

# Contestations over Scale Frames regarding the Sustainability of Mega-infrastructure Project Development

*The case of the Bali Mandara Highway*

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**Abstract:** Some urban megaprojects are framed as a strategic move to achieve broader economic benefits. Project proponents often claim that adverse socio-environmental effects are mitigated accordingly and that all aspects of sustainability are integrated successfully. Using a case study of the Bali Mandara highway, this study drew upon the politics of scale to investigate multiple frames of these effects and mitigation efforts on various scales (and levels). Semi-structured interviews were conducted, and secondary data sources were collected to explore and examine the variety and mix of the scale frames representing all sustainability aspects. Words and phrases related to scale-related issues were identified and tracked in the development phases (i.e., pre-construction, construction, and usage). The study shows that different stakeholders used specific preferred scale types to frame the effects and mitigation efforts, and these frames evolved throughout the project phases. Our findings substantiate that limited scale choices can occur from a lack of open process, resulting in a limited representation of all scale-related issues affecting the sustainability of the highway project development. This paper adds insights into the use of scale to explore the broad effects of urban megaprojects and calls for more transparent and accountable impact audits.

## 1. INTRODUCTION

Megaprojects have become a strategic delivery option to boost economic growth (Mišić and Radujković, 2015). Altshuler and Luberoff (2003) illustrate that the projects have become more inclusive, less disruptive, and more flexible in addressing the different needs of local communities. There seems to be a promising pathway that megaprojects will help policymakers achieve sustainable development objectives (Othman 2013). However, empirical evidence has shown otherwise. Ren (2017) investigates that land acquisition and housing demolition have led to widespread protests in Chinese cities



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where urban megaprojects have been promoted widely. [Delphine \(2019\)](#) studies that mega-transport infrastructure projects in Indonesia have excluded local people during the planning phase and have moved these stakeholders away from gaining future direct and indirect economic benefits.

The rapid development of mega-transport projects can be viewed as an implication of globalising capital into cities ([Chandrashekar and Aithal, 2021](#)), aiming to improve countries' economic competitiveness. [Flyvbjerg, Bruzelius, et al. \(2003\)](#) observe the project development as a new politics of distance to eliminate distance friction and facilitate rapid mobility of capitals. This development often involves multiple stakeholders having diverse interests and operating at different spatial levels ([Flyvbjerg, 2014](#); [Marrewijk, Clegg, et al., 2008](#)). These stakeholders frame related issues differently based on interests and scales of concerns ([Priemus, Flyvbjerg, et al., 2008](#)), making it challenging to pursue a coherent outcome in time and space scales ([Delphine, 2019](#)). For example, new road construction may improve farmers' access to markets (at a lower spatial level). Non-governmental organisations (NGOs) are concerned with species habitat fragmentation (at a higher spatial level). Some stakeholders focus on project benefits in a short period, such as job creation and transport network efficiency ([Li and Pai, 2016](#)). In contrast, others can be much expanded, such as the accumulation of GHGs emissions ([Suprayoga, Witte, et al. 2020](#)).

Recently, the discussions regarding scales have been more extensive than the spatial and temporal scales. Scales can be used as a 'representation trope,' deployed in political discourses by specific actors to acquire persuasive power to frame and legitimise any development projects ([Xu, 2017](#)). From this constructivist view, stakeholders frame problems as local, regional, national, short-term (tactical), and long-term (strategic) through a conscious political act and a highly interactive process. Project developers strategically upscale and downscale decisions as strategic or tactical to mobilise actions and resources for the projects ([Salet, Bertolini, et al., 2013](#)). The strategic decision is framed in such a way as to keep a vital decision and long-term mission in mind. A tactical decision consists of concrete (and short-term) decisions to resolve local and immediate problems. From this discussion, scale is a 'measuring rule,' also a framing device for assessing problems and facilitating the finding of solutions at specific scales (or scale level) ([Buizer, Bas, et al., 2011](#); [Lieshout, Dewulf, et al., 2011](#)). The failure to identify multiple scale frames at play can lead to mismatches of needs and expectations ([Cumming, Cumming, et al., 2006](#); [Lieshout, Dewulf, et al., 2011](#)) that may exclude some stakeholders, usually the weakest ones from gaining prolonged advantages ([Howitt, 2013](#)).

