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ABSTRACT

What They Don't Teach You about Artificial Intelligence at Business School: Stagnation, Oil, and War

This paper discusses four dimensions of the economics of AI that are neglected in business school and university teaching and research. First, students are not being taught that there is no 4th Industrial Revolution; on the contrary, the narrative of the inevitability and wonders of the 4IR is a vital staple of the curricula. Second, students are rarely told that we do not live in a technologically disruptive era; on the contrary, the mantra of "disrupt or else be disrupted" in a world of ceaseless innovation is drummed into students. Third, little is discussed about AI's scaling problem - it faces ecological constraints due to being an energy and water guzzler. Fourthly, business schools largely fail to create awareness that AI has essentially become a project of platform capitalism (techfeudalism) and that the last extraction zone it is being applied to is the Military Industrial Complex (MIC), in furtherance of the Permanent War Economy. Implications for AI governance and business school teaching and research are drawn from this big picture.

JEL Classification: P18, P17, N40, Q55, O33

Keywords: Artificial Intelligence, capitalism, economic growth, climate change, war

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1 Introduction[1]

Business schools teach quite a lot about Artificial Intelligence (AI). For instance, they routinely teach their students machine learning techniques, how to leverage value from data using algorithms, and how to use generative AI in the business context (GenAI). AI ethics, governance, and the various AI legislative initiatives in Europe are highlighted as a matter of course. Some business schools also use AI systems in their day-to-day operations.

There is, however, a significant gap in what most business schools, and for that matter most universities, teach their students about AI. What is rarely taught, discussed, or researched - is the economics of AI (Naudé et al., 2024). Apart from the choice-theory underpinnings that both AI and economics share, there are four critical, interrelated dimensions that are particularly neglected in this regard.

First, students are not being taught that there is no 4th Industrial Revolution and why it has failed; on the contrary, the narrative of the inevitability and wonders of the 4IR is a vital staple of the curricula. Second, students are rarely told that we do not live in a technologically disruptive era; on the contrary, the mantra of "disrupt or else be disrupted" in a world of ceaseless innovation is drummed into students. Third, little is discussed with students about AI's scaling problem due to being an energy and water guzzler. Fourthly, business schools largely fail to create awareness that AI has essentially become a project of platform capitalism (techfeudalism) and that the last extraction zone it is being applied to is the Military Industrial Complex (MIC), in furtherance of the Permanent War Economy.

In this article I will briefly discuss these four neglected dimensions of the economics of AI. I conclude that, given the diminishing returns to AI, the oligarchic nature of the over-commercialised digital economy, the ecological damage from scaling up AI, and the integra-

[1]This paper has been presented as a Keynote Address to the *Economic Perspective on AI*(EPEAI) International Conference about AI in Business and Economics, held on 5 and 6 September 2024 at the Johannesburg Business School at the University of Johannesburg, South Africa.

tion of AI into the military to strengthen the military-digital complex further and facilitate surveillance and warfare, as Heinberg (2024) advised, it is perhaps "*best if we bid it [AI] a quick farewell.*"

The rest of the paper is structured as follows. Section 2 describes the failure of the 4IR. Section 3 provides some reasons for this, arguing that the economies of high-income countries have been experiencing a gradual Great Stagnation since the 1970s. Section 4 then motivates why AI, considered by many to be technology that will facilitate an escape from the Great Stagnation, is not scalable because of its considerable energy and water requirements. AI is incompatible with the energy transition. Section 5 discusses how, in the context of the failure of the 4IR, the Great Stagnation, diminishing returns to the digital economy and the ecological boundaries on AI, Silicon Valley is pivoting towards the Military Industrial Complex (MIC) and the Permanent War Economy. Section 6 concludes.

