Volume 10 • Issue 1 • 2026

Pacific Dynamics
Journal of Interdisciplinary Research

http://pacificdynamics.nz
Creative Commons Attribution 4.0
ISSN: 2463-641X
DOI: https://doi.org/10.26021/16756

Volume 10 (1), 2026

Software scaling the state: Translocal road and bridge asset management in Papua New Guinea

Tuomas Tammisto
Tampere University, Finland

Heikki Wilenius
University of Helsinki, Finland

Abstract

This article examines how Road Asset Management Systems (RAMS) and Bridge Asset Management Systems (BAMS) introduced by international consultants affect state formation in Papua New Guinea. Drawing on anthropological perspectives on state effects, we analyze the translocal processes through which Finnish consultants and Papua New Guinean engineers have developed and implemented asset management software. We argue that these systems produce a "scaling effect" – a process whereby granular infrastructure data is transformed into hierarchical, commensurable units of bureaucratic authority. Unlike more basic record-keeping tools, asset management software prescribes specific modes of governance aligned with data-driven decision-making ideals. By converting physical measurements into standardized metrics aggregated across administrative levels, these systems enact scalar imaginaries of the state while appearing as objective necessities. Our findings contribute to anthropological studies of infrastructure and state formation, demonstrating how digital knowledge infrastructures reconfigure authority and shape what forms of governance become thinkable and enforceable.

Keywords: Infrastructure, state formation, asset management, Papua New Guinea, knowledge infrastructures, scale.

Background

In this article, we examine how the introduction of Road Asset Management Systems (RAMS) and Bridge Asset Management Systems (BAMS) by international consultants affects state formation in Papua New Guinea (PNG). We are especially interested in how translocal processes of and views on "asset management" by different actors affect the governance of public infrastructure, such as roads and bridges. We examine how and why Finnish consultants have introduced asset management systems, both as processes and as software, to PNG, and how the system has been shaped by the cooperation of Finnish consultants and Papua New Guinean engineers of the Department of Works and Highways (DoWH).

Anthropologist Michel-Rolph Trouillot (2001, p. 126) famously argued that the study of the state should go beyond official institutions and focus on the multiple sites in which state processes and practices are recognizable through their effects. In this article we argue that the building of roads and bridges and their maintenance are exactly such sites of state formation, both material and symbolic. Roads are crucial for states because state power is enacted through them, because citizens often evaluate the legitimacy of the state based on the provision of infrastructure and services, and because the large-scale spatial organization of infrastructures often needs an administrative authority comparable to the state. In this article, we focus especially on the last point, namely the administration and maintenance of such infrastructures.

Roads and road building are a particularly pertinent question to the state of PNG as the road infrastructure in the country is limited. PNG is an island nation comprised of mainland PNG on the eastern half of New Guinea island and adjacent islands east of the mainland. With a tropical climate and extremely varied terrain from rugged highlands, swampy lowlands, smaller islands and thick forest cover in many areas, the road building in PNG has been particularly challenging. There are several main highways forming a backbone of road infrastructure, but many rural areas remain without road connection. Due to this, some highland areas rely on planes for transport, while boats and barges are central in the coastal and island regions. In 2021 the government of PNG initiated a large road building programme aimed at developing the country's road network by connecting all the "missing links," namely building road links between existing roads (Kenneth, 2021).

In recent anthropological research, there has been an increasing body of work on infrastructures, expert knowledge, state formation, and their inter-relations (e.g. Larkin, 2013; Appel et al., 2018; Barnes, 2017; Harvey & Knox, 2015). In science and technology studies, attention has been paid to the digital and knowledge-mediating aspects of infrastructure at least since Edwards et al.'s call to study "e-infrastructure" (Edwards et al., 2009), which builds on the famous study of classificatory systems by Bowker & Star (2000). By examining road asset management systems as "knowledge

infrastructures" (Karhunmaa & Käkönen, 2024, pp. 99–100), the affordances of their software implementations, and how they are developed and implemented through translocal processes involving multiple actors, we aim to contribute to both anthropological studies of state formation and studies of knowledge infrastructures.

Crucially, we focus on the collaborative scale-making practices facilitated by these systems. We argue that the development and implementation of asset management software through translocal processes do not simply map existing administrative territories and knowledge; rather, they produce what we call a "scaling effect" – a process where granular data is rendered into hierarchical, commensurable units of bureaucratic authority. Empirically, we examine the development and implementations of such asset management systems in Finland and PNG through the first decades of the 2000s. However, we maintain that our findings on the relationship between public infrastructure provision, software, and state formation – specifically regarding how technology scales the state – are of wider relevance.

Our focus on consultants and officials is a reflection of the phenomenon we study, not a judgement on the agency of people in East New Britain or Papua New Guinea. The people who use the roads and bridges seldom encounter the asset systems directly, and the ways people engage with roads, and care for them, are not recorded by these systems. We have analysed those dealings elsewhere (e.g. Tammisto 2024 & 2025). The relative absence of their voices here is not incidental: as we argue, one effect of scaling is that details of local infrastructure are abstracted into units of a calculus in which communities do not appear. Showing how this omission is produced is one of the contributions of this article.

The idea of physical asset management has emerged from the history of maintenance engineering. A famous example comes from Fredrick Taylor's scientific management principles (2012 [1911]), where he argues for the importance of standardization regarding tools that represent best knowledge (Taylor, 2012, p. 79) and accountability for the care of assets (Taylor, 2012, p. 33). However, a more specific discourse of infrastructure asset management is a relatively recent innovation. One origin story is provided by Penny Burns, who at the time, in 1984, worked for the South Australian Engineering and Water Supply Department (Burns, 2023, p. 2). As an economist, she was interested in the fact that the prices for water and sewage were not based on costs, so she started inquiring after the question of how much the water services actually cost. The background of this thinking was Margaret Thatcher's policies in Britain, which started to have an impact on Australian policy as well. As Burns puts it: "Return on investment was now applied to infrastructure and only economic or financial returns were counted; social and environmental benefits were not factored in" (2023, p. 3).

Burns started collecting data on the condition of water infrastructure, and the place-dependent costs of maintenance and repair, arriving at the kind of principles that the contemporary asset management systems are built on. Since the pioneer work of Burns, the discourse on asset management has evolved to be very technical and specialized. There is an ISO standard (ISO 55000, 2024) for it, originally published in 2014. The rationale for it is expressed in a near-tautological formulation: "Asset management enables an organization to realize value from assets in the

achievement of its organizational objectives" (BS ISO 55000, 2014, 1). A plethora of software has been designed for this purpose. In this article, we focus on a few of them, designed to be used in PNG for the purposes of road and bridge asset management.

Roads and bridges are a special case of assets, since they are often at the forefront of citizen's infrastructure wish lists. In Finnish politics, for example, the phrase siltarumpupolitiikka ("culvert politics"), often used derisively, refers to a specific style of tactical redistribution or pork-barrel politics[1] that focuses on politicians building bridge infrastructure for their constituents. This is probably an almost universal phenomenon in municipal politics (see, e.g., Wilenius, 2020, pp. 112–113). So, road and bridge infrastructure upkeep and investment are politically contentious topics, and asset management software is supposed to help in reducing that contentiousness.