This study drew upon the central practice of scale frames used to argue about sustainability-related aspects regarding megaproject development. The concept of sustainability is rooted in the Brundtland definition, with sustainability principles centring around the needs of current and future generations (intra and intergenerational equity), focused on three aspects—environmental, social, and economic ([Gudmundsson, Hall, et al., 2016](#)). This study aims to explore various scale frames used by the stakeholders to argue about all these aspects. First, we examined these composite scale frames in the development phases (i.e., pre-construction, construction, and usage). This study also investigated the strategic use of scale frames that affect the project outcome overall. Second, the outcome is observed by whether the three sustainability aspects are adequately integrated into the large-scale project development ([Suprayoga, Witte, et al., 2019](#)).

Bali Mandara Highway – an infrastructure project in Bali, Indonesia – was used as a case study. The case illustrates that the project developers had limited capacity to integrate all aspects of sustainable development (i.e., economic, social, and environmental) on various spatial and temporal scales. The developers dealt with stakeholders' concerns about conserving marine species and preserving religious heritages. Furthermore, the delivery of sustainable development from the project undertaking is debatable as different strategic perspectives of what sustainability aspects to integrate have emerged among the stakeholders.

In most cases, as also found in this case, the project proponents (i.e., government officials and project developers) may solely concentrate on completing the project on budget and schedule as the project has a political implication and resource allocation. In their efforts to cope with cost overruns and time delays, the project developers may neglect the different voices of other stakeholders, making it inaccessible for local stakeholders to gain long-run benefits. The BMH project is suitable for observing such complexity as various interests and arguments about project outcomes presented, involving multiple stakeholders (i.e., local communities, NGO representatives, and university experts who carried out the environmental studies).

The rest of this paper is structured as follows. First, the theoretical framework is outlined based on a review of the existing literature. Second, the research design and methods are described. Third, the results section analyses the Bali Mandara highway case. The paper ends with a discussion of the findings and a separate conclusion section.

## 2. SCALE FRAMING REGARDING THE SUSTAINABILITY OF MEGAPROJECT DEVELOPMENT

This paper defines scale as 'the spatial, temporal, quantitative, or analytical dimensions used to measure and study any phenomenon' ([Gibson, Ostrom, et al., 2000](#)). Scale is categorised into units of analysis located at different positions – or levels – on a scale. [Cash, Adger, et al. \(2006\)](#) list spatial and temporal scales and jurisdictional, institutional, management, network, and knowledge scales. All are with their distinct levels. For example, the spatial scale is the best studies scale and provides the fundament for a discipline like geography ([Kurtz, 2003](#); [Sadler and Kurtz, 2014](#)). Within this scale, the units can be distinguished into global/international, national, regional, and local levels ([Wilbanks and Kates, 1999](#)). Temporal scale refers to different 'time-frames' related to rates, durations, and frequency ([Cash, Adger, et al., 2006](#)). A temporal scale can be divided into long-term, medium-term, and short-term levels ([Lieshout, Dewulf, et al., 2011](#)). A different jurisdictional scale (e.g., national, provincial, municipal) is used to structure the geographical space of state actors representing bounded units created by statutory means. A management task and plan can be framed and grouped into hierarchical sets of decisions and actions ranging from tactical and strategic ([Cash, Adger, et al., 2006](#)).

[Gibson, Ostrom, et al. \(2000\)](#) and [Buizer, Bas, et al. \(2011\)](#) provide an overview of how scales are conceptualised in various disciplines. A scale can be distinguished as a neutral construct (or physical entity) and a social construct from their overview. Scale (as adopted for this study) is conceptualised as a social construct rather than a physical entity ([MacKinnon,](#)

2010; [Marston, 2000](#)). This study followed [Kurtz \(2003, p. 894\)](#), who argues that scale 'is not a pre-given, but a way of framing conceptions of political-spatiality.' Therefore, scales and social action are mutually constituted and socially produced.

Scale framing is a process that involves interactions among different stakeholders to justify a particular definition of an issue or problem at a specific scale (or level) ([Dewulf, Mancero, et al., 2011](#)). Scale frames are also conceptualised as a central practice of politics of scale ([Kurtz, 2003](#)). When a specific scale frame is deployed, one can respond with a counter-scale frame to undermine the other's scale frame. [Kurtz \(2002, p. 256\)](#) adds that counter-scale frames 'are not collective action per se but work to counter or undermine one or more elements of scale frames by involving a competing scale of references for the problem at hand.' Through scale framing, actors construct meaningful and actionable linkages between the scales at which they encounter a social problem and propose the solution. [Lieshout, Dewulf, et al. \(2011, p. 40\)](#) add that a scale frame is 'a specific type of issue frame, i.e., framing the topic of concerns that actors use in different communicative contexts' relating to scale. In other words, scale frames can be perceived as a sensemaking device that various stakeholders use to structure relevant issues ([Dewulf, Mancero, et al., 2011](#)).

