPPs as major or dominant models of particularly large-scale infrastructure delivery across many countries globally.

Infrastructure type, or sector

Looking at the infrastructure types or sectors represented within the core review library, water, transport and green infrastructure are the most commonly represented types within papers, with waste and telecom infrastructure the least common (Figure 26). By unique references to each type across all papers, water infrastructure is again the most highly represented, followed by green infrastructure (Figure 27). This may partly indicate the tendency to more commonly use "infrastructure" terms in relation to these sectors.

The references to each infrastructure sector include a diverse range of facilities and services, with overlap between the sectors not uncommon. For example, social or community infrastructure throughout the literature is used in reference to community organisations, services, and programs, health and education infrastructure (such as hospitals and schools), libraries and galleries (Easthope et al., 2020), sports facilities (Hurl, 2017), employment, green open spaces (Mees & Driessen, 2011), community banking services (Colombo et al., 2017), adequate affordable homes and arrangements suitable for work-from-home arrangements (Enright & Ward, 2021), welfare systems (Sage, Fussey, & Dainty, 2015), markets and retail (O'Brien, Pike, & Tomaney, 2019), and even transport infrastructure such as roads (Easthope et al., 2020). Infrastructure sectors are often evoked as broad categories without explicit description of which items are included. More information about the definitions of infrastructure types in this research is available in Appendix A.

Relating each infrastructure type to the different models reveals strong associations within the literature with PPPs across each sector (Figure 28). This also shows each infrastructure type is rarely discussed in relation to public or private ownership models.

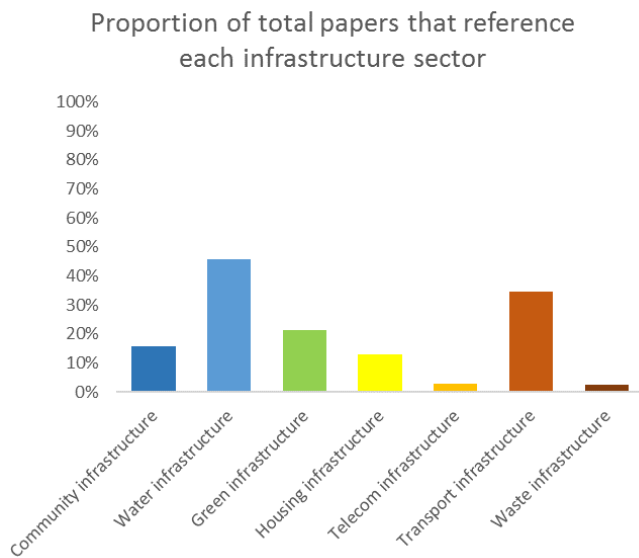


Figure 26 Infrastructure sector themes within the core review library, by the proportion of papers that include each theme.

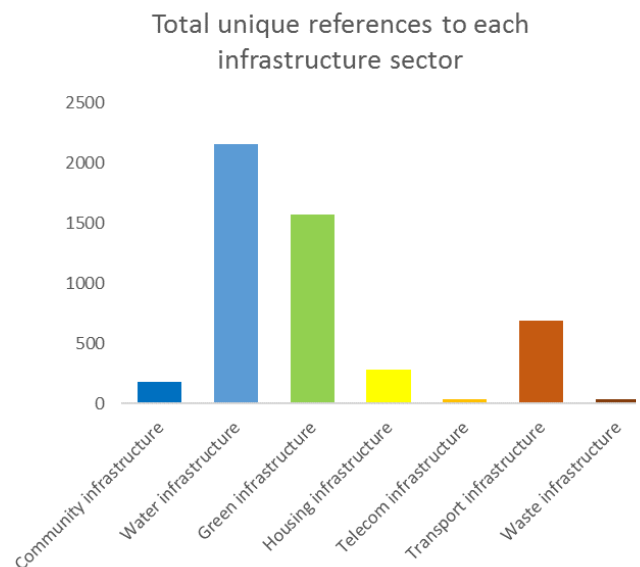


Figure 27 Infrastructure sector themes within the core review library, by number of unique references.

	Private-sector	PPP	Publicly owned
Community infrastructure	0%	12%	2%
Green infrastructure	0%	13%	0%
Housing infrastructure	0%	16%	0%
Telecom infrastructure	0%	9%	0%
Transport infrastructure	1%	17%	2%
Waste infrastructure	0%	10%	0%
Water infrastructure	0%	15%	1%

Figure 28 This matrix cross-tabulation analysis shows the thematic associations between infrastructure models and sectors within the core review library. The colours and data bars represent relatively higher (green) or lower (red) proportions.

Public-private partnerships, mega-projects, and neoliberal governance

Particularly over the past two decades, PPPs have expanded as a substantial model of project financing and delivery across most infrastructure sectors, with particular prevalence within transport and energy sectors (Quak, 2018). While many assessments regarding the effectiveness of PPP models in infrastructure delivery are mixed (Dolla & Laishram, 2020), PPPs are generally subject to a wide range of critiques within the literature.

Critiques largely locate major urban and regional infrastructure failures within the uneven relations between public and private sectors, and more generally in expanding private-sector influence over and privatisation of traditionally public assets and spaces (Bertolin, 2017; Tarazona Vento, 2017). Critiques include the effective transfer of major risks and costs from the market back to governments and publics (Bertolin, 2017), the lack of democratic accountability and private-sector practices of 'illusory transparency' (Valverde & Moore, 2019), political interference (van den Hurk & Verhoest, 2015), and the prioritisation of market interests over public interests (Searle & Legacy, 2021). PPPs are often seen as a "Faustian bargain" (Flinders, 2005; Zaato & Hudon, 2015, p. 28) for governments seeking cost efficiencies and remedies for public funding deficiencies, but coming with substantial trade-offs.

There is also a strong association between mega-project and PPPs within the literature. Examination of relevant texts revealed that most of the infrastructure network associations with PPPs are regarding privatised influence over the potential effectiveness of infrastructure networks, or potential conditions for effectiveness, such as the need for strong institutional arrangements (Bolt, 2011; Dolla & Laishram, 2020; Huck, Monstadt, Driessen, & Rudolph - Cleff, 2021; McLean, 2018; Musonda, 2018). While there are no universal definitions of mega-projects within the literature, they are seen to be large-scale infrastructure projects that involve the wholesale transformation of significant urban space (Lehrer & Laidley, 2008). Mega-projects within critical urban studies literature are associated with the advancement of global neoliberalism, an erosion of public planning capacity, and the post-political de-politicisation of the public sphere (Tarazona Vento, 2017).

Due to their common implementation via PPPs, they are criticised for their lack of transparency and democratic control (Harris, 2017), and technocratic and populist approaches that generate a politics of consensus, dismissing the role of ideology in infrastructure planning and strategy (Jessop, 2002; Keil, 2002). A prioritisation of business interests such as flexibility and profit can distort and manipulate public aspects of governance, and drive significant wealth extraction from public spheres (Harris, 2017). For example, in the case of the mega-project-led urban renewal of Valencia in Spain, despite overall significant urban transformation under the rationality of urban competitiveness, promised wider economic and social wealth distribution didn't materialise. Furthermore, inequality grew as public funds were diverted from welfare sectors such as health and education, and only the construction, property, and tourism sectors grew in influence (Tarazona Vento, 2017).

Public alternatives for mega-projects: State-owned enterprises (SOEs) and direct public provision

The wide ranging and structural critiques against market-led models of governance such as PPPs and private-sector led mega-projects suggest there is value in seeking strong public-led alternatives that can maintain control over infrastructure and better align their planning and delivery with public interests. State-owned enterprises (SOEs) are a potential alternative model of public ownership. SOEs are infrastructure governance models that range from involving purely public ownership to more mixed forms, such as involving public limited companies. SOEs are associated with stronger public control and accountability, greater capacity for maintenance, lower transaction costs without complex contracting, and generating more equitable outcomes (Baldwin, Cave, & Lodge, 2012; Christensen & Greve, 2018). While SOEs were the norm for infrastructure governance in Europe throughout the mid-twentieth century, they were increasingly replaced by PPP models throughout the neoliberal era. SOEs are distinct from direct public provision which uses public procurement for construction and maintenance.

Denmark stands out in the European context for avoiding the domination of the PPP model and instead pursuing a modern SOE model, particularly for large-scale transport infrastructure (Christensen & Greve, 2018). It is arguably their relatively strong and efficient economy at a critical historical juncture that likely reduced the need to seek private-sector financing. Instead, state agencies deliver and fund infrastructure through state guaranteed loans and user charges, but contract out construction. Christensen and Greve (2018) argue that SOEs created a path dependency that locked out any emergence of PPPs as stakeholders developed vested interests and interdependencies on the SOE model.

Chapter 4: Infrastructure governance in times of crisis

Key points:

- **Diverse crises** are discussed throughout the literature: COVID crisis, economic crisis, climate crisis (incl. adaptation/resilience crisis), local infrastructure crisis (financial sustainability), political crisis (often rhetorical/politically tactical).
- **Economic/financial crisis is by far the major type of crisis** referenced throughout the literature.
- Crisis is often understood as a temporary shock or substantial contextual factor in infrastructure matters, but **rarely conceptualised as an ongoing and frequently recurring context** for understanding modes of infrastructure governance.
- Critical infrastructure approaches must endeavour to not simply recover from crises, but also **reflect on the causes of crisis** where they relate to infrastructure governance in order to avoid repeating patterns.
- The reality of ongoing crises **necessitates new embedded approaches to contingency planning** whereby crises and shocks are assumed and accounted for in infrastructure planning.

Multiple ongoing crises and shocks: Understanding governance challenges and responsibilities

In the continued wake of the COVID-19 pandemic, the context of crisis and questions regarding the opportunities and constraints it provides for infrastructure planning and delivery find a particular public prominence. The 2020/2021 pandemic is only the latest global shock, likely to be joined by other overlapping and potentially cascading forms of crisis at global, regional and local levels, particularly as the impacts of the climate emergency advance. Additionally, these notable sudden shocks sit within, and are inextricably entangled with multiple pre-existing and often intensifying crises, such as the wider transforming impacts of the global climate crisis, economic inequality, and the ongoing impacts of colonialism.

While public policy and social advocacy aims to orient action towards mitigating or overcoming these challenges, we face a long-term reality inextricably marked and defined by multiple interconnected crises. It is therefore critical to develop better understandings of crisis contexts and their impacts on urban and regional infrastructure governance in order to transform our approaches to governance in times of crisis. The pandemic offers an exceptional opportunity for public reflection on the interconnected nature of multiple social, economic, environmental, and ethical crises.

Beyond reaction: Transforming the roots of crises

Understandings of crisis impacts and governance shortfalls in addressing them must also be complemented by deep public reflection on the structures, actions, dynamics and relationships that led to and exacerbated current conditions. Consideration of factors that have worked to produce social and economic vulnerabilities provide critical lessons for redesigning our infrastructure governance approaches. This also involves recognition that any "crisis" is at least in part a socio-political construction, relative to different contexts and perspectives, and sometimes masking fundamental historical failures of provision and action.

"What we are experiencing as a "crisis" is a manifestation of weak, bad, or ignored ethical principles" (Groenfeldt, 2013) pg x (in "Water Ethics")

Most common crisis word clusters

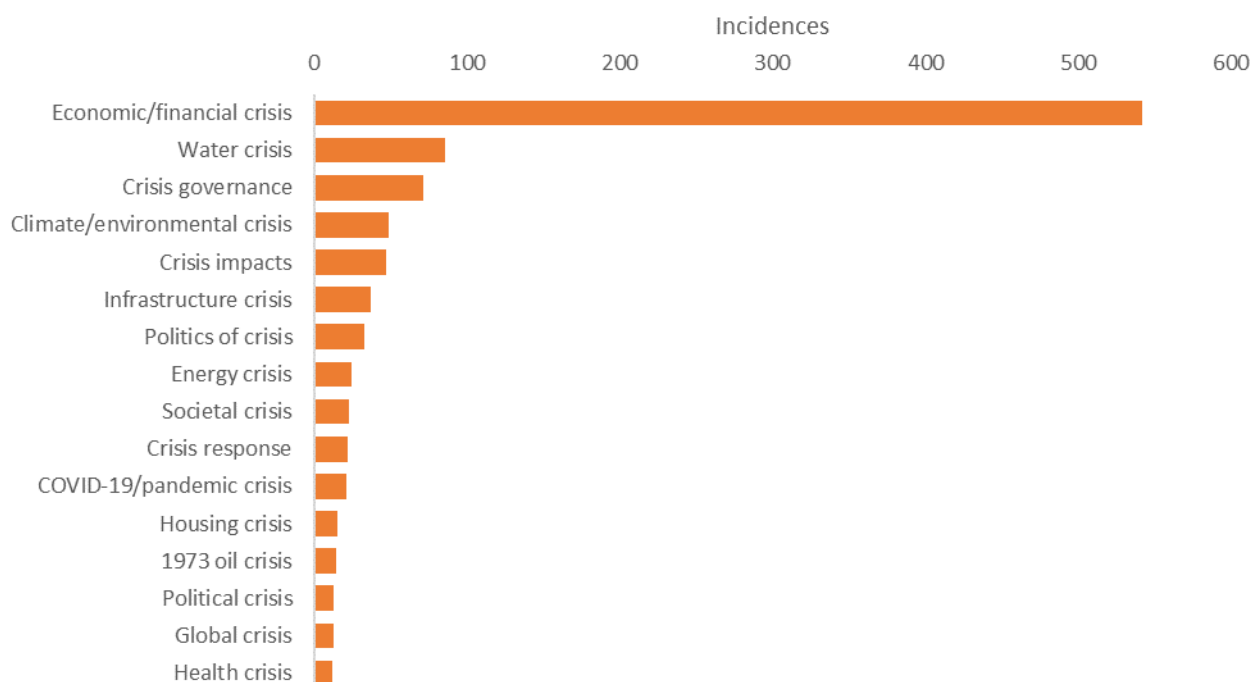


Figure 29 The most common phrase clusters across the core review library in relation to "crisis" or "crises" references. "Before", "during" and "after" crisis clusters have been removed from this chart.

Though there are diverse references to crises throughout the literature, by far the most common is in relation to economic and financial crisis. The most common crisis event mentioned is the 2008 Global Financial Crisis (GFC). This is understandable given the relatively recent and substantial impacts the GFC had on urban development, and in particular on major infrastructure projects globally (Somoza Medina, 2016).

Prominent issues of governance fragmentation during crisis: Integration, risk, and democracy

Governments frequently turn to major infrastructure projects such as transport infrastructure (roads, rail, airports, and so on) in the wake of major economic crises, seeking to spur economic development and gain political capital (Rodríguez-Pose, Crescenzi, & Di Cataldo, 2018). Without careful and sufficient planning beforehand, crisis situations can lead to critical shortcomings in decision-making. Crisis can offer opportunities as 'break points' helping to overcome intransigence and set in new courses of management (Wyeth, 2016). However, in 'crisis driven decision-making' contexts, governments often seek rapid and political shifts in infrastructure delivery, prioritising new supply over strategic management, maintenance or upgrades of existing assets, or more incremental approaches (Caball & Malekpour, 2019).

Existing rules, standards and frameworks may be overturned or subverted as governments seek to take strong actions, and emergency contexts better enable governments direct connections to major legal tools (Legacy, 2017). Crises, whether real or rhetorically manufactured, are sometimes used as political pretence for governments to legitimate interventions and restrict democratic rights through narratives of fear and emergency (Jhagroe & Frantzeskaki, 2016; Legacy, 2017). Jhagroe and Frantzeskaki (2015) shows how the Dutch government used the Crisis and Recovery Act to frame infrastructure problems and advance neoliberal changes within legal structures that suppressed community opportunities in planning. Crises and claims to crisis can be as "entry point for both conservative and progressive forces" (Jhagroe & Frantzeskaki, 2016, p. 361).

The ongoing and overlapping crisis contexts tend to generate greater imperatives for interconnected and networked infrastructures that provide key forms of resilience and adaptive capacities. As such, there is a growing need to improve

governance capacities for fostering infrastructure resilience, and integrated governance that better enable sound action during times of uncertainty (Huck et al., 2021). However, there are still critical gaps within the literature and practice understandings regarding how to approach these kinds of cross-sectoral and multiscale governance integration, especially given existing fragmentation of authority. Particularly in times of crisis, city and local authorities are limited by their dependence on wider public and private actors within highly decentralised and fragmented governance contexts (Huck et al., 2021).

