Sand extractivism and its inequalities:

Elite scripts in the Singaporean demand for sand

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Abstract

Extractive industries must be rapidly scaled down to achieve the decarbonisation targets and climate justice demanded by the imminent climate emergency. However, existing academic literature presenting alternatives to growth lack practical, implementable pathways to degrow extractive industries.

One critical extractive industry is often overlooked: sand. This is despite it being a key extractive industry that various critical supply chains in the urban economy rely on. Unlike other non-renewables such as coal and oil, sand has no mainstream commercial alternative. Sand extraction and dredging result in critical ecosystem and livelihood losses that reproduce and entrench existing inequalities.

This paper focusses on Singapore – currently the world's largest importer of sand. I will present my findings from interviewing critical proponents and opponents to Singapore's use of sand in the country's quest to reclaim land. These different scripts people hold on sand validate and legitimise sand extraction for land reclamation and how they might reproduce inequalities.

Scripts developing around extractives are critical in pathways to scaling down extractives. In this essay, I argue that three scripts related to sand – scripts of growth, mutual benefit and silence – present critical barriers to scaling down Singapore's sand demand. Resistors of these scripts are beginning to question specific elements within these scripts to question their dominance and hegemony. I also offer what scripts of hope in the case of sand in Southeast Asia can look like in achieving environmental and social justice, and explore the implications of these findings to alternatives-to-growth literature.

1 Introduction

There has been a recent rise in scholars arguing that a relentless pursuit of growth has worsened the climate crisis and exacerbated existing intersectional inequalities (Alvaredo et al. 2018; Stiglitz 2016). Particular aspects of urban development within the paradigm of growth such as construction, land reclamation and the consumption of digital technologies, require the primary material of industrial sand. In the last decade, sand dredging and use has resulted in adverse ecological and social impacts in the areas where the sand is extracted, resulting in species loss, droughts, landslides, destruction of livelihoods and land dispossession (Torres et al. 2017; Peduzzi 2014; Lamb, Marschke, and Rigg 2019).

Scholars contesting the need for exponential growth have put forward policy proposals and roadmaps to enable humanity to thrive. In particular, degrowth scholars recommend the use of renewable technologies and scaling down extractive, unsustainable industries (Kallis 2017; Videira et al. 2014; Foster 2011). These recommendations tend to be abstract (van den Bergh 2011) and focus on structural solutions; there is a critical gap in understanding how extractive industries interact with communities and people hosting their activities in supply chains (Malin, Ryder, and Lyra 2019). Despite being an increasingly scarce, valuable non-renewable product without mainstream commercial alternatives, sand is entirely overlooked in academic scholarship (Beiser and Damron 2018; Peduzzi 2014; Torres et al. 2017).

Singapore, with its continued reliance on sand imported from its Southeast Asian neighbours, is now the world's largest importer of sand. Almost a quarter of the country's land is reclaimed (Moser and Schär 2013). In land-scarce Singapore, a

country that has thrived under a neoliberal and capitalist logic over the last 50 years (Yeoh 2003), the paradigm of growth has been heavily tied to land expansion through the process of reclamation, to enable industrial activities such as the development and expansion of the country's port, airport and petrochemical refinery infrastructure (Comaroff 2014; Lim 2017). Land that is taken and traded as sand, a commodity, is further remade into land in Singapore. Sand is hidden and its use fundamentally unsustainable, yet it is the soil of Singapore's economic growth.

Much has been said about the impact of the regional sand trade on sand supplying countries, such as Cambodia and Myanmar (Lamb, Marschke, and Rigg 2019; Hackney et al. 2020; Schmitt, Rubin, and Kondolf 2017; Global Witness 2010). One study touches on how everyday Singaporeans understand the need for sand (Jamieson 2017) but there is relatively little primary research about how demand for sand is shaped and sustained. Scripts are critical in deconstructing Singapore's singular pursuit of growth. As such, my research seeks to illuminate how different elite actors in Singapore think and make decisions around sand. I will focus particularly on the land reclamation supply chain as land expansion is the primary source of Singapore's sand demand. I will investigate two crucial questions necessary to unlock conversations around the sustainability of Singapore's growth paradigm:

(1) What are the different scripts around sand as a technology in Singapore's land reclamation supply chain?
(2) How might the current dominant scripts obscure and legitimise regional spatial, social and ecological inequalities caused by the sand trade?

I conducted ten qualitative interviews with key actors – both proponents and opponents of Singapore's sand use - to explore these questions. Integrating the theoretical frameworks around degrowth and the scripts of things, I argue that it is important to understand the scripts around sand for communities and countries to truly transition to scaling down its commodity use. I further explore how current scripts pose significant barriers to phasing out Singapore's sand demand. Powerful dominant scripts centred on growth, mutual benefit and silence legitimise, justify and underpin the systems and institutional structures around sand. I also explain how scripts of resistance and relationality emerging in the margins question and offer alternatives that enable transitions towards a more socially just and environmentally sustainable sand trade.

In Singapore, the growth mentality and scripts are spatially realised in the form of land reclamation. By relating these insights to the broader literature, I highlight the importance of delving into the unique scripts around growth in different countries to truly understand what ecological and social justice while scaling down extractives can look like.

2 Literature Review

This chapter charts out two strands of literature – substantive and theoretical – that are critical to contextualising my research. The substantive literature focuses on how sand has been approached in academic scholarship thus far, providing a way to situate my work. The theoretical literature explores important frameworks to think about sand as an object whose use needs to be fundamentally reduced to achieve sustainable outcomes.

2.1. Substantive Literature

Non-renewable extractive industries often result in inequalities, disproportionately affecting communities already impoverished and vulnerable (Mohai, Pellow, and Roberts 2009). There is a growing literature around the social relations in extractive industries – scholars in this field emphasise the need to understand how communities form in each sector (Malin, Ryder, and Lyra 2019; Brown 2017; Kirsch 2014). However, these tend to focus on well-known non-renewable resources such as oil and coal (Beiser and Damron 2018). Academic literature around the sand trade is still largely nascent and it splits into two major strands of thinking – one found in civil engineering and architecture and the other found in the social sciences such as environmental studies, geography and sociology.

Civil engineers and architects largely focus on material innovation to achieve sand supply security and quality materials for buildings and infrastructure (Latha and Murthy 2006; Choudhary and Krishna 2016; Shin, Jung, and Kang 2016), while improving

sustainability by reducing the pollution from sand dredging, given how critical sand is for industrial activity.

Responding to this literature and the hegemonic practices around sand use is a nascent group of social science scholars. The sand economy is increasingly seen to be problematic due to its negative impacts, with researchers and activists raising the alarm over its negative environmental and social impacts (Beiser and Damron 2018). Coastal communities in sand supplying countries and environmentalists are increasingly opposing sand extraction, pointing to grave and irreversible environmental, social and economic costs for communities at extraction and destination sites (Lamb, Marschke, and Rigg 2019; Global Witness 2010; Jamieson 2017). As there is currently no inter-governmental regulatory oversight on sediment extraction (Peduzzi 2014), sand dredging in many sites is often indiscriminate, far beyond natural replenishment rates (Hackney et al. 2020), leading to pollution, land dispossession, loss of local livelihoods and ecosystems with the collapse of fish stocks (Torres et al. 2017). The scale of impacts is often contingent on the practices of individual private dredging contractors. Other negative impacts include threats to water security by lowering the water table, which can result in droughts and flooding (Pereira 2011, 13-15). These impacts are often non-immediate, experienced far upstream and downstream in river ecosystems, making traceability to particular sand dredging operations harder (Hübler and Pothen 2018, 5). At sand deposition sites such as in Singapore, a workforce of largely low-income migrant workers is recruited to carry out menial and precarious labour (Lamb, Marschke, and Rigg 2019).

