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A Cultural Shift towards a Sustainable, Bicycle-Oriented Living in Bali

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Abstract: This paper focuses on the development of a sustainable bicycle-led transport system in Bali. Since the coronavirus pandemic, bicycle use has accelerated globally as a cheap, safe, sustainable and healthy form of transport. But given its global reputation for tourism, Bali is lagging massively behind bicycle transport in more developed economies. The paper progresses in five stages. First, the global context for bicycle use is examined. Second, in addition to a more efficient transport system, extraordinary benefits are considered in terms of economic, environmental, societal and human health. Third, due to the lack of prior studies, the Indonesian context is necessarily presented from a seriously constrained data base, and existing legislation. Fourth, the results from an extensive user-focused empirical survey were analyzed. Finally, a series of proposals are suggested for planning policy that would necessarily support bicycle use in Bali.

Keywords: bicycle; health; economy; environment; tourism; Bali

1. Introduction

From 2020-2023, the Covid-19 pandemic debilitated all major economies, and in the process created havoc. This is inline with Castels (1984) views that such a catastrophic event affects urban structure, wealth distribution and conservative ideologies regarding the function of the local state. The consequences of this pandemic were unevenly distributed globally, as well as fiscal policies to mitigate its effects and the long-term impacts are still to be assessed (Flynn, 2020) This has led to a rapid learning process (Nikitas et al., 2021, O'Sullivan at al., 2020), and it is now clear that devastation in the Global South far exceeded that of the Global North (Galbraith, 2020).

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In developing economies like Indonesia, uneven development was also widespread, predominantly in relation to sustainable local economies, primarily those whose life support system was agricultural against those focused on tourism. Reflecting the latter, Bali suffered catastrophic effects to its economy, losing 80% of its income, creating terrible poverty, bankrupting thousands of businesses and decimating private car use due to financial stress and the risk of infection (Wibawa, 2020). This had national repercussions. In 2024, Bali generated 44% percent of Indonesia's foreign exchange earnings from tourism, valued at IDR 107 trillion (Winata, 2025).

During the Covid Pandemic, the use of cycling was universally perceived as a pandemic safety net. At the same time, cycling is an economic generator. It is a necessary and viable alternative to transport planning orthodoxy that has failed to safely accommodate conditions (Mathew & McDonald, 2026). During the Covid Pandemic, all forms of mechanized transport became non-viable such as in national, underground and light rail systems, buses, taxis, private motor vehicles and motorcycles. Schools, government buildings, hospitals, military bases and other institutions came to a standstill. Many airlines were grounded or bankrupted. All systems were reduced to being viral transmission sites through enforced spatial proximity. Automobiles became mobile viral incubators of the disease. Even motorcycles in Bali frequently carry two adults and two children thus guaranteeing family transmission of Covid. This left walking and cycling as the only safe options.

Many lessons were uniformly learned (and many ignored) during the 2-3 years of Covid 19 and its global effects. First, it would be intelligent and safe to assume that another viral pandemic is likely. For example in 2023, tuberculosis cases in the U.S. rose 15% from 8,332 cases per 100,000 population in 2022 into 9,633 cases per 100,000 population in 2023 (CDC, 2024). Also informative is Bali's history, one riddled with plagues and pandemics, as well as earthquakes and volcanic eruptions. Second, a sustainable bicycle-oriented environment (SBOE) is beneficial at all levels of economic development. Under any circumstances, pandemic or otherwise, it remains the only pollution free form of transport including those of emerging electric or hydrogen powered vehicles. Third, it has also been convincingly demonstrated that significant benefits and massive savings occur in other regions such as health, environment, and tourism (Queensland Government, 2019) which we recount below.

Of singular relevance to this study is that in the Global North an enormous literature has been developed in relation to SBOE, with substantial reports from national and state governments and private sector institutions, all promoting cycling as a positive contribution across major economic sectors (Zovko, 2014; Zhang et al., 2015; Utriainen et al., 2023; Saelensminde, 2002; Minet et al., 2015;

Anowar et al., 2017; Aultman-Hall & Kaltenecker, 1999). On the other hand, the Global South is weakly developed in the same literature, and in Indonesia, there are no substantial research or government reports on the post-Covid use of cycling as a driver of SBOE. Positive implementation of legislation for bicycles is close to non-existent despite the Indonesian *Perhubungan* Ministerial Regulation Number PM 59 Year 2020 pertaining to Road Safety for Cyclists (for some tragic reason, cycling was banned in Jakarta during the covid crisis (Kusno, 2023). In Bali it is also true to say that there is no literature, academic or otherwise that has been developed in relation to SBOE. Nonetheless we seek to correct this situation with an original, yet modest research project focused on a world celebrated island culture in Indonesia.

2. Literature Review

Given our data base and in order to précis significant research and government reports affecting the study, we must shorten our commentary to those that are most pertinent. Also, an extensive bibliography of 'cycling facts' can be accessed in Harms and Kansen (2018). Areas of interest have been used to structure our annotated bibliography noted as (United Kingdom Government, 2019) history, overviews (Cycling UK, 2019), National and Agency reports (Queensland Government, 2019), sustainability (Harms & Kansen, 2018), economic benefits-national (Germany National Cycling Plan, 2020), economic benefits-personal (Cycling Singapore, 2019), health benefits-national (Bikeleague Org, 2011), health benefits personal (Irishcycle, 2019), health hazards - pollution, risk, accident (NHTSA, 2023), social benefits (Grous, 2013), bicycle tourism (Prabowo, 2019), bicycle infrastructure (Cycling UK, 2019), personal safety, parking standards and facilities (UK Government, 2019), bike sharing, electric bicycles, mountain bikes (Nacto, 2011), sport cycling (OECD, 2020), case studies (PWC, 2015), Bali (CDC, 2024), undocumented websites (Bubnies, 2020). This annotation alone constitutes a thirty-page document. Problematically as in all taxonomies, certain information can occupy several categories at the same time, but we tried where possible to use the dominant theme of each section of the paper/report.

