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Dangers of the technical fix, techno-optimism, technological inevitability and the stories we tell

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Abstract

The paper argues that a reductionist approach to engineering leads to a deterministic view of the future in which technology dominates and the technical fix to any problem can always be found. It queries how the limits of technology are framed and how this can be explored through engineering education, and poses a series of questions engineering students should be encouraged to ask when evaluating suitable courses of action. The dangers of seeking the narrow technical fix are identified, which can lead to complacency and justify business as usual through the promise of a technological solution (but always sometime in the future). A further series of questions are proposed which techno-optimists need to be able to answer to avoid placing blind faith in technology and repeating mistakes of the past. Technology is always intertwined with the narratives we tell about it, including at the starting point through engineering education. These narratives can frame technological development as a deterministic process to which we have no choice but to adapt (regardless of the impacts or unforeseen consequences). Three case studies are presented which explore how notions of technological inevitability can be abused to legitimise self-serving visions of the future, challenge the certainty of technical/economic logic and illustrate how technical capability alone can result in unnecessary or inappropriate solutions being implemented. The paper concludes that technology (including engineering solutions) must be seen not as inexorable or inescapable, but as part of a wider complex interaction with society, end users and the facilitating mechanisms by which it will or will not come into being. Students should be encouraged to envision the future, challenge inevitability and retain their ability to choose the paths to a better world their engineering skills can help create.

1. Introduction

“You can invent yourself out of any box” Jeff Bezos

This interesting hubristic conviction by the founder and former President of Amazon implies a confidence that if a problem can be solved by technology it eventually will be. The history of technology certainly shows that many wonderful things have been brought into being by the application of science and engineering and have created the modern world as we know it. For example, through clean water supply (and disposal), transportation systems, the manufacture of labour saving products, and rapid forms of communication, all of which have heralded in much of what we experience and benefit from in the modern world today. Clearly current technologies are highly effective in the services they deliver and for some are seen as providing the only solutions to the global challenges we face. This reflects the widely held notion of engineers as smart problem solvers who, given limitless amounts of resources, can fix any problem.

Going forward technology must be an essential part of the solution in creating a sustainable world. For example, future advances are needed in renewable wind, water and solar installations, stationary and mobile battery technology, green hydrogen, agricultural and food systems, de-centralised and intelligent energy grids, bio-principles for circular economies, active and public transport systems at scale, retrofits for existing buildings, heat pumps etc. Each requires advances in current technology, and each will contribute to reductions in carbon emissions and biodiversity loss (Pretty et al, 2025). Technology is an essential basis for significant improvement.

But advances in technology historically have also come at a price of creating unintended consequences and significant negative impacts. Water systems are energy intensive and can deplete natural resources whilst piped drainage dangerously concentrates floodwater at vulnerable communities further down a catchment. Sprawling road networks create congestion and their vehicles have spewed billions of tonnes of greenhouse gases into the atmosphere. The stuff an industrial society consumes has also created widespread pollution and resource depletion and created social inequalities between the have and have-nots, with many citizens lacking basic

access to the services technology can provide. The internet, initially heralded as a force for good, is now home to social media platforms which seem to threaten the basis for open democracy and muddy an objective view of the world.

So this paper asks whether this faith that technology will always deliver is justified, how can it be abused, and can we train the next generation of engineers to look beyond just technology as the only lens through which to see things. It explores the hubris of the technical fix, techno-optimism and technological inevitability and asks just because we “can” do something “should” we ?

2. It’s all about the mindset

At the heart of engineering education for sustainable development lies the need to create a mindset change in those seeking to spend their working lives building, manufacturing and operating things. This is often seen as challenging the reductionist approach to engineering where problems are broken down into their smallest parts, assuming that by understanding these will lead to a better knowledge of the whole system. It is widely acknowledged that such training in the fundamentals of engineering science is vital if the things we create are not to fall down and fail to work. A pre-condition, if you like, for engineering sustainability. However such rigorous analytical understanding alone is insufficient as it fails to recognise real world complexities and overlooks the interactions and synergies between different parts of a system. Instead a complex systems approach to problem solving emphasises the importance of considering all inter-related dimensions of difficult problems.