There is little public access to information on the trade and its impacts in Southeast Asia, so investigative journalism and art advocacy projects have been a critical source of illuminating the secrecy and opacity present in the sand supply chain (Global Witness 2010; Mam 2018; Tuoi Tre News 2017). For instance, local community groups opposed sand dredging for a land reclamation project in South Sulawesi, Indonesia - 43 families had been expelled from their lands for the project and dredging activities resulted in the 80% loss of the fish stock and coastal erosion that led to greater climate vulnerabilities. Where there is academic research around the social relations within and impacts of the sand trade, they tend to focus on sand supplying countries rather than the social relations and power dynamics in sand demanding countries, such as Singapore.

Several sociological theories and frameworks provide a way to think about sand, in particular the debates around growth, inequality and the scripts of things. I will explore these in the next section.

2.2. Theoretical literature

This paper integrates two schools of literature that are not often brought together: alternatives-to-growth literature and the script of things, to explore the sand system.

A. The need to scale down extractives, with gaps in pathways

An increasing number of scholars have critiqued the idea that economies are capable of unlimited economic growth. Climate scientists have declared the next decade to be

critical in limiting further global warming. Anthropogenic carbon emissions would need to fall by about 45% from a 2010 baseline by 2030 to avoid human catastrophe . Growth is increasingly seen as incompatible with global climate targets (Jackson 2017; Kallis 2017). Furthermore, economic growth was originally theorised to reduce inequality in the long-term (Kuznets 1955) but that has empirically not been the case in the last few decades (Milanović 2016; Alvaredo et al. 2018), primarily in developing Asia. Even as countries such as China, Laos, Myanmar and Indonesia have lifted millions out of poverty, economic inequality levels have increased (Simson 2018).

There are disagreements on what the ultimate economic goal should be, if not for growth. The ongoing debate has resulted in three camps: green growth and sustainable development (Hallegatte et al. 2011), a-growth or growth agnosticism (van den Bergh 2011, Raworth 2017), and degrowth (Kallis 2017). Green growth proponents largely argue that growth can and has to happen in tandem with sustainability (Hallegatte et al. 2011). A-growth scholars remain more agnostic toward growth because of the socioeconomic justice issues that a rigid planetary degrowth target poses to the developing world (Raworth 2017; van den Bergh 2011). Degrowth rejects the need for growth entirely, especially in advanced economies, emphasising the equitable reduction of the production and use of material resources within planetary limits (Schneider et al. 2010; Foster 2011).

Despite their differing positions around growth as the final goal, these scholars broadly share common ground in underscoring the need to scale down and phase out extractive industries in order to improve human and planetary wellbeing (Kallis 2017; Raworth 2017; Hallegatte et al. 2011). Current policy proposals in sustainable transitions literature to achieve a rapid phasing out of extractives focus on two areas (1) weakening resource extraction growth and adjusting it to the biopshere’s carrying

capacity and (2) changing the rules of the system, for example by removing harmful subsidies, and imposing a moratorium on resource extraction (Videira et al. 2014, 66-67). A range of instruments such as policy regulation and technological advancements (Turnheim and Geels 2013; Karltorp and Sandén 2012) have been put forth and they largely focus on rapid decarbonisation (Bromley 2016). Given the systemic spatial, social and ecological inequalities communities hosting extractive activities experience, recent proposals particularly focus on achieving intersectional justice in the form of procedural equity (Schlosberg 2013).

A significant gap in existing proposals is that they tend to focus on structural solutions, overlooking deep-rooted cultural, behavioural and discursive issues. Kate Raworth points out the importance of non-structural factors such as growth mindsets that result in communities being "socially locked in, addicted to, and stuck on growth" (Raworth 2017, 280). In the current alternatives-to-growth scholarship, it is unclear how to get specific countries, communities and industries to then get 'unstuck on growth' to achieve ecological and social justice.

More importantly, designed to shift global ambition, the current literature assumes that all extractive industries operate in similar ways such that phasing them out might take the same set of interventions. This assumption is rendered invalid just by looking at the examples of coal and oil. Despite being a cleaner alternative to coal, Timothy Mitchell argues that oil as a commodity erodes democracy by weakening workers' ability to political organise due to the nature of its decentralised supply networks (Mitchell 2013). This illustrates why sector specificity and context *matter* in systemic transitions.

To address these critical gaps in the literature, I propose looking at the scripts of things.

B. The scripts of things

Beyond institutions and social relations, Madeline Akrich writes about how technological objects have their own scripts that enable and constrain relationships. Far from being inert and passive, “technical objects define a framework of action together with the actors and space in which they are supposed to act” (Akrich 1992, 208). Bruno Latour extends this to argue that the materiality of objects enables them to play a mediating role in human and nonhuman relationships (Latour 1994).

The idea of scripts has since been taken up by various scholars who examine scripts in many different contexts, from standardisation (Timmermans and Epstein 2010) to technologies and brands (Verbeek 2005). Notably, a Danish study argues how the ‘inscription’ of renewable smart grids promote passivity and reduce agency in consumption (Hansen and Hauge 2017). Following this line of thought, sand too brings actors together in possibly a way different from other objects.

Critical theorists highlight how discursive instruments such as scripts and narratives have a disciplinary power (Foucault 1995) and maintain asymmetric power relations (Gramsci and Hoare 1985). A critical step in achieving systems change is the ability to tell new stories so that actors can come together in novel ways (Stroh 2015). Scripts and understanding how they change provides a way to understand new pathways for deeper mindset and behavioural shifts to counter inequalities. Nelly Oudshoorn, for instance, explores how cardiac physicians resist scripts in telemedicine to create new, powerful scripts in their healthcare practice (Oudshoorn 2008).

Given the gaps in literature, I am a contributing to the theoretical framework by:

(1) combining theoretical frameworks around alternatives-to-growth and the scripts of things to provide a new way of understanding sand as a technology that needs to be scaled down and;

(2) using the case study of Singapore, the largest importer of sand.

I will next explore the methodology to draw out scripts enabling and disabling the phasing out of sand use in the land reclamation supply chain.

3 Methodology

This study employs qualitative research methods, informed by the secretive nature of this topic. As the result of increased price volatility, and export bans on a commodity so critical to Singapore's land security, the topic of sand is highly securitised (Comaroff 2014).

Investigating understudied areas brings value to sociology by "ordering the field conceptually and hinting at research questions that seem promising" (J. Beckert and Wehinger 2013, 6). I had similar intentions with sand and decided to pursue this research due to my unique access to it. As a Singaporean, I have local contextual knowledge. My professional experience in Asian corporate sustainability also gave me credibility and access to elite networks. Since local students are often discouraged from pursuing this topic, my studying at a reputed international university also was an added advantage.

3.1. Recruiting participants

Since there is a monolithic state narrative defending sand use for land reclamation that is widely accepted by everyday Singaporeans (Jamieson 2017), I wanted to study and interview two groups of people.

The first group consists of powerholders and decisionmakers in the sand trade – largely Government officials, business and civil engineers – who, given their position of power, have significant influence in shaping and reproducing dominant sand scripts.

This was the hardest group to recruit. Since Government officials did not respond to interview requests, I decided to focus on academics producing knowledge and research around sand in Singapore and managed to speak to two civil engineers.

The second group consists of researchers in the social sciences as well as local artists who make up a very small group of people resisting the predominant sand script, critiquing Singapore's land reclamation and sand acquisition practices. I prioritised recruiting people who had lived experiences around land reclamation or had conducted primary research to elicit informed insights reflecting ground realities. People in this latter group have with little decision-making power but are cultural elites taking a critical stance and pave the way for local counternarratives and countercultural scripts. The small size of this group and the fact that most in it are individual activists point to the notable absence of local community mobilisation around sand (discussed later in Chapter 4, Subscript C). As supporters and resistors of a trade that is largely out of the public eye in Singapore, both the groups studied in this research are privy to knowledge and perspectives that might be unavailable to the average Singaporean (for full profile of participants, see Appendix A).