Overcoming "business as usual" to seek effective radical shifts: Preventative, pro-active approaches

To meaningfully mitigate and adapt to crises such as climate change in infrastructure governance, it is critical to confront the tension between necessary radical shifts, and practical solutions (Konvitz, 2016). The kinds of incremental urban changes often pursued under 'politically palatable' governance rationalities will in many cases be inadequate for the scale of transformation required. Radical reforms, while necessary, are more likely to be resisted and challenged by communities and powerful interest groups, as well as often being expensive, resource intensive, and requiring high degrees of coordination and negotiation across governance jurisdictions. These kinds of transformative approaches often have strong public interest advantages across the long-term in terms of reducing inequalities, mitigating future disasters, and building urban and regional resilience, the political and practical challenges represented by radical shifts are still likely to meet substantial resistance by many current policy regimes. The reality of this resistance and governance fragmentation must be acknowledged when considering how to foster effective and strategic infrastructure planning and delivery within the new norms of crisis.

Common government reactions (Konvitz, 2016) when overwhelmed by capacity or partisan political conflict in times of crisis are to:

- turn to market provision
- share risks and costs
- regulate (at the expense of more substantial policy reforms)
- downplay the risk ("pretend it won't happen")

These approaches can all in various ways represent forms of politically "kicking the can down the road" when they represent the evasion of more substantial commitments, such as addressing major funding shortfalls (e.g. via taxation), or working to pass comprehensive laws with more transformative social and economic impacts. Market dynamics (whether for-profit sectors, or individual or community behaviours and demands) are typically not conducive to the kinds of collective planning necessary in contexts of complexity, interconnection and crises such as climate change or global pandemics (Konvitz, 2016).

Planning under and for conditions of uncertainty: Renewing contingency planning

As risks and the potential for sudden shocks increase and intensify, multiscale interconnectivity and the complexity of potential impacts can easily overwhelm government capacities (Konvitz, 2016). Path dependencies and legacy issues such as existing policies and historical investment decisions can create significant conflicts for introducing new policies and approaches in response to crisis conditions. These conditions of uncertainty and overwhelmed capacity can therefore easily breed caution, policy procrastination, failure, or 'under-shooting' (aiming low at the expense of sound long-term infrastructure planning) (Konvitz, 2016).

To avoid overwhelmed capacity, the literature emphasises the importance of pre-existing contingency planning in advance of the onset of crisis situations (Caball & Malekpour, 2019; Haasnoot, Kwakkel, Walker, & ter Maat, 2013; Kwadijk et al., 2010). For example, Huck et al. (2021) call for the explicit establishment of procedures and policies in order to set out guidance for authorities ahead of shocks. Far from being an irrelevant consideration in the wake of the climate crisis and the COVID-19 pandemic, this approach finds renewed relevance in this emerging context of multiple interconnected crises (environmental, economic, and health just to name a few). The pandemic may provide a substantial

opportunity for renewed social legitimacy and public attention to the need for this approach. The assumption and anticipation of various ongoing and sudden-onset crises must become an integral and sophisticated part of infrastructure planning processes.

Public-oriented and pro-active infrastructure planning ahead of crises

A range of approaches are associated with a more pro-active approach to public planning within the "new normal" of crises:

- **Recognising, understanding, and acknowledging the scale of problem.** If the long-term realities and consequences are not publicly acknowledged within policy discourse, it is challenging (or impossible) for infrastructure strategies to plan for the problem.
- **Commitments to adaptation and resilience, and future visioning.** This centres on infrastructure planning and its connection to a comprehensive political vision. When infrastructure delivery is disconnected from this, one of the major public avenues for accountability and scrutiny in evaluating infrastructure decisions are subverted.
- **Shifting investment:** This not only involves substantially scrutinising and shifting key forms of investment and funding to enable strategically defined infrastructure priorities, but also the various forms of capacity to effectively fund infrastructure plans. Addressing the barriers and gaps between infrastructure planning and the capacity to access and deploy investment is a key to enabling integrated
- **Use existing knowledge better:** Crises and disasters necessarily spur a great deal of public questioning, as well as demands for accountability and the articulation of renewed future visions, which incentivises investments in new research, reports, and enquiries. While useful, this can divert critical attention away from existing sources of knowledge that had been neglected or repressed.

This can also encompass forms of subsidiarity (J. George, 2018), whereby public policy action capacity (such as responsibility, decision-making powers, and funding) are decentralised to the most appropriate level of government closest to the level the decisions most effects to enable effective implementation and accountability. This may involve formal government scales, or forms of community-based governance. Whereas subsidiarity is partially formalised within some international cases such as the European Union and the UK (J. George, 2018), Australia's engagement with this approach is less advanced.

Chapter 5: Infrastructure planning

Key points:

- **Integration is a the most prevalent theme across the literature and multiple infrastructure sectors.** These references involve diverse forms of integration, including cross-sector integration (e.g. transport and land-use), strategic planning/policy integration, organisational/stakeholder collaboration, internal public administration integration (multi-level governance, vertical and horizontal integration, etc).
- A **substantial literature concerning integration is narrowly focused** on effective public administration, without critical attention to the wider social goals of infrastructure delivery and its public mandates, such as social equity and equity.
- In terms of the sectoral presence, **water** (with links to both intrasectoral and intersectoral integration issues) and **transport** (which explicit links to land-use) are the dominant sectors discussed throughout the major infrastructure planning literature.
- One **key to planning integration** is the effective coupling of decision-making and strategy-making powers with urban planning responsibility, political power, and capacities such as funding.
- There are **strong links made between infrastructure planning and environmental transformation goals**, however **wider social goals** focused on structural inequality and forms of justice **receive less attention**. **Greater community-driven infrastructure planning** and **Green New Deal approaches** are proposed as ways of integrating these policy aims of sustainability and socio-economic equality.

Infrastructure planning within the literature

TOTAL FILES WITH REFERENCES TO INFRASTRUCTURE PLANNING IN LIBRARY

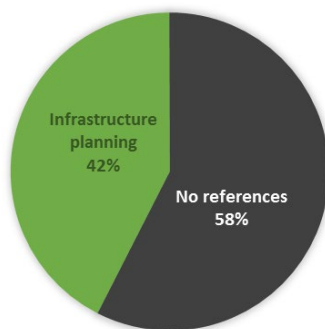


Figure 30 The proportion of papers in the library that reference infrastructure planning or strategic planning.

Infrastructure planning is a challenging theme to capture through the particular analyses used, as planning may often be implied in diverse, and less explicit ways within the literature. With this in mind, the analysis suggests that infrastructure planning (including strategic planning) are explicitly referenced by over 40 percent of the papers in the core review library (n=384).

Fractured governance and planning gaps

Urban and regional infrastructure planning approaches have in many cases shifted dramatically away from universal or comprehensive supply-driven urban planning models towards more piecemeal and demand-driven approaches heavily reliant on the private sector (S. Graham & Marvin, 2001; McLean, 2018). Increasing private-sector roles and influence in infrastructure delivery have contributed to an uncoupling of infrastructure planning and delivery from the societal objectives that were once the primary responsibility of the state to provide (O'Neill, 2010). Infrastructure 'projectification' is also associated with creating governance gaps, as strategic links with and between projects and other developments are weakened or lost (Book, Eskilsson, & Khan, 2010). These fragmented infrastructure governance

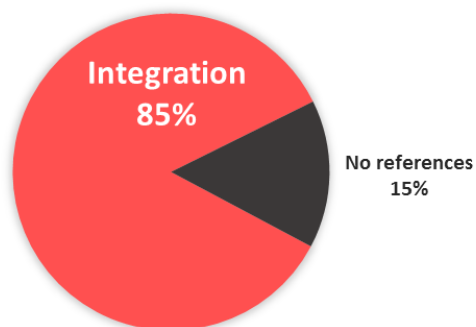
contexts are familiar in the Australian context, where state-level responsibilities are often mismatched with federal-level powers, creating complex tensions around the state's role in welfare and infrastructure provision.

Stockholm offers a useful comparative case to the Australian experience, as it has developed “a unitary networked city with municipal responsibilities for network service provisions and for planning and welfare based upon a tradition of administrative decentralisation” (Rutherford, 2008, pp. 1871-1872).

Integrated infrastructure planning and implementation is seen as a key goal across infrastructure sectors in order to effectively meet growing complex social needs. In particular, advocates argue for a shifts from more ad hoc, technical solution driven approaches towards more integrated, strategic-centred planning approaches (Arts, Hanekamp, Linssen, & Snippe, 2016a). However, within contexts of fragmented governance, integration often remains elusive or partial, as well as poorly understood (McLean, 2018).

Integrated infrastructure planning in the literature

TOTAL FILES WITH REFERENCES TO INTEGRATION IN LIBRARY



Integration is one of the most common themes throughout the literature. It is represented across most papers, but also highly represented by unique references. It is a diverse theme, represented highly across sectoral types.

Within the core review library (n=384), as seen in Figure 32, integration is most strongly associated with integrated water management, and integrated transport planning, particularly in terms of transport and land-use integration.

Integration's prevalence throughout the literature is likely due to its high desirability across infrastructure and urban planning and policy issues, but also due to decades of governance fragmentation in various forms.

Figure 31 The proportion of papers in the core review library that reference integration and integrated planning.

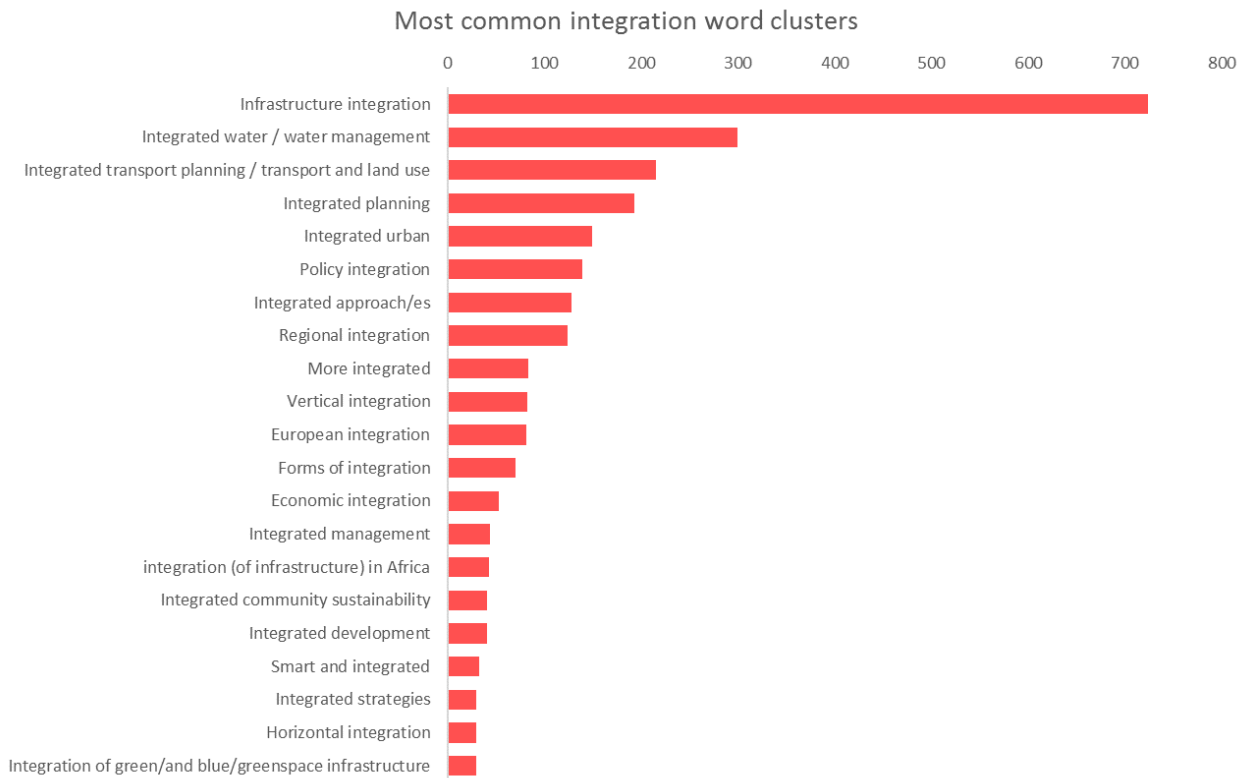


Figure 32 The most common integration word clusters, derived from NVivo Word Tree analysis (with highly similar terms combined).

Diverse definitions and typologies of integration

There are vastly diverse conceptions of what integration means throughout the literature. Figure 33 serves as an illustration of the diversity of ways integration is evoked throughout the literature, including dozens of areas or forms of integration from vertical and horizontal integration, knowledge integration, social integration, to multimodal integration. Many infrastructure sectors such as urban water and energy often focus on the integration of newer distributed technologies, practices, and infrastructure at smaller, local scales into existing systems that have traditionally been more centralised (Quesnel, Ajami, & Wyss, 2017). The use of the term integration without clear articulation of meanings and goals can disguise policy intentions. Meanings in practice are often vague, narrow or cynical when articulated, and are likely dependent on the socio-political context of the city (McLean, 2018).

Some papers define integration in broad terms of shared goals, as “a concern with the whole, agreement on common outcomes, and a commitment to actions and targets to achieve these outcomes” (Westerman, 1998, p. 3). Similarly, in critically evaluating practical understandings of infrastructure integration, McLean (2018, p. 43) sees it as “the bringing together of technologies, actors or organisational structures (whether through changes in governance, operational practices or forms of service provision) at a variety of scales and forms that can lead to more sustainable, economic and resource-efficient infrastructure networks”. Geerlings and Stead (2003, p. 445) consider policy integration in terms of working beyond conceptual or functional jurisdictions, referring to it as “the management of cross-cutting issues in policymaking that transcend the boundaries of established policy fields”. Institutional integration specifically is viewed as an advancement from coordination, wherein separate agencies or functions are directed from a central authority but may pursue different outcomes (Curtis & James, 2004). Integration by contrast is described as involving linkages between players or functions, and may not require a central coordinating authority.

Areas of integration		References	References
Infrastructure integration	784	Market integration	10
Planning and policy integration	168	Political integration	9
Regional integration	124	Integration of technology	9
Vertical and horizontal integration	116	Evolutionary integration	8
European integration	81	Urban integration	8
Economic integration	67	Municipal integration	8
Integrated community sustainability	41	Institutional integration	7
Integrated development	41	Integrated with land use	7
Integration of green/blue infrastructure	30	Environmental policy integration	6
Renewable energy integration	29	Fare integration	6
Systemic/systems integration	24	Operational integration	6
Organisational integration	23	Project integration	6
Sectoral integration	20	Integration of spaces / spatial	6
Spatial integration	20	Building integrated	6
Service integration	20	Integration of housing infrastructure	6
Social integration	18	Integration in practice	5
Knowledge integration	17	Cross-sectoral integration	4
Integration of land use	17	Hierarchical integration	4
Network integration	17	Immediate and long-term integration	4
Multimodel integration	12	Convex integration	4
Data integration	10	Upstream operation integration	4

Figure 33 A list of clustered integration terms derived from an NVivo Word Tree analysis of "integration" and "integrated", organised under headings. The full list of terms can be seen in Appendix D.

Frameworks for understanding dimensions of integration

There are a multitude of different frameworks for understanding and categorising infrastructure governance integration, and integrated plans, policies, approaches and sectors, typically discussed within sectoral silos (Alexandra & Norman, 2020; Guthrie, De Silva, & Furlong, 2017; McLean, 2018; van de Meene, Bettini, & Head, 2020). McLean (2018) for example identifies three forms of infrastructure integration based on the circumstances and motivations from which integration arises:

- Evolutionary integration, arising from daily operational necessities
- Innovation integration, arising from the city's inherent innovative operational practices, and
- Aspiring strategic integration, whereby public authority goals to shift investment are limited by private-sector involvement

Arts et al. (2016a) distinguished between six dimensions of infrastructure that conceptually guide the focus of integration efforts, particularly regarding transport and land use. There are the spatial, network, time, value, institutional, and implementation dimensions, which all require different aspects of integration, and thus implicate different governance concerns. They elaborate on different key aspects to implementing integrated approaches:

- Inclusive approaches, which focus on place connection and liveability from the start of planning, capable of delivering spatial quality at an area level.
- Area-based approaches, which can be successful at linking actors and scales beyond project silos.
- Accounting for scale issues, particularly important for network infrastructure that operates at and impacts both local and regional scales
- Supporting linkages between dimensions, particularly in terms of coordinating spatial development so as to develop tailor-made local solutions.