In megaproject literature, the course of assessment extends the identification and mitigation of socio-environmental effects from a local level (in which the project locates) to a much broader region within a range of periods ([Sturup and Low, 2019](#); [Stoffle, Stoffle, et al., 2013](#); [Howitt, 2013](#)). However, stakeholders think, articulate, and frame issues strategically and in various ways. For example, project developers often shorten the duration of adverse effects to give the impression of low financial risks ([Flyvbjerg, Bruzelius, et al., 2003](#); [Mentis, 2015](#)). Environmental groups are primarily concerned with prolonged and much broader adverse environmental impacts ([Priemus, 2010](#)). Moreover, the project owners appear only interested in immediate economic returns to gain political support ([Stannard, 1990](#)).

Furthermore, such scale frames may evolve. During the pre-construction phase, the decisions are framed in such a way to argue that strategic needs will be met, standards and procedures are in place, and the budget and schedule are delivered as promised ([Pinto and Mantel, 1990](#)). During the construction, local stakeholders may start to experience the local effects (e.g., congestion or traffic-related pollution) ([Delphine, 2019](#)), and this issue framing can undermine the prolonged advantages of the megaproject ([Priemus, 2007](#)). At the usage phase, stakeholders, mostly local communities, often perceive much broader project consequences and frame them as permanent, such as displaced living and working areas ([Delphine, Witte, et al., 2019](#)). Frequently, stakeholders behave strategically by scaling these issues. They either claim or reject other stakeholders' frames, creating contradictory perspectives on the end project results.

Such conflicting frames indicate that megaproject development is a contentious process. Scholars doubt whether the megaproject can deliver a sustainable outcome by studying the common causes, such as mismanagement and ignored interests ([Flyvbjerg, 2014](#); [Jordhus-Lier, 2015](#); [Delphine, 2019](#); [Sturup and Low, 2019](#)). This paper will investigate how scale frames have been involved in this topic by applying the research design and methods below.

### 3. RESEARCH DESIGN AND METHOD

#### 3.1 Data collection and analysis

This study applied a case study design to examine a social process in a megaproject development, in which various stakeholders have either explicitly or implicitly expressed interests. This design is appropriate for the case to identify complex issues from the perspectives of study participants (Hennink, Hutter, et al., 2011). The design is used to understand interpretations of behaviours and events from the participants' perspectives (Hennink, Hutter, et al., 2011) in a specific social context (Flyvbjerg, 2006). A single case helped the researchers to demonstrate the application of pre-existing concepts to the context (Hennink, Hutter, et al., 2011). This design is also helpful for performing an initial investigation before a complete observation (Yin, 2014) and for gathering different data types by mixing research methods (Thomas, 2011).

The Bali Mandara highway was chosen as a case study for several reasons. First, it is a megaproject regarding its physical size, budget, and affected stakeholders. The framing and reframing of the project's goals were inevitable because of the various interests involved (Suprayoga, Witte, et al., 2019). Second, as recorded in public news media, the project was complex, with different perspectives of landscape changes, economic benefits, and accessibility improvement in time and space. Finally, access to data was high, and the cultural circumstances were favourable for the researchers to collect the data.

Semi-structured interviews were conducted with 20 key stakeholders selected through purposive sampling that ensured their involvement in one or more development phases (see *Table 1*). Data were collected from policy documents, project reports, monographs, and news articles to understand the case's issues. The news articles were published by the popular media press with local and national coverage and dated from the pre-construction phase (September 2012) to the early usage phase (October 2013).