In instances where the sample size of those studied is relatively small and hard to reach, snowball sampling – where an initial convenience sample of subjects can recommend subsequent subjects who can in turn recommend others – is widely used in sociological research (Heckathorn 2011). The initial people I reached out to were journalists and academics who had written about sand in Singapore since their contact details were mostly publicly available. Overall, I managed to have 12 conversations, 2 of which were entirely off the record (I will not be including these insights in my

findings). While it is a meaningful group of people, the small sample means it cannot be interpreted as representative of all Singaporean elites. The interviews are more suited to identify who is likely to accept and carry certain scripts, and what narrative positions they hold.

Qualitative interviews are particularly suitable to ask probing, open-ended questions and when examining unchartered territory with vaguely defined barriers and a lack of transparency (Newcomer, Hatry, and Wholey 2015). I used a futures-oriented action research approach, because for a particular future to be created for a society, or industry – in the case of my research, to scale down sand demand and extraction - it may first need to be imagined (Dator 2002). In line with this, interviews were semi-structured conversations. Participants were asked to reflect on their personal understandings and experiences around histories, contemporary realities and anticipated futures around sand use in Singapore's land reclamation (for indicative list of questions, see Appendix B). I also presented participants with opposing viewpoints to understand how they defended the scripts they articulated, as a way to elicit key enablers and barriers to a more environmentally and socially just sand system. Reflections on the histories and contemporary realities helped elicit a nuanced picture of the dominant script and new scripts emerging in the margins.

3.2. Reflexivity and ethics

The researcher's own positionality matters, and feminist methodologists have argued for self-reflexivity (Harding 1991; Collins 2009), by presenting the results of research to communities studied and that researchers place themselves as object of inquiry

themselves to historically situate and contextualise their own assumptions (Collins 1986). As a woman from a minority ethnic group in my country delving into a highly defenced topic often studied in the largely masculine industry of civil engineering[1], my identity and position as what Collins (Ibid.) calls the “outside within” was constantly front-of-mind. One way to confront bias due to positionality is for the researcher to provide an opportunity for participants to challenge these potential misrepresentations with a space in the process for review (Clarke, Friese, and Washburn 2015, 165). My research findings will thus be socialised with participants to lead to shared reflection and potential co-generative action (Ramos 2002).

Since securitisation meant it was hard to recruit participants and anonymity was paramount, I conducted 45-60-minute one-on-one interviews instead of group interviews. Qualitative interviews require an open and trusting alliance between interviewer and respondent to be truly meaningful (Weiss 1995). While I had originally planned to conduct these in person as a way to build trust and rapport, the COVID-19 crisis meant that all interviews had to be held virtually on Zoom. Also, an authorised sand stockpile visit to personally observe how scripts are operationalised could not be obtained. An ethics approval is ever-critical to the protection of researchers, their sponsors and participants in all research projects (Davies and Dodd 2002), let alone one as sensitive as sand in Singapore, so I obtained approval from my academic advisor and sent participants consent forms in advance (see Appendix C). I also assured each participant their ability to go ‘off-the-record’ to encourage open sharing, an option two interviewees exercised.

[1] This is reflected in the largely male demographic of participants, see Appendix A.

Based on the integrated theoretical framework of alternatives-to-growth and scripts of things, and using a methodology suited to the secretive nature of the topic, I next present the key insights and findings from my research.

I argue that current scripts and narratives pose significant barriers to de-grow and scale down Singapore's sand use. Powerful dominant scripts centred on growth, mutual benefit and silence legitimise, justify and underpin the systems and institutional structures around sand. I also explain how scripts of resistance and relationality emerging in the margins question and offer alternatives that enable transitions towards a more socially just and environmentally sustainable sand trade.

4 Contextual background and findings

In my research, I explored and unpicked the different scripts around sand use and land reclamation in Singapore to understand how prevailing scripts might obscure inequalities and pose barriers. In this next section, I will first provide background on Singapore's sand demand and then highlight three elements of the dominant script: growth, mutual benefit and silence. Then, I will show how participants both spoke to and resisted the dominant narratives, while offering new scripts of relationality that pave the way to a more just sand system.

4.1. The case study of Singapore

As the world's largest importer of sand, one cannot overstate the scale of Singapore's sand demand; one reclamation site alone has been estimated to require 88 million cubic metres of sand (Ungku and Latiff 2019). Majority of Singapore's sand procurement is for land reclamation; a staggering 22% of Singapore's land mass has been reclaimed since the 1960's (Global Witness 2010: 2).

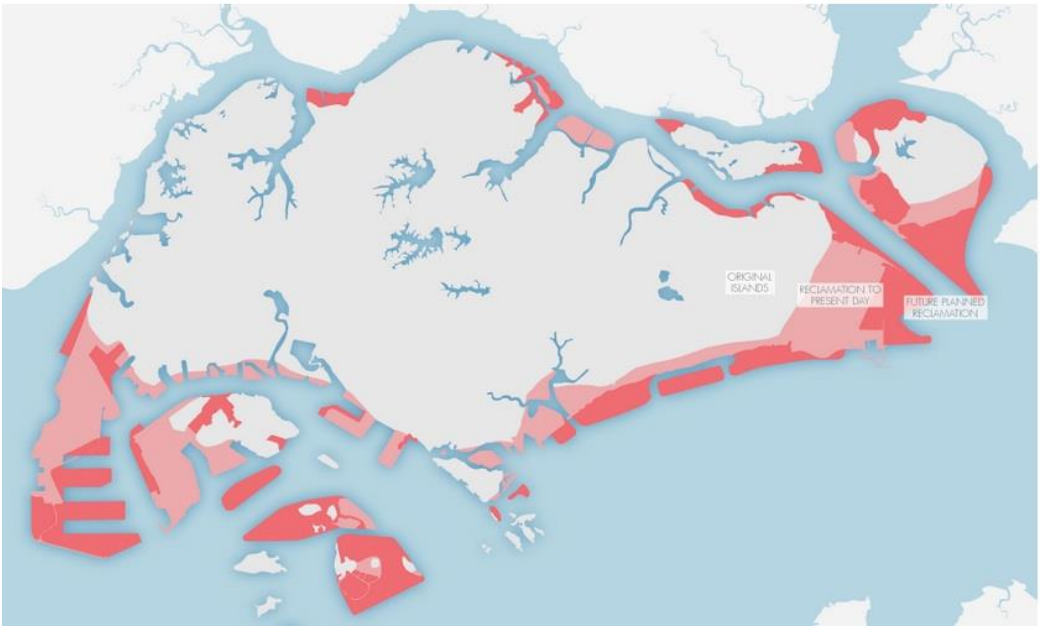

Figure 1: *Singapore's original lass mass (in white), its present reclaimed land (in pink) and future plans for reclamation leading to 2030 (in red) (Source: Nanyang Technological University 2014)*

The importation of sand is a critical engine of the country's industrial development and economic growth (Yeoh 2003). Singapore's strategy of expanding the land mass of its island-state for industrial growth has colonial roots – the practice started in a piecemeal fashion under British rule in 1822 (Lim 2017). As the idea of reclamation

took hold, what started out as piecemeal for port expansion became a concerted political strategy to fuel post-independence Singapore's development within a capitalist framework (Moser and Schär 2013). Since running out of domestic sand resources from cutting hills in the 1970's, Singapore has imported sand from neighbouring countries (Ibid.).

While sand supplying Southeast Asian countries mine sand for their own domestic construction and landfill use as well, Singapore's sheer scale of demand has resulted in the country being accused of indirectly spurring illegal sand extraction in the region (Global Witness 2010; Lamb, Marschke, and Rigg 2019). Communities and ecosystems hosting sand extraction have experienced significant losses due to displacement, flooding, droughts, landslides and biodiversity loss in the form of collapsing fish stocks (Torres et al. 2017). These impacts are often non-immediate and experienced upstream and downstream (Hübler and Pothen 2018, 5). With resistance from local communities and sand bans from exporting countries, sand has become a matter of land security in Singapore (Lin 2017, 27).