Common barriers to integration

Despite the ubiquitous aims of integration, it is a character of infrastructure planning that often remains elusive. As integration is a vast and broadly-defined policy aim, there are many noted challenges to integration. Arts et al. (2016a) notes that integration issues can arise from challenging ownership issues. There are often legal and regulatory separation of different infrastructure types (such as water and energy utilities). There are also political barriers to integration, including the issue of infrastructure decision-making capacity sometimes located within authorities beyond local and regional scales, exacerbating disconnects between infrastructure decisions, social legitimacy, and long-term effectiveness. Centred in a siloed approach to expertise and management, there are often beliefs in government that the separation of infrastructure sectors facilitates a focus (engineering and financial) on the specific needs of that infrastructure (McLean, 2018).

Problems with the evaluation of infrastructure are often barriers to integration. Poor infrastructure evaluation approaches can reduce or misdirect necessary funding, creating gaps between determined needs and expenditure (G. George, Baker, Tracey, & Joshi, 2019). Similarly, inappropriate performance measures can disadvantage more effective and locally-appropriate forms of infrastructure, leading to the implementation of less appropriate projects, and potentially long-term lock-in. Similarly, poor quality decision-making processes without strategic planning approaches, and a lack of effective public scrutiny and social mandate can result in large wastes of public infrastructure investment and lost opportunities over the long-term. Makarewicz, Adkins, Frei, and Wennink (2018) also notes that a political and institutional barrier to action to seek structural change is the deeply normalised sense among local and regional authorities that the power to advocate for change exists at higher scales of government. A major barrier to integration noted within the literature is the challenge of path dependencies, including legacies of poor information that work against policy changes (Schuch, Serrao-Neumann, Morgan, & Low Choy, 2017).

Attention to the social goals of infrastructure planning

Integration between infrastructure and place contexts are key to fostering social legitimacy and crucial for delivering more sustainable and resilient outcomes (Arts et al., 2016a). While the promises of successful integration are great, one of the central keys to infrastructural integration appears to be aligning and making transparent the goals and visions around what integration is aiming to achieve (Alexandra, 2017; McLean, 2018; Zonneveld & Spaans, 2014).

In terms of the policy goals associated with infrastructure planning, it is evident within the literature that there is a strong link between infrastructure planning and the major environmental challenges of our time (sustainability, climate change, and resilience) (Arts et al., 2016a; Gürdür Broo et al., 2021; Schuch et al., 2017). This pattern is supported by the strong prominence of sustainability themes throughout the literature, as well as analysis of the literature keywords categorised by policy aims (Figure 34). While this reflects a strong orientation towards planning for the climate crisis within the literature, and to varying degrees within policy spheres, it is clear that governments internationally still often fall worryingly short of clarifying and integrating these policy aims comprehensively through infrastructure planning and delivery, as well as other realms. Australia's transport sector is an illustrative example, with federal and state governments still investing significant funding in road-based mega projects and car parking projects at the expense of more sustainable alternatives emphasised through strategic processes (Houghton & McManus, 2019; Legacy, Curtis, & Scheurer, 2017; Pittman, Legacy, Stone, & Clements, 2019; Searle & Legacy, 2021; Terrill, 2020).

Top 5 policy aims	Frequency
Climate change adaptation	22
Resilience/adaptation	15
Urban regeneration/renewal	6
Urban development	5
Accessibility	4

Figure 34 The top 5 policy aims derived from keyword analysis of the literature.

Though still substantial, there is relatively little attention throughout the literature to the aims of overcoming structural inequality and justice. Figure 35 and Figure 36 respectively show the proportion of papers that include the themes of sustainability, inequality, and justice, and the total references to each theme. More detailed review of the inequality theme indicates that both spatial and income inequalities are the most highly referenced. Regarding the justice theme, it is mostly referenced in terms of environmental and climate justice, with social justice explicitly around a third as common. This helps illustrate the depth of attention within the literature given to sustainability goals. While there is likely a great deal of overlap inherent in the various notions of climate justice, social inequalities appear to receive less explicit attention. This disjunct is notable within Australian infrastructure governance contexts (Dong, 2009). Other inequalities such as gender and race are referenced infrequently. This potential gap requires closer attention.

Using an illustrative example within the transport sector, prioritising transport infrastructure projects usually focuses on travel time savings and wider economic benefits. Social goals are frequently neglected in business cases for various reasons, such as project evaluation being considered in a transport engineering environment, and because social costs and benefits are more difficult to quantify (Searle & Legacy, 2019). However transport infrastructure planning is now changing from analysis based on modelling based on minimising total travel time costs, which can bias results toward those with higher incomes, to a focus on accessibility in which alternative means of providing decent accessibility for all is key, incorporating social and environmental as well as economic dimensions of sustainable accessibility (Bristow, Farrington, Shaw, & Richardson, 2009; Handy, 2020).

Some of the approaches within the literature that aims to substantially address the intersection between climate and structural socio-economic injustices in infrastructure development include greater community-driven infrastructure planning (Arnold, 2021), and Green New Deal proposals (Gürdür Broo et al., 2021; Maya-Drysdale, Jensen, & Mathiesen, 2020). While current Green New Deal proposals vary considerably in focus and rigour, the approach is essentially aimed at addressing both environmental and socio-economic transformation imperatives in concert, by building a new social contract through a focus on green jobs and social welfare without sacrificing necessary climate transition. However, these proposals raise important questions about the capacity of current infrastructure governance systems to put forth and advance integrated proposals such as these.

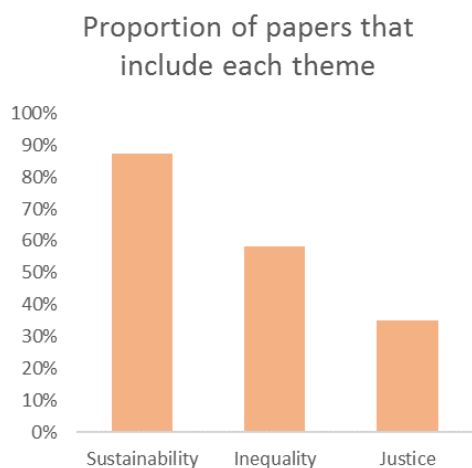


Figure 35 The proportion of papers within the core review library that include references to the themes of sustainability, inequality, and justice.

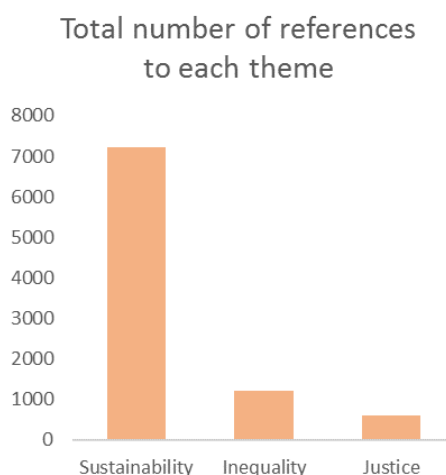


Figure 36 The number of total unique references within the core review library to the themes of sustainability, inequality, and justice.

Actors and enablers: Public planning approaches

Much literature locates the lead role for integration within the public sector, the authority with the capacity to "coordinate and align different projects pursued by disparate groups, maintaining the separation and 'splintering' of infrastructures yet allowing for data sharing and project alignment" (McLean, 2018, p. 174). The principle instruments of integration are seen as master planning and similar urban planning mechanisms and systems able to coordinate across internal and external departments and stakeholders, as well as facilitate the staging of diverse projects to minimise cost

and disruption to communities (McLean, 2018). Integrated infrastructure planning often requires strategic consideration at early stages, coupled with capacities to consider and balance multiple values (Schuch et al., 2017). Quesnel et al. (2017) propose four actions to accelerating integration of old and new infrastructures, focused on "catalysing change, establishing funding sources, using resource pathways, and creating innovative governance structures", however cross sectoral guidance on how to achieve these complex aims is lacking.

However, in fragmented governance setting, public authorities face chronic struggles to amass the resources, social mandates and power necessary for substantially integrated planning. Private sector actors typically lack the structural incentives or capacity to achieve meaningful levels of integration, and in fact their activity and goals may work in opposition to integrated infrastructure planning, focused on short-term profit making. This raises the question of how public authority infrastructure planning capacities can be re-invigorated within contemporary contexts, without simply seeking to reinstate historical versions of comprehensive planning (Bafarasat, 2016). This likely requires attention to interrelated areas, such as sources of public and state-led funding and financing, public land ownership and strong regulatory systems over spatial development, and forms of fostering social legitimacy among communities. Regarding transport and land use integration, Legacy, Curtis, and Sturup (2012) emphasise that simply restructuring agencies is likely inadequate, and instead they suggest a focus on supporting improved network governance capacities. However Low and Gleeson (2001) show that common agency actor 'storylines' about their policy contexts are also major barriers to integration.

McLean (2018, p. 39) emphasises that despite the vast literature espousing infrastructure integration, there is a substantial gap within the research of critical and in-depth studies that closely explore "the processes, technologies, scales and contested relationships that exist that may facilitate or constrain forms of integration policies". There is much need for critical research exploring widescale, area-based forms of infrastructure integration (including multiple forms of integration). This can help to develop more sophisticated and targeted understandings about how and in what ways institutional settings, political priorities, regulatory systems, and social licenses play roles in prohibiting or enabling integrated infrastructure planning.

Chapter 6: Infrastructure funding

Key points:

- Infrastructure funding is a **major theme** across the infrastructure governance literature, likely due to it being a fundamental determinant of project implementation, and frequently contested within neoliberal infrastructure regimes and weakened state finances.
- Over time there has been a **shift from infrastructure grants to investment** as more entrepreneurial models have expanded as the norm.
- While constraints on public funding across the world have caused governments to seek supplementary sources of funding for infrastructure, there are important **limits to co-financing arrangements**.
- The use of private sector funding makes it **more difficult to address issues of sustainability and equity**.
- Certain **public and state-led financing strategies** may help to reduce or deal with uncertainty in anticipation of ongoing crises, as well as address sustainability and equity needs.

Infrastructure funding within the literature

TOTAL FILES WITH REFERENCES TO FUNDING IN LIBRARY

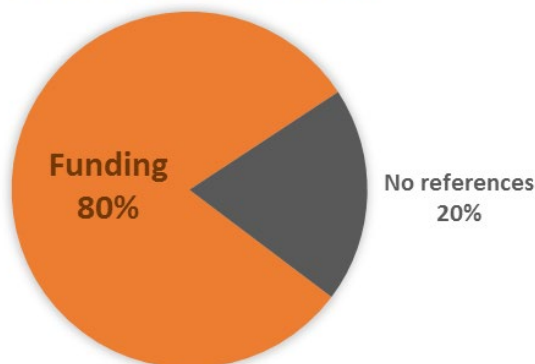


Figure 37 The proportion of papers in the library that reference funding or financing. There is a large amount of overlap between each term so they have been included together.

Funding and financing are major topics across the infrastructure governance literature. References to funding and financing appear broadly across 80% of papers in the core review library (n=384). The funding theme alone (not including financing) is represented in 68% of the literature.

As a clarification between the two, funding is generally used to mean the concern with who ultimately pays for infrastructure (such as users, taxpayers, or customers). Financing concerns with details of how the money to build infrastructure is raised (for examples, through the public sector, private sector, debt, equity, or other methods).

Entrepreneurial models and the erosion of public value: From grants to investment

Much global infrastructure funding has experienced a critical shift from grant-based funding (including fees and levies), to investment-based (including from existing assets and revenue streams, as well as grants and borrowing) (O'Brien, Pike, & Tomaney, 2019). Similarly, whereas financing had been traditionally based on instruments such as borrowing, it has shifted to instruments and practices such as value capture, asset leverage and leasing, and revolving funds. The latter is similar to the NSW practice of asset recycling. More recently, state actors seeking new forms of investment are combining urban entrepreneurialism and managerialism. These hybrid forms can complicate governance challenges such as infrastructure integration, distribution of responsibility, and sustainable financial management (O'Brien et al., 2019).

The case of Transport for London (TfL) illustrates this entrepreneurial and managerial approach to funding new infrastructure, turning to property development for revenue. Its new rail projects such as Crossrail use a mix of TfL

borrowing against future fares, a business rate supplement across London, the sale of property, developer contributions, contributions from Crossrail beneficiaries such as Canary Wharf and Heathrow Airport, and the national government. The agency is also turning to property development to increase revenue. Public value concerns are reflected in the National Infrastructure Commission recommendations for Crossrail 2 funding for government contributions in return for Mayor and borough commitments to build new housing.

Public-Private Partnerships have become a major method of financing large infrastructure projects. PPPs depend on a tranche of public funding as well as private sector funding. Constrained public finance can mean constrained private, and therefore overall finance (Fay et al., 2017). PPPs can often generate government debt (Tarazona Vento, 2017). The World Bank promotes the PPP model to secure public value for money (Fay et al., 2017), balancing the higher cost of commercial instead of public finance must be weighed against potential efficiency gains, but requiring a balance of risk allocation so that the public sector does not bear all implementation risks. The latter goal can be supported by the presence of a regulatory agency, which can improve productivity and cost recovery and reduce potential losses. Nevertheless, the World Bank also sees the needs of the poor as typically best served by a combination of the cost-recovery tariffs that typify PPPs and targeted subsidies and payments.

Pressures on public funding of infrastructure mean that there is an imperative for integrated cross-sectoral evaluation of infrastructure proposals. Infrastructure Australia sets out to address this through its infrastructure plan developed via assessing long-term needs and proposing an investment pipeline. Its insulation from political pressures is an important governance element for achieving this. The various Australian state infrastructure agencies attempt to copy this model, though generally with less reliance on objective benchmarks such as business cases. Centralised and fragmented public finance contexts have also been found to be "corrosive" to local government capacities, and thus particularly so to Indigenous community governance, highly reliant on public finances (Moran & Porter, 2014). New Public Management reforms have deconcentrated administration but not political power.

Mega-projects and the promised versus actual cost gap

Large mega-projects, typically delivered through PPP models, are often associated with large cost overruns far beyond what was originally projected (Tarazona Vento, 2017). Classic cases include the Channel Tunnel, the Washington Metro, and the Humber Bridge (Flyvbjerg, Bruzelius, & Rothengatter, 2003). Such scales of cost overrun not only burden public resources but also erode public confidence in infrastructure governance and strategic planning, further exacerbating gaps between the processes of planning and the outcomes of public value.

Flyvbjerg (2009) states that there are three main types of explanation for large cost overruns. The first is technical explanations, notably inaccuracy in forecasts. The second reason for cost overruns is psychological, with delusional optimism resulting in overestimation of benefits and underestimating of costs. The third explanation is political-economic. Flyvbjerg (2009, p. 351) sees a key research question here as whether estimates of costs and benefits are intentionally biased to serve the interests of promoters in getting projects started. The Grattan Institute (Terrill et al., 2020) concludes that one third of big infrastructure projects it analysed in Australia are announced prematurely for political reasons before business cases have been prepared, and that these account for three quarters of total cost overruns in big projects.

Public funding constraints: The limits of co-financing and planning for crisis

Constraints on public funding across the world have caused governments to seek supplementary sources of funding for infrastructure. However, in most cases there are limits to co-financing. For example, private sector investment requires a financial return that is usually achieved through user-pays models. But the World Bank estimates that globally only 50 per cent of total infrastructure services (including non-water) can be charged to users and theoretically financed on a commercial basis (Fay et al., 2017). In developing countries inefficiencies from water delivery loss and revenue collection limit water utilities' access to commercial finance (Fay et al., 2017). In these countries foreign direct investment in infrastructure may not be environmentally responsible, while multilateral investment banks' narrow capital base means they have not been able to meet the needs of developing countries (Quak, 2018).

Even in states with a history of greater public funding and financing models, emerging co-financing models are proving challenging. In the case of Copenhagen for example, green-blue infrastructure projects where regulatory constraints on the specific costs allowable for publicly financing have incentivised co-financing arrangements (Tubridy, 2020). Co-financing in this case has threatened project integration as financing is not guaranteed and subject to rolling competitive assessment. It has also embedded a structural disregard for wider design aspects of the project, arguably important for long-term project integration but characterised as an 'additional layer' discrete from core function in circumstances of financial constraint.