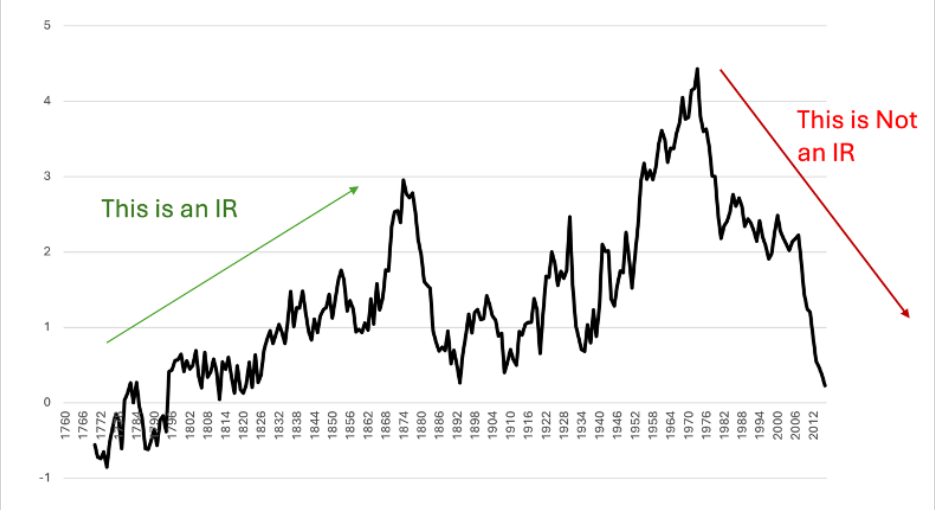
2 The Failure of the 4IR

First, there is no 4th Industrial Revolution. Its was a narrative - a hope - promoted by the World Economic Forum (WEF) (see Schwab (2016)), but which has failed to materialize (Naudé, 2020). Figure 1 shows productivity growth in the UK over the long-run, an advanced economy where the Industrial Revolution (IR) started in the late 18th century.

Figure 1 shows the strong productivity growth that resulted from the IR in the 19th century. It also shows that productivity growth in the UK peaked in the 1970s, and has been declining since. The UK is not exceptional in this pattern, but fairly representative of advanced economies as far as the broad outlines are concerned (Naudé, 2022).

The WEF's failed hopes of a 4IR is underscored by the disappointment of most of the so-called essential 4IR technologies:

Figure 1: Declining Productivity Growth is Inconsistent with Notions of an Industrial Revolution: UK Labour Productivity Growth, 1760-2012



Source: Author's Compilation on Bank of England Data "A millennium of macroeconomic data"

- *Artificial Intelligence* : As far as AI is concerned, and the sections below goes into greater depth, it is still the case that, as Yann LeCun is reported to have remarked, "Machines are still very, very stupid. The smartest AI systems today have less common sense than a house cat" (Velez-Ginorio, 2019).

- What about *3D-printing*? This is no 4IR technology, but a 1980s technology that is still in some sort of infancy (Chan et al., 2018; Naudé, 2023b).

- Then there is the *Internet of Things* (IoT): It is still hamstrung by the fact that "Unlike the home environment where Wi-Fi is universal, there is no standard for connecting distributed IoT devices" (Hatton and Webb, 2020).

- Of the *Metaverse*. What Metaverse? you may ask, given that the dreams of this much touted 4IR-enabler seems to be dead on arrival (Hern, 2023; Wagner, 2023).

- And of the promises of *quantum computing*: Little has materialised, except for several much hyped, but basically bankrupt, start-ups (Hossenfelder, 2024).

- As far as cryptocurrencies are concerned, these have been described as a giant Ponzi-

scheme (Mortazavi, 2022). For these and other concerns about crypto, see also Choi et al. (2024), Scharfman (2023) and Panetta (2023).

Although no 4IR, there has been a digital revolution based primarily on WW2 technologies and of which modern AI based on machine learning only emerged after 2007. The digital revolution has to a large extent run its course- its major productivity gains were enjoyed in the late 1990s and early 2000s (Fernald and Wang, 2015) - as can be seen in Figure 1 in the brief pause in the decline in productivity growth during this period.