The reductionist approach is fundamentally deterministic in nature, where the outcome is predictable and follows a set of rules or laws without randomness. Inherently it teaches there are right and wrong answers and all problems can be subjected to mathematical rigour. So we can narrowly extrapolate to the future where machines dominate - or we can reflect on the challenges they create and who will be the winners and losers.

3. Dangers of the technical fix

Implicit in the reductionist mindset are notions of technological determinism and technological inevitability where the technical fix is always around the next corner and smart problem solving engineers will simply ride in to save the day. This is apparent in governments’ (misplaced?¹) faith in carbon capture and storage (CCS) schemes to solve the climate crisis, or that technology will soon develop to simply remove the range anxiety concerns of current electric vehicle users (Chakrobarti et al, 2022). Such confidence is based on the notion that we can engineer our way out of problems often caused by earlier technological interventions. However it is cautionary to note that in this context the panacea of practical nuclear fusion for unlimited free energy has always been 30-40 years away, for the last 50 years! The attraction is that technology provides a “get out of jail free” approach that would otherwise require more unpalatable solutions. So with respect to CCS, Professor Kevin Anderson of Manchester University has argued it has a “long-established role in supporting the development of the oil and gas industry and in further delaying real cuts in emissions”. In short, business as usual through the promise of a technological solution (sometime in the future).

Technical fixes can frequently be useful in providing temporary relief from a problem but they do not make it go away for good. For example face recognition as a technical fix for safety and security concerns comes with issues of privacy and discrimination. This has led to some individuals with certain characteristics being falsely accused of crimes they have not committed (Marx J. 2022) and alone fails to address systemic and historically embedded issues of inequalities among racial groups. In addressing climate change there are proponents of large scale climate engineering solutions involving manipulations of the planetary environment (geoengineering) to mitigate the anthropogenic emissions of greenhouse gases. These are highly controversial due to the large uncertainties around effectiveness, side effects and unforeseen consequences (Wagner G. 2021). They run a greater risk of unintended disruptions of natural systems, resulting in a dilemma that such disruptions might be more damaging than the climate damage that they offset. A more historic example famously highlighted by

¹ Greenpeace argue CCS is not yet proven to be deliverable or cost-effective at the level needed, see also Harvey and Ambrose (2023) .

Rachel Carson (1963) is in how the use of DDT - initially seen as a “wonder chemical” when used as a farm pesticide to help maximise crop yields to cope with the rising population’s food demands post WWII - led to major health impacts on both humans and animals which resulted in it eventually being banned worldwide.

Technical fixes can range over differing scales. They can include large infrastructure mega projects such as the Three Gorges Dam in China which has contributed to the extinction of the Chinese River Dolphin, an increase in water pollution downstream and around 4 million displaced people (Carney T., 2021). On a smaller scale, appropriate and intermediate technology solutions - that should fit the level of income, skills and needs of the people served - have been used in developing countries but are not always suitable unless the level of development within a country is considered before implementing them (Willoughby K.W., 2019).

A complex systems approach warns us that there are limits to what technology can (and perhaps should) achieve alone. Echoing this notion Geldof and Stahre (2006) contrasted two approaches for water management. Model A describes a closed technical system with the engineer at the centre, fixing observed and predicted (modelled) performance gaps in the hardware, entirely divorced from the needs and wants of society or the environment. In contrast Model B sees the engineer interacting with a messy, complex socio-technical system which adds complications to decision making but is more realistic in the valued outcomes it can produce. Generally in infrastructure provision there is a growing need to consider ways in which service delivery can be maintained by NOT building new assets, but using existing provision more effectively (e.g. congestion charging vs road widening; energy demand management vs energy supply expansion, fixing leaks vs building new reservoirs).

These ideas are encapsulated in a recent paper by Piero Dominici (2023) who observed:

“In fact, the misleading idea that technology is our only pathway to sustainability is part of the “great mistake” we are making today: the belief that the solution to every contemporary problem is an accelerated combination of digital and technical skills, obtainable through a predominantly applicational form of education based on simulation, velocity and connectivity, which teaches competences and know-how rather than stimulating what is so direly needed today: the capacity for reflective knowledge and critical thinking.”

This can perhaps be distilled into the greatest attribute our engineers can leave their University courses with. That is the confidence to simply ask the challenging question “*Why are we doing it that way?*”.