In Singapore's unique model of state capitalism, 90% of land in Singapore is state-owned (Haila 2016). The Government commissions land reclamation for public use such as housing, defence training and to build the country's Marina Bay financial district (Chia 2016). Singapore is poised to grow even further leading up to 2030, as detailed in the Government's 2013 Land Use Plan (Moser and Schär 2013, 26, Ng 2018). Land reclamation is an engineering project that is one of three strategies - the others being building taller and expanding underground spaces - with plans for floating islands (Wong 2019). A study recruiting everyday Singaporeans found that many support the use of sand for reclamation, justifying the practice as 'economically pragmatic' (Jamieson 2017).

4.2. The dominant script: sand as a commodity

This section explores how different interviewees mirrored and related to the dominant scripts that justify sand use in land reclamation. Of the ten people I interviewed, two were civil engineers - one a Government contractor and another working for an international private dredging company. Both were directly involved in land reclamation projects and strongly felt that sand use was justified. The other 8 interviewees who were critical of the sand trade to varying degrees also engaged with this dominant script, often resisting it.

Here are the three key elements within the dominant, state-constructed script that legitimises sand use for land reclamation: growth, mutual benefit and silence. Each of these play a critical role in making sand use largely unquestioned and in marginalising critical voices. Within each element of these scripts, there are emerging scripts of resistance that contain within them the seeds of change toward a more equitable and just sand system.

Subscript A. Land reclamation as a critical vehicle for economic growth

By far, the strongest theme emerging from the interviews was that land reclamation had enabled national economic growth and development in land-scarce Singapore.

One participant, who had overseen land reclamation projects in the 1970s-1990s spoke of the 1989 Interministerial Committee which concluded that Singapore needed more land to grow economically (Interview B). All participants spoke to the oft-repeated narrative of Singapore being a small country that needed an open economy and continued growth to survive. Without natural resources, the country's main resource

was its people and to accommodate a larger workforce, you would need more land (Interviews D, J). The country's coastal areas became sites of industry and defence – for military training, port and airport development as well as the country's petrochemical hub. While many countries aspire for economic growth, tying it to land expansion to its development strategy is relatively unique to Singapore. As one participant explained:

> "This secretive trade is also the ultimate infrastructure of Singapore as a city-state, because extra spaces are how the country copes with the uncertainty of its place in the global economy. It's able to either create a huge petrochemical plant or port which can cope with extra wide berths. And it's how it is able to give itself an X-plus-one amount of space just so it can project ahead into the future." (Interview F)

In this need for land expansion, sand is still the cheapest and technically best resource for landfill (Interviews B and C). Despite price hikes and bans, it is still commercially available and relatively cheap – so it is only 'pragmatic' that Singapore uses it. In other words, land expansion is tied to the very survival of the country and sand is a resource that makes this national imagination technically possible and economically feasible. Since Singapore has largely translated this economic growth into social development, in terms of low-cost public housing, healthcare and education, land reclamation by this account is justified on the grounds of improving the socioeconomic welfare of Singaporeans. This script is so widely accepted that it is culturally internalised and as one participant put it, part of the "Singaporean psyche" (Interview A).

Scripts of resistance

Many participants voiced a moral uneasiness about the fundamental act of taking someone else's sand. Sand, they argued, was not just another commodity - it was also land and ecosystem. The removal of it in quantities so large as to make land in Singapore meant that entire communities and species could have been displaced, often to disastrous extents before stronger sustainability measures were put in place. Several participants (Interviews D, F, G, I, J) pointed out the documentary 'Lost World' featuring a Cambodian woman from a coastal community devastated by land erosion and lost livelihoods who visits Singapore to reflect on how much Singapore had financialised the sand of her land (Mam 2018). Those in coastal communities have lost out profoundly and the dominant script erases the spatial, social and ecological inequalities created by the sand trade.

However, even these resistors could not deny sand's importance to Singapore's growth. The growth mentality is so strong and culturally ingrained, they argue, as it is seen critical not just to Singapore's continued affluence but its very survival. Wishing degrowth on Singapore and its sand demand, would then be considered 'unpatriotic' (Interview E). As one participant articulated it:

> "We're all Singaporeans, our country comes first at the end of the day. So this whole conscience of taking someone else's sand is something that inevitably, even if you argue until the cows come home, we will have to close one eye and say, what can we do? We have got to survive and carry on." (Interview A)

While degrowth or a-growth as an aim was out of the question, participants expressed reservations to growth (Interviews E, I, J). Taiwan has often used as an informal

cautionary tale in Singapore, because of the country's economic slowdown. Despite this, one participant pointed out:

> "When I go to Taiwan, people are very happy. They are not so good in terms of the currency exchange, of course, but they're not so stressed out like us, they're not so pushed out by the fierceness of the market." (Interview I)

For these two participants, the question was about how *much* Singapore needed to grow to survive and whether the parameters of success could be defined and understood beyond economic ones. While resistance to growth scripts was limited, these questions point to how notions of growth are tied to societal happiness and success, beyond survival.

Subscript B. Sand use in land reclamation as a 'win-win'

Amongst the participants, the two civil engineers were notably the only ones who felt that land reclamation and particularly the sand trade was mutually beneficial and sustainable.

They individually reasoned that economically, sand exporting countries not only benefitted from the trading of sand as a commodity but also gained through foreign exchange.

They also argued that land reclamation could be inherently environmentally sustainable (Interviews B and C). According to them, dredging is a necessary practice when river sedimentation means that river water cannot flow. Using material from such

necessary dredging projects for river flow or port expansion as landfill material could be a form of circular economy, where no material goes to waste.

Despite its potential sustainability, sand exporting countries were imposing trade bans which they reasoned were politically motivated because these countries were “holding their sand hostage” because they did not want Singapore to grow at their expense (Interview B). Even though it is a low-cost material, the rising cost of sand due to bans had pushed both the Singaporean Government as well as dredging companies to invest in new technologies. Both engineers pointed to material innovations such as increasing the quality of local alternative fill materials such as clay and silt[2] which were not considered safe previously, or alternative techniques such as the polder or caisson methods that require less sand to make the same amount of land. In some places, these practices could reduce the need for sand “by up to 90%” (Interview C).

Environmental impacts at sand dredging and depositing sites have also improved. One participant acknowledged that while earlier reclamation practices were pollutive because waste was often indiscriminately dumped in the open ocean, strict pollution controls imposed by the Government and new technologies like silt curtains meant that contemporary practices were cleaner (Interview B). Dredging was also done in a more targeted ways to minimise downstream and upstream impacts in riverine ecosystems (Interview C). Local flora and fauna disturbed by reclamation activity, such as coral reefs, were also identified and repositioned away from the port to minimise damage (Interviews A, C). The civil engineers insisted that environmental practices had improved to the point that many environmental concerns were no longer pressing. Where concerns remained, they reasoned, it was likely due to the practices of ‘bad’

[2] Both are technically classified as fines because of their smaller particle size but like sand, they are natural sediments that cause similar environmental impacts upon dredging.

contractors rather than the Government's fault. Advancements in satellite technology also meant that contractors were more likely to be caught by buyers (Interview C).

As one participant summed up:

> "We are not exploiting your ground, we actually just need some materials. It's no different from buying copper or iron ore - we're just buying sand, which for us is an important commodity. For you, there is plenty available. I'm solving you an ecological and environmental problem by dredging to allow your river to flow. And then at the same time, you can use the money for development, assuming that it doesn't go into somebody's pocket." (Interview B)

Scripts of resistance

Many acknowledged that the environmental improvements were a welcome sign but no public access to reclamation sites and environmental impact assessments (EIAs) meant that they could not be verified or held publicly accountable. For instance, a researcher working on sand governance, while acknowledging river sedimentation as a real problem, pointed out issues in traceability because not all projects were about "helping the local people in their flood management" but that dredging was still happening in the main stems of the Mekong to meet high levels of sand demand and "there is no way to trace where the sand procured was necessarily waste material in all these projects" (Interview H).