This suggests the importance of the initial design and regulation of funding and financial systems, subjecting contracts and potential future cost-cutting decisions themselves to assessments of equity and long-term sustainability, rather than short-term political whim. If financial crises can and should be foreseen upfront in infrastructure planning, then risks can also be accounted for, raising questions of how public authorities might approach this complexity.

Governance scale and fund-raising capacities

Infrastructure governance scale has a significant impact on the adequacy of funding capacities. Larger infrastructure networks generally have greater revenue and a wider spread of risks, making fund-raising more attractive. For example, for infrastructure systems involving distributed technologies, Quesnel et al. (2017) propose bundling many projects into one larger group as a low-risk, strategic way to expand financing accessibility for smaller projects. The Bay Area (California) transit system illustrates the importance of governance scale. It crosses several county lines, but state transit funding is distributed by a strong regional authority (Weinreich & Skuzinski, 2021). This contrasts with Los Angeles metro region where the transit system is more disconnected partly because state transit funding is distributed by individual county transport commissions in Southern California.

Crisis, uncertainty, and the need for sustainable and equitable infrastructure funding

A backdrop for infrastructure funding of crisis of one kind or another is likely for the foreseeable future. 'Black swan' financial crises are likely to recur, while the 'green swan' climate crisis will be a constant threat. Can funding practices reduce resulting uncertainty? In the contexts of markets, discussions typically centre around minimising loss of profit. Instead, a more appropriate social focus might lie in rebuilding the capacity of public authorities and in more radical approaches such as decommodifying critical infrastructure (Hall, Jonas, Shepherd, & Wadud, 2019). In the near term, there is a need to seek sustainable forms of state infrastructure financing, which tend to be counter-cyclical, helping regions to weather financial uncertainty. These may involve:

- Green bonds etc to turn infrastructures into value-generating assets that can handle debt (Hall et al., 2019)
- State investment banks (Geddes, Schmidt, & Steffen, 2018)
- Re-municipalisation and public ownership (Friedländer, Röber, & Schaefer, 2021)

Chapter 7: The social legitimacy of infrastructure governance

Key points:

- There are **diverse understandings of social legitimacy** within the literature, based variously around public institutions, moral responsibility, transparency and trust-building over time, and integrated cohesiveness across infrastructure plans and policies.
- Market-led and managerial forms of infrastructure governance are associated with a problematic **shift from citizen rights to consumer rights**, and it results in lack of transparency due to the protection of commercial interests.
- **Public interest claims** and notions used to underpin infrastructural legitimacy require **clear articulation** and must be **open to public scrutiny and contestation** across the entirety of the planning process, from strategic planning and continue through to project planning.
- **Remunicipalisation is an alternative model of re-connecting the public interest** of infrastructure governance, led in Germany by social movements.
- The literature outlines a **range of bottom-up approaches** to infrastructure planning and delivery to improve social legitimacy, including active citizen planning, co-production, community-driven infrastructure, and infrastructure commons.
- The analysis of literature on social legitimacy, public interests, and community involvement in the processes and planning of infrastructure suggest that there are **substantial research gaps in this area**, and substantial work is needed to more rigorously understand these alternatives and how they can inform new infrastructure governance approaches

Social legitimacy and the public interest

TOTAL FILES WITH REFERENCES TO SOCIAL LEGITIMACY IN LIBRARY

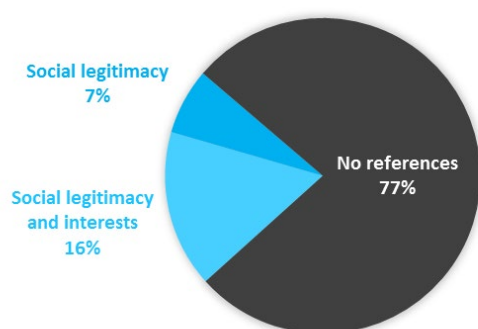


Figure 38 The proportion of papers that reference social legitimacy. Also shown are the proportion of additional papers that reference public interests (there is likely some overlap).

PAPERS REFERENCING PARTICIPATION

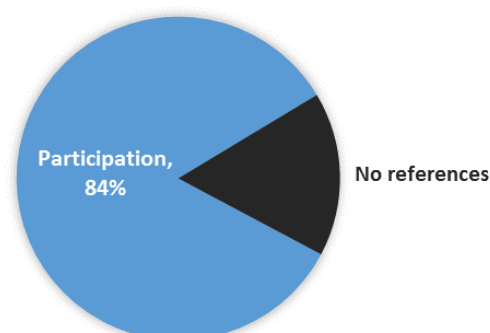


Figure 39 The proportion of papers that include any participation themes.

It is relatively challenging to capture all references to the notion of social legitimacy via methods used in this systematic review process, as authors may express the notion in different ways, or take it as implied through references to community and public participation, democratic planning processes, and other topics. It is nevertheless notable that there are few explicit references to social legitimacy (and related terms) found throughout the core review library (only in 7% of papers). There are a greater number of papers that refer explicitly to a social or public interest in some sense (16%). Taken together, it appears that less than a quarter of the papers in the core review library deal with social legitimacy in an explicit sense (Figure 38). This suggests that there is much scope for more literature on infrastructure governance to more directly engage with the different ways infrastructures, and their planning and implementation are

connected to notions of public legitimacy, and indeed, question what is 'public' in the planning for future transport governance.

By contrast, the theme of community participation and engagement is present in some form across 84% of papers in the core review library. Among more substantive papers that discuss actual processes or theories, community participation is often briefly mentioned as necessary in infrastructure planning without much elaboration.

Diverse understandings of social legitimacy

Though there are not a large number of explicit references to social legitimacy, the definitions are diverse and often relatively vague, but broadly cohesive. References to social legitimacy are often positioned in relation to government-led planning, and described as a social currency for policy action gained through trust-making relations over time (Pohlmann & Colell, 2020), and through an infrastructure project's integrated connection to wider strategies across planning and policy (Book et al., 2010). Some papers discuss social legitimacy as achieved through the inherent 'public' status of organisations, such as planning systems (Greenwood & Newman, 2010; van de Meene et al., 2020). This status in the community can be positively gained through transparent, open and deliberative infrastructure decision-making processes (Colacino & Hensley, 2019; Legacy et al., 2017), or through supportive reactions to the demands that arise from community acts of political mobilisation (Heinelt, 2019). A negative public standing may also be associated with what could be described as cynical political attempts use community engagement processes to claim public mandates (Bosworth, 2018).

In broader moral terms, social legitimacy is connected to claims of the public good (Grabowski, Denton, Rozance, Matsler, & Kidd, 2017), and in opposition to market interests. For example, social legitimacy is harmed when a growth or development mandate leads to further marginalisation of vulnerable communities (Kensicki, 2019). Acquiring a social license is seen as emerging from clearly articulating and balancing short-term issues with long-term objectives (Beall, Cherenet, Cirolia, & da Cruz, 2019), and through attentiveness by government and project proponents to place contexts (Arts, Hanekamp, Linssen, & Snippe, 2016b). Regarding social contracts, Meissner (2021) draws on the original theory by Rousseau, connecting the notion of a social contract to governments' moral responsibility to protect citizen rights and equality in the context of municipal government epistemologies of providing ecological infrastructure.

Most relevant literature discusses social legitimacy as being absent altogether, or otherwise sought in very fragmented and even cynical ways in infrastructure contexts. For example, in settler-colonies, infrastructure mandates may be lacking in relation to occupied Indigenous communities due to infrastructure privatisation prioritising exclusive interests at the expense of meaningful attention to local contexts, histories and economies (Kensicki, 2019). Legitimacy may be lost in project-based infrastructure approaches, where there are weak strategic links across projects (Book et al., 2010), disconnections from transparent planning processes (Legacy et al., 2017), or poor project management and communication (Mottee, Arts, Vanclay, Miller, & Howitt, 2020). Meissner (2021) sees social legitimacy as lost through governments embodying immorality through facilitating privatisation and failing to protect citizen rights and equality.

Social legitimacy is discussed as necessary for successful infrastructure implementation (Levenda, 2016), particularly where communities can obstruct projects (Birkinshaw, 2017), where citizen involvement in decision making is shallow (van de Meene et al., 2020), or where local governments need to lobby state governments for support (Furlong, Phelan, Dodson, & Considine, 2017). It is notable that there are few instances where social legitimacy was claimed as either pre-existing or having been successfully gained in relation to infrastructure projects. However these contexts involve successful community activism (Triyanti & Chu, 2018), or legitimacy fostered through historically-developed First Nations relations of provision, based on profit-sharing and social responsibility (Ghorbani, Eskandari-Damaneh, Cotton, Ghoochani, & Borji, 2021; Heinelt, 2019).

Social legitimacy through environmental principles and attendance to place

There are suggestions that social legitimacy in infrastructure governance is lost through a lack of meaningful attendance to principles of sustainability and ecosystems, and to place (Grant, Beed, & Manuel, 2018). For example, in a 2005 'New

Deal for Cities and Communities' in Canada, promised federal funding for integrated community sustainability planning was undermined by the changing national political priorities, which shifted a focus on neoliberal growth interests (Grant et al., 2018). The resulting lack of capacity at the community level (including the absence of implementation mechanisms) led ultimately to vague future visions, and where there was engagement with principles of sustainability, they presented as greenwashed infrastructure plans and tokenistic.

Conversely, emerging forms of environmentally-centred governance are posited as supporting reconciliation efforts. In the Australian settler-colonial context, caring for and protecting Country needs to be connected to a clear social licence with First Nations communities. Through examining increased governance capacities among Indigenous communities, Cosens et al (2018) suggest that natural infrastructure (such as water systems and ecosystems) can serve as a grounding for reconciliation and Treaty negotiations. "This trend not only suggest a shift from an expert-driven model of politics to more democratic approaches but also raises some important questions about governance within a fragmented system and the role of citizens, professionals and communities in governance" (Cosens, McKinney, Paisley, & Wolf, 2018, p. 1688). The dire social consequences for a lack of attendance to place ecologies and cultural heritage are demonstrated through a recent case in Victoria, where state government destruction of Djab Wurrung sacred trees in pursuit of a highway project undermined Treaty negotiations (Porter, Roy, & Legacy, 2021).

The public interest gap in neoliberal and corporate infrastructure governance

Market-led, managerial, unsolicited, and entrepreneurial infrastructure governance models are subject to much scrutiny throughout the critical literature regarding governance fractures and gaps in public interest planning. Market-led models of major infrastructure projects are associated with elitist and authoritarian decision-making (Tarazona Vento, 2017). Market-led infrastructure governance is also associated with a shift from citizen rights to consumer rights (Taşan-Kok, Atkinson, & Martins, 2020). The fragmented governance contexts generated are likened to a kind of 'institutional schizophrenia' which create a schism that erodes stakeholder confidence (Roe & Mell, 2013).

This fragmentation is further exacerbated with the introduction of the planning instrument called market-led proposals or unsolicited proposals. As described by Rogers and Gibson (2020) they formalise private sector initiative in infrastructure delivery. What makes this instruments problematic, is the extending of commercial in confidence into the planning process posing considerable threat to planning, and especially to public forms of planning. Unsolicited proposals provide zero opportunity for a social licence to be developed through a formal planning process, or for claims made in favour of a proposed project to be publicly tested. Formal governments and authorities are implicated in these shifts, failing to adequately protect or represent public interests, often due to eroded capacity in neoliberal governance contexts. Political motivations often mean that major state-led infrastructure projects become focused on generating a sense of consensus and a shallow notion of a public interest that aligns with state priorities (Haughton & McManus, 2019; Searle & Legacy, 2021).

There are complex and pressing tensions around defining and deploying notions of public or collective interests or political mandates in infrastructure decisions. Legal scholars note that meaningfully and effectively achieving the scale of transformation necessary to engage with global climate change and its local impacts means directly confronting the conflict between collective interests and individual freedoms often deeply embedded within regulatory structures and infrastructural logics (N. Graham, 2020). This requires confronting the tensions of personal sacrifice, and unequal political power. Beyond focusing on specific communities, serving or embedding public interests within place raise specific spatial and temporal complexities around protecting contested public interests (Zamanifard, Alizadeh, & Bosman, 2018).

There are many critical questions around to what degree the notion of a 'public interest' is capable of meaningfully serving diverse and plural publics (Osborne & Alizadeh, 2020). Narrow, captured, or even sincere claims to 'public interests' can and have historically been used to serve private or dominant interests, particularly against the interests of, and often furthering violent dispossession of Indigenous peoples and other marginalised communities (Lane & Morrison, 2006; Reddick, 2002). It is therefore critical that if public interest claims are to be made through, or to underpin infrastructure decision-making processes and connected to strategic planning decisions, they must be at a minimum clearly articulated and open to deep public scrutiny and contestation (Searle & Legacy, 2021).

Public-led governance, social movements, and remunicipalisation

Across the literature there is an interest in seeking more public-led alternatives to entrepreneurial infrastructure models. The case of remunicipalisation is a particularly striking alternative to private sector-led infrastructure governance within the literature. Remunicipalisation is defined as "the (re-)establishment of utilities owned, at least partly, by the local state. This involves either creating a new utility, purchasing shared of an existing one or giving concessions to existing municipal utilities" (Becker, Naumann, & Moss, 2017, p. 63). A successful case of remunicipalisation has occurred in Berlin and Hamburg, where a citizen-led movement has reinstated public and citizen ownership of their energy grids and services (Becker et al., 2017). In this case, social movements politicised the ownership and governance of infrastructure, and enacted the proposed alternative through referenda. Co-production was achieved through the buying of shares, giving citizens direct stakes and meaningful power in the infrastructure delivery and maintenance.

It is important to note that the term 'remunicipalisation' does not suggest that the responsibility of infrastructure management and delivery is downloaded to local governments, especially without the financial resources to support such important work. Rather, the focus here is on contesting the word 'public' in public infrastructure, public planning and public interest, away from something that a government implicated in the market-provision of planning undertakes. What it denotes, instead, is the re-participatorisation and the re-democratisation of infrastructure planning, governance and management through practices of collective ownership. The central tenet is 'collective ownership', and it is upon these grounds that a more democratic model can be forged.

Active citizen planning, co-production, and community-driven infrastructure

Related to the above point, beyond top-down forms of community inclusion and participation, the literature outlines a range of bottom-up approaches to infrastructure planning and delivery. These various community-driven approaches are often contextualised within existing gaps in formal government provision of infrastructure, particularly among marginal, emerging and less represented communities (Gbadegesin, Ojekalu, Gbadegesin, & Komolafe, 2020).

Beyond simply closing infrastructure and service gaps, the literature identifies other benefits to community-driven infrastructure governance and delivery. This includes the potential for:

- Fostering broader social cohesion via bringing diverse interests together under common goals and active practices of infrastructure planning (Gbadegesin et al., 2020)
- Generating social legitimacy for infrastructure projects through direct citizen engagement, and
- Overcoming the binary of private financialised governance versus rigid forms of state provision (Hall et al., 2019)

A frequent challenge across community-driven approaches include a lack of capacity and resources among communities and community organisations, particularly funding, access to expertise and tools, and access to supporting regulatory mechanisms. Because of this, co-production is often presented as a community-focused hybrid approach wherein traditional government capacities and resources are made available to citizen-led initiatives. Another similar but distinct community-driven alternative is approaches that frame infrastructures as commons (Becker et al., 2017; Dalakoglou, 2016; Hall et al., 2019). This diverse and still-emerging analytical approach centres on alternative conceptions of property rights.

Similarly based around property, infrastructure commons are emerging notions of infrastructure governance based on principles of collective ownership and management. Commons are positioned politically as substantive alternatives to conventional private property arrangements and market-based governance, centred on community interests, and active collective governance approaches. The notion of infrastructure commons has been applied to green infrastructure with local community garden management (Frantzeskaki, 2019), and collective and public electricity provision in the UK and Germany as a way to overcome electricity sector financialisation (Hall et al., 2019).

There are striking avenues for new understandings of infrastructure governance that are enabled through attentive research to social interactions with and contestations to existing approaches. For example, (Taşan-Kok et al., 2020) call for more research into, and the development of theories to understand the phenomenon of hybrid contractual landscapes – particularly the "actual technologies of contractual urban development". They call the for the development

of regulatory instruments and tools to safeguard public accountability in these market-led landscapes. Rutherford (2008) problematises the splintering and unbundling of infrastructure planning and delivery through the lens of social and democratic welfare, questioning how much the state could be prepared to sacrifice for the sake of mobilising capital – a key provocation for thinking about urban futures and social contracts. Becker et al (2017) use co-production and the notion of the commons as a heuristic tool to push the boundaries of thinking about urban governance. What does co-production and commons bring into view which may have otherwise been invisible to see? For instance, this lens visibilises the critical role citizens play, and could play, in urban governance and ownership.