*Table 1.* List of interviewees

No.	Category	Number of interviewees	Code
1.	Project manager/ project staff personnel	3	A1, A2, A3
2.	Municipal government official	4	BA1, BA2, B3, B4
3.	Provincial government official	2	C1, C2
4.	National government official	4	DA1, DA2, D3, D4
5.	Environmental and planning consultant/expert	3	E1, E2, E3
6.	NGO director/ coordinator	2	F1, F2
7.	Local leader/ coordinator	2	G1, G2

The interviews were carried out between September 2017 and August 2018. A list of questions guided the interviews. The researchers asked about (a) how the interviewees framed the sustainability of the project, (b) what they considered as issues, problems, or solutions affecting the project outcome overall, and (c) which phases the issues, problems, and solutions were found. All interviews were audio-recorded, and verbatim transcripts of the recordings were sent to the interviewees for comments and confirmation. From the data gathered, qualitative data analysis software (Atlas.ti) was used to bottom-up code the interview transcripts. The first step in our analysis was to read the interview transcripts looking for words and phrases related to scale-related

issues (e.g., 'scale,' 'scale effect,' 'large-scale', 'level', and 'administrative scale'), to time, to spatial or administrative areas, and the project size. The second step was to code these words or phrases as particular scale frames by specific stakeholders. Finally, we traced the evolution, mixing, and working of these scale frames over the development phases.

Regarding positionality ([Schwartz-Shea and Yanow, 2012](#)), the first author was involved in the ex-post assessment of the Bali Mandara highway project to examine whether the project had met the sustainability objectives (e.g., emission reductions, wastewater treatment, and water pollution mitigation). Such an early involvement gave the researchers access to data on the project and the interviewees and in-depth knowledge of the technical, financial, and social issues related to the project's execution. This prior knowledge provided a sense of how scales were involved in debates and how the project decisions (framed as strategic and tactical) played a role in the project execution.

### 3.2 The case study: The Bali Mandara highway

The Bali Mandara highway (BMH) is a 12.7 km toll expressway that connects the triangle area: the Nusa Dua tourist resort, the Ngurah Rai international airport, and the Benoa harbour (*Figure 1*). The highway project entered the public domain in 2005 and 2006 at the Infrastructure Summit, during which the government offered several infrastructure projects to private developers. BMH is a part of the national recovery policies in the 1998 Post-Asian financial crisis, aimed to attract foreign investment, flourish local business, and create jobs in the construction sector ([Dharma, 2016](#)). The Metropolitan Spatial Plan of Denpasar-Badung-Gianyar-Tabanan (Sarbagita) 2011 states that the main aim of the area where the highway is located is to connect urban centres within the urban region and boost regional economic growth through tourism development ([MPW, 2011](#)). The government actors in different jurisdictions collaborated on the project ([Lamade, Budijanto, et al., 2014](#)) despite the complication of coordination and diverse interests. Such a situation reflects a typical road planning in the decentralised system era of Indonesia, forming the process complexity ([Darmoyono 2019](#)). This case shows that the national government had a strong ambition to improve economic development while preserving the local nature and culture. However, some local stakeholders doubted the promise would materialise during the early planning phase ([Lamade, Budijanto, et al., 2014](#)).

The BMH development project was formally incorporated into the Masterplan for Acceleration and Expansion of Indonesia Economic Development 2011 – 2025 ([CMEA, 2011](#)). The project consortium – consisting of state-owned companies and one provincial and one municipal government – spent around €195 million on the design and construction. The project developer converted 1,373 Ha of mangrove forests for the highway site and the construction area ([Marga, Pelindo, et al., 2011](#)). The highway was considered crucial for improving the urban region and national-wide connectivity. In 2012, 14 million international and domestic passengers arrived and departed from the Ngurah Rai airport. The Benoa harbour is vital in transporting goods and people to the eastern part of Indonesia. The same year, 370 star-rated hotels were in the Nusa Dua tourist resort.



Figure 1. The location of the Bali Mandara highway (plotting of locations based on [Lamade, Budijanto, et al. \(2014\)](#))

Various strategic perspectives have emerged regarding how the BMH project would balance socio-economic and environmental development. First, they revolved around the capacity increase of the regional road network to accommodate increased tourist activities ([Lamade, Budijanto, et al., 2014](#)). The second perspective concentrated on preserving the natural and cultural landscape of Tanjung Benoa Bay, a large area of pristine mangrove forest with several religious spots. Local NGOs and local leaders expressed the latest perspective. Third, other perspectives are concerned with the reallocation and distribution of economic activities within the urban area that would ease the congestion in the area.

During the construction, some events occurred that showed insufficient investigation of impacts at the upfront planning phase. The contractors found flaws in the tide tables, affecting the highway piers' installation and the completion schedule. Introducing a new method to resolve the problem increased the sedimentation rate and degraded the water quality in the project's surrounding area. Moreover, road junctions connecting the BMH had become a new traffic bottleneck. Overall, these mixed raised perspectives amongst the local stakeholders regarding how the megaproject delivered a sustainable outcome. The BMH project was planned to be completed in 18 months. Nevertheless, it could be completed four months before the 25<sup>th</sup> Annual Meeting of Asia–Pacific Economic Cooperation (APEC) leaders in October 2013. *Table 2* shows the project timeline and milestones.