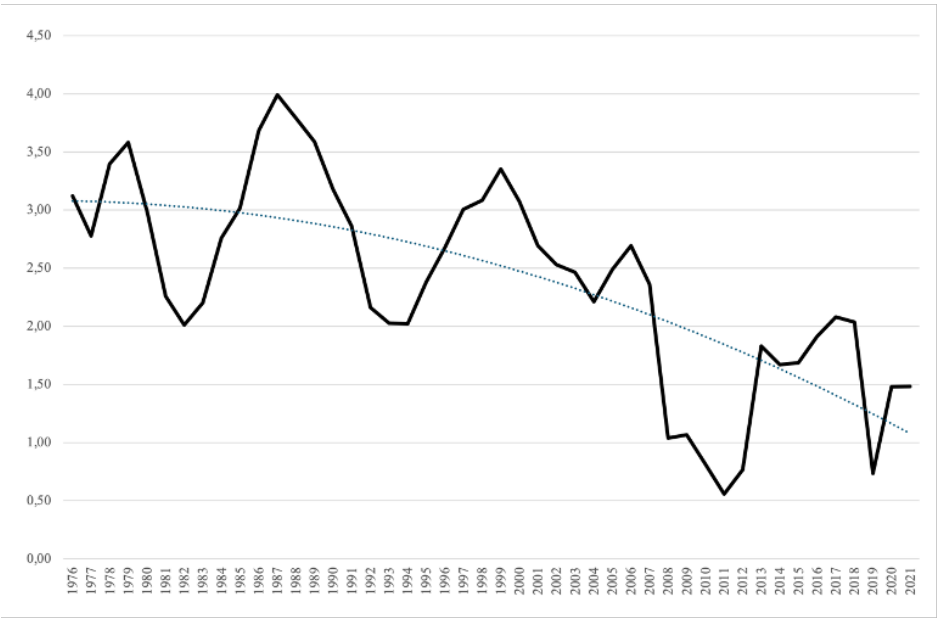
3 The Great Stagnation

A second gap in business school teaching and research is that students are rarely told that we do not live in a technologically disruptive era, on the contrary the mantra of "disrupt or else be disrupted" in a world of ceaseless innovation is drummed into students (Kotter, 2013). The reality is that we live in the *Great Stagnation* - a secular decline in productivity and economic growth in the West that started in the 1970s (Naudé, 2022; Cowen, 2010; Gordon, 2012). The decline in productivity growth, as represented by the UK's long-run experience, has been shown in Figure 1. Figure 2 depicts the decline in economic growth in advanced economies.

The consequence of this gradual but inexorable decline in economic growth is that the West is increasingly resembling a zero-sum economy: One firm, or one country, can generally only make itself better off at the expensive of another (Bris, 2023). Redistribution, instead of production, becomes the basis of the economy(Naudé, 2023c).

This zero-sum logic characterises much of the digital economy, wherein AI is but one product touted by a handful of dominating tech and digital platform firms, mostly USA and Chinese

Figure 2: Capitalism is Failing to Maintain Economic Growth Rates: % Growth in Advanced Economies, 5-yr MA, 1976-2021



Source: Author's compilation based on data from the World Bank Development Indicators Online

firms and platforms.[2] These firms, knowing the the economy is stagnating and that growth is declining, knows that to maintain and grow profits, which they must do least they collapse given the nature of global capitalism (see Binswanger (2013)), they have to keep competitors out and extract more profits from existing markets. This they do by spending hundreds of millions of dollars lobbying policy makers for subsidies (Roeder, 2024), trade protection (hence the USA trade and tech war with China - see e.g. Fetzer and Schwarz (2021) and Wang et al. (2023)) and for government contracts - most concernedly in recent times, contracts from the military-industrial complex (González, 2024).

They also try hard to prevent consumers from getting saturated by creating hype, hysteria, relentless advertising, and regularly making tweaks to their products to create the illusion of continuing novelty- which is one reason why there has been 46 iPhone versions[3] since 2007. And of course, to squeeze as much profits from a limited market they offer poor quality, low-

[2]See for instance the Global Digital Platform Power Index 2023 which details the extent of domination of USA and Chinese platforms.

[3]See `https://theapplewiki.com/wiki/List_of_iPhones`

paying jobs - "bullshit jobs" (Graeber, 2019). It is therefore no surprise that since the rise of digital platform firms there has been a sharp increase in indicators of corporate dominance and industry concentration and a decline in the share of labour in output (Autor et al., 2017; Covarrubias et al., 2019).

Since the Great Stagnation started there has been a gradual decline in virtually all measures of innovation, science and entrepreneurship (Gordon, 2012; Cowen, 2010; Naudé, 2022). This is perhaps not surprisingly given the market and government influence of the billionaire elites - the so-called "tech bro's"[4] - who head the global digital platforms. Patent registrations have been getting narrower in scope and less original (Akcigit and Ates, 2019). Park et al. (2023) found that "*papers and patents are increasingly less likely to break with the past in ways that push science and technology in new directions. This pattern holds universally across fields and is robust across multiple different citation- and text-based metrics.*"

One consequence of this decline in innovation and science is, as Horgan (1996) predicted in his 1996 book *The End of Science*, that "scientists, as they struggle to overcome their limitations, would become increasingly desperate and prone to hyperbole." We see this also in the AI field, where every tweak to AI systems is nowadays heralded as a major breakthrough.