Conclusion: Infrastructure governance research gaps and the way forward

Infrastructure governance research gaps

Informed by the detailed systematic literature review, we identify five areas of major research gaps:

1. In Australia, there's been a shift in the framing of a major infrastructure governance gap away from the public administration notions in the 1990s/early 2000s, where the notions of financial crisis and public debt led to many recommendations to partner with the private sector and foster PPPs. Then from the 2010s, more critical attention shifted to the governance gaps of **fragmented governance and privatisation, and infrastructure disconnected from urban planning and social legitimacy**. In seeking more integrated forms of infrastructure governance, there is a clear need to explore and to attempt to articulate exactly what major and consequential forms of **infrastructure governance integration** capacities are lacking within Australian contexts, and what ends integrated approaches seek.
2. There are major gaps throughout the infrastructure governance literature regarding **Indigenous governance models, and engagement with the settler-colonial contexts** of infrastructure development and land. There is an urgent need for infrastructure governance research in settler-colonial contexts to acknowledge and engage with the context of unceded First Nations land, and explore the implications in discussions of land, development, public value, etc. More specifically, there is a **lack of exploration of Indigenous-led infrastructure governance alternatives**. Exploration of existing and emerging cases and frameworks internationally may help support new approaches locally, or shift critical attention to existing advocacy efforts. There is also a **great need to better connect this research with existing work on decolonisation** in fields such as Indigenous studies and critical geography.
3. The analysis of literature on infrastructure funding shows the popularity of topic and yet warns against the lack of close scrutiny of the major ideas guiding practice. In specific terms, there is a **widening gap between the broader research on urban infrastructure governance models and increasingly private sector-led practices of governance**, including the very different rationales and focuses each realm represents. This particular **practice-research gap** means that sorely needed attention towards alternative governance models and infrastructure approaches (including more critical theories) may be disconnected from wider public discourse and public policy spaces, neglecting much needed public scrutiny of existing models and the potential for alternative approaches (and why they matter).
4. The analysis of literature on infrastructure planning, demonstrate increasing links made between the infrastructure governance and climate change, in the international research. Nevertheless, additional research is needed to **gauge the implications of the current weak political stance on climate change in Australia for infrastructure governance across the nation**. More broadly, there is a shortage of critical research on the societal end goals of infrastructure with explicit reference to equity and equality. The unprecedented social, environmental, economic, and public health challenges – during the COVID-19 global pandemic – has increased the urgency of this research gap and **renewed a major societal focus on infrastructure governance and policy within immediate and long-term crisis contexts**, while likely shifting the political and policy landscape in still emerging ways.
5. The **analysis of literature on social legitimacy**, public interests, and community involvement in the processes and planning of infrastructure suggest that there are substantial research gaps in this area. Recently emerging literature in particular demonstrate an array of powerful cases and theories emerging, but substantial work is needed to more rigorously understand these alternatives, and to bring the lessons into understandings of existing and emerging approaches to infrastructure governance.

Next steps: The Incubator's case study research

In order to further explore the key research questions at the core of the Infrastructure Governance Incubator, and contribute to further understating of the identified research gaps in the literature, the next steps of the Incubator’s work involve empirical work, including in-depth case study research. The Incubator followed a rigorous multi-step process in close collaboration with its Advisory Board to decide on the case study projects. In the first step, a set of criteria, in line with the Incubator’s original research proposal, was put together to guide the case study selection process. The case study selection criteria included:

- **Multiscalar:** the case study projects have to account for the investigation of multiscalar governance in place in Australia including the local, regional, and national implications.
- **Comprehensive:** the case study projects have to be comprehensive, meaning that they have to go beyond one infrastructure sector ONLY and the siloed approach of the infrastructure decision making, allowing for the investigation of the interconnectivity across different infrastructure sectors.

Based on the above selection criteria, a typology of appropriate case study projects for the Incubator was developed:

- **Infrastructure districts:** mostly major growth areas in the metropolitan region where a combination of local, regional and even nationally significant infrastructure of a diverse variety have been proposed, are under construction, or have been recently delivered.
- **Major projects with metropolitan implications:** major infrastructure network (e.g. transport) with significant land-use, environmental, social and heritage implications
- **Bundled projects:** a network of bundled local infrastructure projects that are otherwise (traditionally) planned for, funded by, or maintained by local governments (e.g. local parks, bike lanes) – in order to investigate their multiscalar implications/potentials at the regional levels.
- **Governance structures and approaches (Not place-based):** the range of multiscale (at federal, state or local) Advisory Boards, actors, enablers, and statutory mechanism and processes in place to guide and control infrastructure decision-making process

Informed by the above process, and in conversation with different individuals from the Advisory Board, a list of potential case studies was prepared including place-based case study projects from both NSW and Victoria. The list was then taken to the first meeting of Advisory Board in February 2021, for further discussion and endorsement:

NSW:	Victoria:	Governance structures (Not place-based):
<ul style="list-style-type: none"> • Western Sydney Parkland City (Place-based Infrastructure Compact (PIC) program) – incl. Western Sydney Aerotropolis Growth Area • Bays Precinct (+ Barangaroo) • Eastern suburbs light rail • Greater Parramatta to Olympic Peninsula (GPOP) • WestConnex project • Bundling of local infrastructure projects (e.g. City of Sydney’s transport plan) 	<ul style="list-style-type: none"> • Arden precinct • Fisherman's Bend precinct • Level crossing removal project • Monash precinct • Suburban Rail Loop (SRL) project • Various road projects (Extension of Eastern Freeway, TransUrban CityLink, etc.) 	<ul style="list-style-type: none"> • Advisory bodies across Aust & NZ or/and NSW & Victoria

The Advisory Board meeting discussion was followed up via email correspondence, with specific attention to the point that the focus for the research is on the wider governance approach and context, so the place-basis is only a foundation

for the research (not determining hard boundaries to the examination). At the end of this process, all projects on the above list received some level of support from the Advisory Board. Nevertheless, there was an overwhelming level of support behind the Western Sydney Parkland City, which means it has been selected to be the first detailed case study at the core of Infrastructure Governance Incubator. While conversations are ongoing to select other case study projects to be included in the Infrastructure Governance Incubator, more information is provided below on the Western Sydney Parklands City case.

Case study: Western Sydney Parklands City

The Western Sydney Parklands City (WSPC) is being planned as Sydney's third city in a polycentric structure from Marsden Park in north-west Sydney through Penrith and the planned Badgerys Creek Aerotropolis and Western Sydney Airport to Campbelltown and Liverpool. Its population is projected to grow from 740,000 in 2016 to 1.1 million in 2016 and over 1.5 million by 2056.

There are several features of the WSPC that make it an appropriate case study for research relating to Incubator goals, including understanding key contemporary urban infrastructure governance questions and challenges, and identifying ways that governance can be improved. These include:

- the Western Sydney City Deal,
- Place-based Infrastructure Compacts (PICs), and
- incorporation of Indigenous values, heritage, and voice.

Each of these is overviewed below, along with comments on possible research questions that might be investigated.



Figure 40 An artist impression of the Western Parkland City. (Western Parkland City Authority, 2021)

Western Sydney City Deal

This City Deal, signed in 2018, is an agreement between the Commonwealth and the NSW government. It brings together the Australian and NSW governments and the eight local councils in partnership in the Western Parkland City to deliver

“transformative change” to the region over the next 20 years. The three tiers of government are working collaboratively and contributing resources to deliver the 38 commitments. Key infrastructure commitments include construction of a metro rail line connecting the aerotropolis/airport to the Western rail line at St Mary (to which the Australian government is contributing \$5.25bn), rapid bus services, and ‘digital connectivity’ and smart technology.

Collaboration Areas with local councils at Liverpool, Greater Penrith and Campbelltown-Macarthur will address complexities and coordinate planning, governance and implementation to support growth. A state Western Sydney Parkland City Authority (WSPCA) has been established, incorporating the Aerotropolis Authority, focused on integrating delivery of development across the Western Parkland City, including the Aerotropolis.

One question arising from the Australian Government’s City Deal financial contribution concerns whether such funding is required for adequate infrastructure provision for future greenfield expansion in Australian cities (which would suggest inadequate funding prior to the City Deal initiative), or whether City Deal finance is mainly the result of the special situation of development around Sydney’s second airport that is being funded by the Australian Government, with City Deal funding mainly aligned at making development of the airport a success. A further question concerns how successful the implementation process of the City Deal in Collaboration Areas has been seen by state and local governments, in terms of appropriate local agency and control for example. This question will specifically apply to the operation of the WSPCA.

Place-based Infrastructure Compacts (PICs)

The PICs are central to the development of the WSPC. They use a place-based approach rather than project-based approach to identify true infrastructure costs. They illustrate a framework that can potentially resolve a range of urban infrastructure governance problems. These include the lack of planning and delivery coordination between infrastructure agencies, the frequent misalignment between strategic plans and infrastructure delivery, lack of community licence, and equitably funding urban infrastructure. The PICs are part of the Western Sydney City Deal. The GSC is leading their delivery. The initial PIC area is located at the centre of the Western Parkland City, and extends from Greater Penrith to Western Sydney Aerotropolis Growth Area and then Austral and the Glenfield Growth Corridor (Fig 1).

The PICs are designed to identify and cost the required infrastructure and services to support future growth and determine the staging and sequencing of this future growth. The development of the PICs incorporated an initial process over three months to obtain community and stakeholder input and feedback (Greater Sydney Commission, 2020). This involved giving briefings to the Commission’s Youth Panel, the Commission’s social, industry and environmental peak panels on the WSPC PICs, and major landowners to obtain feedback. The Commission also obtained feedback from four focus groups (totalling 28 participants) and two online forums (17 participants) to provide a diversity of community representation. Stakeholders were asked for their preferred scenarios. They highlighted the need for the development of transport infrastructure and affordable housing to be the priority. In addition, local councils were engaged over an 18-month project development period through the Western Sydney City Deal Implementation Board and its Leadership Group, and the PIC Collaboration Working Group. The Consultation outcomes report states that “The feedback captured within this report was used by the Commission to develop the draft PICs” (Greater Sydney Commission, 2020, p. 11). However, it does not indicate how the feedback was incorporated into the draft PICs.

The PIC model developed in a pilot process has three interrelated components (Greater Sydney Commission, n.d.):

1. A collaborative approach across State agencies, utility providers and councils
2. A six-step method integrating land use, infrastructure and economic evaluation
3. A digital and data tool providing analytics and insights that are important in keeping the PIC dynamic and up-to-date.

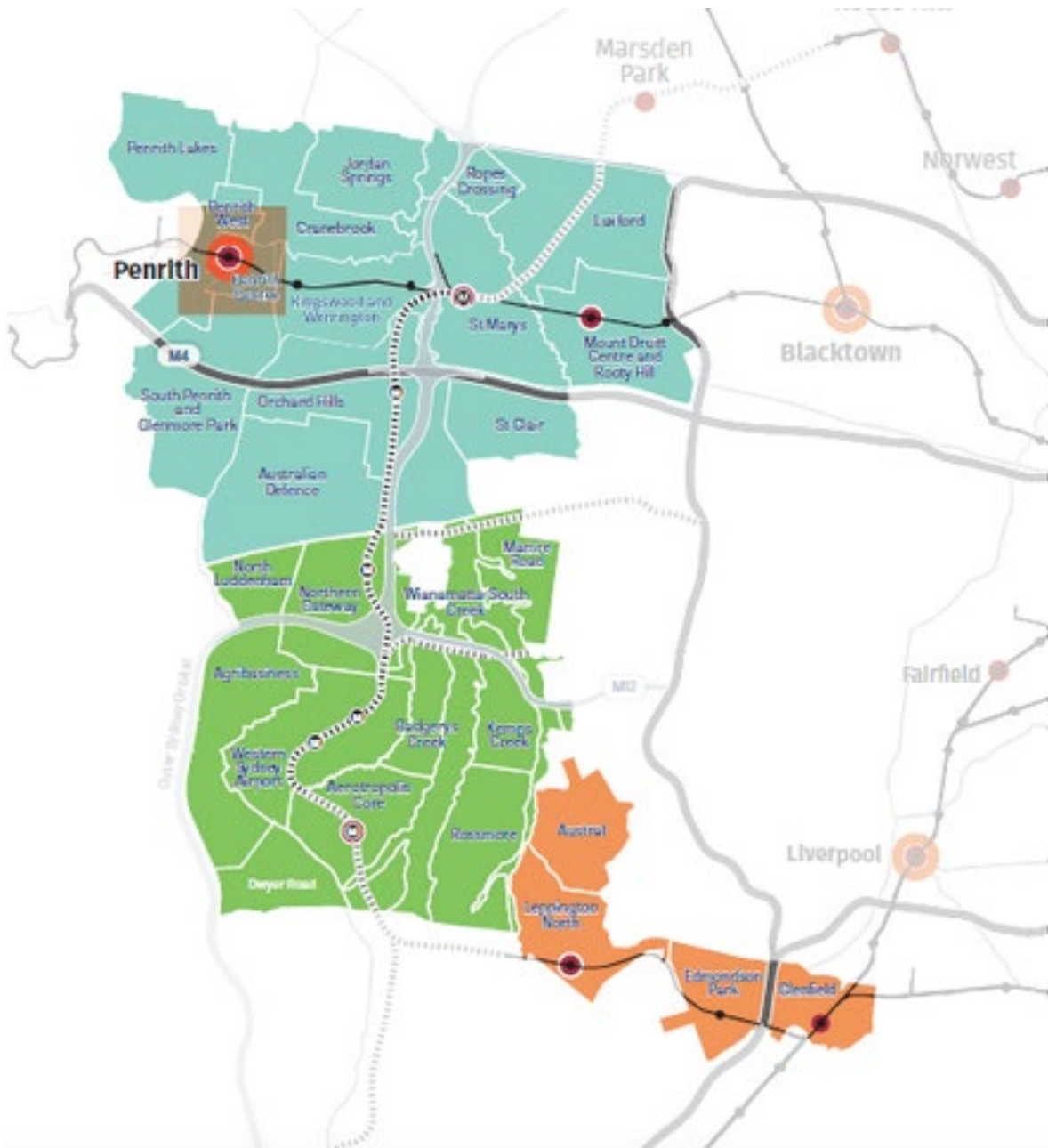


Figure 41 The Western Sydney PIC area. (Greater Sydney Commission, n.d.)

The Draft PIC Report currently on the Commission’s web site states that it has completed steps 1 to 3 to date. Below is a summary of the progress made, so far, with references to the relevant potential directions of research work for the Incubator:

Step 1: Outcomes setting, scenario development and land use forecasting

Outcomes Setting: Six place outcomes were adopted after engagement with partners and stakeholders, and community research, covering Liveability (wellbeing/inclusiveness, Aboriginal living culture & participation), Productivity (jobs, transport. & digital connectedness), and Sustainability (scenic/productive landscapes, connected/diverse/resilient communities). For further Incubator research, the criteria for transport and digital connectivity, and the role of bureaucrats, stakeholders and wider community in their development, are potentially significant.

Scenario development: The Commission engaged SGS to develop three land use forecast scenarios. A ‘business as usual’ scenario contrasted with higher growth scenarios. All three scenarios recognise the need to support investment in city-

serving infrastructure such as schools, community health centres, digital infrastructure, and utilities. It is not known what guidelines were given to SGS to develop the scenarios, or whether/how the outcomes setting stage was incorporated.

Land use forecasting: Population, housing and job forecasts over 10, 20 and 40 years were developed under each scenario for two geographic areas: the Western City District and Blacktown LGA, and the initial PIC area. Councils contributed to the preparation of the forecasts through a co-design process by the Commission, Western Sydney Planning Partnership, Transport for NSW and the Department of Planning, Industry and Environment. This stage is notable for the involvement of councils in preparing the forecasts, which is generally absent in strategic planning at this scale. However, whether such involvement really allows councils to significantly modify higher level proposals is a potential issue.