Table 2. Project timeline and milestones

Timeline	Phase	Project milestone
October 2011 – March 2012	Pre- construction	<ul style="list-style-type: none"> <li>• Metropolitan Spatial Plan of Sarbagita 2011 published</li> <li>• Public meetings on the environmental impact assessment recommendations</li> <li>• Environmental impact assessment approved by the governor</li> <li>• Contractors and auditing consultants selected</li> <li>• Highway design finalised</li> </ul>
April 2012 – June 2013	Construction	<ul style="list-style-type: none"> <li>• Construction work started</li> <li>• Highway design revised</li> <li>• Environmental impact assessment revision approved</li> <li>• All construction works completed</li> </ul>
June 2013 – October 2013	Early usage	<ul style="list-style-type: none"> <li>• Operational and safety devices installed</li> <li>• Highway toll operations started</li> </ul>

Timeline	Phase	Project milestone
		<ul style="list-style-type: none"> <li>• APEC Meeting 2013 held</li> <li>• Metropolitan Spatial Plan of Sarbagita 2011 revised</li> </ul>

#### 4. SCALE FRAMES CONCERNING THE SUSTAINABILITY OF THE BALI MANDARA HIGHWAY PROJECT

This section outlines the study results concerning the scale frames (counter-scale frames) used to argue the megaproject effects. The analysis will be categorised based on the development phases (i.e., pre-construction, construction, and usage) found in most EIA reports in Indonesia.

##### 4.1 Pre-construction

In this phase, the project manager framed their management tasks at a higher level (strategic) and a lower one (tactical), indicating that sustainable development was also their concern. First, he referred to the project's strategic mission to cut down travel time and reduce congestion in the area. Therefore, the project could maximise (social and economic) benefits for the local area. He explained:

“The highway ... helped to connect the harbour, the airport, and the resort, and people could reach them in less than 15 minutes from each point.” (A1)

To attain the mission, the project manager offered route alternatives that shortened time travel from each point. A route that minimised the conversion of mangrove forests to a project site was selected, with the central government's approval as the project owner. From a tactical perspective, the route selection turned out crucial to accelerate the project completion. The project manager and the government claimed they avoided lengthy land acquisition negotiations. Second, they framed a sustainable solution as avoiding further conflicts with groups of people who resisted the project plan. The project manager claimed:

“Selecting this [highway] alignment above the water avoided a social conflict caused by land acquisition. ... This option was a win-win solution to resolve the interests between connectivity improvement and reduce tensions among the local people.” (A1)

Using a spatial scale frame, the central government framed the development project to maintain Bali's position as one of the top tourist destinations (internationally). They argued that the highway completion would relieve traffic congestion in the region and result in more convenient mobility for tourists. They also referred to the national spatial plan, leading the way for project implementation. Therefore, the project was considered necessary.

“Bali is the leading tourist destination in Indonesia and is well known worldwide. ... The highway has a vital role in maintaining its image as a competitive tourist destination worldwide.” (DA1)

“The highway [development], as the implementation of the Metropolitan Spatial Plan 2011, was aimed at strengthening the connectivity in the urban region and enhancing tourists' visits and distributing the traffic concentration wisely.” (DA1)

If the central government concentrated on a higher spatial level (international) and national level, the municipal and provincial governments



focused on a lower spatial level (local and regional) where the advantages could be delivered. They argued that the highway would be a new touristic icon which would attract tourist visits to Bali and accelerate Bali's economy.

“... the highway would improve the tourism sector and other economic activities in Bali. Moreover, this [highway] could be a new tourist attraction because of its impressive structure and the beautiful landscape.” (BA2)

“... the highway would accelerate regional growth and create business and employment in Bali, particularly in its southern part.” (C1)

Using the temporal scale frame, the central government argued that the highway could achieve socio-economic benefits. First, they claimed that the highway relieved acute congestion in the area in the medium term (less than five years). Second, in the short term (less than a year), the highway facilitated the APEC meeting's success with a return of economic improvement from increased tourist visits after the event.