4 AI's Ecological Boundaries

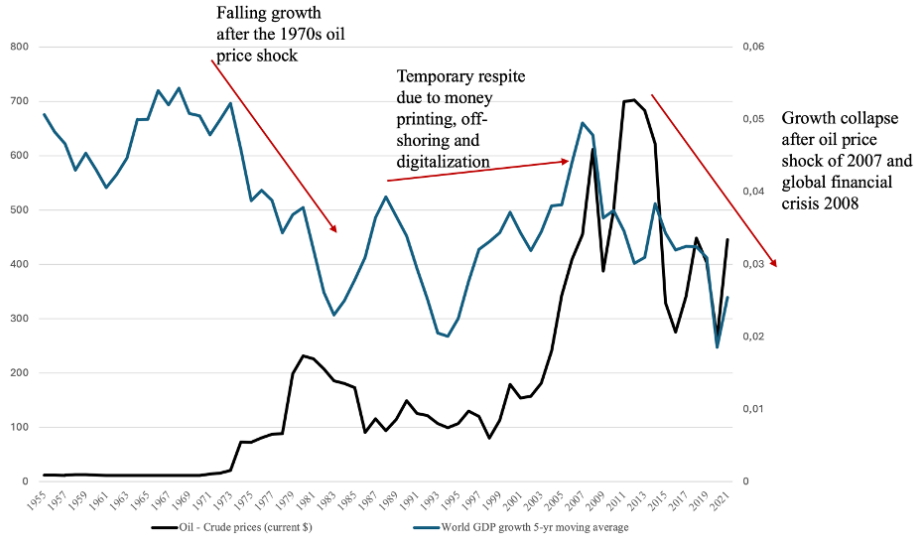
AI has a scaling - energy - problem - an inconvenient fact often downplayed or trivialised in teaching and research - often AI is offered as a tool in the fight against climate change. What students do get taught is that since the beginning of the 19th century global GDP - and the world's population - has grown exponentially - and that this is due to a combination of entrepreneurship and technological innovation enabled by appropriate "institutions" (such as property rights and rule of law) that are good for business and investment (Acemoglu and

[4]See Wong and Cantor (2019) for an explanation of "How to speak Silicon Valley."

Robinson, 2013; Mokyr, 2016). What they are not told is that it was actually the commercial exploitation of fossil fuels which kick-started the Industrial Revolution and made possible the subsequent unprecedented growth in world GDP (Hagens, 2020; Naudé, 2023a; Smil, 2018). The importance of fossil fuels - energy - to the modern economy has been nicely described by Hagens (2020), who pointed out that the "*110 billion barrels of oil that were needed in 2018 to power the world economy is equivalent to more than 500 billion human workers toiling day and night.*"

Growing GDP requires growing fossil fuel consumption - if the latter is cut, GDP growth will decline - as the world dramatically experienced in the 1970s and more recently in the run up to the global financial crisis of 2008 - see Figure 3.

Figure 3: Rising Oil Prices Dampens Economic Growth -World GDP Growth and Oil Prices, 1955-2021



Source: Author's compilation based on data from the World Bank Development Indicators Online and Our World in Data

Figure 3 shows that the post-war period until 1973 were the golden years in terms of plenty of cheap fossil fuels being available. These were also golden age of economic growth, at least in most advanced western economies which had access to all of this cheap oil (Cairncross, 2014). However, since 1973 oil prices have been permanently on a higher level and has continued to rise -making a further structural increase to higher levels after 2003. These

increases in oil prices are clearly associated with a decline in overall world GDP growth (although some individual oil producing countries benefited), and more substantial declines in growth in energy dependent advanced economies (Figure 2) because these economies are using more oil in total, even if they are using oil more efficiently. Bradford DeLong (2022, p.431) explains the start of the Great Stagnation in the 1970s as being due partly to the fact that "energy diverted away from producing more and into producing cleaner would quickly show up in lower wage increases and profits."

For a while, the world and advanced economies enjoyed a temporary respite - from the early 1990s - by throwing money at the problem - through liberalising the financial sector and the US printing large quantities of money so as to ensure that the economic system is flushed with credit to keep firms in business, and interest rates and inflation low (Boccia and Lett, 2024; Lin and Tomaskovic-Devey, 2013). So much credit has been pumped into the world economy since the 1970s that interest rates dropped in the past decade to levels not seen in 5,000 years (Goldstein, 2021; Homer and Sylla, 2005). The average debt level of the industrial economies rose from 165% of GDP in 1980 to 320% of GDP by 2010 (Chan, 2011). It planted the seeds for the Global Financial Crisis of 2008 and remains a threat to global financial stability: during the COVID-19 pandemic the US Federal Reserve printed an additional US$ 4 trillion (Boccia and Lett, 2024). The USA, as the issuer of the world's reserve currency indeed believes that it can print as much dollars as it wants and spend its way out of stagnation - a former chairman of the US's House Budget Committee voiced this saying[5] that "*We are a sovereign currency, we can print all the money we want to serve the people whom we serve [...] why do we borrow money anyway? We can print it and put it in the Treasury.*"

