Taiwan Fellowship Research Report

Adam Jarvis, July 2024

Principal Advisor, Palmerston North City Council

The Future of Smart Cities: Lessons from Taiwan for Western Municipalities

The rapid urbanization of the 21st century has prompted municipalities around the globe to explore innovative solutions for managing the complex challenges associated with modern urban living. Among these solutions, the concept of "smart cities" has emerged as a compelling vision for the future. Smart cities leverage advanced technologies such as the Internet of Things (IoT), data analytics, and artificial intelligence to enhance urban infrastructure, improve public services, and promote sustainable development. While many cities worldwide are investing in smart city initiatives, Taiwan has distinguished itself as a leader in this field through its comprehensive and successful implementation of smart city projects.

With only three months available to conduct this research, the project scope was constrained to producing a 'map' of areas of high interest to Western professionals and city-makers. This report is structured into three sections. First, general commentary about the state of 'smart city' practice in Taiwan, and the difficulties often faced in properly communicating even the foundational elements to Western audiences that are usually only in the beginning stages of their smart city journey. Second, I present an overview account of how these practices, together with excellent physical design, combine to create a world-class underground metro system worthy of widespread emulation. Third, a case where, despite excellent data collection enabling an enviable understanding of the ongoing housing crisis, Taiwan's legacy systems have, as yet, been unable to adequately address.

Finally, I note that the areas covered below are but two of the many areas worthy of further study for Western public sector officials. Any party considering reform in the areas of healthcare, asset management, manufacturing, or urban design, should first examine the state of practice in Taiwan – their successes are often astounding, while the failure modes are invariably instructive.

'Failure to Connect'

Hundreds of foreign mayors and city executives are sitting in a corporate lecture theatre in northern Taiwan. They've spent the last few days at an expo thoroughly impressed by Taiwan's 'smart city' innovations. They can see the enormous value of bringing these back home, but aren't sure how to do so. Now they've been brought out to the headquarters of one of the companies that's paid for their flights and accommodation. They could not be more primed to be sold to.

An executive walks out and introduces himself. He has a Ph.D. in electrical engineering from MIT; his 'Internet of Things' division generates billions in annual revenue. He begins his presentation by explaining the company's history. It started in the early 1960s as a grain distributor before diversifying into chlorine gas manufacturing. The founder's son saw an opportunity to acquire a fabrication company that made the cases for early IBM PCs. They've since exited that market, but thanks to the vision of their current chairman and the dedication of their world-class engineers they now make 35% of the world's networking devices and 0.5% of its chlorine gas[1].

"Enough history", he says. "Let's watch a quick video".

The lights dim. The guests sit up in their chairs. The video opens with a Hollywood-quality CGI flyover of Taipei's digital twin. Pulsing rivers of light crisscross the city. A female voiceover begins at ear-splitting volume, perhaps to highlight the company's highly impressive audio system. She explains that behind every node on the network sits her company, using the latest in 5GAI-IoT technology. A torrent of buzzwords and jargon spills out over the subsequent five minutes, utterly incomprehensible to the majority of the audience.

The rivers of light are now drawn together into a single point. The camera zooms in, revealing the nexus to be the very HQ everybody is now sitting in. In a thundering crescendo of sound and light, the camera crashes through the front door and into the sun-lit uplands of IoT connectivity.

His audience now thoroughly bewildered, the executive launches into a detailed blow-by-blow of his product line. Their fourth-generation devices had issues with abrasion when deployed in desert mining operations. They responded by developing an updated casing that prevented ingress while limiting the consequential increase in internal temperatures to 15%. Meanwhile, continued development of their main line transmitters has resulted in a power efficiency improvement of 6%, and a 3% weight reduction thanks to shifting to the new composite materials - all while retaining GH58 certification.

This continues for about half an hour. Even the unfailingly polite British delegation resorts to discreetly using their phones to catch up on emails[2]. Eventually, he sums up, saying: "Whatever you need, talk to us, and we'll deliver it" to a round of polite applause.

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[1] To be clear, this is not a real company but an amalgam of my experiences with about half a dozen different Taiwanese organisations. Writing this essay was a challenge, as Taiwanese friends I showed early drafts to thought I was talking about some company in particular, and it is not my intention to single one out. At the same time, I was concerned my Western audience would assume I was writing pure satire. Rest assured, this is an accurate representation.

[2] I can only presume this sort of marketing approach is highly effective to local audiences. Establishing the history and connections of your company is of extreme importance, as is providing an exhaustive list of relevant projects. One friend told me that corporate

Unfortunately, the audience has no idea what they need, let alone how to ask for it.

Everyone returns home. Six months later, some consultancy company makes the right connection at a conference in Sydney. They talk about the great work Taiwan is doing in

smart cities, before unveiling their own smart city package. It's easy to understand, but is twice the price and provides half the service. It runs on proprietary data standards, meaning the council is unknowingly locking itself into a monopoly provider for any future devices it wants to deploy. Officers will access the data by logging into the provider's website and downloading a poorly formatted spreadsheet.

Midjourney makes an incomprehensible smart cities sales pitch. The problem isn't just the jargon. It's that the technical details don't add up to a compelling story that connects with the audience.

Whether due to a separate culture, language, or geopolitical isolation, Taiwan's professional culture has limited overlap with even the likes of Singapore and South Korea. Taylor Swift may play in Taiwanese supermarkets, but professionals here work a world away from Western conferences, projects, standards, and social media.