The road and bridge asset management systems (henceforth: asset systems) are knowledge infrastructures (Edwards, 2010, p. 17), namely networks of people, institutions and databases, which are used to manage information about roads and bridges, their condition, and maintenance costs, as well as to generate reports based on this information. They can also be framed as protocols (Easterling, 2014, p. 78), or processual schemes, of road and bridge maintenance, and they typically have a software interface. Asset systems are also tools for budget distribution. With information stored in them, and reports produced by them, decision makers can evaluate what roads are in need of maintenance when and how much maintenance costs at a given point in time. The rationale behind the implementation of asset systems is "data-driven decision making" (see Velkova & Johnson, 2025, pp. 7, 13), namely that based on the information stored in them, decision-makers can distribute limited budget funds in the most effective way. Hence, asset systems are not only knowledge infrastructures for the maintenance of public infrastructures, but also prescriptions of certain modes of governance.

We argue that asset systems have political effects on three levels. First, following David Graeber (2001, p. 88) if politics is understood as the discussion and struggle over the appropriation and distribution of value, asset systems as cost-benefit analysis tools are explicitly about this, namely to help distribute road management funds. Secondly, asset systems are material implementations to assist in data-driven decision making, that is, a certain mode of governance. Their implementation, then, is a prescription for how politics should be done and framed. Finally, following again Graeber (2001, p. 88), politics is not only about how value is controlled and distributed, but what is defined as value in the first place. As asset systems are about data-driven decision making, the question of what is the data on which decisions should be based and who defines it, becomes crucial.

This article is based on four interviews with Finnish road consultants conducted by the authors in January and February of 2025 in Finland; three interviews with Papua New Guinean road engineers, two interviews with contractors and two interviews with district officials conducted

1 See Stokes (2009) for a definition and discussion on pork-barrel politics, and how it relates to other kinds of redistributive policies.

by Tammisto in PNG in May and June 2024 and March, and April and May 2026; document analysis; and ethnographic fieldwork on road-building and road use conducted by Tammisto in East New Britain Province, PNG, between March and July 2024 and February and May 2026. Interviewees, and those who spoke with Tammisto during fieldwork, are pseudonymised and identifying details have been altered, in line with the confidentiality we agreed with them.

Infrastructure and state formation

As many scholars of infrastructure have noted, roads are crucial for the state. First, the modern state's power is enacted and advanced through infrastructure in important ways (see Chalfin, 2010, p. 238; Harvey & Knox, 2015; Tammisto, 2024, p. 158), for example by making areas accessible to the security forces (see Ferguson, 1994, p. 253). Second, people in PNG and elsewhere, evaluate the legitimacy of the state through its provision of infrastructure and services (see Ballard & Banks, 2003, p. 296; Andersen, 2016, p. 18; Appel et al., 2018, p. 11). Thirdly, infrastructures, like mundane practices of governance, are an important aspect through which the state becomes manifest to its citizens (Appel et al., 2018, pp. 5, 20; Larkin, 2013, pp. 333–334).

A key observation in the new anthropology of the state is that the state is not only formed by official state institutions, but state effects. That is, processes that result in state and state-like governance, are produced in multiple locations by different actors (Lund, 2011, p. 885; Tammisto, 2024, pp. 172–175; Trouillot, 2001, p. 126). Roads and road-building are such sites, both physical and metaphoric, of state formation, where multiple actors from state officials to private contractors produce state effects. Infrastructures are constitutive of states, not only because they are vital for their functioning, but also because the large-scale spatial organization of infrastructure systems often needs an administrative authority comparable to the state, as Keller Easterling (2014, p. 15) notes. This is in line with the notion that government control of property rights does not only reflect sovereignty, but produces it (Lund, 2011).

Asset systems are also sites of state formation. As our consultant interlocutors noted, asset systems are intended to be used as a tool for decision making, namely optimising the allocation of limited budget funds for road maintenance. RAMS is designed to indicate which roads need maintenance when, and help to compare which different roads sections should receive early maintenance in order to avoid higher maintenance costs in the future. It is, in short, a tool of cost-benefit analysis. Asset systems are explicitly designed to aid and foster specific ideals of governance, such as data-based decision making, as well as mundane practices of government, namely the distribution of funds.

Our interlocutors noted that on the one hand, asset systems typically have other effects on governance, because the adoption of asset systems typically tends to shift the locus of decision making to the central authority, for example from regional road departments or municipalities to their national equivalents. On the other, one of our interlocutors noted that access to web-based asset databases are also easier to share across departments, which makes the data more widely available compared to an earlier version of RAMS, which was tied to specific computers in specific locations, such as road departments in the capital.

These shifts in the locus of decision-making and patterns of data access point to how software systems do not simply support existing governance practices but actively reconfigure them. Moreover, asset systems, as sociotechnical systems, embed certain forms of action and inhibits others – what might be called "affordances" (Gibson, 1977; Keane, 2015). The shift toward centralized, database-driven decision-making is not simply a matter of improved efficiency but reflects how the software's design inscribes particular assumptions about proper governance: that decisions should be "data-based," that road maintenance priorities can and should be calculated through standardized metrics, and that such calculations are best managed through centralized databases rather than distributed across regional offices.

As Bratton (2016) argues in his analysis of computational infrastructure, such systems effect an "emergent order" that reorganises spatial and administrative relationships (Bratton, 2016, pp. 163, 327, 367). The transition from desktop-based RAMS tied to specific locations to web-based systems accessible across departments exemplifies how technical affordances – in this case, networked accessibility – can simultaneously enable certain forms of transparency while consolidating decision-making authority in new ways.

Our interlocutors also noted that asset systems make, or are intended to make, decision-making and discussions on budget allocations more transparent, as they are ideally based on the data stored in the system. This notion is in line with Theodor Porter's claim (1995, pp. ix, 90) that numbers are used in situations of limited trust, and conversely, that the use of numbers is also intended to reduce distrust; or as another of the DoWH officials put it in an interview:

> We run this inspection [update the asset system] for all bridges and roads, because the DoWH is the custodian of bridges and roads. So the reporting from the site is in real time. And the bosses in Port Moresby [the capital] will be able to see it and verify that "Yes, the bridge is really broken." Not that they think we cheat them.[2]

This is not to say that there is inherent distrust within the administration or between different government departments or areas, but asset systems and the numbers they produce are designed to mitigate situations in which each municipality, district, province, etc., wants priority. As one of our interlocutors noted, a comprehensive road registry was introduced relatively late in Finland (in the 1970s and 1980s) and before that funds were distributed according to "who shouted the loudest." A central, and intended, "state effect" of asset systems is, as noted above, to foster particular processes of governance and specific ways about how the state should work.