Dominici (2023) goes on to urge students to “learn how to inhabit complexity and the uncertainty it implicates, in a mind frame stimulated to accept – and even celebrate- the *inevitability* of unexpectedness”. The engineer’s role then becomes one of rationally calling out false hope, whilst highlighting the wider societal impacts certain technological futures may create. This echoes the notion of the engineer as “honest broker” who fairly appraises a range of options, rather than “technical advocate” for pre-determined solutions (Clift, 2005).

4. Misplaced Faith in Technical Solutions

Similarly in economics techno-optimism is the belief that technological advancements can drive economic growth, solve societal problems, and improve overall quality of life. Innovations in fields like artificial intelligence, renewable energy, and biotechnology are seen as engines of economic expansion and that innovation and technological progress are key to overcoming challenges such as resource scarcity, environmental degradation, and economic stagnation. Efficiencies can be improved by future technologies therefore fostering stronger economic development, even if those technologies don’t yet exist today.

But such faith in technical solutions can lead to over-reliance on technology, ignoring social, ethical, and environmental considerations. In particular there are dangers of complacency and a false sense of security leading to a tendency to delay or neglect actions which are needed now to address current issues such as climate change by delaying the transition away from fossil fuels. There may also be unintended consequences, particularly associated with new technology, such as recent advances in AI, where the full impacts on society are not yet understood and existing social inequalities (e.g. between those with access and those without) are exacerbated (Qian Y et al, 2024). Over-reliance on new technologies can divert resources away from proven,

immediate solutions and there always remains the risk that they may not deliver the expected benefits. Believing that technology alone can shape society's future can undermine the importance of human agency and ethical considerations. It can reinforce a deterministic view where social and political actions are seen as less relevant.

Miller S, (2017) highlights the dangers. If you're concerned about world hunger don't worry about changing agricultural infrastructure just wait for indoor farming to revolutionise the food industry. Fixing the climate crisis doesn't need legislating on energy use, just wait until nuclear fusion takes off. The concern is that the problems new technologies seek to answer don't disappear while humanity waits for solutions. The biggest danger of techno-optimism is allowing the pretence of Business-as-Usual because technology will always find a way to clean up the mess. Max Oelschaleger (1979) contends that despite Karl Popper's argument that the advance of knowledge cannot be predicted, humankind has come to expect that science will eventually answer any question. After all, technology has helped bend nature to human purposes. This can be a dangerous viewpoint if inadvertently distilled into our future engineers, for reasons the examples given in the case studies below will demonstrate.

John Danaher (2022) offers 5 critiques of techno-optimism arguing that techno-optimists hold that technology is some kind of elemental force that will save us from ourselves. First we need to agree on the values we want future technologies to reinforce. An economist may decide growth is good, and more of everything is good. These values are not universally accepted and in a sustainable world increasingly are being challenged. We should encourage a more anticipatory approach and ask *what kind of future are we trying to create?*

Secondly, as life gets better we adjust to a new baseline or norm, we then revert to thinking things are bad because they are not better than this new baseline. This drives a treadmill mentality where as soon as we satisfy one desire we move on to the next, never reaching a state of equanimity. We should therefore consider the question *when is enough technology enough?*

Thirdly, there are sustainability concerns regarding the demands on resources and the environment future technologies may demand, with real limits to growth bounding not what may be possible but what may be practical. We already see the vast energy requirements needed to support our advances in AI and data handling which is a serious concern with respect to significant impacts on climate change (Luccioni A.S. et al, 2024). Therefore we should ask *what are the resource implications and environmental impacts of future technological solutions, and given these, are there alternative ways of addressing the problem?*

Fourthly, technology alone will not be the key or decisive variable in ensuring that the good (or desirable) prevails over the bad (or undesirable). Danaher argues (2022) that material technologies do not just pop into existence from nothing, they require human labour and ingenuity supported by institutional structures and social organisations that requires:

- a) an ideas generation system
- b) an ideas selection system and
- c) an ideas translation system (which turns the ideas into a material reality that changes how we live).