In some cases, this is to their detriment. They've missed, for example, the last decade or so of public debate in the English-speaking world about the need for zoning reform. Urban planning here remains a niche interest concerned with making minor tweaks and dubious trade-offs, the consequence is a catastrophic housing crisis only mitigated by accelerating population decline.

On the other hand, as with smart cities, the gap between best practice here and Western governmental standards is sometimes incomprehensible to even the international sales teams of massive Taiwanese tech companies. This is why their pitch revolves around the latest marginal improvements to their product, rather than connecting with the audience by explaining the basic foundations and value of these systems.

What needs to be said is something like the following:

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presentations here will frequently run to over one hundred information-dense slides for a half-hour meeting. So much ground is covered that speaking to the slides is a specialised skill requiring the ability to speak extremely quickly, even to the point of no longer being intelligible. I cannot imagine how this is a truly optimal strategy, and it seems like a classic case of a 'local maximum'. For example, only presenting 70 slides will be seen as lazy and uncommitted, but decision-makers are unprepared for a more targeted approach aimed at creating an open discussion. So, deviations from the norm are punished, even though the overall approach is flawed.

I discuss these local maxima and these sorts of coordination problems in the context of geopolitics and how cultures and organisations optimise themselves around the physical and cultural landscape, here.

Delivering Smart Cities

Moving to digital monitoring saves money and enables new capabilities for automation, more informed decisions, and making useful information available to the public.

The key is having all your information available in a single place. All your systems should feed data into this platform so it can be used whenever and however it's needed. This will only become more important as you scale up. Avoid having a dozen platforms managed by five suppliers that don't make the data accessible. Do it once, do it right.

Taiwanese software will allow you to deploy sensors interchangeably across your city. Don't hand a monopoly to your supplier. In two years' time, if you no longer like our prices or we're not selling something you need, you can go to our competitors and their devices should work seamlessly too.

We know you're not experts in data or electrical engineering. Leave that to us. Whether you're monitoring birds, cyclists, or trains, whether you're working in extreme cold or remote locations, we'll work with you to design a system that meets your needs at a fraction of the cost you'd otherwise be paying.

This is all assumed by Taiwanese presenters to be understood by Western audiences. Unfortunately, it isn't. Consequently, there's a huge market opportunity for Taiwanese companies that can compellingly describe the water they're swimming in. Of course, Western city governments should meet them halfway, because millions are wasted by obsolete systems every day this isn't done.

As I outline in 'Why we need Taiwan', there's no shortage of valuable cultural and economic work that could arise from a greater exchange of ideas. Unfortunately, as we've seen, the language barrier is easily overcome compared to the difficulty of bridging completely different paradigms to establish a shared understanding.

We'll also this below in the context of underground metro design, where the true value of the system comes not from some fancy innovation, but rather the simplicity and consistency of its design and operations. Next time, we'll see how insular Taiwanese planning policy has brought about a housing and development crisis.

Taipei's World Class Underground Metro

Metro systems are typically assessed and ranked in terms of the frequency of their service, the number of passengers served, the number of stations, and the length of track. Alternatively, travel guides and news websites take an alternative approach, often emphasising the heritage beauty of systems like Moscow or London. This is all very well, but

few cities can usefully measure their system against Tokyo (pop. 37m), or compete with the old brickwork of the world's first underground.

The lack of an acknowledged standard for design and service delivery means decision-makers and the public have little to go on in terms of properly calibrating their expectations in terms of what level of service can be delivered for a given cost.

As we'll see, Taipei Metro operates near the frontier of service and convenience for a given cost, and can usefully set the standard for other cities to emulate or attempt to better. It's not perfect, but it's fast, cheap, extremely easy to navigate, and staggeringly, is all delivered with a small operational surplus[3].

The key to these achievements is a smart city backbone that allows for extensive data collection, providing early detection for faults, and real time information to be served to passengers, combined with a simple and consistent design that's both extremely legible and easy to maintain, as we'll see.

[3] Although the specifics of how the metric is accounted differ from one jurisdiction to another, annual revenue from ticket sales typically covers about 30-60% of annual operating expenses outside of East Asia. These figures tend towards the lower end of the range in the US (with many systems as low as 5-10%), and towards the higher end in Europe and in denser cities in general.

Figure 1 - Typical Taipei Metro entrance, New Taipei City.

Signage is bilingual and always uses the same font and colour, to the point where third-party ads for an event will use the same visual language (e.g. directing people to an event near Exit 3, Sanchong Station). To the right of the image, we see a map of other entrances, including directions to a nearby elevator for mobility-impaired users. Night lighting is bright and illuminating, highlighting the entrance as a landmark from afar, and flooding the key surrounding features (stairs, signage, etc.) without ever being directed into people's eyes or creating glare.

Figure 2 – Typical station entrance/exit lobby area

Down the escalator, we're immediately greeted by a large, high-contrast and easy-to-read bilingual map of the station and its various locations of interest, as well as a map of the entire metro system. For those leaving the station (approaching from left of image, moving towards escalators on right) there's a live feed of bus arrivals to the stop outside, allowing people to hurry if their bus transfer is about to arrive.

Lighting is consistently bright throughout the system, with a gradient at entrances to allow people to adjust to ambient lighting when exiting/entering the station.

Figure 3 - Every station is equipped with an ATM and a bank of ticket machines near every entrance/exit

Like with most modern public transport systems tap-on-tap-off preloaded cards (EasyCard) that streamline the payment process, reduce queue times, etc. Every station is also equipped with ATMs, and banks of ticket machines. These are always prominently located next to every set of entry/exit gates, making it easy for tourists or people who've forgotten or run out of credit on their card, no matter how unfamiliar they might be with the station.