2 This and the following quotes in the text are translated from Tok Pisin, the lingua franca of PNG. It is not uncommon for professionals in PNG to insert English phrases with Tok Pisin, as in these quotes. The original quote is as follows: *[M]ipela ronim desla inspection long olgeta bris long olgeta rot (…) bikos DoW em i custodian bilong olgeta bris na rot (…) So in the form of reportim sait, it's a real time … Ol bosman long Mosbi tu ol bai lukim, ol bai tokim: "Yes, trutru bris i bagarap, ah." Olsem. Nogut ol bai tok mipela giaminim ol nating* (June 2024, East New Britain).

The ideal of data-based decision making and the "optimal" use of funds are often discussed in critical social science as depoliticizing and "rendering technical" (Li, 2007, pp. 7–10) inherently political questions, such as how public funds are distributed. As asset systems aim to help in data-based decision making, a key question is what type of data is gathered in it. The Finnish consultants we interviewed noted that first and foremost asset systems are a tool for distributing funds, and hence the data is about road conditions and costs of maintenance.

However, one interlocutor pointed out that a funder wanted, for example, the inclusion of the impacts of different climates, and that the spectrum of data to be gathered could include factors such as how many people the road serves and multi-criteria analyses, so that other aspects beside the economic factors of road maintenance were taken into account. This is one attempt to take into account different, and possibly incommensurable values (see Rappaport, 1976). In addition to the process of data-based decision making that gets built into the asset system is then also what counts as "data" to be considered in decision making. An important question here is who defines what is relevant data to be considered. As David Graeber (2001, p. 88) has noted, politics and political struggles are not only about how value is distributed and who gets to appropriate it, but who gets to define what value is.

One of our Finnish interlocutors noted that he was also happy to see that Papua New Guinean politicians used asset systems data in parliamentary debates to argue for the reparation of roads in their areas and in debates over road maintenance. According to our interlocutor, this is exactly what RAMS is intended for. Hence, asset systems are not simply de-politicising, or ways of making politics technical, but they shape the political in the sense that numerical data mediated by asset systems are used as arguments in political debates.

An asset system is a key site of state formation because it is an objectification of specific ideals of governance, that is data-based decision making, and what is regarded as important data to be taken into account. Overseas consultants and others, whose knowledge is classed as "expert knowledge", may indeed influence practices of state formation especially by defining processes of how states should work instead of direct policy suggestions. At the same time, as our interlocutor noted, asset data should be politicised, that is, used as political arguments, so it is not simply an "anti-politics machine" (cf. Ferguson, 1994), even though asset systems are intended to frame the debates in particular ways, for example as arguments over relative costs and benefits (see also Allen & Lowe 2006, pp. 1–2).

Having established the framework for understanding asset systems as sites of state formation, we now turn to the case of how these systems have been developed and implemented through translocal processes between Finland and PNG.

International road building and translocal dynamics

In this section, we examine the translocal dynamics of international road building projects in PNG, focusing on how different actors – Finnish consultants, PNG Department of Works and Highways officials, international donors, and local contractors – engage in collaborative scale-making practices through development cooperation.

The connection between Finnish consulting companies and PNG's Department of Works and highways has a long history, going back at least to the 1990s with World Bank and Asian Development Bank funded road projects. Initially, it was a state-led project of exporting infrastructure expertise that operated under a consortium called Finnroad. Finland had developed its own road registry and pavement management systems in the 1970s and 1980s, which led to a road maintenance approach that emphasized preventive maintenance over reactive repairs.

According to the consultants we interviewed, funding packets for these projects were negotiated between state representatives. The ideal was to create long-term projects with international funding, so that they could draw on sustained local knowledge and build enduring institutional relationships. However, this international project model – with its emphasis on large-scale, multi-year interventions backed by major donors tended to favor certain types of infrastructure work while marginalizing others. Projects had to be substantial enough to justify the diplomatic negotiations and bureaucratic apparatus required to secure funding packets, which meant that smaller-scale, community-level interventions or experimental approaches often fell outside the funding logic entirely. The slow pace of road construction, which our consultants acknowledged as inevitable, was in tension with donor expectations and political cycles, yet the system was designed around these large commitments rather than more flexible, incremental models that might have been better suited to local conditions and adaptive learning.

As Graan and Rommel (2024, pp. 2, 7) posit, the project form's temporal logics and requirements for planning, scheduling, and budgeting privilege action amenable to management while rendering other kinds of intervention – those deemed too small, too experimental, or too incremental – effectively unfundable.

The narratives of the consultants also challenged the simple model of asymmetrical flows of knowledge from the Global North to the Global South. For example, while some of the consultants argued that Finnish road management approaches were more advanced than what was requested in PNG, other consultants mentioned having learned new, more advanced ways of thinking regarding traffic management, after a consulting gig in Azerbaijan. Additionally, every project abroad was a learning process for the consultants. For example, in order to implement the use of a piece of software always required localisation. This was true for asset system software as well. The consultants explained to us that in every deployment of software, the reporting needs are different, and because of different weather conditions, the environmental risk calculations need to be adapted accordingly. This localisation was a necessary step in the use of these software programmes in order for them to work as boundary objects for different actors (Star & Griesemer, 1989; Bowker & Star, 2000, p. 16).

On the one hand, this work of translation is an abstract endeavour – adapting the system to work with a new kind of formal criteria. On the other hand, a major part of this task is incorporating very context-dependent knowledge into the asset management system. For example, in the BAMS system that one of the consultants showed to us, detailed bridge component prices could be set for all the different regions. (We delve into the details of the BAMS software in the next section.) Managing the variation in component prices is an important factor for planning bridge upkeep, since in a geographically variable country like PNG, material prices vary significantly

between different regions. This is also an example of how the "legibility effects" (Trouillot, 2001, p. 126) of these pieces of software are not simple high-level abstractions for the purposes of policy planning, but instead, they create multipolar legibility. For example, while the underlying logic of data-driven decision-making remains constant, the data inputted to the system is, in many cases, created on the basis of the context-dependent knowledge of road engineers. The users of the software – Finnish consultants, DoWH officials, and politicians, are all active participants in the scale-making endeavour that is afforded by the asset system software.

The scale-making afforded by asset system software intersects with another crucial scalar logic: the monetary scale of contracts themselves. In PNG's infrastructure governance, contract size operates as a fundamental organizing principle that determines the geographic and temporal scope of interventions. As we learned from interviews with both DoWH officials and consultants, road projects are deliberately subdivided into contracts of approximately 10 million Papua New Guinea Kina (PGK; ca. 2.4 million euros in 2024) to ensure that decision-making and procurement remain at the provincial rather than national level.