Step 2: Cross-sector infrastructure needs, costings and funding sources

State agencies and utility providers strategically analysed infrastructure needs and costings, including land requirements, for the scenarios and 28 precincts over 10, 20 and, for major utilities and transport proposals, 40-year horizons. The Commission integrated this analysis using Co.Lens. The draft report points out “the PIC process includes stormwater management; this is typically considered as local infrastructure. Its inclusion supports a whole-of-water cycle approach that considers water, wastewater and stormwater holistically at the regional level, and requires reform to implement”. This is a positive step, as while such consideration is in principle the responsibility of Sydney Water, actual integration of these elements has been restricted for cost and agency-local government coordination issues [preliminary observation to be investigated]. The early incorporation of transport agency forecasts for rail, motorways etc. is also a positive, although past experience indicates this is not a sufficient condition for land use-transport infrastructure integration.

Step 3: Analysis of scenarios and precincts to study preferred sequencing

The draft report summarizes the analysis thus: “A cost-benefit analysis (CBA) and cost-effectiveness analysis (CEA) evaluated each scenario for the initial PIC area and the 28 precincts. This informed the high-level sequencing of ‘initial places’ within precincts. Liveability, productivity and sustainability criteria enabled the place-based benefits of each scenario to be measured in monetary terms relative to costs over a 40-year horizon. The CEA determined the cost of accommodating a new resident or job in each of the 28 precincts. For both the CBA and CEA, precincts are distinguished by their main function as either ‘employment’, ‘mixed use’ or ‘residential’ to enable reasonable comparison. The results of this analysis and alignment with strategic policy, committed investment and realising the vision of the Western Parkland City – as well as targeted engagement with partners and stakeholders – have guided the high-level sequencing.” The draft report notes that CEA is a good supplement to CBA where there is insufficient data to estimate benefits, but there is sufficient data to estimate outcomes using another common unit such as homes and jobs.

The application of CBA to the three options showed that the Growing Parkland City option (a modified base case) had a net cost of \$1.1bn. The Thriving Aerotropolis scenario has a net benefit of \$3.5bn, and the Thriving Metropolitan Cluster had a net benefit of \$4.0bn, even though both had total capital costs that were more than 2.5 times the capital cost of the first scenario. This shows the importance of access to adequate funding sources if maximum place benefits are to be achieved.

The use of CBA and CEA for identifying place-based benefits to guide infrastructure sequencing is ground-breaking, and means that liveability and sustainability place considerations carry equivalent weight to economic considerations. The case study analysis could investigate how this was achieved, in terms of analytical cost and resources, and inter-agency information and other linkages and agreement that were required, inter alia. The identification of non-costed, but important, planning elements and the consideration given to the effects of their exclusion from the CBA and CEA could also be investigated. Indigenous issues and concerns should be part of this.

Incorporating Indigenous concerns and values

There is virtually no public domain information on the extent to which Indigenous concerns and values are being incorporated in infrastructure and other planning of the WSPC. Case study research will need to explore what is being done, and limitations to Indigenous involvement, together with what more might be possible under existing legislation, and perhaps exploring what legislative changes might be necessary to achieve involvement that can fully reflect an Indigenous voice.

It is understood that the GSC has already done work on how infrastructure providers should engage with Indigenous communities over design, etc. There has also been specific consultation about Indigenous issues in planning the

Aerotropolis. In addition, there has been consultation about Indigenous cultural design issues for the new metro link, although this appears to have come when basic design matters have already been determined.

Appendix A

THEME	SEARCH TERMS FOR AUTOCODING	FILES	REFER-ENCES
Context	context or challenge	379	19628
Corruption	corrupt OR corruption	82	428
Crisis	Crisis OR crises	184	1201
Crisis (economic)	"economic crisis" OR "financial crisis" OR "fiscal crisis" OR "GFC" OR "banking crisis" OR "employment crisis" OR "2008 crisis" OR "1990 crisis" OR "crisis of 1998" OR "crisis of 1929" OR "crisis of 1973" OR "economic crises" OR "financial crises" OR "macro crises"	75	311
Economic growth	"economic growth" OR "economic development"	227	1547
Inequality	Inequality OR inequity OR equality OR equity OR inequalities OR equalities	223	1219
Justice	justice	135	606
Politics	Politics OR political	333	5549
Neoliberalism	neoliberal OR neoliberalism OR "neo-liberal" OR "neo-liberalism"	104	610
Resilience	Resilient OR resilience	176	1549
Sustainability	sustainability OR sustainable OR "climate change" OR "climate crisis" OR "climate adaptation"	335	7218
Co-production	"Co-production" OR coproduction	56	199
Factor		379	13419
Accountability	accountability OR accountable	163	677
Integration	integrated OR integration OR integrating	326	3657
Knowledge	knowledge OR knowledges	293	2503
Regulation	Regulation OR regulating OR regulate OR regulates OR regulated	264	1819
Responsibility	responsible OR responsibility	304	1861
Subsidiarity	subsidiarity	13	55
Tools	tools OR tool OR instrument OR instruments	307	2127
Transparency	transparent OR transparency	166	720
Gaps	"governance gap" OR "governance gaps" OR "planning gap" OR "planning gaps" OR "infrastructure gap" OR "infrastructure gaps"	44	106
Indigenous governance		110	1274
Decolonisation	settler-colonial OR decolonise OR decolonize OR decolonisation OR decolonization OR settler-colony OR colonial OR colonise OR colonize	65	330
Decolonisation (strict)	decolonise OR decolonize OR decolonisation OR decolonization	11	35
Indigenous	indigenous OR aboriginal OR aboriginals OR "First Nation" OR "First Nations" OR Indigeneity OR "First Peoples"	75	909
Infrastructure models		258	2467
PPP	PPP OR "public-private partnership" OR "public private partnership" OR "public-private" OR "public private"	246	2016
Private-sector	"private sector infrastructure" OR "private-sector infrastructure" OR "private-sector ownership" OR "private infrastructure" OR "privately-managed infrastructure"	39	96
Publicly-owned	"public ownership" OR "publicly-owned infrastructure" OR "publicly managed" OR "state-owned infrastructure" OR "state ownership" OR "public asset" OR "public procurement"	68	245
Place		379	24902
Australia	Australia OR Australian	165	1932
Canada	Canada OR Canadian	129	672
New Zealand	"New Zealand" OR Kiwi OR Aotearoa	44	135
Regional	regional OR region	351	5443
Rural	rural OR remote	217	1540
United States	"United States" OR USA OR America OR American NOT "South America" NOT "South American" NOT "Latin America" NOT "Latin American"	234	1626
Urban	urban OR city OR metropolitan OR cities	368	13554
Infrastructure scale		205	1608
Bundled	Bundled OR bundling	29	211
Infrastructure networks	"network infrastructure" OR "network infrastructures" OR "networked infrastructure" OR "networked infrastructures" OR "infrastructure network" OR "infrastructure networks"	126	512

Mega-projects	megaproject OR megaprojects OR mega-project OR mega-projects OR gigaproject OR gigaprojects OR giga-project OR giga-projects OR "mega project" OR "mega projects"	77	503
Precinct	"precinct" OR "precincts"	31	309
Precinct (specific)	"precinct-scale" or "precinct-scales" OR "precinct-level" OR "precinct level" OR "precinct design" OR "precinct development" OR "precinct developments" OR "precinct plan" OR "precinct planning" OR "precinct project" OR "precinct projects" OR "precinct infrastructure" OR "precinct scale" OR "precinct scales"	14	73
Infrastructure stage		373	9441
Decision	Decision-making OR "decision making" OR "infrastructure decision"	288	1669
Delivery	"infrastructure delivery" OR "project delivery" OR implementation OR implement OR implements OR "deliver infrastructure"	326	3108
Maintenance	"infrastructure maintenance" OR "maintaining infrastructure" OR "project maintenance" OR "maintenance of infrastructure" OR "maintenance cost" OR "maintenance costs" OR "maintenance plan" OR "maintenance plans" OR "maintenance budget" OR "maintenance budgets"	88	146
Management	"infrastructure management" OR "project management" OR "managing infrastructure" OR "managing projects"	119	801
Participation	Participation OR engagement OR participatory OR deliberation OR consultation	321	2911
Planning	"infrastructure planning" OR "strategic planning"	163	806
Terms		375	11850
Markets	market OR markets OR market-led	271	3063
Power	power OR powers	310	3407
Resistance	resistance OR resist OR resists OR protest OR protests OR protester OR protesters OR protests OR resisting OR resisted	156	626
Success	success OR successful	287	1928
Topic		315	5517
Funding	funding OR financing OR finance	309	3340
Funding (strict)	funding	260	1856
Social legitimacy	"public licence" OR "public license" OR "social licence" OR "social license" OR "social legitimacy" OR "public legitimacy" OR "political legitimacy" OR "social contract"	26	42
Social legitimacy & interest	"public licence" OR "public license" OR "social licence" OR "social license" OR "social legitimacy" OR "public legitimacy" OR "political legitimacy" OR "social contract" OR "social interest" OR "social interests" OR "public interest" OR "public interests"	88	279
Infra type		306	4957
Community infra	"community infrastructure" OR "social infrastructure"	60	181
Green infra	"green infrastructure" OR "nature-based infrastructure" OR "living infrastructure"	82	1576
Housing infra	"housing infrastructure" OR "housing governance" OR "public housing" OR "social housing" OR "community housing"	50	279
Telecom infra	"telecommunication infrastructure" OR "telecommunication governance" OR "broadband infrastructure" OR "internet infrastructure"	11	35
Transport infra	"transport infrastructure" OR "transport governance" OR "mobility infrastructure" OR "transit infrastructure" OR "mobility governance"	133	688
Waste infra	"waste infrastructure" OR "waste governance"	10	35
Water infrastructure	"water infrastructure" OR "water governance" OR coastal OR "blue infrastructure" OR stormwater	175	2163
Values		345	4217
Ethics	ethics OR ethic OR ethical OR moral OR morals OR morality	109	473
Ethics (specific)	Utilitarianism OR utilitarian OR "liberal equality" OR liberalism OR "capability approach" OR "capabilities approach" OR "intergenerational justice" OR fairness OR feminist OR feminism OR socialist OR socialism OR Marxist OR Marxism OR communitarianism OR libertarian	107	387
Principles	principles OR principle OR principled	261	1720
Public value	"public value" OR "public values"	18	34
Value/interest	"public value" OR "public values" OR "public interest"	73	218
Rights	"right to" OR rights NOT "rights reserved"	211	1385

Figure 42 The full list of themes coded in NVivo (relevant to this report), including their specific search terms used to autocode the themes.

Appendix B

Major clusters (20+)		Moderately common clusters (8-20)		Minor clusters (7>)			
Human rights	324	Civil rights	20	Citizen/s' rights	7	Specific rights	4
Water rights	284	rights discourse/s	18	Constitutional rights	7	Land-use/user rights	4
Property rights	155	rights and responsibilities	18	Decision rights	7	Rights to WatSan	4
Indigenous rights	67	Group rights	17	Women's rights	7	Rights to land	4
Land rights	33	rights framework/s	17	Rights of way	7	Rights of communities	4
Development rights	30	Cultural rights	15	(civil / Indigenous / treaty /	7	Rights law	4
		Individual rights	15	women's) Rights movements		Rights and duties	4
		Private property rights	15	Community rights	6	Human rights abuses	4
		WatSan rights	15	Naming rights	6	Building rights	3
		Rights over	14	Rights to use	6	Monopoly rights	3
		Rights of Indigenous people/s	14	Rights of occupancy	6	Construction of rights	3
		rights and obligations	14	Rights of nature	6	Political rights	3
		Citizenship rights	13	Rights of Mother Earth/nature	6	Protection of property rights	3
		water rights administration	13	Rights claims	6	Resource rights	3
		Treaty rights	12	Rights certificates	6	Shared rights	3
		Collective rights	11	Rights approche/s	6	Tenancy rights	3
		Legal rights	11	Land rights Act	6	Protect the rights	3
		Social rights	11	Democratic rights	5	Understand their rights	3
		Territorial rights	9	Ownership rights	5	Usufruct rights	3
		Rights to water	9	Water access rights	5	Workers rights	3
		Rights issues	9	Consumer rights	4	Rights solution	3
		Inter-American human rights system	8	Customary rights	4	Rights of the people	3
		Bill of rights	8	Exclusive rights	4	Water rights market	3
		Voting rights	8	Fishing rights	4	Rights knowledge	3
		Rights-based approach	8	Local rights	4	Rights for Indigenous/and	3
				Special drawing rights	4	afro-descendent people	
						Human rights focus	3
						Human Rights Council	3
						Human Rights Commission	3
						Rights and development	3
						Rights and control	3

Figure 43 Full list of word clusters derived from an NVivo Word Tree analysis of "rights". This only counts phrase clusters of 3 or more.

Appendix C

The full list of Word Tree clusters generated in NVivo 12 Plus from text searches of "crisis" and "crises" within the core review library. This list combines the two searches.

Major clusters (20+)		Moderate clusters (8-20)		Minor clusters (3-7)	
Financial crisis/es	183	Growth after crisis	17	Response/s to crisis	7 *Crisis and contingency
Economic crisis/es	115	Subprime crisis	15	Crisis of 1973	7 management
Water crisis	86	Crisis response	15	Ecological crisis	7 following the crisis
Global financial crisis	68	Crisis and Recovery Act	15	Oil crisis	7 Humanitarian crises
Crisis management	51	Energy crisis	15	*Crisis problematization	7 Political crises
Crisis discourse/s	38	Environmental crisis	15	*Crisis in Spain	7 Banking crises
Infrastructure crisis	37	Housing crisis	15	2008 crisis	6 Environmental crises
Current crisis	32	Crisis situation/s	14	Waste crisis	6 East Asian crisis
Crisis of 2008	27	*Macro crises	14	Crisis environment	6 Banking crisis
Post-crisis	26	During (the) crisis	14	Health crisis	6 Democratic crisis
Crisis politics	23	Times of crisis	14	Contemporary crisis	6 Employment crisis
Climate crisis	23	Global crisis	13	*Transportation crises	6 beyond crisis
Global economic crisis	23	Impact of crisis	11	Health crises	6 National crisis
*Societal crisis	23	COVID-19 crisis	11	Pre-crisis	5 Regional crisis
after crisis	23	Crisis and its impact	11	Electricity crisis	5 Crisis scenarios
		Politics of crisis	10	Pandemic crisis	5 Crisis of 1998
		Fiscal crisis	10	Sanitary crisis	5 *Crisis fund
		Crisis governance	10	Prior to crisis	5 Crisis driven decision
		Political crisis	9	*Crisis frames	5 *Crisis coordination
		Asian crisis	9	*Macro crisis	5 Crisis contexts
		Before crisis	9	Mortgage crisis	5 Debt crises
		Effect/s of crisis	9	Periods of crisis	5 Effects of the crisis on the
		Crisis in 1997	9	Effects/impacts of the c	5 poor
		Debt crisis	8	Framing a crisis	4
		Affected by crisis	8	Power crisis	4
		Crisis infrastructure/s	8	Urban crisis	4
		Crisis growth	8	Crisis of 2001	4

Figure 44 Full list of word clusters derived from an NVivo Word Tree analysis of "crisis" and "crises". This only includes phrase clusters of 3 or more incidences. A * indicates all incidences of the phrase occurred within one paper.