Prior to the coronavirus bicycle use had already been initiated in countries as far apart as Britain (Lumsdon 1996), Norway (Saelensminde, 2022), New Zealand (Richie, 1998; Ritchie et al., 2010), China (Pan, 2012; Giolzetti, 2020; Zhou et al., 2020), and Canada (Burns et al., 2014, Malaysia (Shokoohi & Nikitas, 2017), with an expressed need for socializing tourism post-pandemic for more ecological and just outcomes (Higgins-Desbiolles, 2020; Mathew & Macdonald 2006). There has also been a significant 'gentrification' of sport cycling as bicycle use becomes more sophisticated, with various road races lasting three weeks over 3000 km (Mignot, 2016).Today, nation states around

the world are promoting cycling as a major antidote to climate change; to improving the economy and urban life, and to reducing debt in national health systems. Major reports have been issued by governments e.g., British (United Kingdom Government, 2019; Cycling UK, 2019), Australian (Queensland Government, 2019; Faulks et al., 2007), Dutch (Harms & Kansen, 2018; Germany National Cycling Plan, 2020), German (Germany National Cycling Plan, 2020), Singaporean (Cycling Singapore, 2019), USA (Pucher et al., 1999; Bikeleague Org, 2011), Ireland (Irishcycle, 2019) and by NGO's (NHTSA, 2023) as well as prestigious research facilities such as London School of Economics (Grous, 2013, Farla et al., 2023).

Cycling involves E.E.C. Policy for 27 countries as well as the populist 'Smart City' and its advocates (Suartika & Cuthbert, 2020; Karanikola et al., 2028; Behrendt, 2019). Cycling also makes a huge contribution to sustainable environments in lowering greenhouse gas emissions (Bussière & Ravalet, 2010; Anowar et al., 2017), to sustainable tourism (Fletcher, 2011), to health (Gorobets, 2016) and to the sustainability of ride sharing systems (Zhang et al., 2015). In addition, bicycle tourism can also provide a boost to remote regions (Gazzola et al., 2018).

Major contributions can also be made in improving existing infrastructure, for example in replacing on street parking with bike lanes (Arancibia et al., 2019), in transitioning urban arterial roads to activity corridors (Curtis & Tewari, 2008) in reducing the need to continually expand space for parking, and in preventing negative health effects (Cavill et al 2008). Personal Safety is also a big issue (Utriainen et al., 2023, Edwards & Mason, 2014; Aultman-Hall & Kalteneker, 1999). Most significant are the two categories relating to Bali and to developing countries. Bali is notable by its absence of any context whatsoever, and in fact we could only find one article by Prabowo (2019) that dealt with getting people out of their cars. Virtually all local sources were from private tourism companies trying to source clients.

Bicycle tourism is not however confined to the Global North. More rewarding is the increasing involvement of several developing countries in promoting sustainable cycling practices. Mexico is also becoming a leader (Bussière & Ravalet, 2010; Flannery, 2021). Castillo-Manzano & Sánchez-Braza (2022) courageously tackles the problems inherent to South American capitals when the demand for bicycle infrastructure exceeds the supply. Cordovez et al. (2021) deal with bicycle related mortality in Ecuador. Curitiba (Brazil) has long been known as a centre of innovation in urban planning and transport policy, and two articles by Duarte et al. (2014) and Poljičak et al. (2021), are enlightening regarding the support for bicycle infrastructure.

In Southeast Asia, Shokoohi and Nikitas (2017) examine the possibility of incorporating bicycling within the existing road infrastructure of Kuala Lumpur. In Kyrgistan, Sabyrbekov (2020) asked why one should choose to cycle in a low-income country. Overall, it is easy to conclude that while North and South America, Europe and other major geographies are significantly involved in promoting SBOE, the clear absence of data and scholarship dealing with the subject is nearly absent in S.E. Asia with the singular exception of Singapore. The purpose of a literature review is to demonstrate what is absent from consideration. In the case of Bali this is not difficult since nothing exists of any consequence. We seek to change this attitude that is seriously widespread in academic and professional circles. We begin by investigating our three major considerations, namely the economic, environmental, social and health benefits accumulating from bicycle transport. If implemented, these categories all suggest significant benefits for Bali, both financially and personally for the population.

3. Method

Consequent upon the above, our adopted method does not fall neatly into any specific category. Our usual theoretical base is spatial political economy (Suartika, 2018; Suartika & Saputra 2019; Suartika & Nichols, 2020; Suartika & Cuthbert, 2020; 2022; Suartika et all., 2018; Cuthbert & Suartika, 2017; 2024; Cuthbert, 2011), and this methodology has also been used to great effect in analyzing planning practice (Scott, 2000; 2008; Friedmann, 2011; Pojani, 2022; Mariotti & Leetmaa, 2023), as well as the post-covid functioning of the local state (Mishra, 2025; Salama et al., 2020). But this process must be set to one side for the moment in order to elaborate the outcomes of an original and significant empirical research product. We adopt a synoptic approach to the problem.

There is no point in studying bicycle use in a vacuum, without acknowledging its overall economic impact and significant benefits to the population. This study has no precedent in the Balinese economy. Nonetheless what remains clear is that all strategies regarding transportation and bicycle use in Denpasar ultimately constitute planning problems, where so called 'planning problems' actually constitute social problems in disguise. Clear lessons can be learned from overseas.

Since planning is a servomechanism of the state, it ultimately depends on how the legal context is framed. We accept the existing planning law as the legitimation device for any potential outcomes or propositions. Consequently, the empirical focus of the paper is ultimately on urban planning practice which constitutes a social and political process rather than a purely scientific one (see Cuthbert & Suartika, in press). Hence the scientific demand for 'proof' within empiricism must give way to the messy and frequently confusing processes

of diffuse ideologies, urban planning standards (or non-standards), guidelines and design controls.

Consequently, the outcomes of our empirical research also suggest certain propositions as to how SBOE might be implemented by city authorities. Overall, three processes were used. First as a method, we use critical thinking and the resource quantum of archival research, academic journals, private sector reports and associated websites. Second as an information base, over 300 journals were accessed and catalogued into an annotated bibliography with 18 sections ranging from national and agency reports, sustainability, and personal health to bicycle tourism, safety considerations and the provision of parking standards and facilities. Third, our central resource was our survey that was carried out in 2024. It employed a questionnaire with a list of relevant questions and used a random sampling method targeting respondents from all over Bali Island. Overall, the survey obtained 1008 filled responses.

This methodology will be further elaborated below within the case study section. We note however that the normal limitations of publication do not allow us to present the massive database for this project. It can only be represented in diagrams that illustrate essential outcomes. Finally, we also recognise the limitations associated with studying an original, novel, socially rewarding topic that has been embraced around the world.