This creates a fundamental tension in the translocal assemblages formed by international development projects. While international consultants and supranational funding agencies conceptualize projects at scales of hundreds of millions of dollars – seeking the sustained engagement and institutional relationships we described earlier – local officials and contractors work to keep projects below the 10 million PGK threshold. Money here is not simply a measure of project inputs or a source of rent-seeking opportunities; it is the medium through which different actors conceptualize geographic and temporal scales of intervention. A road corridor that international donors might envision as a single, large-scale project becomes, through contract subdivision, a series of provincially-managed interventions. Officials of a rural and remote district noted that their priority was to use the limited funds they had to build at least some road connections to rural areas and address costlier bridges later.

The contract subdivisions reflect different priorities and "cost-benefit" analyses by different actors. An engineer of a road-building company which worked on national road projects hoped the contracts would take into account the slowness of building roads. Moreover, he hoped the roads would be built as ready as possible from the start in order to reduce future maintenance work – and protect the reputation of contractors:

> If we planned, say a five year plan, then in a year we can do five kilometers and then slowly go forward (...). It's not over-night that we build roads. No. (...) Because when we push forward and then we come back, we repeat the same work we did some months ago. (...) And in the eyes of the people, that gives a bad reputation to the contractor. Like: "You already did that and now you are working on it again and stealing the money of the people." Those kinds of views.[3]

3 *Bai yumi plenim, sapos five year plan, then in a year we can do five kilometer, isi isi igo ... . It's not overnait na yumi*

Indeed, when a road-building project on which Tammisto conducted research in 2024 was on hold, because the last contract into which the project had been broken down had not been approved by the government, locals sometimes noted that the "contractor from town" did not have the capacity to build the road in the rugged area. Similarly, when the same company was building the road in the rural area in 2024, some local women noted to Tammisto that the contractor would not build a proper road, because, as townspeople, they do not care about rural areas. The temporal logics embedded in asset systems further complicate these scalar politics. As one consultant explained to us, the Nordic approaches that informed these systems emphasize that continuity and consequential thinking is important – that roads change very slowly but do change, requiring fine-grained measurement over long timespans. The system is designed to capture cumulative effects: a small bump might be minor for a single driver, but multiplied for thousands of drivers each day, it has significant effects on energy consumption and vehicle wear. Yet in practice, RAMS is primarily used for optimising bureaucratic processes rather than for this kind of long-term infrastructural reasoning. The slow temporality of road change that the software is designed to capture exists in tension with both donor funding cycles and the fragmented temporality of 10 million Kina contracts.

These development cooperation projects thus cannot be understood as simple knowledge transfer from North to South. Instead, they create hybrid forms of governance that produce what we are calling, following Carr and Lempert's (2016) work on scale and Trouillot's (2001) analysis of state effects, "scaling state effects" through translocal assemblages. We will extrapolate on this point in section Five. The asset systems, the contract subdivision practices, and the international funding apparatus together create particular forms of legibility and spatialization – ways of seeing and organizing territory, infrastructure, and governance. Crucially, this scale-making is collaborative: while the software and its associated logics come from consultants, the context-dependent knowledge that populates the systems comes from local engineers and officials. Different actors mobilize these tools toward different scalar projects: international actors toward consolidation and long-term engagement, and provincial actors toward maintaining local control through contract fragmentation. But what is it about the software itself – its design, its material features, its embedded assumptions – that enables and constrains these negotiations? To answer this, we now examine the affordances of asset systems software in greater detail.

Software and its affordances

In the previous sections, we have argued that asset systems function as sites of state formation and that their implementation involves complex translocal negotiations across different scalar logics. But how do these systems actually work in practice? What are the social and material arrangements that surround their use? The consultants, developers, and end-user engineers we

bildim rot. No. … Bikos taim yumi go pus long frant na yumi kam bek, bai yumi repeatim same job we did some months ago. … And then it will be, laik long lukluk bilong ol pipol, em bai kam, em bai givim bad reputation gen long kontraktor olsem … Yupela wokim pinis na yupela wokim gen, yupela wok long stilim mani blo mipela ol pipol. Ol kain lukluk olsem. (March 2026, East New Britain)

interviewed offered insights into how the software mediates between abstract ideals of data-driven governance and the messy realities of infrastructure management.

Let's take one of the software's functionalities and implementation into closer inspection: a BAMS system was implemented by a Finnish consulting company, which was a subconsultant on a project that won an international public tender. The task was to develop an asset management system for PNG's Department of Works and Highways, and a software to operate and update it.

A consultant we interviewed noted that the system coexists with projects from other donors, all of which have different demands and implementation standards, and overlapping features. Nevertheless, the starting point of the project was that bridges tend to be forgotten, until they are seriously damaged or unusable. As a DoWH engineer put it:

> So they [Finnish consultants] come with us to collect data about bridges. They will form a maintenance program for the country. So these locations, such as Kilak has a bridge, New Britain Highway, up there at Airi there is bridge, River Mailo has a bridge. Then, within this period, we maintain them. To maintain the structure, because in the country, we have bridges, but not a maintenance program. So the bridges are left to stand, stand, stand, we don't maintain them, they break. And then we install new ones again.[4]

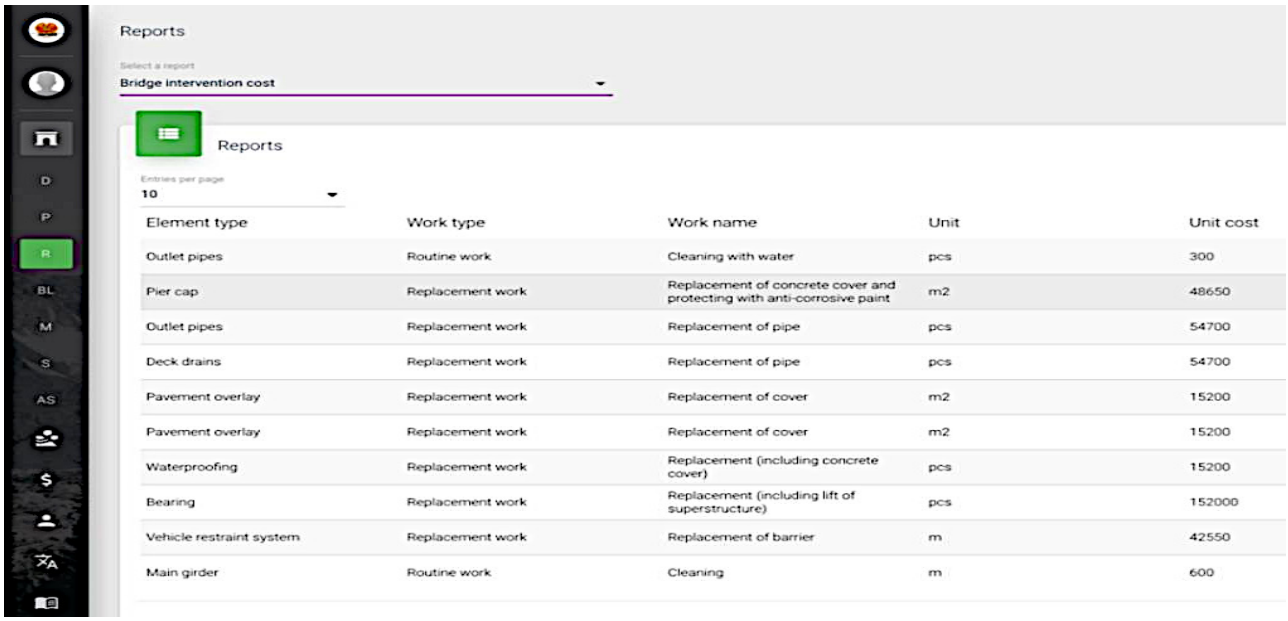
A holistic assessment of the condition of a bridge is a difficult engineering problem, and multiple standards exist that address it. At its simplest, a bridge quality standard might be a scale between one and five, assigned after visual inspection. Representing an intermediate assessment system is the Recording and Coding Guide for the Structure Inventory and Appraisal of the Nation's Bridges (Federal Highway Administration, 1995), a manual by the U.S. Federal Highway Administration, which lists various bridge components and associated zero-to-ten scales for assessing their condition. A complex, well-known assessment system is the Bridge Inspection Manual (AASHTO, 2018), published by American Association of State Highway and Transportation Officials (AASHTO), which describes bridge assessment procedures in excruciating detail, and suggests building a quality percentage of various bridge components.