This encompasses many non-technical dimensions including market forces, democratic choices, scientific institutions, legal - regulatory frameworks and ethical standards, taking us back to seeing the world as a complex system. This raises the questions *what supporting structures and social organisations must be in place for future technology to "work"?* and *"in what plausible future scenarios will it NOT work?"*

Finally, and perhaps most obviously, is that techno-optimism rests on an unjustifiable faith in future technologies that cannot be predicted or known, and often lacks an appropriate rational or evidential foundation. It requires predictions about future states of affairs and future technological developments that are either unknowable or cannot be predicted with any high degree of certainty. It assumes future technological growth may be smooth and linear (not borne out by past developments which have typically been lumpy and unpredictable). This can be tested by asking *what is the evidence that current technological trajectories can lead to a better world, and what is needed to develop them?*

5. The stories we tell

All this matters in terms of what we tell our students about the possibilities of engineering. Technology is always intertwined with the narratives we tell about it, including at the starting point through engineering education. We see engineering as producing a wide variety of tools, and this always implies one simple story. There is a situation where something needs doing (Sacacas L.M.,2021). But narratives can frame technological development as a deterministic process to which humans have no choice but to adapt. Thus technological inevitability denies any possibility of human influence over what is cast as natural, self-fulfilling technological forces that operate beyond human agency and the choices of communities. It can lead to the disempowerment of governments and communities in the face of stories they are told (and in turn retell) about the unstoppable arrival and expansion of new technology (Zenz A. and Powles J., 2024) .

These narratives of ever expanding technological development can be hopeful, gloomy and everything in between, whether it be about artificial intelligence, self driving cars, carbon capture or the increasingly all pervasive internet (and the digital platforms and technologies it spawns). What is in common is how individuals are separated from action because technology itself is the spectacle, and we can just look on. This means we cannot step in or change the drama because of the logic of inevitability.

But history is littered with failed technologies which in their day were going to change the world. Examples include the wearable glasses designed to create an augmented reality, the Segway which was expected to revolutionise personal travel, Elon Musk's Hyperloop and even Concorde which promised everyday supersonic flight but was ultimately grounded due to high operational cost, noise issues and a tragic crash in 2000. These remind us not just of the improved capabilities technology offers but the parallel importance of market readiness, user acceptance and practical implementation. Thomas Misa (2004) makes an interesting observation when considering the technological alternatives that once existed and our failure to understand the decision making processes that winnowed them down, pointing out: " We assume.... there was no other path to the present. Yet it is a truism that the victors write the history, in technology as in war, and the technological "paths not taken" are often suppressed or ignored".

We have too often ignored the warning about technological systems, confident that we will be able to change direction before things get too bad, only later to shrug at the idea of changing direction because we can't go backward. As we move into the second quarter of the twenty-first century it would seem absurd to suggest we should turn even some of our computers off. We have reached a time when we can't imagine doing even basic tasks without computers. But if we look back at the twentieth century many critics were trying to warn against turning so many of them on in the first place (Weizenbaum J., 1976). Kelly K (2020) sees technology as having an almost organic intention of its own. He terms this the "technium". It represents what technology wants, above and beyond what companies (and societies) want from technology. In some ways this relates to a self-fulfilling prophecy where expectation of future capability drives the inventive process and assures that the new thing will be realised (Euchner J., 2021).

In the UK a report making the case for a tech friendly government stated " It is impossible to resist the rise of the machines so we must let them lift us towards a Global Britain that uses the Fourth Industrial Revolution as a springboard to a more productive, outward looking economy". (Mak A., 2017). But we must ask *is this consistent and compatible with the three pillars of sustainability*, specifically in the social and environmental domains? Such declamations are closely linked to notions of technological determinism or the belief that technology alone can shape society's future. Sacacas (2022) suggests that "stories of technological inevitability tend to flourish in contexts where the cultural ground has been prepared by linear and teleological understanding of history". Such narratives also arise from commercial self-interest by minimising opposition or resistance through convincing consumers that they are buying into a necessary, if not necessarily desirable future. Sacacas (2022) concludes that "The appearance of inevitability is a trick played by our tendency to make a neat story

out of the past and project it onto the future” citing Margaret Heffernan’s comment that “Anyone claiming to know the future is just trying to own it”.