4. Result and Discussion

4.1 Economic benefits of SBOE

In a briefing paper by Cycling UK in 2016 (Cycling UK, 2019) information was presented from a number of European studies to support the contention that economic benefits in investing in small-scale, pro-cycling projects are often underestimated and that "car-dependence and large-scale transport projects (e.g., roads) are not the value-for-money they are often thought to be" (Cycling UK, 2019). Notably, bicycle tourism has been promoted in Britain for over thirty years (Lumsdon, 1996).

Significantly, leisure has massive economic potential. In 2011, it was estimated that 2.295 billion cycle tourism trips in Europe had a value more than £35.5 billion per annum (UK Government, 2019). In the 27 E.E.C. countries on average 8% of people use a bicycle daily, but in the Netherlands, it is 36%, and in Denmark 23%. Now beyond reproach is the fact that cycling is a huge generator of wealth (Krizec 2007, Kuster and Blondel 2025). In the United States, cycling is a US$ 6 billion industry, where 'One study estimates that the spill-over effects of all cycling-related activities could be as large as US$ 133 billion, supporting 1.1 million jobs and generating US$ 17.7 billion in federal, state, and local taxes (Han et al., 2020).

The multiplier effect of bicycle tourism is demonstrated by the nation's 60 million annual recreational bicyclists spending US$ 46.9 billion on meals, transportation, lodging, gifts and entertainment (Bikeleague Org, 2011), Flusche, 2024). Taking a synoptic view, economic benefits are vast ranging from less absentee days from work by employees to the differential costs of car use against bicycle use (Blondiau, 2016; Buis, 2000).

Two specific examples are germane. First, in Britain a revolutionary approach has been undertaken to urban restructuring that involves the hundreds of millions of pounds sterling in potential benefits that can accrue from sustainable bicycle use as part of national economic development. Consequently, many governments are embracing the idea of 'Bike Boulevards' (Nacto, 2011; Connoly, 2020). The publication 'Technopolis' by the British Government is by far the most rigorous analysis and research strategy for bicycle use in the UK (UK Government, 2019; Mehmet, 2020). It states that "The cycling industry is in itself quite a large area of economic activity, with an estimated 3.7 million new bicycles sold (£1.62 billion) in 2010 and with 2,500 cycle shops across the UK" (13: 30) and 'The cycle industry alone provides around £1.2 billion in direct economic benefits and tax, with a further £0.6 billion in benefits from cycle tourism, events and infrastructure' (13: 30).

We can see from Table 1 that Scotland, a country within the UK, has a slightly larger population but a smaller number of tourists than Bali. But Scotland manages to generate a revenue of US$ 700,000 per annum, against an unrecorded or non-existent figure for Bali (Zovko, 2014). Based on proportional tourism numbers, Bali could potentially generate US$ 800,000 per annum (Table 1). This estimation is based on *(i)* a statistical data informing there was 16,454,146 domestic and international tourists visiting Bali in 2024 (Badan Pusat Statistik Provinsi Bali (2025), and *(ii)* an assumption that a close to a quarter (4 million) of these visitors are into bike riding.

Table 1. Revenue from bicycle tourism - Scotland and Bali

	Population	**Tourists Per Annum**	**Revenue from Bicycle Tourism**
Bali	4,2000,000	4,000,000	US$ 800,000 (potential?)
Scotland	5,000,000	3,600,000	USD$ 700,000 per annum

Source: Zovko (2014); Badan Pusat Statistik Provinsi Bali (2025)

Second, in the Netherlands, the benefits of extensive use of bicycles are overwhelming. The Netherlands has 7 million cars and 22 million bicycles. The population of Amsterdam is 850,000 with 900,000 bicycles that travel 2 million km. each day. The city has nearly 800 km of cycle lanes with special

consideration for cyclists and safe parking for bicycles. The following are illustrations of bicycle use in Leiden, Netherlands (Figure 1, 2, 3 and 4).

Figure 1. Underground bicycle parking (Source: Suartika, 2023)

Figure 2. Car free roads (Source: Suartika, 2023)

Figure 3. On street bicycle parking (Source: Suartika, 2023)

Figure 4. Pedestrianised central area (Source: Cuthbert, 2023)

In addition, bicycles are accommodated into machine transport (buses, ferries, rail systems etc. In the Netherlands, 'if we only look at costs/benefits for society, one kilometer by car *costs* EUR 0.15, whereas society *earns* EUR 0.16 on every kilometer cycled' (Science Daily 2015). Overall, the Netherlands is an object lesson in pollution free urban transport.

The bottom line is that the economic debt to individuals of car ownership can be prohibitive, given costs associated with car purchase, loans, maintenance, insurance, parking, registration, taxes, and depreciation. These can easily absorb one third of a family income especially in developing countries where car ownership is severely taxed, and incomes are significantly less. They frequently represent a lifetime commitment to debt and a subsidy to government spending on public transport. Then there is the endless thirst for gasoline, parking charges and entry fees to facilities. Buying a car will usually entail a loan with substantial interest on capital. It loses money immediately when it is purchased; when it

is used, when it is idle and when it is sold. Maintenance can be prohibitive as a car ages, insurance can also be expensive and usually represents money lost assuming no claims on the policy. Garaging is also a major overhead, since it can represent 10-40% of domestic accommodation, at least equal to one room. Registration and taxes are not cheap, and depreciation is easily 10% of the purchase price on leaving the showroom.

4.2 Environmental benefits of SBOE

Automobile use is a major cause of global warming. It affects atmospheric, terrestrial and marine based ecologies. Causes are ubiquitous. Pollution of air, water and land from toxic residues are breathed in by populations, washed into drainage systems, hence into the sea and pollute agricultural land. Vehicles leak motor oil, brake fluid oil, antifreeze, as well as poisonous residue from brakes and tyres. This gets worse as vehicles age, decay and become more inefficient. So arguably the main environmental benefit to society in the adoption of SBOE, economic issues apart, is its overall capacity to contribute to the reduction of global warming by reducing motor vehicle exhaust emissions, direct pollution from vehicles, improving human health through exercise, the reduction personal costs of transport and potentially to increase the quantum of public space (Minet et al., 2021; Chapman et al., 2019).