On top of these taxonomic systems operate the software solutions that are implemented in consulting projects. For example, the Finnish consulting company organized the inspection of roughly 450 bridges on PNG, and trained the engineers to record bridge component data with an offline software operated on a tablet computer, which would later, once within internet coverage, synchronize the data to the cloud-hosted BAMS database. The database, in addition to containing basic metadata about the bridges (such as length, type, road class) and condition data, also has

4 *So ol i save kam wantaim mipela long kisim ol data bilong bris. So they will form a maintenance program for the country. So ol desla location, Kilak i gat wanpela bris, Niu Briten Highway antap long Airi gat wanepela bris, warai Mailo i gat wanpela bris. Then, ok within this period, yumi wokim maintenance. To maintain the structure, bikos insait long kantri mipela gat ol bris, but mipela nogat maintenance program. So bris i stap igo igo igo, yumi no menteinim, bagarap. Then yumi installim niupela gen*. (May 2024, East New Britain)

financial data that helps with planning bridge maintenance. For example, since the cost of various repair materials differs regionally, these component price variations can be entered to the database as well.

The BAMS software has different views: a dashboard for a quick overview, and separate views for maintenance planning, report generation, and various views for browsing database items such as a map view, bridge list, and a unit cost list. In addition to a condition grade, bridges have photos of their components in the database, taken with the offline inspector software, allowing for reviewing the assessment remotely. To give an idea of the granular capability of the software, the consultant showed us a report of the software that listed 27 016 possible repair work projects for the 461 bridges in the system at the time of our interview. See Figure 1 below which reproduces the same view of the software from the manual, where it is shown without real data.



Element type	Work type	Work name	Unit	Unit cost
Outlet pipes	Routine work	Cleaning with water	pcs	300
Pier cap	Replacement work	Replacement of concrete cover and protecting with anti-corrosive paint	m2	48650
Outlet pipes	Replacement work	Replacement of pipe	pcs	54700
Deck drains	Replacement work	Replacement of pipe	pcs	54700
Pavement overlay	Replacement work	Replacement of cover	m2	15200
Pavement overlay	Replacement work	Replacement of cover	m2	15200
Waterproofing	Replacement work	Replacement (including concrete cover)	pcs	15200
Bearing	Replacement work	Replacement (including lift of superstructure)	pcs	152000
Vehicle restraint system	Replacement work	Replacement of barrier	m	42550
Main girder	Routine work	Cleaning	m	600

Figure 1: Bridge intervention cost report in BAMS software

The BAMS software – and similar software suites for road management – attempts to make bridges and their management legible at an unprecedented level of detail and abstraction. In other words, it is an infrastructural scale-making project that aims to center technical knowledge in bridge maintenance decisions at the expense of political preferences. From this perspective, it is a classic example of how quantification creates authority (Porter, 1995). As Jessica Barnes (2017) has argued in the context of irrigation infrastructure in Egypt, state-led maintenance is not just about keeping the infrastructure operational, but just as much about reasserting the authority of the state (Barnes, 2017, p. 9).

Furthermore, Giorgio Grappi and Brett Neilson (2019), in the context of logistical automation in Chile, have argued that attention should be given to political dimensions of "logistical technologies" such as software, since it shapes resource allocation and labour relations, for example. Different software has different technological affordances. For example, Grappi and Neilson found out that a labour allocation software in Valparaíso docks bypassed traditional work lists that were controlled by trade union representatives (Grappi & Neilson, 2019, p. 841).

Additionally, Kate Hepworth (2014) has emphasized software's role in resource allocation. Her context, similar to Grappi's and Neilson's, is logistics, which, she argues, should be understood as "the monetisation of time and space" (Hepworth, 2014, p. 1121; see also Cowen, 2010, p. 612). These observations resonate with our case of road asset management as well, in addition to the software creating state effects that produce legibility and spatialization (see Trouillot, 2001) by creating taxonomies and abstractions of road assets for the use of the central government. Implementing software to handle aspects of road and bridge management creates a distinct mode of governmentality, which is – as Kitchin and Dodge argue – "automated..., automatic..., and autonomous" (2011, p. 85).

Furthermore, what is specific about asset systems software is the way they create scaling state effects: granular understanding and authority about "local conditions" (see Strathern, 1995, p. 167; Demian, 2023, p. 156), and an associated imaginary of how the road and bridge infrastructure is a hierarchical order of assets, to be controlled from a dashboard. (We discuss the scaling effect in relation to state effects more in depth in the next section.) When the software creates a scalar approximation of bridge repair costs by aggregating data from bridge engineers, economists, consultants, and DoWH officials, it creates not just practical recommendations, but, additionally, performative effects about how bridge infrastructure should be seen and talked about – evident in how the politicians started to argue based on this data in the national parliament, as mentioned earlier.

This scalar representation of infrastructure and authority, however, renders certain tensions invisible. For example, when the asset management system claims to make all kinds of infrastructural work comparable and rankable, what kinds of infrastructural care is left unrecognized (see Barnes, 2017, p. 13) or what kinds of distinctions are left unidentified by the claim of making everything commensurable (see Espeland & Stevens, 1998)?

The DoWH engineer quoted above also noted that the tablets and the web-based database make collecting data about bridges easy, and also more secure, because paper notes get easily damaged by rain or get lost when transported from site to town and then to the capital. What hinders data collection is however the difficulty of accessing remote rural areas, which may have company-built bridges the DoWH is aware of, but which cannot be accessed by car from town. Independently of him, the district official who had accompanied the DoWH engineer to collect data on bridges noted in an interview that the DoWH could provide district officials with tablets so that they could assist in gathering the data.