Many felt that the Government pointing the blame to 'bad contractors' constructed the practice to be morally defensible while obscuring the Government's own accountability in creating the demand for sand in the first place (Interviews D, F, G, H, I, J).

Some also questioned the economic defensibility of the trade from the sand sourcing countries' side. Even where economic gains were to be made, corrupt officials meant that economic gains were rarely shared with the communities most affected by the removal of sand (Interviews A, D). Pricing increases often were a reflection of transportation costs from Singapore importing sand from further destinations rather than the result of integrating environmental and social "externalities" (Interviews C, F, H). These meant that the economic costs of negative impacts such as landslides and livelihoods loss were rarely quantified to truly understand if the economic benefit outweighed the cumulative cost (Interview J). The sheer asymmetries in economic advantage after accounting for this reality meant that Singapore stood to gain much more than Cambodia or Myanmar, thereby rendering the economic 'win-win' story invalid for these countries.

Participants voicing this moral script of resistance also questioned whether reclaiming was an undisputed economic win for Singapore – Singapore bore costs that were often unconsidered. Several pointed to the country's continued reliance on imported low-cost migrant workers (Interviews D, I, J). In land reclamation sites, they had heard of several instances of work hazards and precarity. As the COVID-19 pandemic unfolded in Singapore, some noted how this precarity came to public attention (Interviews D, E, J); the packed living conditions and neglect of migrant workers meant that the spread of the disease went unchecked, resulting in a second wave of the disease in Singapore.

As one participant put it,

> "Imported sand and labour are things that the state has to keep secret and suppressed. The country doesn't really succeed without those things" (Interview F).

Environmentally, Singapore's hydrology was being affected which meant that Singapore's marine biodiversity, particularly benthic life, were decimated (Interview A). Stronger ocean currents from a changing hydrology will mean that more land erosion might happen, requiring costly coastal climate adaptation efforts on Singapore's part in the long-term. While Singapore made billions of dollars industrialising and financialising its coasts, this participant pointed out, the Prime Minister had announced that the country was investing over $100 billion for climate defence and further commissioning of coastal reclamation to protect Singapore from rising sea levels (Chang 2019).[3] If the country was re-investing so much of its profits, was the enterprise of land reclamation truly an economic win in the long run?

Subscript C. Silence as a script: securitising sand

Something a sand researcher in Singapore cannot avoid is the disquieting silence around sand. Since sand trade is politicised in terms of price hikes and export bans, its use is tied to land security for Singapore's economic growth and tightly controlled by the state. Consequently, sand itself is securitised.

[3] Others also pointed the irony of Singapore importing sand from other low-lying countries vulnerable to coastal climate incursions for its own climate defence (Interviews E, I).

An important side-benefit of this securitisation, some argued, was that Singapore's particular model of state control made its reclamation more responsible. In other countries like Indonesia, one civil engineer pointed out, private companies could commission and carry out reclamation activities (Interview B). The Government was very strict in obtaining sand only from licensed contractors (Interviews A, D). The state control of land in Singapore meant that only projects in the country's national interest and not critically damaging to ecosystems and livelihoods were approved (Interviews B, C). For instance, one civil engineer participant (B) had advised against a project in Jakarta Bay that would have caused too much pollution and cost fisher-communities.

Furthermore, the state heavily invested in research and development to reduce Singapore's sand resource insecurity by working closely with universities and consultancies around the world, being a key lever in efforts for better environmental practices (Interview C).

Operationalisation of silence

Even prior to my research, I was discouraged by friends and professional contacts who felt that no one would want to speak with me. A professional contact affiliated with Singapore's Building and Construction Authority (BCA) - a statutory board approving sand import licences - said most employees had limited access to information and clearance around sand; those who did would likely not respond to interview requests from researchers (see Appendix E). Of the over 40 cold emails I sent and calls I made, the majority failed to respond and 2 of the most prominent civil engineers presently working on land reclamation projects responded only to decline, explicitly citing

security reasons. Even some academics spoke of fear (Appendix E). Fear was a critical barrier in people speaking up more. For one participant:

> "It would be very difficult for me to go out and do this 'rah rah' activism stuff. I don't think anyone would do that. Someone I know tried to do that, to provoke but even he got a little worried because there are repercussions." (Interview A)

Consequently, few researchers work on this topic, especially those who are critical of the sand trade. Notably, many of them are not Singaporean. An investigative journalist who looked into Singapore's sand use did not have work visas renewed (Interview D). Of the researchers who have managed to persist, many reported experiencing significant pushback in the form of people refusing to talk to them for security reasons (Interviews F, G, H, I), funding refusals (D) and refusals of entry to sand stockpile sites (F, G). Art projects had been decommissioned or removed without prior notice (Interview J). Two potential participants in this project – a civil engineer and a researcher - declined to go on the record, the researcher because they had been threatened to be prosecuted under the Official Secrets Act[4] for their research.

One respondent noted how this changed the approach and modality of questioning land reclamation practices. Art, more than science of journalism, became the primary mode of communication:

> "You do realise that most of us who end up dealing with sand, we've all used some kind of fictocriticism methodology. *XXX*[5] had this whole storyboard of photographs. And *ZZZ*[6] also did a whole series of narrative-based artwork." (Interview G)

[4] State law enacted to prevent disclosure of confidential official documents and material
[5] Name anonymised - this person was approached for this study but declined participation
[6] A participant in this research study

Scripts of resistance

Notably, of all the elements in the dominant script, state control of land as a positive force faced greatest resistance from seven - the vast majority - of the participants. The biggest costs of state control, many argued, were the lack of public consultation and the erosion of relationships to land.

Questioning the lack of public input

Some participants pointed out that state control of land reclamation did not necessarily result in projects of national interest. Because sand is reconstituted into land through civil engineering and infrastructure processes, technocratic, engineering knowledge is privileged over other knowledges like the environmental and social sciences. Civil engineers are held in great esteem. The biggest impact of this is that without public consultation, wider questions of whether a project should even occur due to potential negative impacts are not truly considered.

“Engineers seem to think that it's a matter of fact to just do reclamation because it's a very interesting civil engineering project and you're doing Singapore's bidding by growing the land mass at whatever cost. So these guys are engineers who just do the Government’s bidding.” (Interview A)

The set-up of state decision-making within the Government also posed a critical barrier, according to a few participants. One example of this was raised by a few participants - the Gardens by the Bay project. In this particular case, the sand deposited did not consolidate to be made into land that could be built on. As a result, the full financial return of the land reclamation was not achieved. Natural habitats were

razed to reclaim land that was ultimately turned into a manmade garden, a tourist site (Interviews A, J).

Grieving lost connections to land

One participant shared the lesser-known history of how many coastal communities in mainland Singapore as well as the surrounding islands were evicted from their land as late as in the 1970's (Interview J). In this process, coastal areas were turned into productive, industrial land while citizens were concentrated into Singapore's central areas. Coastal communities and their deep relationships with the sea were dislocated. While it is still alive in many other parts of Southeast Asia, the memory of Singapore's own maritime culture is long forgotten in official narratives. Several participants expressed the spatial disconnect of "not feeling like we are on an island at all" (Interview E). In fact, another participant voiced, few parts of the country's coast – such as the East Coast - is publicly accessible at present (Interview D).

The almost ritualistic process of sea being turned into land was also significant. Under the Proclamation Act, once land reclamation engineers monitoring the settlement of sand deemed it safe to be built on, the President of Singapore proclaims what was once sea to be land for development (Interviews I, J). Sand could be sitting in an area for years before it is legally considered land and the sites are closely guarded and not accessible to the public (Interview E). One participant – a sailor - articulated a literal spatial disconnect here, sharing how reclamation happened so quickly that navigational maps sometimes reflected a space to be sea but were in actuality land (Interview J).