In contrast, cycling reduces pressure on land development, lowers the costs of public services, decreases pollution, protects against global warming and returns more control over the public sphere back to the citizens. Cycling is therefore capable of transforming urban life. In comparison to cars, bicycle maintenance costs are close to zero, and the benefits are clearly immense. Due to these indicators, expanding environmental research on bicycle use now has a significant base, from urban policy (OECD 2020) to greenhouse gas emissions (Bussière and Ravalet 2010), to accident analysis and prevention (Aultman-Hall, Kaltenecker, 1999) to cycling master plans (Campisi et al., 2020), and as a stimulus to remote regions (Ritchie 1998). More directly, the case for non-motorised environments has been strongly made (Barbarossa, 2020), along with the argument for a bike-centric future (Nikitas et al 2021), and an anti-virus-built environment (Megahed & Ghoneim, 2020). More directly, research has also focused on the environment that cyclists must inhabit in terms of pollution, risk and accident (Anowar, 2017; Berghmans et al., 2009; Félix et al., 2019; Gossling & Choi, 2019).

In contrast, bicycles produce no noise, do not wear down infrastructure, are user friendly for everyone and are easy to rent. Initial costs can be whatever a person wants to spend, running costs are close to zero and there

is no environmental impact whatsoever. Well maintained, a bicycle will last indefinitely. At a national level, bicycle use can massively reduce the potential social costs to health services by improving individual wellbeing and serious illness. Apart from a significant increase in transport to work using bicycles, commerce has also been radically altered through the accelerated use of on-line shopping. A new industry has arisen in the delivery of goods, materials, food and provisions using electric bicycles (Figure 5, 6, 7), but also in their use as personal transport.



Figure. 5., 6., 7. Electric bicycle rental in Sydney, Paris, and Amsterdam (Source: Cuthbert, 2023)

New models of electric bicycles are emerging daily for purchase or rent. These are now fast, efficient, almost non-polluting, except for problems of battery use, disposal and recycling. Given the correct conditions, they are completely safe. Once purchased they cost almost nothing to run. In some models, batteries can be recharged during use and downhill movement. Environmental benefits are also immense. There is a huge reduction in air pollution (cancer forming phenyl-hydrocarbons, nitrous oxide, soot etc.), road deaths and injuries. The reduction of congestion on roads is substantial and policing is improved (bicycles do not need policed). One only has to experience the reality of having thousands of cars removed from the roads as in the Netherlands to see that the effect is transformational. In addition, 6,500 road deaths are prevented each year (Erviani, 2016).

4.3 Social and health benefits

Directly related to health issues, truly enormous social costs can also be defrayed (Johnson et al., 2021; Custer & Benoit, 2021). By lowering insulin dependence, increasing weight loss, and improving fitness, cycling may also reduce the treatment expense of diabetes (Technogym, 2019). In the UK diabetes costs US$ 20 billion per annum or 8% of the total health budget - with the potential to bankrupt the National Health Service. Cardio–vascular disease in the UK costs over US$ 10 billion annually (Cebr, 2014). The United States annual expenditure on chronic mental and physical illness represents 90% of its budget of US$ 3.5 trillion (20% of US GDP).

One third of all deaths are from heart disease or stroke (Waters and Graf 2018). But being overweight or obese was associated with half of these costs (Pratt et al., 2000; PWC, 2015). The data is clear that overall, automobile use supports global warming, encourages economic domination by big capital and promotes ill health in populations. But, it has taken a pandemic of global proportions for governments in both the Global North and the Global South to appreciate the hidden benefits of widespread bicycle use. In Indonesia, stroke, heart disease, diabetes and hypertension are all among the top causes of death, with smoking, high blood pressure, high body mass index and high levels of 'low density Lipoprotein (LDL)' being major causes (CDC, 2024). Overall, it is clear that the benefits to health from bicycle use are legion.

The personal benefits of cycling are equally huge, ranging from a feeling of euphoria to a reduced risk of dying from several chronic illnesses. Benefits are simultaneously social, physical and psychological. The costs of physical inactivity are legion (Pratt et al 2000). Cycling is also a low impact sport that pays dividends to individuals with joint problems. Being highly aerobic, the release of endorphins and other neurotransmitters into the body after 20 minutes of cycling generates a feeling of wellbeing. There is serious neurological benefit when the individual's heart rate exceeds 60% of resting pulse, which is also lowered after exercising.

Cycling strengthens the heart muscles and reduces blood fat levels. It stimulates the heart, lungs and circulation, and cycling 20 miles per week to work can cut the incidence of cancer and cardiovascular disease by 50%. That alone is an enormous benefit. Weight loss is accelerated by burning between 400 and 1000 calories per hour (Bubnies, 2020). It also boosts HDL levels (good cholesterol) and results in improved joint mobility and lessens strain by expanded muscle quality. Posture and coordination are enhanced. In addition, cycling also strengthens the immune system, helps to stabilize blood pressure and reduces insomnia and fatigue.

There is recent evidence it staves off Alzheimer's and Parkinson's diseases and can ameliorate the effects of osteoarthritis. In addition, 'cycling at a moderate pace for an hour allows overweight people with diabetes to halve their blood sugar levels in the next 24 hours' (Oakley, 2025). None of these singular benefits accrue to car or motorbike drivers. There are also no 'skill sets' required and unlike car ownership, cycling is a social activity that can begin at the age of three or four. Bicycles are also adaptable due to their simple structure. Overall, it is a win-win for every individual.

There is also a substantial boost to psychological health by lessening anxiety and depression, and an increased capacity to concentrate. Cycling reduces stress by 40%, burns fat and discourages obesity, increasing a more

positive sense of self (Basset et al., 2008). People suffering from sleep disorders can also benefit from adopting cycling as a way of life, not just as an occasional holiday event. But the one great benefit from riding a bicycle is the immense sense of freedom it gives, psychologically liberating in itself. It avoids the omnipresent aggression experienced when driving, exchanging this for the social benefits of bonding with like-minded individuals.

All of these benefits would accrue to the Indonesian people as well as to the Balinese. There are no class distinctions here. Paradoxically, a singular health benefit of bicycle use to the Balinese public would be in the reduction of traffic accidents which are significant. There are approximately 1.500 deaths per annum on the island, 80% of which are caused by motorcycles.

4.4 Case study of Bali

For the first time since the Bali bombings of 2002, the opportunity exists post-covid to rethink Bali's economy as a whole. This implies an entirely new political economy of place and space rooted to guaranteeing the self-sufficiency of the entire island for the Balinese people. Nothing can remain the same. The old mass tourism strategies based on a constantly expanding quantum of tourists on an annual basis must be questioned as it has recently been elsewhere. There is a burgeoning tourism backlash in many countries and cities. Clearly fortunes are to be made from history, and it is the historic cities that are worst affected e.g., Paris, Rome, Barcelona, Amsterdam, Florence, Prague, Majorca and many other European cities (Henley, 2020; Misachi, 2019). So, 'over tourism' ubiquitous across Europe for many years, has now gone global, with Asian countries such as Cambodia, Vietnam, Thailand and Japan, now suffering in select locations (Siem Reap, Halong Bay, Phuket, Canggu, etc.) (Misachi, 2020; Mowforth, 2015). Bali is now on the danger list.