This is, of course, not only a problem of officials working at certain scales being unable to access rural areas with limited infrastructure. People living in rural areas may also face considerable difficulties in accessing relatively "low" levels of government, such as the District. For example, in rural East New Britain, Tammisto frequently witnessed cases in which elected village representatives faced immense difficulties in reaching District officials, as travelling by boat to the district headquarters was prohibitively expensive, while making the journey on foot could take several days each way.

The lesson here is not the familiar one about the centre's inability to see the periphery. It is that the labour of producing legibility remains lodged within DoWH, even though the collection itself could be devolved to actors already present at the district level. The software's claim to comprehensiveness thus rests not only on what its categories can register, but on where its data-gathering instruments and the people holding them happen to be.

This uneven distribution of capabilities rests on a commensurating logic that is not original to the software. The scalar organization of the state administration already renders its nested units comparable: when a province is divided into districts, each is "made the same" – represented by an MP, granted comparable responsibilities and budgets – even though, in practice, the differences between them may be vast. What the software does is extend this commensuration to a far finer grain, and, crucially, recast it as a matter of technical fact rather than administrative convention.

For example, East New Britain province is divided into four districts, but one of the rural districts comprises over two-thirds of the province's area. This poses particular challenges for infrastructure provision, because of the distances, lack of existing infrastructure and costs of shipping due to the remoteness of the area. As a district official put it:

> The amount of money that we get is a big challenge. The other districts, their areas are small and their challenges are not big, but still we have the same allocation of money coming in. (...) That restricts us from helping all the people of the district.[5]

In such settings, in the case of PNG, local people who communally hold the lands they inhabit under PNG's land legislation may allow logging companies to operate on their lands, and demand that the companies not only pay for harvested logs, but also build locally needed infrastructure, such as roads (Leedom, 1997, p. 44; Tammisto, 2024, pp. 111–112). Similarly, inhabitants of remote rural areas with limited transport infrastructure may maintain existing roads and bridges, or even build new ones, on their own accord or create their own transport networks (see Post Courier, 2022, 2023; Kassas, 2024; Tammisto, 2025). Extractive companies also build roads either purely for their own purposes (Tammisto, 2025), under the so called "tax credit scheme," which allows companies to offset taxes by building infrastructure (Bainton & Macintyre, 2021, pp. 133–134), or when contracted to do so by the state.

Indeed, our interlocutors who worked in the administration of a rural district, noted that the district administration seeks to hire logging or oil palm plantation companies to build or upgrade roads, because the companies have some road-building machinery, and more crucially, they are the only ones the district administration can afford, because bringing in contractors from the towns is costly. Even then, there is no guarantee that the companies will agree to build roads or even

5 *Amount of mani we i kam em wanpela bikpela challenge. Ol narapela district, em landmass blo ol i liklik na ol challenges bilong ol i no bikpela, na we still have the same allocation of money i kam in. ... Em i restrictim mipela long halpim olgeta pipol within long Distrik* (May 2026, East New Britain).

reply to the district's requests. Crucially, none of this self-built or company-built infrastructure automatically registers in the asset system. (For roads built by logging companies, see Bell, 2015, p. 138 and Lattas, 2011, p. 92. For examples of self-made infrastructure, see Kassas, 2024 and Khaleghiyan, 2025.) Rather it requires the cooperative work with people on site, mid-level officials and the database developers – a reminder that the dashboard's claim to comprehensiveness rests on rendering invisible precisely the infrastructural care it cannot count.

The scaling effect

In this text, we have discussed both how the building and management or road infrastructure is a site of state formation and what effects the introduction of asset systems have on governmental processes, and hence on state formation. As a contribution to the study of state formation, we propose a heuristic concept of scaling effect to discuss the production of "scale". Here we follow the work of Trouillot (2001) and Bainton and Skrzypek (2021).

In his discussion on state formation outside official state institutions, Trouillot (2001, p. 126) identified four main types of "state effects:" the isolation effect, or the creation of atomized subjects; identification, the alignment of subjects along collective lines; legibility, the production of language and knowledge for governance; and spatialization, the production of boundaries and jurisdiction.

Discussing the role, or the "absent presence," of the state in natural resource extraction projects in Australia and PNG, Bainton and Skrzypek (2021, pp. 5, 8) note that the state is often only partially present in resource projects, but gets also built through them, as companies and other actors produce state effects of their own. Building on the work of Trouillot, Bainton and Skrzypek identify further effects: the "order effect," as when company security assists or replaces the police; the "responsibility effect," when companies assume responsibility for the inhabitants in settings of absent state; and the "materiality effect," whereby companies build roads and other public infrastructure typically associated with the state (Bainton & Skrzypek, 2021, pp. 8, 29–30).

Joining this discussion, and based on our examination of the various actors involved in road building and maintenance projects, we identify a further effect: the "scaling effect." By this, we mean that state governance both produces and relies upon a process of "scaling" – a hierarchical and encompassing operation through which smaller units are nested into larger ones. Scaling involves an idea of quantification inasmuch as it results in an order of magnitude, that is, different levels are defined as either smaller or larger within a nested hierarchy.

Examples of such orders are the levels of government. In Finland, these comprise the municipal, regional and national levels; in PNG, they include the ward, local-level government, district, provincial and national levels. In such a model, each level is composed of distinct and commensurable units, such as municipalities or districts, which together form and are encompassed by the next level, such as the region or province. At the highest level is the national state, which exists on the same tier as other states and may form supranational groupings, such as the EU or the Melanesian Spearhead Group.

Carr and Lempert (2016) note that "scale is a process before it is product" and is never ideologically neutral (Carr & Lempert, 2016, p. 19). Hence the importance of focusing on the processes of scale-making. Consequently, "scale" is not our analytical starting point but our object of analysis, as state governance often involves the production of various scalar levels. These scales are enacted through mundane practices of governance, such as classifying a road as "district", "provincial" or "national" to determine budgetary responsibility. With the introduction of asset management software, however, this process of scale-making reaches a new level of intensity. As we discussed in the previous section, the taxonomy and record-keeping capabilities afforded by the database software renders these hierarchical nestings with an unprecedented, forensic accuracy. By converting granular physical data – down to the condition of a single bridge component – into standardized metrics that can be aggregated instantly into national reports, the asset management software makes the state's scalar effects both more encompassing and imposes a very particular knowledge infrastructure that might not recognize certain modes of infrastructural care, for example.

While the scaling effect shares traits with Trouillot's (2001, p. 126) state effects discussed above – "legibility," the production of language and knowledge for governance, and "spatialization," the production of boundaries and jurisdiction – it represents a distinct synthesis of the two. It involves the making of hierarchical scales of governance that allows for state power to operate within or across these scales. For example, as we discussed earlier, the gathering of information on bridges was conducted by officials working at the "national scale", while officials in charge of infrastructure at the district level were excluded from it. Another example we discussed is the division of a road building project into distinct contracts in order to keep the cost of a single contract within the decision-making authority of a particular level.