Figure 4 - Closeup of standardised ticket machine interface. Easy to use and understand, with a conveniently located map for reference.

Ticketing is by ride value, not station, avoiding the hassle of having to select your destination from a long list. One just looks at the map above the machine to determine the cost of your ride, pushes the button corresponding to that amount, pays, and then collects

your ticket. If you want to buy multiple tickets (e.g. for a group, or your return later), that's as easy as one extra tap on a big wide button. It's extremely simple and intuitive compared to many other systems (we'll get to these counter-examples next time).

Figure 5 - Fare gates, security/payment booth. Note the timer displays above the fare gates indicating the arrival times of upcoming trains.

The fare gates are extremely simple - tap with your TPass or single-use ticket coin (depositing the latter in a little slot in the gate at the end of your journey), and the gates open. Double-wide gates for wheelchairs are positioned at every entrance/exit. Booths positioned at the boundary can be approached from every direction, and provide security, information, brochures, TPass top-ups, and a backup option for riders seeking single-use tickets.

Figure 6 - Consistent signage clearly directing passengers to their various destinations at every decision-point.

As you'll notice signage is consistent and regular. Every potential decision point for a confused tourist looking to get to exit 2 is clearly signposted. Take a right from here and through the exit gates, you'll immediately see another sign pointing towards the exit on the right, which itself will always confirm you're on the right track. Wherever you're going - just follow the signs.

Other features worth noting here include the live update signage on the middle left letting people know how far away incoming trains are, an ever-present map on the far wall (in this case providing a map of the local area above the station, and positioned for exiting passengers), and the subtle but consistent orange theming of this orange-line station.

Figure 7 - Platform doors, route map, live arrival timer.

On the platform, the situation is as you're probably now coming to expect. Clear, high-contrast, bilingual signage. Route maps, live updates, orange line colouring. A small red light above each door flashes as the train approaches while a pleasant jingle plays at a comfortable volume, attracting the attention of people who're otherwise able to zone out, chat with their friends, or use their phones without any concern of missing their train. That said, seating is highly limited throughout Taipei's stations, and could easily be doubled or better in most locations without cluttering the existing layout.

Figure 8 - View down length of train carraige. With the exception of the above-ground Brown Line, all carriages are connected, allowing people to move smoothly down the carriages to meet with friends or move closer to the location of their destination.

Onboard, we see the same design philosophy in action. A simple and consistent design. Signage is frequent, and colour instantly conveys meaning. All below-ground trains are the same, and considerable effort has been made to create a consistent design language with the raised-platform above-ground trains.

One minor issue here is that since people cluster near the exits, the live display can sometimes be obscured. Since there are few visual cues in an underground network, one

can occasionally lose track of the train's location if you've become crowded in on an unfamiliar route and you happen to miss the audio announcement. It's a problem that could be addressed by introducing an additional live display between train exits. It's a rare flaw that proves the rule of the otherwise easy user experience.