Tourism must focus on participating in the promotion of Balinese culture, in community development, education, and cultural production (Dickinson et al., 2011). Balinese culture viewed as spectacular consumption should be relegated to the past and participatory tourism encouraged (Ionnides & Gyimóthy, 2020). Now is the time for this to take place. There are clear arguments for reducing tourism intake (overcrowding dilutes Bali's unique culture) and focusing on shrinking vehicular use, adopting green and sustainable policies that promote self-sufficiency, adopting baseline concepts that deliberately discourage mass tourism and encouraging bicycle use for the benefits noted above. SBOE is undeveloped in Bali.

Given the above, we can suggest that there are a series of generic conditions that are uniformly adopted in the Global North and increasingly frequently in the Global South that could be applied to forward movement of SBOE in Bali.

Table 2 lists ten points summarizing the varied *baseline* conditions that support bicycle promotion. They represent a basic set of global principles adopted in most self-conscious countries that authorities in Bali should immediately consider.

Table 2. Baseline Policies and Practices

No.	**Baseline policies for Bali's Progression towards a sustainable bicycle economy**
1	A Local government system that promotes an understanding of all aspects of bicycle use across all levels of the educational process starting with first grade education.
2	A planning system that actively supports and integrates all aspects of cycling into its policies and practices and actively educates its staff in a correct attitude to cycling and its benefits.
3	Financial support by the government for e-bike and bicycle access through gift, rental, e-bikes, tax credit, free loans, etc., as in Germany (JobRad), and U.K. (Cyclescheme).
4	A system of transport planning that does not consider bicycle use as a separate activity from urban development in general, but part of a holistic system of health and human movement.
5	The planned integration (rather than exclusion) of bicycle transport with other transport forms (bus, ferry, light rail, train, etc.)
6	The creation of a standard code of practice for all physical design requirements such as transit ways, pedestrian integration (or otherwise), crosswalks, lighting systems, etc.
7	Ensure that the government provides both electric and push bikes for rental, with technical support, storage and repair.
8	Creation of 'a highway code of practice' for bicycle use that is legally enforceable and policed.
9	The state should set an example by encouraging bicycle use in its institutions – military, police, civil service, education, for the rest of the community. Neither should large corporations be exempt. All supporting facilities should be provided (secure parking, storage, changing facilities, showers, etc.).
10	The implementation of a widespread campaign across all media to demonstrate the economic, social and personal benefits that come from a sustainable bicycle economy.

Source: Authors (2025)

In accordance with these general principles, we can begin to suggest some fundamentals to guide the implementation of bicycle use in Bali.

4.5 The cycling environment and urban space in Bali

Bali has a current population of 4.4 million people (in 2023). Motor vehicles in Bali top 5.2 million (in 2018) with roughly 20% cars and 80% motorbikes, increasing at approximately 10% per annum. Bali, where this paper originates, contains 4 million motorcycles, one for every man woman and child on the

island. It has almost 100 vehicles per km of road, second only to Jakarta (Table 3). This means that every single person on the island owns 1.2 vehicles.

Given that Denpasar has a population of 1 million, there are approximately 200,000 automobiles and 800,000 motorcycles in the capital. Both cars and motorcycles need space for parking and space for movement. Also, each type of vehicle needs several parking spaces, at home, at work, shopping and other facilities. At this point it is a matter of speculation as to how much urban space is allocated for each function. But even a conservative estimate of two parking spaces per car at 10 m^2 results in 4 km^2 of urban space - (200,000 x 10 M^2) x 2 = 4 million m^2). If we add parking space for motorcycles, at 2 m^2 per motorbike, we require another 3.2 km^2-, (800,000 x 2 m^2) x 2 = 3,2 million m^2). So, to accommodate all vehicles, Denpasar needs 7.2 km^2. of urban space. Significantly, this calculation does not include both space for parking required at homes and space required for vehicle movement on the road. In the current condition, there are no premises in Denpasar that provide parking spaces dedicated for bicycle users.

Table 3. Ratio of roads to cars in several provinces in Indonesia

Province	Roads (km)	Cars	Unit/km
DKI Jakarta	7,094.31	3,869,635	545,5
Bali	8,790.84	878,193	99.9
DI Yogyakarta	6,199.51	406,308	65.5
West Java	24,810.05	1,456,569	58.7
South Sumatra	18,078.37	915,056	50.6
Central Java	28,563.83	1,140,300	39.9
East Java	39,516.56	1,444,394	36.6
Riau Island	6,006.49	184,130	30.7
Riau	24,564.73	681,741	27.8
Banten	7,327.94	190,858	26.0

Source: Prabowo (2019)

A bicycle, on average, uses 1 m^2 for parking (Five at Heart, 2025). If bicycle use was successfully encouraged and accommodated in Denpasar, it could potentially remove 50% of vehicle use. This represents a massive potential since most motor vehicles only carry one person. If this were to happen, it would liberate parking space of (4 + 3.2)/2.00 km^2 = 3.6 km^2. Assuming the social distancing protocol required during a viral pandemic, that each bicycle replaces one vehicle (either a car or motorbike), parking space required for bicycles that replace the 50% vehicles removed from uses will be ((100,000 + 400,000) x 2) x 1.00 m^2 = 1 million m^2 or 1 km^2. This implies a reduction of 2.6 km^2 of space required for parking across town. In the case of Denpasar, Bali's capital, since

premises do not usually provide sufficient parking, this excess space could support other functions. Premises are required to have enough parking, but most often development proposals are given consent even when they do not offer adequate parking space. Consequently, on-street parking disturbs traffic flows and contributes to traffic congestion.

But even a conservative estimate of two parking spaces per car at 10 m^2 results in 4 square kilometers of urban space. If we add motorcycles to this, we can easily double the number to 8 km^2 - and this only accounts for parking, not space for vehicle movement. What is clear is that every car removed from the road by bicycle liberates valuable space *with the potential to extend the public realm*. The metropolitan population of Denpasar is now roughly one quarter of the island's population. Building heights are limited to less than 4 stories and any proposal to increase building heights would be a highly fractious event. This law was introduced in 1971 to protect Bali's unique culture, but it remains to be demonstrated how this actually works (Christopher & Sutherland, 2007).