For one participant, Singapore's lack of connection spoken to an erosion of national identity, having the effect of citizens feel like foreigners on their own soil.

> "Because everyone is just very transient going through here, we all don't have much connection with the land. We don't have much visual recollection of what was here before. We don't own the land. Our ecosystems are all aliens. So maybe that's why everything is kind of transient and we don't really know what's ours to protect." (Interview E)

Beyond land reclamation, another participant spoke of state control and the resulting disconnection of citizens with their land as a form of violence in and of itself:

> "This garden city for me is a very violent dream. We never get to farm in it, we don't get to plant any of this green. In fact, we're not even allowed to touch them, touching them is illegal. So this relationship with our land, is paternally given to us. We are really cut off from our land, and I think that's politically important." (Interview I)

Both the lack of public consultation and a poor relation to land have critical impacts on the people. Because of the disconnection to land, most Singaporeans do not have an awareness of the environmental and social costs of all the development and land reclamation in Singapore (Interviews A, D, F, G, H, I). For one participant, this was a critical barrier because it foreclosed possibilities of care and accountability:

> "Responsibility can be legalised or emotional. Not just the Singapore state, many states are in the business of denying responsibility in a kind of legalistic way. And I think if you do that, then someone on the street can say, well, why should I care? If we are aware and feel responsible, then the next step is to care." (Interview D)

The state's land ownership is contingent on people's disconnectedness from it and the scripts of the capitalist, technocratic state has a Foucauldian disciplining power that renders issues around the sand trade invisible. Without visibility and awareness, most Singaporeans are unable to extend spheres of care to the most vulnerable - Singapore's migrant workers and coastal communities. This is evidenced in my own research sample. Most of my research participants who cared enough about the sand trade to resist and challenge it were intimately connected to Singapore's coasts in a way most Singaporeans are not. Two participants were from families displaced from coastal areas (Interviews E, J). A few researchers had loved ones working as architects and engineers, providing access to reclamation sites (Interviews F, G, I).

Sites of silence are analytically important, and who will and will not talk about sand matters. Not being able to talk about sand is a position of power in and of itself, and it creates a power asymmetry and inequality. The researchers and artists resisting powerful state-led scripts – are making their resistance public, that make silence less and less possible and create new social relations and power.

4.3. New scripts of relationality: sand as land and ecosystem

I have argued how powerful and embedded the dominant script around sand is in legitimising Singapore's sand demand, making the termination of sand extraction more difficult. Two elements in scripts in particular: (1) land expansion enabling growth for the very survival of Singapore, and (2) the silence around sand due to its securitisation – pose intractable barriers in shifting towards a more equitable system and sustainable sand system.

The mentality and scripts in favour of growth was identified as the most pressing barrier towards socioenvironmental justice and long-term sustainability of the trade. Many also pointed out the growth script as the underlying factor that ensured the defensibility of the trade as a 'win-win' and the justification of the silence and securitisation around sand use.

As a result, many participants expressed a sense of helplessness in achieving any change at all (Interviews A, E, G) – Singaporeans and the world was "locked into the growth mindset" (Interview H) which would put us squarely on the path of endless construction and indiscriminate resource use. Some mentioned the COVID-19 pandemic as a potential source of disruption, forcing post-growth considerations following a likely impending economic recession (Interviews G, J) while others felt that COVID-19 might actually spur sand demand if the Government commissioned additional infrastructure projects to jump-start the economy (Interview H). The overwhelming sense was Singaporeans were not ready to think about degrowth and that this will hold true for the next few decades to come (all interviews).

However, a few suggest that it is not in tackling the problem head-on with shifting mindsets around growth ideologies – instead they spoke about creating new stories and scripts.

As articulated by one participant, the state control of sand use and privileging of engineering knowledge had restricted the story of sand and reclamation to be a primarily technocratic and capitalist one and this needed to change:

> "Sand has been made invisible because we don't see it in our day-to-day, there's no immediacy to it. To humanise it without the technical babble is to have our own story." (Interview G)

New stories told by the participants in my study highlight the unsavoury histories of land reclamation. They critique the construction of sand as ‘just another commodity’ by influential actors such as civil engineers. They highlight how the British levelled entire hills in Singapore to flatten the country, using the labour of local Chinese and Indian coolies (indentured workers) (Interviews D, J). They mourn the decimation of Singapore’s maritime culture and local biodiversity as people in the coasts were evicted to make way land expansion that built ports, airports and petrochemical refineries (Interview I, J). They make parallels between colonial histories of exploitation and the contemporary realities of low-income migrant workers forming a critical part of the workforce In carrying out modern land reclamation (Interviews D, E, I).

Instead of downplaying the importance of growth to Singapore, these emerging scripts recognise sand and its role in literally building Singapore. A big part of that recognition is to remember relcaimed land is not “land without any history or baggage” (Interview J), the sand that contained it had its own histories and stories - it was once land and ecosystem for others. One artist-activist points out:

> “With reclamation, we have the ability for to ignore national formations of what we are. We are literally buying somebody else's land and making it our own, expanding our territorial space. I really think about sand itself as history. We're just buying this history of a sand, crushing it down. We're making the aggregate and reconceiving it into our own history.” (Interview I)

When such stories reach the average Singaporean, the “ultimate beneficiaries of Singapore’s land reclamation” (Interview D), they widen people’s sphere of concern beyond Singapore and create opportunities to build new relationships between people and their land. Some felt that this was already beginning to happen. In recent years,

local activists had fought to protect remaining heritage and green spaces that were earmarked for development, such as Bukit Brown cemetery and MacRitchie Forest (Interview G). As COVID-19 unfolded, many community organisations working on migrant worker rights were coming together in new ways since the pandemic disproportionately affected migrant worker communities in Singapore (Interviews D, E, F, I, J). Participants pointed to newspaper stories of how workers who were hospitalised had a hand in building the very hospitals they were treated in (Interview I). The groundswell of civil society action opened up broader debates around the reliance of low-wage workers and Singaporean attitudes toward them (Ibid.). Under lockdown, people were noticing local biodiversity in a way they had not done before because they stopped to notice (Interview A). These is a new attention to relationality and the entanglements around sand, growth, identity and community in Singapore that can enable people to “accommodate a lateral dimension of concerns” (Interview I) beyond economic growth.

5 Discussion

Alternatives-to-growth scholars emphasise the need to limit throughput (the amount of material passing through a supply chain) (Kallis 2017; Schneider, Kallis, and Martinez-Alier 2010; Videira et al. 2014). In the case of sand where there is no regenerative or renewable alternative, this reduction would require Singapore – and the world – to build a lot less infrastructure, which directly conflicts with deeply ingrained scripts and beliefs around growth. An integrated theoretical framework that combines alternatives-to-growth literature with that of the scripts of things illustrates just how high the barriers are in achieving degrowth and highlight the importance of softer, narrative pathways, on top of structural ones, in achieving a rapid scaling down of non-renewable resource extraction. Even while existing knowledge, institutions and technologies to phase out sand use are either already there or being invested in, the dominant scripts around sand present a necessary apathy towards their use.

In many ways, the trade of sand speaks to David Harvey's argument of "accumulation by dispossession", where actors are able to buy, spatialise, and financialise an object whose removal potentially displaces entire communities and habitats. Despite this, the dominant scripts surrounding sand – growth, mutual benefit and silence - are so deeply sedimented and pervasive in the Singaporean populace that it is an exercise of Foucauldian 'disciplinary power' (Foucault 1995), a societal conditioning.