Appendix D

Areas of integration	References 1812	Integrated things	References 2710	Integrated governance	References 879
Infrastructure integration	784	Integrated approaches	135	Integrated water / stormwater management	313
Planning and policy integration	168	Integrated management	44	Integrated transport/land use planning	215
Regional integration	124	integrated projects / delivery	27	Integrated planning / processes	215
Vertical and horizontal integration	116	integrated assessments	25	Integrated strategies	41
European integration	81	integrated processes	25	integrated governance	25
Economic integration	67	integrated systems	23	integrated community sustainability planning	22
Integrated community sustainability	41	integrated sustainability	22	integrated coastal zone management	16
Integrated development	41	integrated designs	20	integrated community plan	12
Integration of green/blue infrastructure	30	integrated solution	18	integrated waste management	4
Renewable energy integration	29	integrated development plans	17	Integrated Resource Management	4
Systemic/systems integration	24	integrated environment	17	integrated risk management	4
Organisational integration	23	integrated models/modelling	16	integrated flood management	4
Sectoral integration	20	integrated spaces	16	integrated island management	4
spatial integration	20	integrated water use	15		
Service integration	20	integration of adaptation	13	About integration	References 266
social integration	18	integrated networks	12	Forms of integration	70
knowledge integration	17	integrated river basin management	12	integration values/principles	44
integration of land use	17	integrated cities	10	Levels of integration	29
Network integration	17	integrated framework	10	integration mechanisms/instruments	28
multimodel integration	12	integration of renewables	10	integration initiatives/processes	17
data integration	10	integrated utilities	9	integration theories	16
market integration	10	integrated transport system	8	integration meaning/concepts	16
political integration	9	integrated urban infrastructures	8	integration projects/management	16
integration of technology	9	integrated view	8	integration efforts	8
evolutionary integration	8	integrated decision	8	integration challenges	8
urban integration	8	integrated solid waste	6	integration map	5
municipal integration	8	integrated surface water & groundwater	6	integrated planning Work Group	5
institutional integration	7	integrated operations	6	integration agenda	4
integrated with land use	7	integrated Pollution Control	6		
environmental policy integration	6	integrated mountain development	6	Integration level	References 501
fare integration	6	integrated critical systems	5	More/greater integration	106
operational integration	6	integrated vision	5	better/well integrated	45
project integration	6	integrated relationships	5	lack of integration	37
integration of spaces / spatial	6	integrated organizations	5	full/most integration	37
Building integrated	6	integrated perspective	5	Smart and integrated	33
integration of housing infrastructure	6	integrated planning project	5	integration & coordination	27
integration in practice	5	integrated thinking	5	integrated manner/way	26
cross-sectoral integration	4	integrated climate	4	effective integration	24
hierarchical integration	4	integrated companies	4	towards integration	22
immediate and long-term integration	4	integrated supply chain	4	increasing/further integration	21
Convex integration	4	Riverscape integration	4	integrated and sustainable	15
upstream operation integration	4	integrated mobility	4	highly/deep integration	14
		integration of health	4	strategic integration	12
		integrated adaptation	4	integration and cooperation	12
				innovative integration	9
				successful integration	9
				partial integration	8
				functional integration	8
				integrated and coordinated	4
				integrated smart and green	4
				seamlessly integrated	4
				genuinely integrated	4
				closely integrated	4
				intergrated or superficial	4
				global integration	4
				regional integrated	4
				international integration	4

Appendix E

Full descriptions of the visualisations of the bibliographic analysis performed on citation data (n=) in VosViewer, using data from Scopus and Web of Science databases.

Figure	Analysis type and description	VosViewer data
Figure 4	The keywords co-occurrence network shows clusters of interconnected keywords. Each cluster (red, yellow, green, blue) represents keywords that are highly interconnected across the literature. Larger keywords are more common, and those in the centre are more interconnected with other keywords.	Weight=occurrences. 7477 keywords, minimum number of occurrences=25, 58 linked items, and 4 clusters.
Figure 5	The keywords co-occurrence overlay network is the same as above, but the colours represent years (i.e. lighter colours show where there are higher proportions of more recently used keywords).	Weight=occurrences. 7477 keywords, minimum number of occurrences=25, 58 linked items, and 4 clusters.
Figure 6	The Countries co-authorship network shows the countries most commonly linked via co-authorship. The lines show other countries authors most commonly co-authored with. The close distances between them represent countries most commonly in co-authorship relationships. The colours represent clusters.	Weight=occurrences. 108 countries, minimum number of documents per country=5, 36 linked items, and 8 clusters.
Figure 7	The Countries co-authorship overlay network is the same as above, but the colours represent years (i.e. the lighter colours show more recent co-authorship relationships).	Weight=occurrences. 108 countries, minimum number of documents per country=5, 36 linked items, and 8 clusters.
Figure 8	The sources citation network shows how closely the different sources are related to each other in terms of citations (e.g., how many times Journal A cites Journal B or vice-versa). The larger spheres represent the most common journals. Links represent journals most commonly cited together.	Weight=occurrences. 794 sources, minimum number of documents per source=5, 41 linked items, and 10 clusters.
Figure 9	The sources citation overlay network is the same as above, but the colours represent years (i.e. the lighter colours show more recent citations).	Weight=occurrences. 794 sources, minimum number of documents per source=5, 41 linked items, and 10 clusters.

References

- Adkins, L., Cooper, M., & Konings, M. (2021). Class in the 21st century: Asset inflation and the new logic of inequality. *Environment and Planning A: Economy and Space*, 53(3), 548-572.
- Alexandra, J. (2017). The city as nature and the nature of the city - climate adaptation using living infrastructure: governance and integration challenges. *Australian Journal of Water Resources*, 21(2), 63-76. doi:10.1080/13241583.2017.1405570
- Alexandra, J., & Norman, B. (2020). The city as forest-integrating living infrastructure, climate conditioning and urban forestry in Canberra, Australia. *Sustainable Earth*, 3(1), 1-11. Retrieved from <https://sustainableearth.biomedcentral.com/track/pdf/10.1186/s42055-020-00032-3.pdf>
- Arnold, C. A. T. (2021). Resilience Justice and Community-Based Green and Blue Infrastructure. *William & Mary Environmental Law and Policy Review*, 45.
- Arts, J., Hanekamp, T., Linssen, R., & Snippe, J. (2016a). *Benchmarking Integrated Infrastructure Planning Across Europe - Moving Forward to Vital Infrastructure Networks and Urban Regions*. Paper presented at the Transportation Research Procedia.
- Arts, J., Hanekamp, T., Linssen, R., & Snippe, J. (2016b). Benchmarking integrated infrastructure planning across Europe - moving forward to vital infrastructure networks and urban regions. In L. Rafalski & A. Zofka (Eds.), *Transport Research Arena Tra2016* (Vol. 14, pp. 303-312).
- Audit Office of New South Wales. (2014). *WestConnex: Assurance to the Government*. Sydney: Audit Office of NSW.
- Bafarasat, A. Z. (2016). Meta-governance and soft projects: A hypothetical model for regional policy integration. *Land Use Policy*, 59, 251-259. doi:10.1016/j.landusepol.2016.09.004
- Baldwin, R., Cave, M., & Lodge, M. (2012). *Understanding regulation: theory, strategy, and practice*: Oxford University Press on Demand.
- Ball, D. P. (2020). Seńák development set to generate billions for Skwxwú7mesh. *Salish Sea Sentinel*. Retrieved from <https://salishseasentinel.ca/2020/01/sen%CC%93a%E1%B8%B5w-development-set-to-generate-billions-for-s%E1%B8%B5wxwu7mesh/>
- Beall, J., Cherenet, Z., Cirolia, L., & da Cruz, N. F. (2019). Understanding infrastructure interfaces: common ground for interdisciplinary urban research? *Journal of the British Academy*, 11-43.
- Beaton, B., Burnard, T., Linden, A., & O'Donnell, S. (2015). Keewaytinook mobile: An indigenous community-owned mobile phone service in Northern Canada. *Indigenous People and Mobile Technologies*. New York and Abingdon: Routledge, 109-124.
- Becker, S., Naumann, M., & Moss, T. (2017). Between coproduction and commons: Understanding initiatives to reclaim urban energy provision in Berlin and Hamburg. *Urban Research & Practice*, 10(1), 63-85.
- Bertolin, M. (2017). *The New Political Spaces of Infrastructure Provision*. Newcastle University.
- Birkinshaw, M. (2017). *Murky waters: infrastructure, informality and reform in Delhi*. London School of Economics and Political Science (United Kingdom),
- Bolt, J. A. (2011). *Challenges to Public-Private Transport Infrastructure Development in Mexico*. Retrieved from
- Book, K., Eskilsson, L., & Khan, J. (2010). Governing the balance between sustainability and competitiveness in urban planning: the case of the Orestad model. *Environmental Policy and Governance*, 20(6), 382-396. doi:10.1002/eet.557
- Bosworth, K. (2018). *The People versus the Pipelines: Energy infrastructure and liberal ideology in North American environmentalism*.
- Bristow, G., Farrington, J., Shaw, J., & Richardson, T. (2009). Developing an evaluation for crosscutting policy goals: the accessibility policy assessment tool. *Environment and Planning A*, 41(1), 48-62.
- Caball, R., & Malekpour, S. (2019). Decision making under crisis: Lessons from the Millennium Drought in Australia. *International Journal of Disaster Risk Reduction*, 34, 387-396. doi:10.1016/j.ijdr.2018.12.008
- Charles, S. (2020). The (re) urbanization of Honolulu: Colonialism and urban renewal in Hawaii. *Ayana. Revista de Investigación en Turismo*, 1(1), 006-006.
- Christensen, L. T., & Greve, C. (2018). Choosing state owned enterprises over public-private partnerships for infrastructure governance: explaining institutional change with evidence from Denmark's transport sector. *International Public Management Review*, 18(2), 137-161.
- Colacino, P., & Hensley, H. L. (2019). The Australian Infrastructure Audit 2019. *Planning News*, 45(8), 6-7.
- Colombo, E., Leone, P., Taisch, M., Cheli, F., Pinzone, M., Arrigoni, S., . . . Boccardo, P. (2017). *Toward Smart and Integrated Infrastructure for Africa: An agenda for digitalisation, decarbonisation and mobility* (8894122646). Retrieved from

- Cosens, B., McKinney, M., Paisley, R., & Wolf, A. T. (2018). Reconciliation of development and ecosystems: the ecology of governance in the International Columbia River Basin. *Regional Environmental Change*, 18(6), 1679-1692. doi:10.1007/s10113-018-1355-1
- Cunningham, S. W., & Kwakkel, J. H. (2009). *A theory of infrastructure provision*. Paper presented at the 2009 2nd International Conference on Infrastructure Systems and Services: Developing 21st Century Infrastructure Networks, INFRA 2009, SSN Nagar.
- Curtis, C., & James, B. (2004). An institutional model for land use and transport integration. *Urban Policy and Research*, 22(3), 277-297. doi:10.1080/0811114042000269308
- Dalakoglou, D. (2016). Infrastructural gap: Commons, state and anthropology. *City*, 20(6), 822-831. doi:10.1080/13604813.2016.1241524
- Dodson, J. (2017). The global infrastructure turn and urban practice. *Urban Policy and Research*, 35(1), 87-92.
- Dolla, T., & Laishram, B. (2020). Governance Issues in PPP Procurement Options Analysis of Social Infrastructure: Case of Indian Waste Management Sector. *Journal of Infrastructure Systems*, 26(4). doi:10.1061/(asce)is.1943-555x.0000578
- Dong, J. V. (2009). *Splintering Urbanism and Sustainable Urban Water Management in Sydney and Melbourne*.
- Easthope, H., Crommelin, L., Troy, L., Davison, G., Nethercote, M., Foster, S., . . . Horne, R. (2020). *Improving outcomes for apartment residents and neighbourhoods* (18347223). Retrieved from <https://www.scopus.com/inward/record.uri?eid=2-s2.0-85097895186&doi=10.18408%2fahuri-7120701&partnerID=40&md5=1b794f26cdd74a01fe172cf237f1a3a3>
- <https://www.ahuri.edu.au/research/final-reports/329>
- Enright, T., & Ward, K. (2021). Governing urban infrastructures under pandemic conditions: some thoughts. *Urban Geography*. doi:10.1080/02723638.2021.1893050
- Fay, M., Andrés, L. A., Fox, C., Narloch, U., Straub, S., & Slawson, M. (2017). The Road Ahead: Spending Better to Meet “Real” Infrastructure Needs. In.
- Flinders, M. (2005). The politics of public–private partnerships. *The British Journal of Politics and International Relations*, 7(2), 215-239.
- Flyvbjerg, B. (2009). Survival of the unfittest: why the worst infrastructure gets built—and what we can do about it. *Oxford review of economic policy*, 25(3), 344-367.
- Flyvbjerg, B., Bruzelius, N., & Rothengatter, W. (2003). *Megaprojects and risk: An anatomy of ambition*: Cambridge university press.
- Frantzeskaki, N. (2019). Seven lessons for planning nature-based solutions in cities. *Environmental Science & Policy*, 93, 101-111. doi:10.1016/j.envsci.2018.12.033
- Friedländer, B., Röber, M., & Schaefer, C. (2021). Institutional Differentiation of Public Service Provision in Germany: Corporatisation, Privatisation and Re-Municipalisation. In *Public Administration in Germany* (pp. 291-309): Palgrave Macmillan, Cham.
- Furceri, D., Loungani, P., Ostry, J. D., & Pizzuto, P. (2020). Will Covid-19 affect inequality? Evidence from past pandemics. *Covid Economics*, 12(1), 138-157.
- Furlong, C., Phelan, K., Dodson, J., & Considine, R. (2017). Scoping the potential role of the water sector in urban greening and cooling: A case study of Melbourne. *WIT Transactions on the Built Environment*, 170, 85-95. doi:10.2495/CC170091
- Gbadegesin, J. T., Ojekalu, S., Gbadegesin, T. F., & Komolafe, M. O. (2020). Sustaining community infrastructure through community-based governance (the social practice of collective design policy). *Smart and Sustainable Built Environment*.
- Geddes, A., Schmidt, T. S., & Steffen, B. (2018). The multiple roles of state investment banks in low-carbon energy finance: An analysis of Australia, the UK and Germany. *Energy Policy*, 115, 158-170.
- Geerlings, H., & Stead, D. (2003). The integration of land use planning, transport and environment in European policy and research. *Transport Policy*, 10(3), 187-196.
- George, G., Baker, T., Tracey, P., & Joshi, H. (2019). *Handbook of inclusive innovation: the role of organizations, markets and communities in social innovation*: Edward Elgar Publishing,.
- George, J. (2018). *The contribution of community governance towards the sustainable planning and management of urban and regional green infrastructure*. Curtin University,
- Gergan, M. D. (2020). Disastrous hydropower, uneven regional development, and decolonization in India's Eastern Himalayan borderlands. *Political Geography*, 80. doi:10.1016/j.polgeo.2020.102175
- Ghorbani, M., Eskandari-Damaneh, H., Cotton, M., Ghoochani, O. M., & Borji, M. (2021). Harnessing indigenous knowledge for climate change-resilient water management – lessons from an ethnographic case study in Iran. *Climate and Development*, 1-14. doi:10.1080/17565529.2020.1841601