There has been the suggestion that this relationship is illusory (Suartika et al., 2019a; b). In addition, it is clear that this law has generated problems of its own, given the widespread extent of vacant urban space and the low density of many areas. Urban sprawl has been a singular, and arguably a negative consequence, promoting an acceleration of the social costs indicated above (Christiawan 2019). We can speculate that urban density could easily be averaged down to that of a single-story building, with population density at 750 persons per km^2 (World Population Prospects, 2024). Tokyo for example is 6158 per km^2.

Given that Denpasar does not have any real 'city center' (or even sub-centre) where urban services and facilities are concentrated, this results in millions of unnecessary vehicle trips since urban functions are too spread-out and distant from each other, making walking distances too great and vehicle trips dangerous. This is not an argument for releasing the 4-story density rule. Nonetheless it does represent a pragmatic solution to the complex problem of urban density based on an ideological commitment to culture rather than through systematic research and enquiry, without any justification on the basis of significant research.

Alternatively, trips by car or motorcycle, for example in Berlin average only 4 km, a distance easily accessible by bicycle, and Paris now has a policy of a 'fifteen- minute city' where all basic needs are to be accessible within fifteen minutes walking or cycling from home (Willsher, 2020; O'Sullivan & Bliss, 2020). Bali is yet to grapple with such concepts, but similar policies in Bali should form part of a basic framework for action as in Table 2.

4.6 Urban planning and the law

It is important to mention that urban planning has little autonomy and actuality is a servomechanism of the state, and hence is it ideological – influenced by urban politics at all levels. We can therefore say that urban planning could not exist without the law that defines it. Hence in order to survive, the bicycle economy must be supported in legislation, linked to an overall system of public space provision, and be adopted and welcomed by the public. Such legislation usually falls within the aegis of urban planning law and is often invoked by some kind of crisis. But the notion of public space as a fundamental physical component of a democratic society is, in practice, virtually absent from the planning regulations of the Indonesian Government. Existing regulatory frameworks focus merely on the provision of green open space (GOS). This space can be provided either by the state or by non-state parties (Ministerial Regulation of the Home Affairs Number 1 Year 2007 (signed on 11 January 2007), National Policy Number 26, year 2007 (signed on 26 April 2007) on Spatial Planning.

The first category is named after public-GOS, and includes urban parks, cemeteries, and strips of conserved green areas that exist along roads, rivers, and littoral zones. The latter is denoted as private-GOS and embraces landscaped areas that exist within domestic, private, and communal premises. Ministerial Regulation of Home Affairs Number 1, (2007) further explains that the importance of the GOS is encompassed by its multiple functions in maintaining ecological, social, cultural, economic and aesthetical sustainability (clearly this agenda is too vast for any single agency). Being directed by these parameters, the Indonesian National Policy Number 26, (2007) outlines that each locality should reserve 30% of its whole area for GOS, and 20% of it should be public-GOS. Problematically, information on many subjects on Bali is unavailable and sources speculative.

Other data defies logic. For instance, paddy fields used for growing rice are frequently classified as green open space (GOS) when in fact they are clearly agricultural. While this allows a singular flexibility in land use classification, it also encourages the possibility of abuse to enter the process, for example by allowing paddy fields to be sold for development, hence eroding Bali's natural capital. In greater detail, urban policy in regard to bicycle use, Indonesia had not had regulatory framework in regard to bike riding till august the 14th 2020, when Indonesia's minister for Transportation – Budi Karya Semadi - signed a Ministerial Regulation Number PM 59 Year 2020 pertaining to Road Safety for Cyclists. This regulation outlines three basic requirements to ensure a safe bike ride, namely provision of bike paths, appropriate signage and public parking facilities. This regulation also outlines basic behavioral guidelines for cyclists when they are on the road.

Depending on where the facilities are required, provision of bike paths and parking areas are jointly provided by central and local government bodies who are assigned for the task. If we assume that the GOS is a mere representation of public space, the incorporation of bicycle infrastructure into the GOS is therefore problematic and extant to the Indonesian planning paradigm.

Recreational bicycle use may be possible under this arrangement but will not embrace cycling as a means of daily transportation. In this context, this activity should be accommodated within the overall urban public infrastructure, which to contemporary planning practice, represents an integral part of public space formation. The increasing use of bicycles in many major cities in Indonesia during the pandemic resulted in significant pressure on the Indonesian President, Bapak Jokowi. In his ministerial structure, he proposed a national policy in regard to bicycle use to the Indonesian Public Representative Board in Jakarta.

The immediate response by the top administrative level demonstrates the seriousness of the issue. It is expected the policy will be adopted quickly and efficiently. What this means is that there is nothing to prevent local authorities across Indonesia, including Bali, implementing comprehensive plans to include bicycles as an accepted form of transport, since legislation legitimizes the need for financial support. Paradoxically, a cycling revolution had been promoted by the Governor of Jakarta (Anies Baswedan) several years prior to covid's emergence. "Paradoxically, cycling was banned in Jakarta during the pandemic where cities around the world were encouraging its use (Kusno, 2023: 207)."

Locally there have been specific legal instruments passed that indicate a willingness to support bicycle use. For example, Denpasar City Regional Regulation No. 8/2021 concerning Denpasar City Regional Spatial Planning for 2021-2041 covers the overall planning mandate for the next 20 years. Denpasar City Mayor's Decree No. 28/2013 also denotes the Niti Mandala Renon Area as a place to implement a motor vehicle free day. Also, Perwali No. 55/2022 adopts Guidelines for the management of tourist attractions in the Sanur Coastal Area. This is one of the very few locations where bicycle lanes have been installed with some success. In addition, each of the nine regencies in Bali has relative autonomy from the provincial government. Hence both policies and practices will vary from one to the other, thus ensuring that a uniform policy towards SBOE is unlikely. The authors have spreadsheets of this variation, but they are too complex to reproduce here. Both Bangli and Denpasar regencies appear to be proactive in regard to bicycle use, with Bangli regency currently at the Planning Stage for Procurement of bicycle lanes in the city area.

Understandably, Denpasar being the capital has a special interest in moving towards bicycle integration in the city and within the tourist areas of

Sanur, Kuta and Legian. In order to consolidate some planning principles prior to discussing survey outcomes, three tables (4, 5, and 6) have been assembled as a foundation for discussion. On the basis of the authors combined experience of 70 years in planning and urban design practice both in Indonesia as well as in Europe, Hong Kong, China, the United States, Britain and Australia. These tables are designed to support existing planning policy locally by offering a comprehensive set of ideas/policies for discussion.