Narratives supporting technological or engineering advances can expeditiously change over time as has been the case with HS2, the high speed railway originally intended to link London via Birmingham to Leeds and Manchester. Initially presented as technologically catching up with more modern rail systems in Europe and elsewhere the initial justification on speed was abandoned when it became clear the escalating costs were not justified to save little more than minutes in travel time between the major destinations. This narrative was replaced by a capacity argument: relieving congestion on existing rail lines, handling increased demand, improving reliability and stimulating economic growth. When the disputed likelihood of realising these benefits was challenged in light of further burgeoning costs then justification rested on a politically motivated switch to supporting the levelling-up agenda (Benson M. 2024).

Even how we describe our own professional outlook has changed replacing Treadgold’s phrase of civil engineering being: "The art of directing the great sources of power in nature for the use and convenience of man” when it cuts across current values. Now the Institution of Civil Engineers website describes civil engineers as working “in harmony with the natural environment to keep towns and cities running and to build a more sustainable world”. These alternative descriptions offer a very different view of a technological future. So before jumping to assumptions about how technology may advance it is important to ask students how they see themselves and what role they feel they should have in getting there. In this sense the story is about evolving values rather than achieving new capabilities.

Contrasting narratives of technology are illustrated below through 3 case studies exposing the flawed logic of technological inevitability through the experiences of communities living with new technologies.

6. Case Study 1: Delivery drones for sky based commerce in Canberra Australia

This example is from a study by Zenz & Powles (2024) who showed that in the introduction of residential delivery drones (Figure 1), Google made extensive use of the technological inevitability myth as a tool of corporate and political power, and adopted narratives to legitimise self-serving versions of the future. Initially launched at its first residential test site in the Canberra suburb of Bonython in 2018, by 2021 Google Wing (a subsidiary of Google) was making 100,000 deliveries a year of predominantly single item consumer and household goods. Its introduction was supported by a narrative of the unstoppable arrival and expansion of new technology. However the company was plagued by a significant backlash based on a series of negative impacts suffered by local residents and the environment.



Figure 1: A Google Wing delivery drone

Google Wing began by creating a flattering portrayal of the Australian capital for being a recognised leader in technology and research. The honour of being chosen by Google Wing instilled a sense of triumphalism and competition in city leaders. The focus was on addressing urban priorities such as reducing traffic congestion, emissions, accidents, assisting accessibility, and combating urban sprawl, playing to notions of smart urbanism which portray technological solutions as the inevitable response to impending urban crises (Sadowski J., Bendor R. (2019)). Google Wing’s central argument relied on the unproven premise that drones replace road traffic and thereby reduce congestion. In reality delivery drones have serious impacts on communities by creating new air corridors which didn’t exist previously and which create both visible and audible intrusion on suburban populations and impacts on wildlife. In the Bonython trial the service was only available to less than 5% of residents, such that the other 95% had to endure drone intrusion delivering drinks, fast food and forgotten shopping items to a very small minority.

Whilst the physical safety risks posed by drones was considered, other concerns such as noise, visual pollution, distraction to road users, privacy, security, and environmental disturbances were not investigated. The Government uncritically promulgated corporate narratives of inevitability accepting the technical fix in response to noise complaints that quieter drones were on the way. Meanwhile Bonython residents were experiencing high levels of noise as drones flew over their homes and hovered for dispatch causing adverse mental and physical health problems and the overall loss of amenity, with many in the community feeling forced to leave their houses for extended periods to escape the noise. This led to the community group Bonython Against Drones (BAD) demonstrating how the logic of inevitability could be challenged and local surveys indicated 80% of residents opposed the trial feeling they had been presented with a *fait accompli*.

This example, shows how a company used notions of inevitability to seek community acquiescence on the grounds that if citizens believed that delivery drones would be inevitable they were more likely to be silent or passively tolerant. Eventually by August 2023 Google Wing announced it would cease its operations in Canberra stating it had “shifted its operating model” and moved to Queensland leaving behind a public enquiry which became an investigation into why and how public officials had been deceived by the myth of technological inevitability. The investigation highlighted the kind of questions that should be asked when proponents of new technologies cite “innovation” or “progress” as justifications for their actions (Naughton J. 2024). The key lessons here are to see how to puncture the logic of inevitability that permeates technology, by exposing the presentation, replication and legitimisation of unsustainable technological developments as natural, ineluctable forces. Secondly is the need to resist the self-fulfilling logic that takes silence and resignation as signals of acceptance and approval. Zenz and Powles (2024) conclude that narratives of technological inevitability are no more than stories, which can be designed to disempower communities and governments from actively designing and demanding the futures we want and need.