- Grabowski, Z. J., Denton, A., Rozance, M. A., Matsler, M., & Kidd, S. (2017). Removing dams, constructing science: Coproduction of undammed riverscapes by politics, finance, environment, society and technology. *Water Alternatives*, 3(3), 769.
- Graham, N. (2020). Learning sacrifice: Legal education in the Anthropocene. In *From Environmental to Ecological Law* (pp. 209-222): Routledge.
- Graham, S., & Marvin, S. (2001). *Splintering urbanism: networked infrastructures, technological mobilities and the urban condition*: Psychology Press.
- Grandinetti, T. (2019). Urban aloha 'aina: Kaka 'ako and a decolonized right to the city. *Settler Colonial Studies*, 9(2), 227-246.
- Grant, J. L., Beed, T., & Manuel, P. M. (2018). Integrated Community Sustainability Planning in Atlantic Canada: Green-Washing an Infrastructure Agenda. *Journal of Planning Education and Research*, 38(1), 54-66. doi:10.1177/0739456x16664788
- Greater Sydney Commission. (2020). *Consultations Outcomes Report: Place-based Infrastructure Compacts for the Western Parkland City*. Retrieved from
- Greater Sydney Commission. (n.d.). Making the Western Parkland City: Initial Place-based Infrastructure Compact (PIC) Area. Retrieved from <https://www.greater.sydney>project>western-sydney-PIC-program>
- Greenwood, D., & Newman, P. (2010). Markets, Large Projects and Sustainable Development: Traditional and New Planning in the Thames Gateway. *Urban Studies*, 47(1), 105-119. doi:10.1177/0042098009346864
- Groenfeldt, D. (2013). *Water Ethics*.
- Gürdür Broo, D., Lamb, K., Ehwi, R. J., Pärn, E., Koronaki, A., Makri, C., & Zomer, T. (2021). Built environment of Britain in 2040: Scenarios and strategies. *Sustainable Cities and Society*, 65. doi:10.1016/j.scs.2020.102645
- Guthrie, L., De Silva, S., & Furlong, C. (2017). A categorisation system for Australia's Integrated Urban Water Management plans. *Utilities Policy*, 48, 92-102. doi:10.1016/j.jup.2017.08.007
- Haasnoot, M., Kwakkel, J. H., Walker, W. E., & ter Maat, J. (2013). Dynamic adaptive policy pathways: A method for crafting robust decisions for a deeply uncertain world. *Global environmental change*, 23(2), 485-498.
- Habis, D., Phillips, R., Phibbs, P., & Verdouw, J. (2014). *Progressing tenancy management reform on remote Indigenous communities*. Retrieved from <https://www.scopus.com/inward/record.uri?eid=2-s2.0-84905373098&partnerID=40&md5=96725306f5aed54daa3201a007974d82>
- Hall, S., Jonas, A. E. G., Shepherd, S., & Wadud, Z. (2019). The smart grid as commons: Exploring alternatives to infrastructure financialisation. *Urban Studies*, 56(7), 1386-1403. doi:10.1177/0042098018784146
- Handy, S. (2020). Is accessibility an idea whose time has finally come? *Transportation Research Part D: Transport and Environment*, 83, 102319.
- Harris, M. (2017). Competitive Precinct Projects: The Five Consistent Criticisms of "Global" Mixed-Use Megaprojects. *Project Management Journal*, 48(6), 76-92. doi:10.1177/875697281704800607
- Haughton, G., & McManus, P. (2019). Participation in postpolitical times: Protesting westconnex in Sydney, Australia. *Journal of the American Planning Association*, 85(3), 321-334.
- Heinelt, M.-S. (2019). How to face the "fight of an ant against a giant"? Mobilization capacity and strategic bargaining in local ethnic conflicts in Latin America. *Zeitschrift Fur Vergleichende Politikwissenschaft*, 13(1), 93-133. doi:10.1007/s12286-019-00417-5
- Howard-Wagner, D. (2018). "Moving from transactional government to enablement" in Indigenous service delivery: The era of New Public Management, service innovation and urban Aboriginal community development. *Australian Journal of Social Issues*, 53(3), 262-282. doi:10.1002/ajs4.53
- Huck, A., Monstadt, J., Driessen, P. P., & Rudolph - Cleff, A. (2021). Towards Resilient Rotterdam? Key conditions for a networked approach to managing urban infrastructure risks. *Journal of Contingencies and Crisis Management*, 29(1), 12-22.
- Hurl, C. (2017). Governing Indigenous Sports and Recreation, 1972–2008: Citizenship Regimes, Nation-Building, and the Politics of Ambivalence. *Journal of Canadian Studies*, 50(3), 727-755. doi:10.3138/jcs.50.3.727
- Jessop, B. (2002). Liberalism, neoliberalism, and urban governance: A state–theoretical perspective. *Antipode*, 34(3), 452-472.
- Jhagroe, S., & Frantzeskaki, N. (2015). Framing a crisis: exceptional democracy in Dutch infrastructure governance. *Critical policy studies*, 10(3), 348-364. doi:10.1080/19460171.2015.1066690
- Jhagroe, S., & Frantzeskaki, N. (2016). Framing a crisis: exceptional democracy in Dutch infrastructure governance. *Critical policy studies*, 10(3), 348-364. doi:10.1080/19460171.2015.1066690
- Keil, R. (2002). "Common–sense" neoliberalism: progressive conservative urbanism in Toronto, Canada. *Antipode*, 34(3), 578-601.

- Kensicki, A. (2019). "Smart" Colonialism and Digital Divestment: A Case Study. *Journal of Palestine Studies*, 48(2), 7-25. doi:10.1525/jps.2019.48.2.7
- Konvitz, J. W. (2016). *Cities and crisis*.
- Kwadijk, J. C., Haasnoot, M., Mulder, J. P., Hoogvliet, M. M., Jeuken, A. B., van der Krogt, R. A., . . . van Waveren, H. (2010). Using adaptation tipping points to prepare for climate change and sea level rise: a case study in the Netherlands. *Wiley interdisciplinary reviews: climate change*, 1(5), 729-740.
- Lane, M. B., & Morrison, T. (2006). Public interest or private agenda?: A meditation on the role of NGOs in environmental policy and management in Australia. *Journal of Rural Studies*, 22(2), 232-242.
- Larionova, M., & Shelepov, A. (2016). Potential role of the new development bank and asian infrastructure investment bank in the global financial system. *Herald of PFUR, International Relations*, 16(4).
- Legacy, C. (2017). Infrastructure planning: in a state of panic? *Urban Policy and Research*, 35(1), 61-73.
- Legacy, C., Curtis, C., & Scheurer, J. (2017). Planning transport infrastructure: examining the politics of transport planning in Melbourne, Sydney and Perth. *Urban Policy and Research*, 35(1), 44-60. doi:10.1080/08111146.2016.1272448
- Legacy, C., Curtis, C., & Sturup, S. (2012). Is there a good governance model for the delivery of contemporary transport policy and practice? An examination of Melbourne and Perth. *Transport Policy*, 19(1), 8-16.
- Lehrer, U. T. E., & Laidley, J. (2008). Old Mega-Projects Newly Packaged? Waterfront Redevelopment in Toronto. *International Journal of Urban and Regional Research*, 32(4), 786-803. doi:10.1111/j.1468-2427.2008.00830.x
- Levenda, A. M. (2016). *Configuring the Urban Smart Grid: Transitions, Experimentation, and Governance*. (Doctor of Philosophy (Ph.D.) in Urban Studies). Portland State University,
- Low, N., & Gleeson, B. (2001). Ecosocialization or countermodernization? Reviewing the shifting 'Storylines' of transport planning. *International Journal of Urban and Regional Research*, 25(4), 784-803.
- Makarewicz, C., Adkins, A., Frei, C., & Wennink, A. (2018). "A little bit happy": How performance metrics shortchange pedestrian infrastructure funding. *Research in Transportation Business & Management*, 29, 144-156. doi:10.1016/j.rtbm.2019.01.002
- Maya-Drysdale, D., Jensen, L. K., & Mathiesen, B. V. (2020). Energy Vision Strategies for the EU Green New Deal: A Case Study of European Cities. *Energies*, 13(9). doi:10.3390/en13092194
- McCreary, T., & Turner, J. (2018). The contested scales of indigenous and settler jurisdiction: Unist'ot'en struggles with Canadian pipeline governance. *Studies in Political Economy*, 99(3), 223-245.
- McLean, A. J. (2018). *Un-Splintering Urbanism: Examining the Integration of Urban Infrastructures*. University of Sheffield,
- Mees, H. L. P., & Driessen, P. P. J. (2011). Adaptation to climate change in urban areas: Climate-greening London, Rotterdam, and Toronto. *Climate Law*, 2(2), 251-280. doi:10.3233/CL-2011-036
- Meissner, R. (2021). eThekwini's Green and Ecological Infrastructure Policy Landscape. In *eThekwini's Green and Ecological Infrastructure Policy Landscape* (pp. 81-233): Springer.
- Mhunduru, F. K. (2016). *Financing infrastructure in Africa: an assessment of the role of the African Union*. University of the Free State,
- Moran, M., & Porter, D. (2014). Reinventing the governance of public finances in remote Indigenous Australia. *Australian Journal of Public Administration*, 73(1), 115-127.
- Mottee, L. K., Arts, J., Vanclay, F., Miller, F., & Howitt, R. (2020). Metro infrastructure planning in Amsterdam: how are social issues managed in the absence of environmental and social impact assessment? *Impact Assessment and Project Appraisal*, 38(4), 320-335. doi:10.1080/14615517.2020.1741918
- Musonda, C. (2018). *Spatial implications of foreign direct investment (FDI) on infrastructure delivery: A case of the City of Lusaka, Zambia*. University of Cape Town,
- Norman, H., Apolonio, T., & Parker, M. (2021). Mapping local and regional governance: reimagining the New South Wales Aboriginal sector. *Cosmopolitan Civil Societies: an interdisciplinary journal*, 13(1).
- O'Brien, P., Pike, A., & Tomaney, J. (2019). Governing the 'ungovernable'? Financialisation and the governance of transport infrastructure in the London 'global city-region'. *Progress in Planning*, 132. doi:10.1016/j.progress.2018.02.001
- O'Neill, P. M. (2010). Infrastructure Financing and Operation in the Contemporary City. *Geographical Research*, 48(1), 3-12. doi:10.1111/j.1745-5871.2009.00606.x
- O'Brien, P., Pike, A., & Tomaney, J. (2019). Governing the 'ungovernable'? Financialisation and the governance of transport infrastructure in the London 'global city-region'. *Progress in Planning*, 132. doi:10.1016/j.progress.2018.02.001
- OECD. (2015). Towards a Framework for the Governance of Infrastructure. In: OECD Paris.
- Oke, C., Bekessy, S. A., Frantzeskaki, N., Bush, J., Fitzsimons, J. A., Garrard, G. E., . . . Callow, D. (2021). Cities should respond to the biodiversity extinction crisis. *npj Urban Sustainability*, 1(1), 1-4.
- Osborne, N., & Alizadeh, T. (2020). Public Cities. In *Understanding Urbanism* (pp. 117-133): Springer.

- Otsuki, K., Read, M., & Zoomers, E. (2016). *Large scale investments in infrastructure: Competing policy regimes to control connections*. Paper presented at the Global governance and agrarian justice, The Hague.
- Perkins, M. (2020). 'Devastated': Anger after 'culturally significant' tree cut down at highway site. *The Sydney Morning Herald*. Retrieved from <https://www.smh.com.au/environment/conservation/devastated-anger-after-culturally-significant-tree-cut-down-at-highway-site-20201026-p568pm.html>
- Pittman, N., Legacy, C., Stone, J., & Clements, R. (2019). \$500m for station car parks? Other transport solutions could do much more for the money. *The Conversation*. Retrieved from <https://theconversation.com/500m-for-station-car-parks-other-transport-solutions-could-do-much-more-for-the-money-114908>
- Pohlmann, A., & Colell, A. (2020). Distributing power: Community energy movements claiming the grid in Berlin and Hamburg. *Utilities Policy*, 65. doi:10.1016/j.jup.2020.101066
- Porter, L. (2018). From an urban country to urban Country: confronting the cult of denial in Australian cities. *Australian Geographer*, 49(2), 239-246.
- Porter, L., & Barry, J. (2016). *Planning for coexistence?: Recognizing Indigenous rights through land-use planning in Canada and Australia*: Routledge.
- Porter, L., Roy, A., & Legacy, C. (2021). Planning Solidarity? From Silence to Refusal. *Planning Theory & Practice*, 22(1), 111-138.
- Quak, E.-j. (2018). *The public investment gap: the need for external finance to increase public investment*. Retrieved from Quesnel, K. J., Ajami, N. K., & Wyss, N. (2017). Accelerating the Integration of Distributed Water Solutions: A Conceptual Financing Model from the Electricity Sector. *Environ Manage*, 60(5), 867-881. doi:10.1007/s00267-017-0914-4
- Reddick, A. (2002). *The duality of the public interest: networks, policy and people*. Carleton University,
- Rodríguez-Pose, A., Crescenzi, R., & Di Cataldo, M. (2018). Institutions and the thirst for 'prestige' transport infrastructure. In *Knowledge and institutions* (pp. 227-246): Springer, Cham.
- Roe, M., & Mell, I. (2013). Negotiating value and priorities: evaluating the demands of green infrastructure development. *Journal of Environmental Planning and Management*, 56(5), 650-673. doi:10.1080/09640568.2012.693454
- Rogers, D., & Gibson, C. (2020). Unsolicited urbanism: development monopolies, regulatory-technical fixes and planning-as-deal-making. *Environment and Planning A*. doi:10.1177/0308518X20952421
- Rutherford, J. (2008). Unbundling Stockholm: The networks, planning and social welfare nexus beyond the unitary city. *Geoforum*, 39(6), 1871-1883. doi:10.1016/j.geoforum.2008.05.002
- Sage, D., Fussey, P., & Dainty, A. (2015). Securing and scaling resilient futures: neoliberalization, infrastructure, and topologies of power. *Environment and planning D: Society and space*, 33(3), 494-511. doi:10.1068/d14154p
- Schnarch, B. (2004). Ownership, control, access, and possession (OCAP) or self-determination applied to research: A critical analysis of contemporary First Nations research and some options for First Nations communities. *International Journal of Indigenous Health*, 1(1), 80-95.
- Schuch, G., Serrao-Neumann, S., Morgan, E., & Low Choy, D. (2017). Water in the city: Green open spaces, land use planning and flood management – An Australian case study. *Land Use Policy*, 63, 539-550. doi:10.1016/j.landusepol.2017.01.042
- Searle, G., & Legacy, C. (2019). Australian mega transport business cases: Missing costs and benefits. *Urban Policy and Research*, 37(4), 458-473.
- Searle, G., & Legacy, C. (2021). Locating the public interest in mega infrastructure planning: The case of Sydney's WestConnex. *Urban Studies*, 58(4), 826-844. doi:10.1177/0042098020927835
- Somoza Medina, X. (2016). Governance, urban competitiveness and crisis in Spain. *Journal of Urban and Regional Analysis*, 8(1), 47-60. Retrieved from <https://www.scopus.com/inward/record.uri?eid=2-s2.0-84979295815&partnerID=40&md5=9dee78c30768b3f1bb3901f8799aa2d0>
- Tarazona Vento, A. (2017). Mega-project meltdown: Post-politics, neoliberal urban regeneration and Valencia's fiscal crisis. *Urban Studies*, 54(1), 68-84. doi:10.1177/0042098015625025
- Taşan-Kok, T., Atkinson, R., & Martins, M. L. R. (2020). Hybrid contractual landscapes of governance: Generation of fragmented regimes of public accountability through urban regeneration. *Environment and Planning C: Politics and Space*, 2399654420932577.
- Temper, L. (2019). Blocking pipelines, unsettling environmental justice: from rights of nature to responsibility to territory. *Local Environment*, 24(2), 94-112.
- Terrill, M. (2020). Budget 2020: the big infrastructure spend is misplaced. Retrieved from <https://grattan.edu.au/news/budget-2020-the-big-infrastructure-spend-is-misplaced/>
- Triyanti, A., & Chu, E. (2018). A survey of governance approaches to ecosystem-based disaster risk reduction: Current gaps and future directions. *International Journal of Disaster Risk Reduction*, 32, 11-21. doi:10.1016/j.ijdrr.2017.11.005
- Tubridy, D. (2020). Co-financing green resilient infrastructures in Copenhagen: integrated or superficial design? *Landscape Research*, 1-12. doi:10.1080/01426397.2020.1850664

- Tuck, E., & Yang, K. W. (2012). Decolonization is not a metaphor. *Decolonization: Indigeneity, education & society*, 1(1).
- Valverde, M., & Moore, A. (2019). The performance of transparency in public–private infrastructure project governance: The politics of documentary practices. *Urban Studies*, 56(4), 689-704. doi:10.1177/0042098017741404
- van de Meene, S., Bettini, Y., & Head, B. W. (2020). Transitioning toward Sustainable Cities—Challenges of Collaboration and Integration. *Sustainability*, 12(11). doi:10.3390/su12114509
- van den Hurk, M., & Verhoest, K. (2015). The governance of public–private partnerships in sports infrastructure: Interfering complexities in Belgium. *International Journal of Project Management*, 33(1), 201-211. doi:10.1016/j.ijproman.2014.05.005
- Weinreich, D. P., & Skuzinski, T. S. (2021). Organizing transit institutions to facilitate cross-jurisdictional service integration: A multi-region comparative case study. *Journal of Urban Affairs*, 1-25. doi:10.1080/07352166.2020.1722031
- Westerman, H. L. (1998). *Cities for Tomorrow: Integrating Land Use, Transport and the Environment: Better Practice Guide*. Western Parkland City Authority. (2021). Creating places - The Western Parkland City - Western Parkland City Authority. Retrieved from <https://wpcasidney/creating-places/the-western-parkland-city>
- Wyeth, R. (2016). *Flows of power: Water crisis and governance in the Republic of Georgia*. MSc thesis. University of Indiana, Dept. of Geography,
- Zaato, J. J., & Hudon, P.-A. (2015). Governance lessons from public-private partnerships: examining two cases in the Greater Ottawa Region. *Commonwealth Journal of Local Governance*(16/17), 12-30.
- Zamanifard, H., Alizadeh, T., & Bosman, C. (2018). Towards a framework of public space governance. *Cities*, 78, 155-165.
- Zonneveld, W., & Spaans, M. (2014). Meta-governance and developing integrated territorial strategies: The case study of MIRT territorial agendas in the Randstad (Netherlands). *Planning Theory & Practice*, 15(4), 543-562. doi:10.1080/14649357.2014.963379