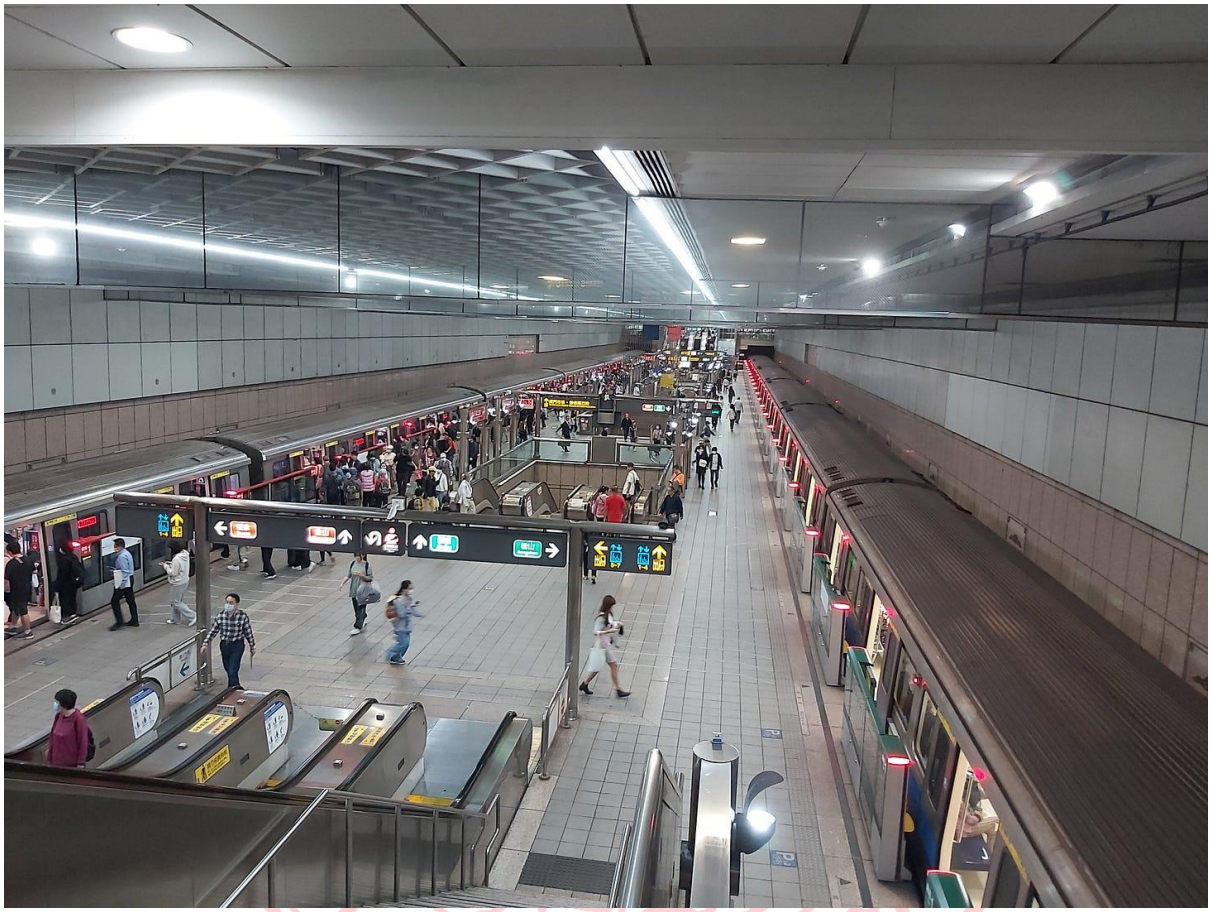

Figure 9 - Chiang-Kai Shek Station, with simple Red/Green transfer.

Taipei's transfer stations are an understated marvel. Wherever lines intersect in parallel, the directions are split across levels, enabling transfer between lines as simply as walking across the platform and into your new train.

It's a simple idea, but its accomplishment is an extraordinary feat of planning and engineering. The idea would have needed to be enshrined in not only the original design of the station but also in the design of the lines themselves so that the tunnels could be properly aligned in all three dimensions.

The standard station design involves a relatively simple split - parallel tracks will diverge horizontally to 'wrap' around the platforms. The Taipei design involves the tracks splitting vertically while bringing them into horizontal alignment to be 'stacked atop' each other for visual clarity of the station.

It's a simple enough idea conceptually, but as any tunnelling engineer will tell you, messing around with line depths like this adds considerable complication to construction at both

ends of the station. That it was done anyway speaks volumes about Taipei's confidence in its engineers, as well as its willingness to invest upfront in order to save people a small amount of time and effort for as long as these lines continue to operate[4].

Figure 10 - Selection of public art taken throughout the Taipei Metro system.

Use of the same non-slip floor tiles, plain architecture, and consistent colour scheme may help users navigate the system, though do mean the Taipei Metro will never be as visually stunning as Moscow. That said, the simple design and muted base colours do provide a

[4] Note this is only practical on lines that intersect at near-parallels. Otherwise, passengers would collectively lose more time aligning the trains than the minority would gain during the easier transfer.

Another minor note - in splitting the lines, considerable thought has been put to which transfers are likely to be most popular. For example, those who've been Southbound on the red line in the image above typically want to continue their journey in the same general direction on the green, rather than head back to the North-West. These sorts of little considerations are easy to miss but are common throughout the Taipei Metro. From the perspective of the user, everything is simple and intuitive - as it should be.

great canvas for a range of wonderful artwork, such as sculptures, paintings, mozaics, and photo exhibitions, as you can see above.

Grand architecture has its place, but mediocre architecture does not. Taipei's design philosophy not only provides a more visually interesting experience than most, it also does so at far lower cost than almost anywhere. When every station uses the same tiling, escalators, paint, gates, sensors, and so on: maintenance is easy to schedule, parts can be ordered in bulk, and operating costs are world-class. Where most public transport systems rely on enormous public subsidies, Taipei Metro returns an operating profit, joining Hong Kong[5], Singapore, and some Japanese lines as the only metros to achieve such a surplus.

Metro systems are a great example of a public good, and a significant part of the value they create accrues to non-users in the form of lower traffic congestion, better air quality, lower carbon emissions, enabling greater housing density, and broader economic benefits resulting from improved transportation links (e.g. for better connected commercial outlets). Subsidies are clearly justifiable, but can often enable complacency given the absence of strong commercial drivers or competition.

Public spending represents public cost, and is obviously not unlimited - economically or politically. Public transport systems are typically tremendously expensive, often running at a third or more of city government spending. At these levels, public appetite for expansion will always be mixed at best. Raising our standards to that of Taipei's would free up considerable funding, build public confidence, and enable a huge expansion in the value these systems create, such as through new lines or more frequent services.

If we're to have any hope of meeting such standards, it'll require a much greater level of focus on maximising the primary objective of convenience at cost than we typically see in the Western public sector[6]. If our organisations can reorient in such a way, then we'd be wise to skip decades of 'lessons learned', and simply copy Taipei's approach.

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[5] Hong Kong benefits from an interesting funding model where a proportion of the increased land values caused by the provision of a new metro line to an area accrues to the Metro service. This mechanism for value capture makes them the only metro in the world to also cover capital expenses. It's a model that, on the surface, deserves greater consideration and more widespread use.

[6] Indeed it's not always evident in Taiwanese public facilities either, with competing priorities across different levels and parts of government sometimes creating what my wife and I semi-affectionately call 'maintenance hells' - particularly in the municipal swimming pools, as we'll see in a future post.

Taiwan's Housing Crisis

The price of housing in Taipei has tripled in the last twenty years. Three-bedroom apartments out in New Taipei City routinely sell for 20x the median annual income, making housing significantly less affordable here than even San Francisco, Sydney, Vancouver, and London[7]. The result is a generation priced out of housing and a dramatic collapse in family creation.