The arguments by the project manager and government representatives sound somewhat optimistic. To encounter such claims, the NGO representative framed the project as unsustainable by pointing out that the megaproject plan was incoherent with the lower spatial plan. He argued that the project implementation required revising the provincial spatial plan to analyse the spatial effects comprehensively.

“... the highway should be built at another location. We believe that the government intentionally changed the location because it was built to support the implementation of the event [APEC gathering]. The [provincial] spatial plan should, therefore, be revised.” (F1)

As a response, the central government produced the Metropolitan Spatial Plan 2011 to legalise the project undertaking. One university expert said this plan had deviated from the initial goal of balancing the ecosystem and economic concerns because the mangrove forests would have been primarily impacted. Another expert suspected that the central government produced the plan to keep up with the complete schedule and secure their interests as consortium members. This analysis result has shown that the spatial and temporal scales were used to frame the project effects in space and time. The administrative scale was applied to frame issues with the responsible parties for producing such effects.

## 4.2 Construction

In this phase, the project manager framed the compliance with stricter and higher environmental standards as their success in protecting the surrounding ecosystems. By referring to the tactical management decision, they claimed that deploying what they called 'environment-friendly technologies' had protected landscape quality. They also argued that they had taken necessary measures to secure the surrounding species' habitats.

“[Some technological] measures, such as material types and technical methods, were applied to minimise the construction's adverse consequences on the environment.” (A2)

“The contractors installed wooden piles that allow sea birds to remain safe in their habitat. Through this [effort], we have already protected the landscape and the species' habitat from displacement.” (A1)

These claims sound rather technical but reveal management decisions to achieve the higher strategic mission. The manager claimed that the project had created jobs for the local community. One of the university experts backed the claim and said that multiplier effects had indeed occurred, although for a

limited period: 'The construction work created jobs for the local people and generated multiplier effects in the area' (E1).

However, the NGO director and the local leaders disagreed with that claim. They undermined the claim by pointing out the effects of the revised environmental impact assessment (EIA) document when the construction was carried out. The document permitted the project contractors to alter the construction method. The method allowed the contractors to use materials from boreholes for the bridge's piles and sources on land to raise the seabed along the route of the new road to transport equipment and personnel. The method solved the problem of tidal sea-level rise and made pile driving and other construction activities much more manageable.

The project manager claimed that such a change had no adverse effects on the coastal environment. Otherwise, the NGOs and one local leader discovered that the mangrove forests were being destructed. One of the experts supported the NGOs' study, emphasising the temporal effect of the method utilisation.

“...the new method for the construction should not be deployed. It potentially destroys the mangrove forest. It has turned out that some parts of the forest have become too difficult to restore [in the long term].” (F1)

“... the soil materials injected at the project site during construction have had a cumulative effect on the fragile landscape, such as a loss of biodiversity.” (E1)

An NGO and one of the experts argued that the provincial government was responsible for the consequences. In this way, this administrative scale level was used to point out the party responsible and to convey the inability of certain levels of government (i.e., the provincial government) to monitor such effects.

“The implementation of the new method has had some effect on mangrove forests. Despite the consequence, the provincial government took no action to enforce environmental impact assessment [EIA] recommendations.” (E1)

In this phase, different scale frames regarding the megaproject effects occurred. As impact monitoring and fact-finding were absent in this phase, the contestations of these scale frames evolved. The project manager thought some measures were sufficient to mitigate the effects of the tactical management decisions. Otherwise, the other stakeholders (i.e., NGOs and local leaders) disagreed by pointing out the spatial and temporal effects of the decisions. Despite all these disputes, the project continued.

### **4.3 Early usage**

The consortium completed the development project in March 2013, four months ahead of schedule. Some minor works were performed to ensure safety and low-emission operation, such as installing solar lighting. The project manager referred to these works as measures to achieve environmental sustainability. However, the NGO representative and the local leader considered such efforts insufficient. They argued that degraded landscape quality became prominent. One local leader protested the increase in biochemical oxygen demand (BOD) and chemical oxygen demand (COD), threatening the marine ecosystem at a broader spatial level than the project site.