7. Case Study 2: Water infrastructure for Stonefields development , Auckland, New Zealand

This case study relating to one of Auckland’s largest housing developments (Stonefields), designed to house around 6000 people upon completion in 2025, has been reported by Trowsdale et al, (2020). The development made use of Water Sensitive Urban Design principles incorporating bioretention, infiltration and pipes into three large retention basins providing a natural amenity at the lowest point of the site and included the construction of a stormwater re-use ‘third-pipe’ system. Stormwater and groundwater would collect in retention basins, before being pumped to a storage reservoir at a high point of the site. The water would then be piped back to each lot/house to be used for non-potable use, such as toilet flushing and irrigation.

The system was vested to the new Auckland Council who in turn transferred it to Watercare (a region wide water and wastewater service provider) to own and operate. Neither institution wanted responsibility for the third-pipe infrastructure arguing it was beyond their remit such that by 2014 the project had gained a reputation as an expensive failure. Auckland Council, Watercare and the developer tussled over who should fund the storage reservoir, and it was not built. Instead, the third pipe was plumbed into the mains potable water supply. Understandably many of the residents, who had paid for the system through their house purchase, felt that the institutions that govern water should comply with environmental priorities—this was after all sold as a way to save water and targeted towards ecologically conscious individuals.

The majority of water professionals felt the public were not prepared to interact with ‘dirty’ stormwater and the risks that entailed. This created a narrative about the future in which the technical operator/competent authority knew (and would impose) what was best for the residents. Yet the Stonefields residents had agreed to pay extra for this scheme showing that people were willing to take on the responsibility for the third pipe and were open to the change it entailed. Even though some of the Stonefields residents felt ready to experiment with ‘bad’ or ‘dirty’ water, experts assumed it was not in their best interest, or even an interest of theirs at all.

The corporate structure for Watercare re-framed the public as customers (rather than citizens) who were expected to act out their sustainability concerns indirectly through changes to their own behaviour. In wanting

the original water capture and recirculation reinstated the public were ahead in seeing and valuing the sustainability benefits this provided. This desire by the residents to have a voice and participate in how their water supplies were sourced was in direct conflict with the water company and its narrow vision of the future where technology decisions should be exclusively and inevitably within the company's remit.

The third pipe politicized, and therefore questioned, the presumed idea that the public are best understood as consumers with no capacity to challenge an imposed decision with technical consequences. The conflicts around the public becoming water managers themselves challenged the preconceived idea that only experts can be responsible for securing safe water. This "technologist knows best" attitude reflects Geldof and Stahre's Model A approach mentioned earlier. The desire of Stonefields' residents to have a stormwater re-use system for the 'sustainability' aspect—outside of technical or economic logic—challenged normal thinking. Narratives around the technological solution advanced by those with institutional responsibility for the system were contested with the end users of the technical solution choosing to take a different path.

8. Case Study 3: Solar power in Honduras


The adoption of technology can often be traced back to the capability of those providing it, and in this sense becomes inevitable as other requirements or constraints are dismissed or ignored. An extreme example of how technological "solutions" are perpetuated in the face of real needs can be seen in the work of an NGO with a key remit to provide renewable energy in the countries of Central America. Working in several villages in Honduras they conducted a series of meetings with the local communities which revealed that the over-riding concern of the villagers was the alarming rise in teenage pregnancies. In response to this the NGO went ahead regardless and constructed their solar panels - because they could.

9. Techno optimists vs Techno not-so-sures: a student activity


The following is an exercise that can be completed in a classroom session or adapted as a more extended coursework assignment (Box 1). The purpose is to explore how a new technology is framed by the questions that are asked of it, and how this may lead to a conclusion of technological inevitability or otherwise.