As with Akrich's and Latour's original assertion that objects have their own scripts (Akrich 1992; Latour 1994), sand's scripts are unique in their specific entanglement with growth, identity and interstate relations. In the Singaporean land reclamation supply chain, sand brings actors together within land reclamation in several unique

ways. As a superior and relatively cheap material that can be technically manipulated to be made into land, sand is turned into land. Along with this material reality, the securitisation and fencing of reclamation sites renders sand use largely invisible to the vast majority of Singaporeans. Because of how sand use is entangled with land expansion and growth, the primacy of economic rationality makes the costs of its extraction appear justified. Finally, the technical expertise needed to manipulate sand into making land results in a very small and elite group of specialised actors who participate in the sand trade and shapes the stories they tell of sand to be a technocratic one, rather than a human story.

Because of the significant barriers the dominant script poses, my participants point to how resisting the current script and creating new ones are a critical next step to shape change. Looking growth through the lens of the 'soft' scripts instead of 'hard' structures reveals an underlying root problem of a disconnection - in the case of Singapore, a disconnectedness to land, nature and society. Sand that is land and ecosystem to different human and nonhuman actors is stripped of its prior history and relationalities to be turned into a commodity, which is then again made into land in the land reclamation supply chain.

Emergent scripts of resistance that reassert relationality fundamentally question and critique the sand trade based on moral principles. Markets are moralised and morally embedded (Polanyi 2001; Thompson 1971) and have the ability to shape preferences for certain types of products (Jens Beckert 2009; Jens Beckert and Aspers 2011). Beliefs and values about what is right and wrong shape whether and how economic exchange happens (Fourcade and Healy 2017). In a sand trade that continues – both legally and illegally – scripts around growth prioritise economic benefit to always be a higher order of concern than environmental and social cost. Scripts around the sand

trade as a ‘win-win’ distinguish Singapore’s use of sand as more discerning, less pollutive and legal, current scripts construct the Singapore’s sand demand to be morally justified. Within this modality of moral justification, community resistance to land reclamation and sand export bans are seen as politically motivated and petty, rather than taken as serious socioenvironmental grievances. This is the first and foremost critical barrier in achieving environmental and social justice within the sand supply chain.

Similarly, scripts of silence based on state control and securitisation of sand a script relies on alienation. As Anna Tsing argues, alienation is a recurring feature in capitalist systems such as in Singapore:

> “Through alienation, people and things become mobile assets; they can be removed from their life worlds in distance-defying transport to be exchanged with other assets from other life worlds, elsewhere.” (Tsing 2015, 5).

Stories of relationality, then, are not just feel-good and optional. They fundamentally defy alienation and speak to an alternative politics – one that as Edward Kohn puts it, “grows from attention to another way of being, one here that involves other kinds of living beings” (Kohn 2013, 14). Because of the power such stories wield, a lack of this attention results in the persistence of growth mindsets and scripts that lead to a cycle of overconsumption and disaffection. They also create the conditions for new social relations to emerge and question current power structures.

The profound impacts of the sand trade illustrate this well. Sand has to be removed from its life-world – amidst crabs and fishing communities – to be made into a commodity that can be fabricated into land, glass, concrete, digital technologies and even toothpaste. This splintering of the supply chain into multiple supply chains and

commodities renders the exchange of sand invisible and particularly hard to trace. Particularly in the land reclamation supply chain, where sand is turned again into land, traces of the sand's history are lost when new buildings and industries take hold on newly reclaimed land.

Amidst the looming barriers of disciplinary power and alienation, new stories that emphasise difficult histories and deep relationality recover hope. By amplifying these scripts, everyday citizens – who are beneficiaries of a sand trade that costs those whose voices are often unheard – understand how their actions unwittingly perpetuate social inequalities, and discover how changing their behaviour can achieve social change (Stroh 2015: pg 43).

6 Conclusions

I started this research with the macro-level concerns of the climate crisis and the need to rapidly scale down extractive industries like sand. Singapore's use of sand for land reclamation presents a critical opportunity to understand how growth is pursued spatially. To understand how this extractive industry can be phased out to meet climate and social justice aims, we need to first understand how Singaporean actors think and talk about sand, and what scripts around sand emerge. Since so much of the land created is financialised for Singapore's development and progress, sand is an entry point into understanding Singapore's singular vision of growth.

Singapore is at an interesting middle ground in its growth trajectory. As an advanced growing economy, it sits between mature economies such as Western Europe and US – where growth has largely stagnated – and developing economies with aspirations of rapid growth. Its set of challenges to degrowing are thus very different and warrant attention, especially against the backdrop of an impending recession due to the COVID-19 pandemic.

In a world where the need for growth has long been taken for granted, the climate crisis and growing inequalities have forced many scholars to consider alternatives to economic growth. These alternatives offer important end goals for humanity to aspire towards, but their focus on abstract and structural pathways to achieve these goals constrain the ability to phase out environmentally and socially damaging extractives.

I have argued the importance of understanding scripts of things in extractive industries that are difficult to scale down, such as sand, using the case study of Singapore. While there is no regenerative or sustainable alternative to sand, Singapore's case study

shows that perhaps part of the answer lies not just in technologies enabling sustainable alternatives, material reuse and resource efficiency but also in reclaiming relationality. Sand, understood relationally, is much more than a commodity – it is land and ecosystem. An attention to this cultivates care and accountability, opening up conversations around phasing out sand use.

It is important to note that while the conversations I had provide important insight, this is a nascent area of study where knowledge is opaque and often hidden. My research is only the beginning of the work that needs to happen to truly shift towards a more just and sustainable sand system. There is much more to be done, particularly in understanding the key mechanisms to amplify scripts of relationality. This is a long-term project in the making, one that fosters engaged dialogue between marginal voices and incumbent decision-makers, as well as between a people and their land.

While Singapore is unique in the sheer quantity of its use of imported sand to spatially manifest economic growth, land reclamation is a strategy used by many countries, from China to Egypt to the United Kingdom. Outside of land reclamation, sand use for other products such as concrete and glass is expected to significantly increase in the decade with urbanisation and rising consumption. Each of these objects has its own script that can inhibit or enable its phasing out, on top of structural and institutional factors. My research highlights the critical need to understand these different scripts. An attention to such scripts – the barriers and enablers they present - will pave the way to rapidly scaling down non-renewable resources to achieve human flourishing in a thriving planet.

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8 Appendix

A - Participant profiles

Code	Profile	Areas of expertise	Date of interview	Length of interview	Other notes (Age, Gender, Nationality)
A	Botanist and Horticulturalist	Environmental, biodiversity impacts	15 June 2020	1:07:50	50s, Male, [redacted]
B	Senior Civil Engineer and local university professor	Sand sourcing and material sciences research for alternatives to sand	4 May 2020	1:57:39	60s, Male, [redacted]
C	Civil Engineer at international dredging company (contractor)	Sand trading, pricing and material sciences research for alternatives to sand	17 June 2020	0:57:18	30s, Male, [redacted] (Singapore-based)
D	Geography Professor	Research in regional sand trade and socio-environmental impacts	20 April 2020	1:01:24	50s, Male, [redacted] (once Singapore-based)
E	Artist-activist	Personal experience of losing coastal home, landscape changes	1 May 2020	0:43:19	38, Male, [redacted]
F	PhD student in Geography	Lived experience of land reclamation impacts	30 April 2020	1:20:04	20s, Male, [redacted] (Singapore-based)
G	Masters student in Architecture	Sand materiality and sustainability in Singapore's construction sector	28 April 2020	1:18:19	20s, Male, [redacted]
H	Economic Geography Professor	Global impacts of dredging and sand resource governance	18 May 2020	0:42:58	40s, Female, [redacted] (once Singapore-based)
I	Filmmaker	Social impacts, national identity, migrant worker rights	22 April 2020	1:53:14	30s, Male, [redacted]
J	Artist-activist and filmmaker	Personal experience of losing coastal home, alternative histories and stories around Singapore's land reclamation	2 May 2020	2:30:57	40s, Male, [redacted]

B - Interview Questions

Interview questions – Singaporean cultural scripts around sand

These questions are intended to give you a flavour of the type of conversation you are likely to have during the interview. Do note that I might take the conversation in a different direction based on your insights and responses.