4.7 Specific results from user surveys

The user survey was conducted to determine user-based needs and attitudes, which both represent the alpha point in any successful SBOE. Naturally, it is impossible for the full extent of the data to be presented here. But it will be sufficient to present the more critical results from our user survey below. This survey was conducted online using google form and was participated by a group of respondents who were randomly selected. The number of responses was significant with 1008 completed survey forms. Due to the extent of the survey, much of the data had to be simplified and converted to information that illustrates user needs, preferences, inhibitions/requirements etc. This information is represented in the following diagrams. Since the consequences of each chart are transparent, we retain any commentary on these to conclude remarks. As commented above, such survey results have little impact without a planning strategy that supports the results of the survey. Figure 8 demonstrates their gender and age groups.

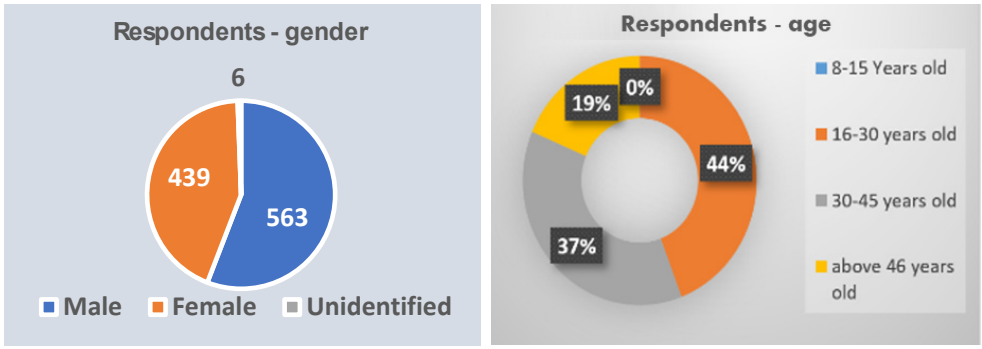

Figure 8. Respondents' gender and age (Source: Authors, 2025)

The results of our survey support a positive attitude to bicycle use, and the number of respondents has been encouraging. This is particularly so given that 80% of respondents were aged between 16 and 45, the age when most people might feel like adopting bicycle use. Without the development of an appropriate infrastructure for bicycles, the social consequences are significant, ranging from increased road fatalities, pollution and traffic jams to an overall

decline in the human health of the population. Indeed, 45% of respondents stated that riding a bicycle was primarily a health issue, with the recreational and social interaction reasoning being closely following (Figure 9).

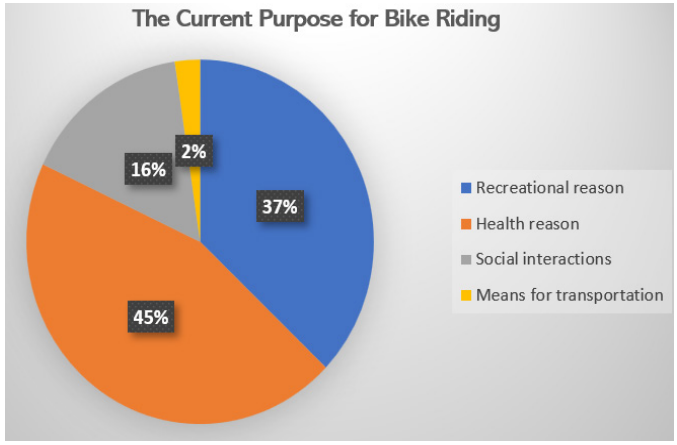

Figure 9. Purpose for bike riding (Source: Authors, 2025)

Problematically, 68.24% (688 respondents) stated that they seldom ride a bicycle, with 'often' only 16.17% (163 respondents), 1,58% (16 respondents) stated a continuous (always) use, 12% (121 respondents) had never done bike riding and 1.98% (20 respondents) did not thick the four patterns of bike riding provided in the google form (Figure 10).

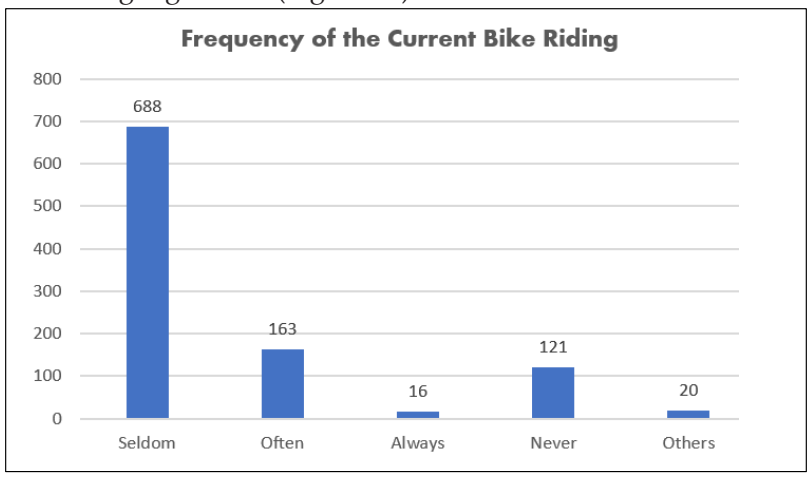

Figure 10. Frequency of the current bike riding (Source: Authors, 2025)

In addition, obstacles to use were overwhelmingly due to 'many vehicles park on the existing roads' and 'the absence of bike lanes (Figure 11).