Learning this was a great shock to me. Taipei seems to be covered in highrises, and with pragmatic and low-cost construction, I assumed houses would be small but reasonably affordable, as in Japan. Instead, dysfunctional urban planning has created one of the world's least affordable cities.

Data.

[7] Estimates of Taiwanese housing affordability vary considerably. The 'median sale price' method (often quoted in media articles) is an easy way to look across cities in North America or Australia, where the median dwelling is a broadly comparable house in the suburbs. However, it tends to obscure more than it reveals when applied to Taipei, where dwellings have fewer and smaller rooms and minimal additional land area.

Using 'price per square metre' allows a more direct comparison. Taipei apartments within walking distance of central metro stations are approx $13000USD/sqm, higher in absolute terms than Vancouver, and not far behind New York. Consider though that the median Taiwanese salary in 2023 was ~$22000USD. Levelised affordability in these terms produces figures as high as 28x annual median income.

Figure 11 - View from Taipei 101. Modern redevelopment in the foreground, older precincts in the midground, office parks and, eventually, mountains to the rear.

The crisis has deep roots in Taiwanese history and the transition to democracy. In 1945, the Japanese colony of Taiwan was ceded to the Chinese Nationalists (Kuomingtang, or KMT), who began a series of disastrous experiments in collectivization. All senior judiciary, managerial, and administrative postings were replaced by KMT loyalists. Businesses and property were seized and amalgamated into state-sanctioned monopolies who, it was believed, would be more efficient under the guidance of benevolent state than in the hands of private individuals.

As with every other occasion this has been attempted, the result was a collapse in the production of goods and agricultural products and a breakdown in public services and order. Inflation skyrocketed, shortages grew, and the price of rice rose over 100x. Protests broke

out throughout the country. Martial law was declared, and the protests were violently put down, resulting in the deaths of some 20,000 Taiwanese.

Severe inflation and economic stagnation continued until after the communist defeat of the KMT on the Mainland prompted the retreat of the nationalist armies to Taiwan, and a period of deep soul-searching[8]. A new economic model began to emerge favouring a capable state providing stability, education, infrastructure, and R&D investment, all aimed at the flourishing of private enterprise.

Land reform was a core part of this programme. Public farmland was sold, land rents were capped, and the 'Land to the Tiller' scheme provided state compensation to landowners in return for redistribution of land to their tenant farmers, establishing the pattern of tiny family farms that dominate Taiwan's countryside.

Figure 12 - Small family plots in Miaoli County. Photo by Taiwankego under a Creative Commons licence.

Widespread land ownership gave many a stake in society and agricultural production grew rapidly[9], but it also created difficulties for urban development. Now, many owners would

[8] Nationalist leader Chiang Kai-Shek, though undoubtedly flawed in many ways, deserves some credit for his willingness to put aside ideology and honestly reflect on his failures.

[9] Increased land supply and reduction in land rents created surpluses for farmers previously working barely above subsistence. These surpluses, along with generous loans, enabled

need to cooperate to bring enough land to market for redevelopment into a new apartment complex or factory. Meanwhile, negotiating with a single large landowner about land for public infrastructure will always be more straightforward than dealing with hundreds. The KMT government responded by exercising broad unilateral powers. Land was compulsorily acquired, rezoned, and redeveloped with the threat of imprisonment to any local opposition.

While public engagement with the state was discouraged throughout most of the KMT era, local communities remained highly connected through family and business ties. Consequently, as democratic reform began to gather momentum in the 1980s, resentment over the state's treatment of local issues was a major driver for reform. The result was a general limiting of the power of the state, and a dramatic shift in Taiwanese land planning in particular. Now, 80% of local residents (including those surrounding the area) need to approve before redevelopment can occur.

Taiwan is a small, extremely mountainous island with a shortage of buildable land. This is particularly true of Taipei, which sits in a mountain basin. Yet many 'greenfield' areas at the edges are still theoretically available for housing. In practice, modern redevelopment is proving virtually impossible. In one case I looked at, a ~1sqkm rural zoned site on the edge of Taipei has been in rezoning negotiations for 15 years, lacking the required supermajority agreement to proceed. The surrounding area is heavily urbanised, with frequent bus links, a nearby university, and even a metro line on the way, but until a supermajority can come to full agreement on a plan (including on such details as where roads and public facilities will be situated), no redevelopment can occur.

While redevelopment laws changed after democratisation, the legacy zoning did not. The effects on housing were not felt immediately as development capacity remained[10]4. In fact,

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farmers to invest in their newly-owned farms in the form of modern machinery, new techniques and seed-stock, etc. Agricultural production doubled in the decade following these reforms and continued to rise throughout the remainder of the century as the green revolution took hold.

[10] Non-residential sites have been relatively plentiful due to greater relative supply and the 'mixed-use by default' zoning that makes lower stories throughout the cities available for commercial use such as restaurants, small offices, retail outlets. In addition, the government has been delivering a series of 'Ease of Doing Business Reforms' since 2008, aimed at reducing barriers to entry for small businesses such as waving fees, tax-writeoffs for startups, and implementing an online 'one-stop shop' for everything from permits and registration to infrastructure connections. These enablers of small-business contribute greatly to the vibrancy of Taiwanese cities, and should be widely adopted abroad.