Introduction

1) First of all, tell me a little about your background and area of expertise with regards to sand (either in terms of: research and development or business experience in the sand supply chain)?

The past: Understanding Singapore's history with land reclamation

2) What is your understanding of Singapore's need for sand? Why is sand and its role in land reclamation important to Singapore? How has this changed over the last few decades/20 years?

The present: how Singapore is dealing with change

3) How do you anticipate that Singapore's demand for sand will shift in the next 10 -20 years?

4) Where is Singapore displaying leadership in terms of sand?
    - Optional follow-up questions:
        - What are the most interesting developments in this area, in your perspective?
        - How might they develop further?

5) How would you respond to concerns around the environmental impacts of sand dredging in the countries we source sand from: Cambodia, the Philippines, Myanmar?

The visionary future

6) What is the best possible outcome for sand in the next decade, as we approach further supply crunches, price volatility and environmental degradation? What might future leadership in a more sustainable sand supply chain look like?
    - Optional follow-up questions:
        - What will enable this future? Are you seeing emerging signs of this?
        - What might prevent this future? What are the potential barriers?

Do you have any thoughts and reflections?

Thank you for your time and for sharing your perspectives!

C - Informed consent

PARTICIPATION IN THIS RESEARCH STUDY IS VOLUNTARY

I have read and understood the study information dated February 2020, or it has been read to me. I have been able to ask questions about the study and my questions have been answered to my satisfaction.	YES / NO
I consent voluntarily to be a participant in this study and understand that I can refuse to answer questions and that I can withdraw from the study at any time up until 20 July 2020, without having to give a reason.	YES / NO
I agree to the interview being audio recorded	YES / NO
I understand that the information I provide will be used for my dissertation and that the information will be anonymised.	YES / NO
I agree that my (anonymised) information can be quoted in research outputs.	YES / NO
I understand that any personal information that can identify me – such as my name, address, will be kept confidential and not shared with anyone other than myself.	YES / NO
I give permission for the (anonymised) information I provide to be deposited in a data archive so that it may be used for future research.	YES / NO

D - Excerpt from Thematic Analysis Codebook

Descriptive Themes	Sub-themes	Examples
Justifications for Singapore's sand use in land reclamation	The need for growth	"In 1989, Singapore had this interministerial committee to start to plan for the future of Singapore. What is the ultimate population for Singapore? How can we grow? How much can we grow? The long and short of what they concluded is: for Singapore to grow, we need more space." "To me, reclamation in Singapore is a side product of its success because I mean, it's a small island and they never expected to have this kind of success. But they were the very first who actually started to work with big containers. They were one of the first ports to actually allow containers. And the whole container revolution of the 60s and 70s has basically centred around Singapore. "This secretive trade is also the ultimate infrastructure of Singapore as a city state, because it's how it's able to cope with uncertainty. Extra spaces is how it copes with the uncertainty of its place in the global economy. It's able to either, you know, create a huge petrochemical plant or create a huge port which can cope with extra wide berths. And it's how it is able to give itself like an X plus one amount of space just so it can project ahead into the future" "The problem is that Singapore is on this track of growth. It means you've got to keep growing just to survive, to sustain and be sustainable. This idea that in order for us to survive, we need to be a market force. We need to have like eight million people. So for more people to last, you need more land."

		“We always come back to the rhetoric of scarcity, fear and economic slowdown. Actually, this is the number one narrative of Singapore: we don't have natural resources. That is why our only resource is human resource. Yes. And then human resource is why the economy must be very strong. I don't think this is going to change.” “When you start putting economics, the economics of it against the social context, it seems like the economics will always prevail. Because that's the Singapore psyche. That's exactly how we've actually grown, have been taught to grow and will actually do that. And the narrative for the next hundred years will be the same - survival at all costs, progress at all costs.” “We still want all the growth that our port sectors are going to give us, which is about oil tanks and sea ports. We still want oil refineries because we are one of the biggest refinery hubs in the world. And then airplanes. In some strange way, we are not hypocritical about it.” “We are stuck in the 80s. It's always about productivity and efficiency and we are still called a developmental state because there is no finality to progress. More is more, always more is more is more. It gets translated to many different places, even in design these days, in all the sectors. It's just very frustrating, this hamster wheel we are in.” “And in a sense, that 2013 white paper encapsulates why you need more land. You need more people to drive the economy. And if you're going to have more people, you need more land and so on and so forth. So there's a kind of

		intersectional logic behind the whole development ethos in Singapore and land and the value of land and land reclamation is one of, I suppose, the outcomes of that. So, I mean, I think in a way to understand why you need more land, you need to ask, why do we need more people, you know, and a larger workforce? And what does that mean for housing and feeding and employing them and so on. So in a sense, I would almost argue that you have to go right back to the start of what is Singapore's development strategy and logic.”

E - Record of participation refusals for security reasons

Please note that in the spirit of confidentiality and anonymity, all information potentially revealing the identities of these participants have been blacked out.

Email 1 – from senior civil engineer working with Government

Dear [redacted]

Thank you for writing to me. The topic on land reclamation and sand use is a sensitive topic. I am sorry i can't be of help on your Master's dissertation. Hope you are able to find other sources of information that you need.

[redacted]

Email 2 - from senior civil engineer working with Government

Dear [redacted]

Thank you for your email. I am not in the position to discuss the use of sand and I hope you understand.

Best regards

[redacted]

Email 3 – from a private contractor working with the Singapore Government, who declined to sign my consent form and go on the record

Dear [redacted]

I am not keen to sign such a form. I had helped other postgraduate students of other European universities, none of them asked me for such a form. I don't understand this practice of LSE.

I attach here with another of my paper [redacted] This may be help to you

Also, a good example of proper regulatory regime for sandy earth extraction is in the development of Bedok new town. The hills in the Bedok area were levelled for the development of Bedok new town. The extracted earth was transported by a conveyor system to the sea for the reclamation of the land for Marine Parade new town. In addition, sand quarrying operation was carried out to produce concreting sand to make concrete for the construction of HDB projects for many years before the quarry was handed to PUB for the development of Bedok Reservoir. There were thousands of squatters in the Bedok area prior to the earthwork. They were resettled with an allocated HDB apartment each and monetary compensation in accordance with HDB's resettlement policy (details please look at Housing a nation: 25 years of public housing in Singapore published by HDB). It was the same for the mechanized sand quarry.

I am not aware of any environmentalists' protest reported.

I hope the above are useful to you.

Rgds
[redacted]

Email 4 – from senior overseas academic

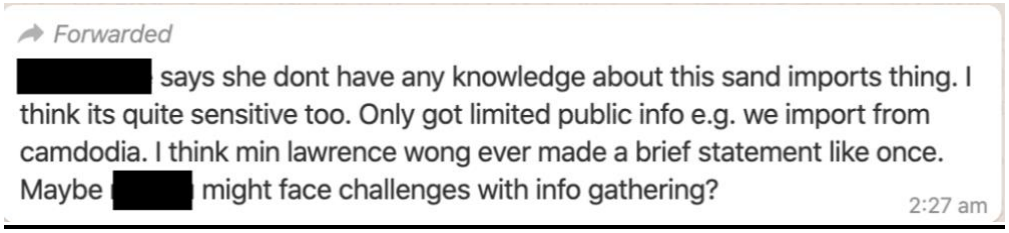
Dear [redacted]

Thanks for your message. Unfortunately, there is not much I can do to help you. All I know about land reclamation and sand imports by Singapore is summarized in my published work. There is therefore no point in my phoning you to discuss the topic.

Good luck with your dissertation!

[redacted]

Text from a friend in the Government on the ability to contact her colleague from the Building and Construction Authority (BCA)



Email from potential participant detailing difficulties of contacting BCA

[redacted]

Many have tried to do this research. BCA almost never speaks to them. Look up the ETH report and speak to the academics who wrote it.

[redacted]