“BOD and COD reached higher levels than the minimum level. The local fisheries watch a drop in the number of marine animals they catch. Crabs, for example, consume plankton and are unable to grow naturally

in such a polluted area. The residual materials from the project [site] also block the circulation of [vast] seawater transporting the planktons. Fisheries have suffered economically from the decreasing production of marine resources.” (G1)

Although this conflicting argument, most stakeholders agreed that the project scope was too small to solve congestion. They explained that the land-use change had become rapid and generated more traffic than predicted. Three nearby intersections have become traffic bottlenecks, worsened congestion, and increased air pollution in the area. One of the experts said:

“The highway exits become dense with motorised traffic, especially during peak hours. The project developers seemed to fail to anticipate such a situation in the planning phase. Some of the land in the area has also been profoundly affected by this increased traffic.” (E2)

The director of an NGO complained that the development failed to deliver a permanent, sustainable solution because of the congestion. He claimed that the project actualisation only served a short-term interest (i.e., holding an international event) and did not have any prolonged benefit. With the local leaders, he argued that the project had produced unprecedented long-term adverse effects. The director and the local leader substantiated his argument by pointing out the transfer of property ownership to foreigners and the displacement of local fishing grounds.

“A demographic shift occurred as property ownership changed. The local people and big businesses compete to benefit from the [highway] development, and unbalanced competition has happened among both.” (F1)

“The local communities and fisheries are affected by the highway project. In the past, they could catch crabs and fish in the area. The massive structure has blocked the movement of their boats and reduced the number of marine species [in the highway site].” (G1)

The local leaders and the NGOs framed the accumulated effects in temporal and spatial scales to undermine the project manager's claims regarding the project success criteria (i.e., schedule and finance). One of the local leaders, for example, said:

“Most people were sceptical of the development plan in the area because their voices were often unheard. People already spoke about a delay in the project implementation and that all effects should be investigated thoroughly. However, the project was still carried out ... The people's concerns were considered unimportant.” (G1)

This study's results reveal that these stakeholders used composite frames to argue about highway development. These frames can be positioned into scales (also levels) in which the stakeholders discuss and contest issues regarding the project effects, problems, and solutions. The frame contestation has led to diverging opinions on whether the project successfully delivers its promise regarding socio-economic benefits and environmental protection. Mismatches of these frames emerge as the room for communication between the stakeholders is lacking. The following section will discuss this matter.

## 5. DISCUSSION

Two main results of the study are explored for discussion. First, stakeholders use different scale frames to argue about the sustainability aspects of the megaproject development. Moreover, those frames have evolved. Second, without adequate room for mediating the scale frame

differences, scale frame mismatches occur, making it difficult to achieve a coherent view of the aspects. The sub-sections below will elaborate the discussions further.

## **5.1 The use of different scale frames and the transformation**

Our findings show that stakeholders use various and mixed scales to frame issues regarding megaproject development. First, the project managers mainly refer to management decisions to show that the project strategically reduces travel time and congestion in the area. They also claimed that they tactically selected a route to shorten time travel from each point, avoiding social conflicts with people. On the other hand, government officials refer to broader spatial effects of improved connectivity and economic growth (i.e., at the national and regional level) as the main advantages of project undertaking. The local leaders mostly used a timescale to frame the prolonged and accumulated consequences of the project on local nature and culture.

Although the government officials and the local people similarly used timescale in their arguments, both parties frame the issues differently—the officials are concerned about limited benefits, such as congestion relief and the APEC Meeting facilitation. In contrast, the local people fear that the surrounding ecosystems will degrade massively, and sacred sites will be displaced. In addition, the university experts frame various project impacts in space and time and point out that a coherent spatial plan at higher and lower administrative levels is required.

The study has shown that the uses of a limited number of scales are inadequate to analyse complex and interactive effects and other related issues in megaproject development. Moreover, these scale frames were often used strategically to pinpoint problems and solutions each stakeholder wanted to focus on. For example, project developers and managers frame their decisions (both on the strategic and tactical level) to mobilise necessary resources and complete the project on schedule ([Salet, Bertolini, et al., 2013](#); [Giezen, 2013](#); [Bruijn and Leijten, 2007](#)). The local leaders were often concerned about long-term productivity of the natural resources that they depended on ([Howitt, 2013](#)). Using these scale frames, the stakeholders can structure arguments and express their concerns about the sustainability of the development projects.

Furthermore, those scale frames have transformed. In the pre-construction phase, the government authorities firmly believed that the highway would deliver more benefits, namely supporting Bali as an established international tourist destination and distributing economic growth at a broader spatial scale level. Later, in the early usage phase, they admitted that the project scope was too small to deliver such solutions. The project managers claimed that some tactical actions had been taken to mitigate the measured impacts. The manager excluded other parties' arguments about the adverse environmental effects by applying the new method that NGO representatives and local leaders pointed out regarding the degradation of water quality, mangrove forests, and fishing grounds. These stakeholders joined in debates, as shown by their different scale frames. Without room for resolution, the debates produce scale frame mismatches.