While small commercial businesses continue to thrive, large industrial companies have lately begun to struggle as industrial land capacity begins to run short. Even TSMC, Taiwan's highest prestige and most politically well-connected company has struggled to navigate the

spurned by strong economic growth and rising incomes (household income quadrupled in ten years from 1986), the 1990s were a boom time for Taiwanese housing construction. The number of completed residential units reached as high as 300,000 units/year in the mid-90s. It was not to last. Given the difficulties of further rezoning, capacity for housing development shrank rapidly. By 2000, annual completions had crashed to less than 100,000. Supply failed to keep up with demand and prices began their rapid rise. Today, despite every incentive to build and sell at record-high prices, little construction takes place. Taipei has only built 25,000 units in the last five years.

Taipei's zoning is deceptive. The city lacks a typical centre, and tall apartment buildings are permitted alongside most arterial roads, creating the impression they're allowed everywhere. In fact, most of the city is limited to a maximum of 5-6 stories, limiting population density to around 20,000people/sqkm[11], similar to Central Paris, and creating the characteristic urban form of the city:

redevelopment process required to build new chip fabs in recent years, driving their expansion overseas to Japan in particular.

[11] Population density estimates vary due to administrative boundaries, and whether nearby Taoyuan and Keelung are considered part of 'Taipei'. While these cities do share strong economic ties, and many Taiwanese do commute from these areas, for the purposes of this discussion, I'm considering the continuous urban area of 'Taipei City' and 'New Taipei City', home to roughly 6.6 million people across some 300-400sqkm of urban area (the majority of the administrative area, like Taiwan in general, is highly mountainous).

Figure 13 - View looking north across Sanchong, New Taipei City

Taipei's zoning is much more restrictive than it first appears. Most of the buildings you see above cannot be rebuilt today due to maximum building area and floor area ratios (BAR and FAR respectively). The BAR limits the size of new buildings to 50-60% of the development site, while the FAR restricts the total private floor area of the building to 225-250% of the area of the site. This means, for example, a 1000sqm site is allowed to have a building size of up to 500sqm, with a maximum of 2500sqm of private apartments. This means the default permitted redevelopment is a five-story building on half the site[12], ultimately providing a maximum of half the dwelling capacity of the existing buildings.

Each of the mini-blocks above is comprised of about 15 buildings of 5 stories each, each dwelling on a separate title. Let's imagine a developer manages to buy all 75 of these at

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[12] In actuality, this example would likely end up as six story building (if allowed under height limits), after lift lobbies, shafts, and other 'shared' spaces that don't contribute to the FAR are added. The fact that these spaces can be provided 'for free' incentivises absurd outcomes in such a space-constrained city, such as how otherwise modest apartment buildings in Taipei will typically have grand lobbies covering the entire ground floor. On the whole, these 'requirements' simply make new housing more expensive, and reduce development capacity for minimal public benefit.

market prices (i.e. without any existing owners catching wind of a potential redevelopment and demanding a higher price). These dwellings lack modern amenities like large windows, elevators, and passive cooling, and they sell for about $13-15m NTD each[13]. However, for reasons that will soon become evident, many of these dwellings are poorly maintained and have lower sales prices. Optimistically, $12m on average, for a total market value of the block of $900m NTD.

15 buildings, 5 stories each	= 75 dwellings
Bought at $12m each	= **$900 million NTD**

A new apartment will sell for a substantial premium, at around $20m NTD. However, with B/FAR, a new building will only provide around half the yield, at around 38 dwellings. This means the total market value of the new building is only $760m! Despite replacing a poorly maintained building with a brand new one, and entirely absorbing construction and transaction costs (legal fees, agent fees, sales taxes, sweeteners for holdout owners, etc.), our hypothetical developer has only managed to provide fewer homes and destroy $140m of value.

Building Area Ratio	= 0.5
Floor Area Ratio	= 250%
5 stories, on half the site	= 38 dwellings
Sold at 20m each	= **$760 million NTD**

It's no wonder then, despite continued low construction costs and the staggering growth of the Taiwanese economy, the majority of the cheaply constructed housing of the 1960s and 1970s remains today. They're uneconomic to replace, and as they continue to age, increasingly uneconomic to even maintain.

[13] Many of the floors in these buildings will have been split into multiple smaller dwellings, making the acquisition that much more difficult. However, the price/floor area is similar, so for the sake of simplicity, let's imagine that these are all 3-bedroom dwellings.

Figure 14 - Highlights from a quick structural survey of a single block. Deep cracks, water damage, exposed rebar, poor wiring. Every building of this era had major maintenance issues clearly visible from the street.

The strategic thinking behind the use of B/FAR is to manage the effects of density on public infrastructure. Despite the success of the Metro, Taipei has fallen behind on providing many public services. Water supply is consistent, but not considered drinkable due to poor piping. Wastewater blockages are common. Footpaths are of poor quality. Local parks, swimming pools, and community centres are often dated, suffering from severe maintenance problems, and stretched beyond capacity.

Allowing more people to live in a district only increases the pressure on these services. The government policy response tries to incentivise developers to provide public amenity in return for additional FAR allowances. Circumstances vary across different jurisdictions, but as examples:

- +50% FAR for providing additional carparking for public lease
- +30% for providing a public plaza area on-site
- +15% for a footpath or qi-lou (an inset footpath that sits below the first-floor)
- +10% for tree planting along the site boundary
- +10% for providing an onsite gym/swimming pool/lounge/library, etc.