Thus, we propose the "scaling effect" as a tool to analyze how knowledge infrastructures such as software-afforded asset systems do more than just manage assets: they implement specific scalar imaginaries of the state, while appearing as objective, technical necessities.

Conclusion

In this article, we have shown how asset systems such as RAMS and BAMS act as sites of state formation in Papua New Guinea. Particularly, we have argued that asset systems should not be understood just as technical systems, but instead, as systems that prescribe specific modes of governance, in particular, those in accordance with the ideal of data-driven decision making. Additionally, we have demonstrated that the state formation processes that happen around asset management systems are shaped by translocal assemblages, consisting of – in our case – Finnish consultants, international funding agencies, and PNG engineers and other state officials.

The asset management systems we have analyzed in this study are political: they do not just redistribute value, but instead, they define what constitutes value through the data they prioritise. Furthermore, asset systems have what we call a "scaling effect" – they produce hierarchical, nested, and commensurable units of governance through mundane practices and affordances of software. In this sense, they create a novel effect on state formation, even though it resembles

the legibility and spatialization effects identified in earlier research on state formation. The scaling effect becomes particularly visible when bridge inspection data flows through the asset management software: a single measurement of a bridge component partially forms a condition rating that aggregates into structural assessments, which compile into provincial reports, ultimately generating national priority rankings – a process that transforms material deterioration into nested hierarchies of bureaucratic responsibility while obscuring some of the associated politics, such as the decisions about which bridges get inspected in the first place or how the provincial cost indexes of maintenance operations are constructed.

Regarding the affordances of asset management software, our analysis has argued that the shift from local asset databases to cloud-based, granular reporting reconfigures authority and foregrounds technical knowledge in political debate. These systems also enable different official actors to navigate and contest the scalar logics through which they operate, even as the software's affordances prioritise certain forms of infrastructural maintenance over others. At the same time, officials at "lower" levels of the administration – and, even more so, local communities – may be excluded from these systems altogether.

We have made our argument within the specific context of Papua New Guinean road and bridge asset management, but we posit that the relationship between digital infrastructures, software affordances, expert knowledge and the "scaling effect" is relevant for understanding the dynamics between state formation and knowledge infrastructures elsewhere as well. Beyond PNG and road management, our analysis suggests that wherever digital knowledge infrastructures mediate state-building – from smart city dashboards to climate adaptation platforms – the seemingly technical question of how data gets structured, aggregated, and reported is simultaneously a political question about what forms of authority become thinkable, legitimate, and enforceable.

List of references

AASHTO. (2018). *The manual for bridge evaluation* (3rd edition). American Association of State Highway and Transportation Officials.

Allen, B. & Lowe, M. (2006). *Papua New Guinea roads priority study*: *Review of national roads in Papua New Guinea*. Canberra: AusAID. https://doi.org/10.13140/RG.2.1.4678.7609

Andersen, B. (2016). Temporal circuits and social triage in a Papua New Guinean clinic. *Critique of Anthropology*, *36*(1), 13–26. https://doi.org/10.1177/0308275X15617306

Appel, H., Anand, N., & Gupta, A. (2018). Introduction: Temporality, politics, and the promise of infrastructure. In N. Anand, A. Gupta, & H. Appel (Eds.), *The promise of infrastructure* (pp. 1–38). Duke University Press. https://doi.org/10.1215/9781478002031

Bainton, N., & Macintyre, M. (2021). Being like a state: How largescale mining companies assume government roles in Papua New Guinea. In N. Bainton & E. Skrzypek (Eds.), *The absent presence of the state in large-scale resource extraction projects* (pp. 107–139). ANU Press. https://doi.org/10.22459/AP.2021.06

Bainton, N., & Skrzypek, E. (2021). An absent presence: Encountering the state through natural resource extraction in Papua New Guinea and Australia. In N. Bainton & E. Skrzypek (Eds.), *the absent presence of the state in large-scale resource extraction projects* (pp. 1–41). ANU Press. https://doi.org/10.22459/AP.2021.01

Ballard, C., & Banks, G. (2003). Resource wars: The anthropology of mining. *Annual Review of Anthropology*, *32*(1), 287–313. https://doi.org/10.1146/annurev.anthro.32.061002.093116

Barnes, J. (2017). States of maintenance: Power, politics, and Egypt's irrigation infrastructure. *Environment and Planning D: Society and Space*, *35*(1), 146–164. https://doi.org/10.1177/0263775816655161

Bell, J. (2015). The structural violence of resource extraction in the Purari Delta. In J. Bell, P. West & C. Filer (Eds), *Tropical forests of Oceania: Anthropological perspectives*. Canberra: ANU Press. http://dx.doi.org/10.22459/TFO.08.2015.06.

Bowker, G. C., & Star, S. L. (2000). *Sorting things out: Classification and its consequences*. MIT Press. https://doi.org/10.7551/mitpress/6352.001.0001

Bratton, B. H. (2016). *The stack: On software and sovereignty*. MIT Press. https://books.google.com?id=dEGdCwAAQBAJ

Burns, P. (2023). *Asset management is a never-ending quest. How the story began.* https://talkinginfrastructure.com/wp-content/uploads/2023/06/Quest-Part-1.pdf

Carr, E. S., & Lempert, M. (2016). Introduction: Pragmatics of scale. In E. S. Carr & M. Lempert (Eds.), *Scale: Discourse and dimensions of social life* (pp. 1–21). University of California Press. https://doi.org/10.1525/luminos.15

Chalfin, B. (2010). *Neoliberal frontiers: An ethnography of sovereignty in West Africa*. University Of Chicago Press.

Cowen, D. (2010). A Geography of logistics: Market authority and the security of supply chains. *Annals of the Association of American Geographers*, *100*(3), 600–620. https://doi.org/10.1080/00045601003794908

Demian, M. (2023). Collapsing the scales of law. In M. Demian (Ed.), *Grassroots Law in Papua New Guinea* (pp. 155–178). ANU Press. https://doi.org/10.22459/GLPNG.2023.06

Easterling, K. (2014). *Extrastatecraft: The power of infrastructure space*. Verso.

Edwards, P. N. (2010). *A vast machine: Computer models, climate data, and the politics of global warming*. MIT Press.

Edwards, P. N., Bowker, G. C., Jackson, S. J., & Williams, R. (2009). Introduction: An agenda for infrastructure studies. *Journal of the Association for Information Systems*, *10*(5), 6. https://doi.org/10.17705/1jais.00200

Espeland, W. N., & Stevens, M. L. (1998). Commensuration as a social process. *Annual Review of Sociology*, *24*, 313–343. https://doi.org/10.1146/annurev.soc.24.1.313

Federal Highway Administration. (1995). *Recording and coding guide for the structure inventory and appraisal of the nation's bridges* (Nos. FHWA-PD-96-001). U.S. Department of Transportation.

Ferguson, J. (1994). *The anti-politics machine: "Development," depoliticization, and bureaucratic power in Lesotho*. University of Minnesota Press.