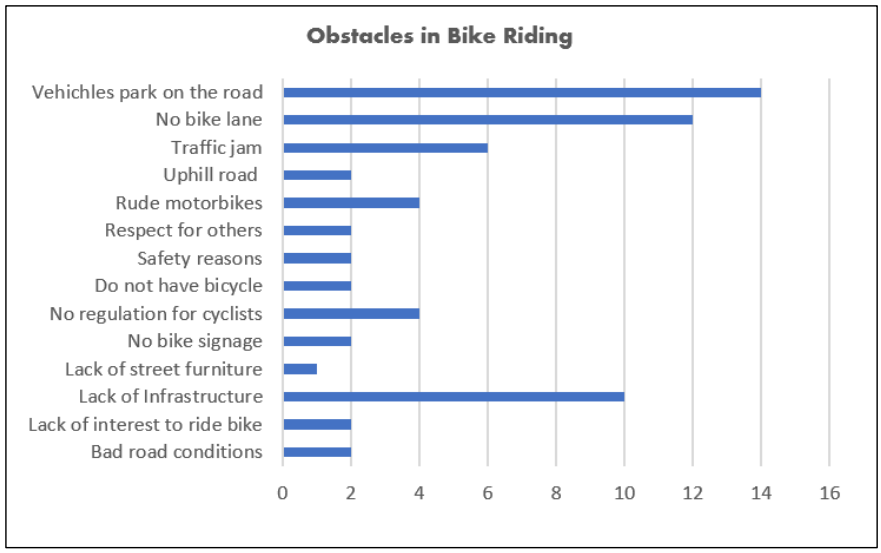

Figure 11. Obstacles in bike riding (Source: Authors, 2025)

The authors, all of whom live in local areas can attest to this fact. Almost no residents actually walk if it is possible to ride a motorcycle even 50 metres to the local warung or grocery store. The level of unfitness of local people needs serious study, and the benefits of aerobic exercise is clearly consequential upon educational programs for adults and children alike. Reasons given for cycling were still perceived as beneficial for health reasons, followed by the idea that cycling was a social activity that could be done with friends and therefore a mental stimulus as well (Figure 12).

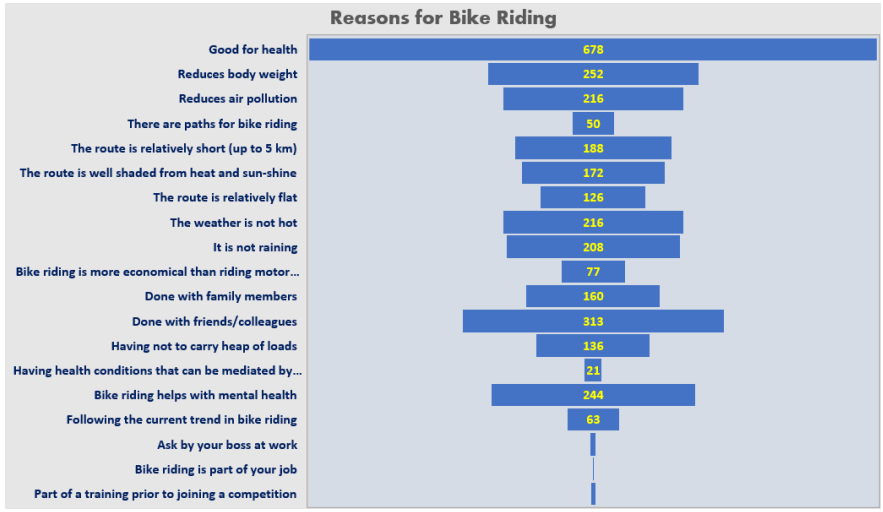

Figure 12. Reasons for bike riding (Source: Authors, 2025)

While 80% of respondents would ride for health, social and recreation, only a small percentage view bicycles as a form of daily transportation (Figure 13). Herein lies the essence of the problem, that people should be encouraged and supported as a predominant 'journey to work' option. Incidental responses from many individuals also indicate the climate as being a significant reason for not riding to work. No-one wants to arrive hot, sweating and disheveled for office meetings, indicating the need for the provision of facilities at the work place.

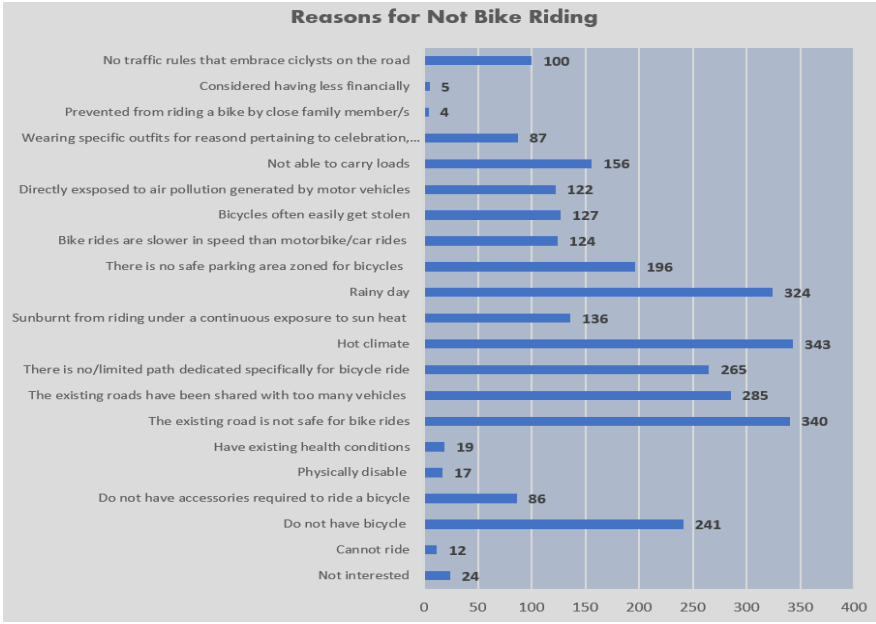

Figure 13. Reasons for not bike riding (Source: Authors, 2025)

5. Conclusion

The potential of SBOE for the transformation of urban space in Bali are substantial. In the recent pandemic of Covid-19, awareness of the destructive effects were experienced globally. Economies in both the Global North and the Global South have mostly reacted positively, tacitly accepting that another global pandemic remains a future possibility. Therefore, Bali has a simple choice to make. It can proceed to implement the results of this paper and accrue the benefits across a wide range of rewards. Or it can choose to fall behind a burgeoning movement across developed and developing countries alike.

Defensive measures apart, it is clear that during the pandemic governments promoted aspects of bicycle use that were previously unseen or ignored. This implies a positive attitude to the only available transport that is not a viral incubator –bicycle use. Pandemics apart, the widespread encouragement and use of bicycles as an integral part of urban transit is no longer debatable.

The enormous benefits both personally and collectively have been accepted across all economies as demonstrated above. Hence bicycle use has expanded beyond its normal recreational function. It has become a major contributor to the conservation of health and well-being of entire populations as well as a generator of wealth. The development of a sustainable transit system for Denpasar based upon bicycle use is not merely a matter of a few more bicycle paths. It requires consideration and action from national to local government, the reorientation of urban planning practice, and a widespread commitment to the benefits afforded to human health. It requires integration of landscape, industry and commercial development to generate an inclusive bicycle culture that will benefit everyone, not only cyclists.

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