FAR incentives are capped by law to no more than an additional 150%[14]. However, developers can also buy and transfer unused FAR rights from other properties in the city

[14] The FAR incentive cap is legislated in the Urban Renewal Act, article 65. The act allows for up to a 200% bonus in the case of 'strategic renewal areas' which can be specially designated by the local authority in areas close to a railway station or airport, which also

(making a mockery of the idea that the policy helps to control density within a local area). Add enough FAR bonuses and rights together, and you eventually arrive at a viable project providing enough gross profit to cover transaction costs, construction costs, interest costs, taxes, and return a healthy enough profit to incentivise redevelopment:

15 buildings, 5 stories each	= 75 dwellings
Bought at $12m each	= **$900 million NTD**
Building Area Ratio	= 0.5
Enhanced Floor Area Ratio	= 600%
12 stories, on half the site	= 90 dwellings
Sold at 20m each	= **$1800 million NTD**

The situation is completely insane. In return for some of the world's least affordable housing, the city receives scraps of mostly theoretical public amenity. Unnecessary second footpaths, essentially inaccessible public plazas, and tiny libraries and swimming pools that go unused even by building residents. These push up construction and maintenance costs for minimal public benefit.

provide land value/housing tax reduction for a period of up to two years. I'm told this happens extremely rarely in practice.

Figure 15 - Here in Sanchong, New Taipei City, a pointless second public footpath has been provided by the developers of this apartment building to meet the city's FAR incentives. It ends abruptly at the property boundary, and thus provides no amenity for the public.

Taiwan is a young democracy. Most political attention is absorbed by the issues of cross-strait relations, Taiwanese identity, and the question of formal independence. The recent presidential election was widely regarded as a referendum on these issues. Given this focus, it seems to me that Taiwan has yet to develop a vibrant 'middle-layer' of public discourse on issues like housing, defence, and education. People talk about these topics with their friends, but a robust and well-informed public discussion supported by think-tanks, universities, and other such institutions is still sorely lacking.

Whatever the reason, Taiwan has yet to address the fundamental issue of a supply shortfall. Instead, the analysis of local media and politicians remains superficial, and focuses instead on managing essentially inelastic housing demand. Well-intentioned government policy here has often making the problem worse and compromising other strategic goals.

Counterproductive Taxes

The government levies a range of property taxes. These taxes incentivize certain types of behaviour while disincentivising others. For example, Taiwan levies taxes on 'amusement places' like nightclubs, theatres, music venues, magic shows, and dance halls. The tax explains Taipei's relative lack of these facilities, and also the abundance of bars, cafes, restaurants, and other gathering places that escape having to pay the tax.

The key taxes affecting the supply of residential property in Taiwan are land taxes, housing taxes, and taxes on the sale of housing.

When tax is charged on the value of the land (rather than what sits above it) it encourages landowners to make valuable investments in that site. An alternative approach is to tax the total 'capital value' of the property. This encourages the opposite - land banking of vacant lots, and smaller investments than otherwise to minimise the tax burden.

Taiwan's approach is a mix of the two: a broad-based land value tax that generally encourages efficient use of land, but combined with a housing value tax that discourages housing in particular and allows for a lower land value tax rate. Further, an exemption is made in the land tax law for parking lots, agricultural warehouses, and cram schools[15]. In a country crying out for more housing, the net result of these laws is that housing is discouraged while vast swathes of premium real estate are wasted on surface parking lots and low-value commercial buildings.

It gets worse! An appropriately titled 'special privileged tax rate' for housing taxes is offered for owner-occupied properties. This deduction ranges from 66% to an 80% discount in New Taipei City. In terms of their contribution to the upkeep of the city, this effectively means those lucky enough to own their own home are subsidised by everybody else.

Taiwan also places a range of taxes on the creation of property. New property deeds are taxed at 4% of the value of the property. Partition of an existing property is charged 2% of the combined value. These taxes discourage capital investment in property (relative to other forms of investment like overseas capital markets) and discourage partition of property to enable more people to live in a given area of land.

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[15] Private school tax exemption provided in Section 3, Chapter 2, 'Land Tax Reduction and Exemption Regulations', of the Land Tax Act. Note that cram schools also receive other tax benefits, such as generous government health insurance subsidies 350% higher than those received by any other private enterprise.

Unfortunately I lacked the time to properly research these institutions, but I was routinely told by foreigners and locals alike that standards are very poor in terms of long-term learning outcomes. Instead, the long hours spent in these schools are geared to towards performance on the next test, which are typically given every two days. The remainder of the time spent teaching to the next test, with little educational benefit. Unfortunately, Taiwanese society is highly structured around these schools, such that opting out leads to lower expectations for the child by their school teachers, segregation into lower quality schools/lower streams within those schools, and difficulty in adjusting to such an intensive environment upon re-entry. It's not that the system is entirely without benefit, but it's a product of the hyper-competitive years during the population boom of the late 20th Century (many people competing for relatively few stable well-being jobs), and ill-suited to the reality of a working-age population now projected to halve within a generation with too few people to fill required roles.

In another misguided attempt to limit rising sales prices, housing sales are taxed at 6%. With supply/demand unaddressed, this only serves to reduce housing mobility. Instead of downsizing to a smaller apartment once the kids leave home, freeing up the home for a young family, these taxes encourage people to stay on, only to eventually hand the property down to their children once they're too old to raise a family of their own.

Finally, the government levies a 'Land Value Increment Tax', essentially a capital gains tax on property, further discouraging people to sell, reduced investment in property relative to other investment vehicles untaxed in this way (e.g. discouraging badly needed refurbishment of older properties). However, it does allow the city government to capture some of the heightened property values caused by their regulatory regime.