## 5.2 Scale frame mismatches and the sustainability of megaproject development

Scale frame mismatches occur when various scale frames point in different directions, making a mutual agreement on specific issues difficult ([Lieshout, Dewulf, et al., 2011](#)). For example, the project manager deployed the new construction method they claimed to mitigate unwanted effects in our case. Otherwise, NGOs and local leaders argued that the treatment resulted in ecosystem degradation at a broad spatial scale. Another example, most government officials initially believed that the project resulted in a permanent solution to the regional (metropolitan) congestion problem. On the other hand, the residents feared rapid losses of local biodiversity would occur. These examples also show that stakeholders consciously or unconsciously include or exclude other arguments by using specific scales that they want to focus on ([Lebel, Garden, et al., 2005](#)).

As the study case illustrated, the scale frame differences were never mediated over the development phases. [Eeten \(1999\)](#) defines such a situation as a 'dialogue of the deaf,' in which each party is unresponsive to what others say. The situation may stagnate identifying problems and solutions and potentially freeze the pursuit of solutions ([Salet, Bertolini, et al., 2013](#); [Giezen, 2012](#)). As also found in other cases, infrastructure projects are often characterised by engineering-driven interventions in which project managers mostly initiate and execute so-called technical solutions ([Mentis, 2015](#); [Bruijn and Leijten, 2007](#); [Clegg, Sankaran, et al., 2017](#)).

Our findings have also substantiated that the limited scale choice occurs from a lack of open-process auditing of impacts. From such behaviour, other stakeholders will likely be excluded ([Flyvbjerg, Bruzelius, et al., 2003](#)). Moreover, the owners may fail to capture various aspects associated with the sustainability of the development projects ([Howitt, 2013](#); [Stoffle, Stoffle, et al., 2013](#)). As a result, all scale-related issues are limited to capturing the sustainability aspects ([Cash, Adger, et al., 2006](#); [Lebel, Garden, et al., 2005](#)). Therefore, the local stakeholders are potentially at risk of being marginalised, and their active participation is being undermined. Such a situation indicates that the development is unsustainable for the local communities' livelihood ([Septanti, Santoso, et.al, 2023](#)).

## 6. CONCLUSION

This study shows that megaproject stakeholders used various scale frames to represent all related sustainability aspects of the Bali Mandara highway project. This study has found that these frames have become intractable without broad stakeholder engagement. The study's results imply that scale frame differences can enrich discussions on all aspects affecting the sustainability of megaproject development. These differences allow debates and fact-checking about the problems and solutions. As found in this case, on the contrary, one party may strategically close the discussions sooner and reject others' relevant concerns about significant social and environmental effects in time and space. Second, scale frame mismatches result from lacking room for shared understanding. A part of the issue is that the quality of stakeholders' engagement is still low, as shown by the project managers' failure to comply with stakeholders' expectations to mitigate unwanted short-

and long-term effects, especially those affecting the quality of natural and cultural resources.

The finding confirms that adopting relevant and scale frames is necessary to properly structure the analysis of sustainability aspects into megaproject development ([Lieshout, Dewulf, et al., 2011](#)). In this study case, project managers fail to do so for various reasons, such as substantial political pressures and limited budget and time allocations. As found in this case, the environmental aspect is inadequately incorporated, and vulnerable stakeholders (e.g., the fishing community at Benoa Bay) are potentially marginalised for a prolonged period.

The study adds an understanding of scale and scale framing in megaproject development. Planners and policymakers can use scale framing to explore, capture and structure all possible sustainability aspects that affect the development. Our study calls for a more solid ground for better stakeholder engagement and the use of scale framing to fill the current gap in the present literature on megaprojects.

## **AUTHOR CONTRIBUTIONS**

Conceptualization, G.B.S. and T.S.; methodology, G.B.S., M.Z. and M.B.; investigation, G.B.S.; resources, G.B.S. and T.S.; data curation, G.B.S.; writing—original draft preparation, G.B.S. and T.S.; writing—review and editing, G.B.S., M.Z., M.B. and P.W.; supervision, P.W. and T.S. All authors have read and agreed to the published version of the manuscript.

## **ETHICS DECLARATION**

The authors declare that they have no conflicts of interest regarding the publication of the paper.

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