Box 1: A Group Activity


The class is divided into 2 groups and asked to select one of the following promising technologies:




Smart Infrastructure
(Internet of things etc)



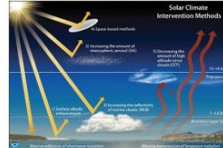
Space engineering
(Mars colonisation)



Autonomous transportation
(self driving cars)



Genetic Engineering



Geo Engineering
(aerosols, mirrors in space)

Each group is split again into 2 groups who choose to either take the role of "Techno-optimists" or "Techno not-so sures", each group is respectively asked to consider the following questions:

Techno Optimists	Techno Not-So-Sures
<p>Identity arguments that support the innovation</p> <p>Give examples of success</p> <ul style="list-style-type: none"> • What engineering principles support the technology's feasibility? • What claims are made by developers, politicians, the media? • What are the projected societal benefits, efficiencies, sustainability and cost savings? 	<p>Identify risks, drawbacks and ethical concerns</p> <p>Give examples of failures</p> <ul style="list-style-type: none"> • What technical limitations or practical hurdles exist? • What are the economic and ethical concerns? • Is the technology constrained by funding, ethics or regulation and should society halt its development?

Based on the responses to the questions each group is then asked to conclude :

Is the technology inevitable?

This can form the basis for an interesting debate concerning how the limits on technology are framed. Supplementary questions which might be considered are as follows:

- Should engineers assume that their innovations will always be adopted?
- How do regulations, costs, and public perception shape the success of engineering projects?
- Can society deliberately slow or reject certain engineering advancements ?
- Does technology always advance, or can external forces slow or stop it?
- What role do ethics and policy play in shaping technological progress?
- How could society deliberately choose to halt certain advancements (e.g., AI surveillance)?

This highlights the non-prescriptive nature of sustainability in relation to engineering and technology and demonstrates that it is by asking searching questions of a technology that will determine if it is suitable for adoption, or otherwise.

10. Conclusion – the power of choice

The purpose of this paper has been to examine the hubris which surrounds a blind faith in technology as the solution to all future problems and question the mindsets that drive this. The narratives of inevitability, presented as facts about the future, are always rooted in other agendas and there will always be winners and losers. This is important to Engineering Education for Sustainable Development as students must be warned against going down the rabbit hole of the technical fix and placing undue faith on technology to ultimately deliver solutions to the climate crisis, diminishing resources and energy provision. This is not to say that technology has a crucial part to play in all these issues, of course it has, and without it our fragile circumstances would be even more dangerous. But there are limits to what technology can achieve alone and technology (including engineering solutions) must not be seen as inexorable or inescapable, but as part of a wider complex interaction with society, end users and the facilitating mechanisms by which it will or will not come into being. Importantly the social dimension of sustainability must not be lost in the hyperbole. This is at the heart of Engineering Education for Sustainable Development, which may wittingly or unwittingly be driven by the stories we tell and therefore whether a consensus can be built from which we can all move forward.

Tomorrow is uncertain and the future is ambiguous giving us all the opportunity to shape it. So in ending we should encourage all our students to ask the following series of important questions. These are rooted in complexity rather than the narrow linear solutions an over confident faith and reliance on technology alone might suggest:

- *Does anticipated new technology need a participatory approach in its widespread implementation?*
- *Who serves to benefit when the anticipated technology is adopted?*
- *Have the social and environmental consequences of new technologies been fully and neutrally explored?*
- *What honest narratives should sit alongside new technical advances?*

Finally we need to reflect not just on how a new technology will be introduced but also on whether it is beneficial to do so. Engineers are not powerless in this debate. We make technology and we can choose what to do.