The net effect of these taxes is to create a split society. Those who own property enjoy a range of special tax privileges (especially if they never sell), while the younger and less well-off are squeezed as more of society's paper wealth becomes locked up in housing.

Other policy failures

Promises to provide more social housing have been a long-running major policy platform of both national and city government politicians. Unfortunately, results have been limited because, unlike Singapore, the state has no mechanism to bypass its own planning laws, so state-led development faces all the same barriers and difficulties as private sector development, in fact competing for available sites, bids up the price of transfer rights, etc. No winning here without zoning reform.

Acknowledging the issue with maintenance, the government recently passed the 'Statute for Expediting Reconstruction of Urban Unsafe and Old Buildings' where buildings 'not reaching minimum structural safety standards' receive a bonus 10% FAR to incentivise reconstruction, declining to 1% by 2028.

Returning to our earlier example, here's how the enhanced FAR works in practice:

15 buildings, 5 stories each	= 75 dwellings
Bought at $12m each	= **$900 million NTD**
Building Area Ratio	= 0.5
Enhanced Floor Area Ratio	= 260%
5 stories, on half the site	= 40 dwellings
Sold at 20m each	= **$800 million NTD**

If this is the policy response for even cases of structurally unsafe buildings, the country is still fundamentally unserious about the scale of the problem.

Here are my proposals for fixing this mess:

1) Large-scale upzoning and elimination of building/floor area ratios

Demand-side thinking and policy has created a disaster for young Taiwanese, and consequently, for the nation. If young people cannot afford housing, they're far less likely to start businesses and families. Taiwan is aging rapidly. The generation born today is already 1/3 the size of those 40-50. Fertility is among the world's lowest. A nation without children has no future.

Upzoning works. After Auckland's widespread upzoning in 2016, the number of building completions rose over 50% to record levels. Affordability is improving rapidly. Rents, previously unrelenting, have since stagnated - falling relative to incomes and inflation.

House prices are high because people want them and are willing to pay for them. A programme of zoning deregulation would unlock this latent value. It would spurn a construction boom (placing upward pressure on stagnant wages), allowing the city's crumbling buildings to be replaced with modern apartments of higher quality, and in much greater quantity, finally allowing supply to catch up to demand.

2) Eliminate the housing tax, and tax breaks for surface parking, and other inefficient uses of land.

The taxes on housing are well intentioned, but counterproductive to the goal of getting more houses built. Let the market determine the best use of land. Right now, high prices are the only signal required for people to make money by providing more housing, if the government would only allow it.

Many people are in larger houses they no longer need. Nostalgia and personal connection will keep many of them where they are, but the government should not be putting up tax barriers in the way of people downsizing and opening up those dwellings to families that need the space.

Taipei is space-constrained. A tax regime that favours surface carparking comes at the cost of something else more useful that could be on that land instead. Remove the tax breaks for carparking. If motorists want more parking, then they can pay its true cost rather than being subsidised by everyone else.

3) Address density concerns separately through 'development contributions'

Taiwan gets very poor results from relying on B/FAR incentives to address density and provide amenity. Instead, the city government should be empowered to capture a proportion of the large increase in capital values enabled by deregulation, and use this funding to improve public services.

15 buildings, 5 stories each	= 75 dwellings
Bought at $12m each	= **$900 million NTD**
24 stories, full site	= 320 dwellings
Sold at $20m each	= **$6.4 billion NTD**

District needs $200 billion capital works for an expected	
100000 new people	=$2m/person
~550 extra people	**=$1.1 billion levy**

As you can see, such a framework would allow many more houses to be built, while providing a much needed injection of capital into local governments, allowing investment in modern facilities, footpaths, water pipes, sewers, and other required infrastructure.

4) Build a movement

As we've seen in New Zealand, this means a decade or more of sustained effort before generating enough momentum to translate into policy changes. It involves supporting grass-roots organisations of pro-housing young people, academic research, and think-tank policy development.

The idea is to create a movement for political change supported across each level of analysis. Politicians need to see this as a vote winner, and that requires a broad base of people who see the (normally abstract) issue of zoning reform to be in their interest. Students need to be talking about these issues at university and on social media. Activists and economists need to be on the radio/talk shows laying out the moral and economic case for reform. When politicians start to become interested in the idea, the movement needs to be prepared with detailed proposals laying out how it all works in practice, including anticipating objections and providing politically viable solutions.

Success would require building and sustaining a broad coalition for change, but the seeds could be planted by a lean organisation of a dozen or so dedicated individuals. You'd need: a charismatic media-savvy leader type; policy specialists in planning, law, and urban economics; creatives able to make a splash on social media; networking types able to reach out and convert key groups like politicians, students, and existing housing pressure groups into the movement; and several talented administrators able to smooth the way, distribute and monitor funding, bring international speakers to key events, etc.

Even with funding for scholarships and community organisation grants, this could still be delivered relatively cheaply: something like $1.2m USD/year salaries, and as much again to cover overheads and other expenses. So something like $22m USD over 10 years, far outside

the budget of the young people who most need this to be done, but well within the means of a small group of patriotic Taiwanese-American business people or software developers.

One way or another, Taiwan's housing crisis will resolve itself. Currently each generation is half the size of the one before. Taiwan’s population has plateaued and is beginning to fall. In the absence of change, demand (i.e. the number of people wanting houses) will continue to fall to meet static supply, leaving another generation locked out - with dramatic implications for Taiwan's future.