Gibson, J. J. (1977). The theory of affordances. In R. Shaw & J. Bransford (Eds.), *Perceiving, acting and knowing: Toward an ecological psychology* (pp. 67–82). Lawrence Erlbaum Associates. https://doi.org/10.4324/9781315467931

Graan, A., & Rommel, C. (2024). Projects and project temporalities: Ethnographic reflections on the normative power of the project form. *Social Anthropology/Anthropologie Sociale*, *32*(3), 1–19. https://doi.org/10.3167/saas.2024.320302

Graeber, D. (2001). *Toward an anthropological theory of value: The false coin of our own dreams*. Palgrave Macmillan.

Grappi, G., & Neilson, B. (2019). Elements of logistics: Along the line of copper. *Environment and Planning D*, *37*(5), 833–849. https://doi.org/10.1177/0263775818814535

Harvey, P., & Knox, H. (2015). *Roads: An anthropology of infrastructure and expertise*. Cornell University Press. https://doi.org/10.7591/9780801456466

Hepworth, K. (2014). Enacting logistical geographies. *Environment and Planning D*, *32*(6), 1120–1134. https://doi.org/10.1068/d13044p

Karhunmaa, K., & Käkönen, M. (2024). Turning attention to the afterlives of knowledge infrastructures. *Suomen antropologi: Journal of the Finnish Anthropological Society*, *48*(2, 2), 99–103. https://doi.org/10.30676/jfas.143115

Kassas, S. (2024, March 1). Community builds road to connect school. *Post Courier: Top Stories*. https://www.postcourier.com.pg/community-builds-road-to-connect-school/

Keane, W. (2015). *Ethical life: Its natural and social histories*. Princeton University Press.

Kenneth, G. (2021, August 25). Connect PNG Road Plan 2020-2040. *Post Courier*. https://postcourier.com.pg/connect-png-road-plan-2020-2040/

Khaleghiyan, A. (2025, December 17). The bridge that cocoa farmers built: A model of rural resilience in the Sepik, Papua New Guinea. FAO: News & Story. https://www.fao.org/in-action/eu-streit-png/news/detail/bridge-cocoa-farmers-built-rural-resilience-sepik-papua-new-guinea/en

Kitchin, R., & Dodge, M. (2011). *Code/space: Software and everyday life*. The MIT Press. https://doi.org/10.7551/mitpress/9780262042482.001.0001

Larkin, B. (2013). The politics and poetics of infrastructure. *Annual Review of Anthropology*, *42*, 327–343. https://doi.org/10.1146/annurev-anthro-092412-155522

Lattas, A. (2011). Logging, violence and pleasure: Neoliberalism, civil society and corporate governance in West New Britain. *Oceania, 81*(1), 88–107. https://doi.org/10.1002/j.1834-4461.2011.tb00095.x.

Leedom, J. (1997). Private dealings: A social history of the Hawain Local Forest Area, East Sepik Province. In C. Filer (Ed.), *The Political Economy of Forest Management in Papua New Guinea* (pp. 35–66). National Research Institute.

Li, T. M. (2007). *The will to improve: Governmentality, development, and the practice of politics*. Duke University Press Books. https://doi.org/10.1215/9780822389781

Lund, C. (2011). Fragmented sovereignty: Land reform and dispossession in Laos. *Journal of Peasant Studies*, *38*(4), 885–905. https://doi.org/10.1080/03066150.2011.607709

Porter, T. M. (1995). *Trust in numbers: The pursuit of objectivity in science and public life*. Princeton University Press.

Post Courier (2022, December 29). Pawa youths rehabilitate Morr-Girol road link. *Post Courier: National News*. https://postcourier.com.pg/pawa-youths-rehabilitate-morr-girol-road-link/

(2023, November 14). New bridge helps people overcome pain. *Post Courier: National News*. https://www.postcourier.com.pg/new-bridge-helps-people-overcome-pain/

Rappaport, R. (1976). Forest and man. *The Ecologist: Journal of the Post Industrial Age*, *6*(7), 240–246.

Star, S. L., & Griesemer, J. R. (1989). Institutional ecology, "translations" and boundary objects: Amateurs and professionals in Berkeley's Museum of Vertebrate Zoology, 1907-39. *Social Studies of Science*, *19*(3), 387–420. https://doi.org/10.1177/030631289019003001

Stokes, S. C. (2009). *Pork, by any other name... Building a conceptual scheme of distributive politics*. https://papers.ssrn.com/Sol3/papers.cfm?abstract_id=1449057

Strathern, M. (1995). The nice thing about culture is that everyone has it. In M. Strathern (Ed.), *Shifting contexts* (pp. 153–176). Routledge. https://books.google.com?id=4fx_PxvK5q0C

Tammisto, T. (2024). *Hard work: Producing places, relations and value on a Papua New Guinea resource frontier*. Helsinki: Helsinki University Press. https://doi.org/10.33134/HUP-29

Tammisto, T. (2025). Roads, marketplaces and plantations. *Roadsides* 14: 50–60. https://doi.org/10.26034/roadsides-202501407

Taylor, F. W. (2012). *The Principles of scientific management*. The Floating Press.

Trouillot, M. (2001). The anthropology of the state in the age of globalization: Close encounters of the deceptive kind. *Current Anthropology*, *42*(1), 125–138. https://doi.org/10.1086/318437

Velkova, J., & Johnson, E. (2025). Critical Data Studies meet Sociology. *Sociologisk Forskning*, *62*(1–2), 7–18. https://doi.org/10.37062/sf.62.27811

Wilenius, H. (2020). *Routine work: Authorizing representation in East Javanese regional politics*. Research series in anthropology 31. Helsinki: University of Helsinki. http://urn.fi/URN:ISBN:978-951-51-5891-8

Acknowledgements

This article's argument was influenced by our discussions in the seminars and reading groups organized by Matti Eräsaari as a part of his project "The Properties of Units and Standards". We thank the people who took part in those discussions: Hilja Aunela, Melissa Demian, Matti Eräsaari, Saana Hansen, Xin Liu-Toivanen, Rodolfo Maggio and Sonja Trifuljesko. We are especially grateful to our interlocutors in Papua New Guinea and Finland for their time and insights. We extend our gratitude to Robert Nicole for his editorial work. Our contributions to this work were funded at different times by the Finnish Cultural Foundation, the Kone Foundation and the Research Council of Finland.

Author biographies

Tuomas Tammisto is a socio-cultural anthropologist specializing in human–environmental relations and political ecology. He has conducted research in Papua New Guinea, focusing especially on land-use, various understandings of work, plantation labour and natural resource extraction. He works as an Academy Research Fellow in Social Anthropology, Tampere University. https://orcid.org/0000-0001-9767-7832

Heikki Wilenius is a postdoctoral researcher at the University of Helsinki, working at the intersection of anthropology, science and technology studies, and AI. His research examines infrastructure, resource frontiers, state formation and political economy, as well as how software and generative AI reshape professional work. https://orcid.org/0000-0003-4601-2392