References

- Benson M (2024) High Speed Rail 2: An overview. House of Commons briefing paper Number CBP-9313
- Bonython Against Drones (2022) Report on the trial of delivery drones in Bonython Canberra, Australian Capital Territory Australia (2018-2019) 1 June .
- Carney T(2021) China's Three Gorges Dam: Development, Displacement, and Degradation Nebraska Anthropologist University of Nebraska <https://digitalcommons.unl.edu/cgi/viewcontent.cgi?article=1193&context=nebanthro>.
- Carson R (1963) Silent Spring. Hamish Hamilton Ltd ISBN-10 : 0241905931
- Chakrobarti P, Parker R., Hoque T., Cruz J., Du L., Wang S. Bhunia S. (2022) Addressing the range anxiety of battery electric vehicles with charging en route *Scientific Reports* volume 12, Article number: 5588 (2022)
- Clift (2005) Engineers as honest brokers for sustainable development 3rd Annual Series of Public Lectures in Sustainable Development, Cambridge University Engineering Department 2nd February 2005.
- Danaher J (2022) Techno-optimism: an analysis , an evaluation and a modest defence. *Philosophy and Technology.* 35: 54 <https://doi.org/10.1007/s13347-022-00550-2>
- Dominici P. (2023) Sustainability is social complexity: re-imagining education towards a culture of unpredictability" *Sustainability* 15 16719 (<https://doi/10.3390/su152416719>)
- Euchner J.(2021) is the evolution of technology inevitable?" *Research-Technology Management* Jul-Aug 2021
- Geldof G and Stahre P. (2006) On the road to a new stormwater planning approach: from Model A to Model B. *Water Practice and Technology* Volume 1 Issue 1 IWA Publishing
- Harvey F Ambrose J (2023) Controversial technology is at centre of 'powering up Britain' strategy, but critics argue it has 'little merit' and 'delays real cuts in emissions' *The Guardian* 30 March 2023
- Heffernan M (2020) "Uncharted: How to map the future together" Simon & Schuster ISBN-13: 978 1471179785
- Kelly K (2010) What technology wants 1st edition. New York. Penguin Books
- Legislative Assembly for the Australian Capital Territory (2019) Standing Committee on Economic Development and Tourism., 2109 Inquiry into drone delivery systems in the ACT, Transcript of Evidence, Canberra Wednesday 6 March
- Luccioni A.S., Jernite Y., Strubbell E., (2024) Power Hungry Processing: Watts Driving the Cost of AI Deployment? Cornell University arXiv:2311.16863v3 [cs.LG] <https://doi.org/10.48550/arXiv.2311.16863>
- Mak A. (2017) The Fourth Industrial Revolution 5) A Global Britain must look to the future . Conservative home
- Marx J (2022) With State Ban Set to Expire, Local Police Could Bring Back Facial Rec. *Voice of San Diego*
- Miller .,S (2017) The dangers of techno-optimism. *Berkely Political Review* Nov 16 2017
- Misa T (2004) Leonardo to the Internet: technology and Culture from the Renaissance to the Present. John Hopkins University Press **ISBN-10** : 9780801878091
- Naughton J (2024) What resistance to drones shows about big tech's disrespect for democracy" *The Observer* 11/08/24
- Oelschlaeger M. (1979) The myth of the technical fix *Southwestern Journal of Philosophy* 10 (1):43-53 (1979)
- Qian Y., Siau K.L., Nah F.F. (2024) Societal impacts of artificial intelligence: Ethical, legal, and governance issues *Societal Impacts* Volume 3 June 2024 100040
- Pretty et al (2025) How the Concept of "Regenerative good growth" could help increase public and policy engagement and speed transitions to net zero and nature recovery. *Sustainability* 17, 849 <https://doi.org/10.3390/su17030849>
- Sacasas L.M. (2021) Is resistance futile? The myth of tech inevitability" *The Convivial Society: Vol. 2, No. 7* <https://theconvivialsociety.substack.com/p/resistance-is-futile-the-myth-of>
- Sadowski J., Bendor R. (2019) Selling smartness: corporate narratives and the Smart city as a sociotechnical imaginary *Sci Technol. Hum. Values* 44 540-563
- Trowsdale S., Boyle K., Baker T. (2020) Politics , water management and infrastructure. *Philosophical Transactions of the Royal Society A* 38(2168): 20190208
- Wagner G. (2021) *Geoengineering: The Gamble.* Publisher : Polity. ISBN Paperback 9781509543069
- Willoughby K.W (2019) *Technology Choice: A critique of the Appropriate Technology Movement* Routledge eBook ISBN9780429308444
- Wing (2019) Wing launches commercial air delivery service in Canberra Wing Blog 8 April <https://blog.wing.com/2019/04/wing-launches-commercial-air-delivery.html>
- Weizenbaum J (1976) *Computer Power and Human Reason: From Judgment to Calculation* W.H.Freeman & Co Ltd; **ISBN-10** : 0716704633
- Zenz A., Powles J., (2024) Resisting technological inevitability: Google Wing's delivery drones and the fight for our skies *Philosophical Transactions of the Royal Society A* <https://doi.org/10.1098/rsta.2024.0107>