In addition, Western economies started in the 1970s and 1980s to massively off-shore their manufacturing industries to developing countries where wages and costs were lower in an

[5]Reported by Boccia and Lett (2024).

effort to reduce inflation and maintain competitiveness (Vietor et al., 2008) The emergence of the digital economy following the creation of the WWW in early 1990s also gave a temporary respite to falling economic growth (and helped with off-shoring) (Borenstein and Saloner, 2001). The digital platform firms that came to dominate soon realised that the digital economy was one of the last extraction zones available - except perhaps for mining the sea floor or expanding into outer space (Gilbert, 2023; Weinzierl, 2023).

A short explanation may be required here of the concept of extraction zone, as many students of standard managerial economics at business schools may not be aware of the fundamental nature of the neoliberal capitalist system.

The *modus operandi* of the global capitalist system is, as explained succinctly by Monbiot and Hutchison (2024) one of "*Boom, Bust, Quit*" where corporations, because they have to sustain growth in sales to maintain profits which are needed to pay interest on debt and dividends on capital, are continually saturating customers and markets, hence the need for evermore expansion into new areas and markets for continued extraction - and to reduce labour costs. Capitalist firms are locked into a growth-spiral (Binswanger, 2013), which is a growth-or-die rule (Alexander and Gleeson, 2019): if they do not continue to make profits, which requires a continually growing market - then they collapse. This growth-or-die rule underlies the Rosa Luxemburg thesis (see Luxemburg (1913)) - which explains why in the past western corporations and states became imperialistic and expanded globally - systematically looting "one region after the another" (Monbiot and Hutchison, 2024).

The creation of colonial empires by the Portuguese, Spanish, French, British and Germans were driven by this constant imperative of economic growth to have ever expanding access to markets, resources and cheap labour - hence also the trade in enslaved people that marked much of the colonial era (Nunn, 2008). When the colonial empires collapsed after the two world wars of the 20th century, the most brutal and destructive wars in history, it was superseded by the US Empire, who immediately "created history's greatest military alliance to

arrest, contain, and beat back the Soviet Union" (the beginning of the Cold War) and moreover "to cement their coalition" promoted the globalization of the world economy, effectively expanding the extraction reach of its corporations (Zeihan, 2022, p.2-3).

The US economy massively benefited from the consumption and investment boom of taking part in WWII - the production of military goods raised the US's GDP between 1940 and 1945 by 72% (Fishback, 2020). At the end of the war it established what has become known as the Permanent War Economy with the Military-Industrial Complex (MIC) being the major beneficiary in terms of government contracts to produce military supplies and tech (Duncan and Coyne, 2013). Writing in 1944, Walter Oaks described how the USA's industrial and political elite realised that a Permanent War Economy would be a useful permanent source of economic growth. He defined a war economy to exists "*whenever the government's expenditures for war (or 'national defense') become a legitimate and significant end-purpose of economic activity*" (Oakes, 1944). That this is the case is clear from the fact that between 1940 to 1996 the USA spent $16.23 trillion on the military compared to only $1.70 trillion on health care (Hedges, 2003).

Today, the Permanent War Economy is deeply entrenched and becoming even more essential given that other sources of economic growth and extraction are drying up - see for instance the Biden administration's 2023 National Defense Industrial Strategy.[6] Not surprisingly, the MIC is "more powerful than ever" (Hartung and Freeman, 2023). This is despite Eisenhower's prescient 1961 warning[7] that we "*must guard against the acquisition of unwarranted influence, whether sought or unsought, by the military-industrial complex. The potential for the disastrous rise of misplaced power exists and will persist.*" This misplaced power has built an USA economy where making war has become a major business incentive. Even though the Cold War ended in 1991, the US's military interventions abroad accelerated.

[6]See `https://www.businessdefense.gov/docs/ndis/2023-NDIS.pdf`
[7]See `https://tinyurl.com/ysf9tdhv`

As documented by Tuft University's Military Intervention Project[8] (MIP) over 100 military interventions, a quarter of all US military interventions ever, took place after 1999. Most of these have followed the "Boom, Bust, Quit" template of global capitalism - notable examples are Vietnam, Afghanistan, Iraq, and Syria (Wolff, 2022). As will be shown below, Silicon Valley (and the AI industry) is cashing in on war as well.

Having described the basic nature of global capitalism and its need for continued expansion, one can now understand the basic predicament - and hence strategy - that drives the digital platform oligarchy. This is that the digital economy that arose in the 1990s, and that was captured by the oligarchy, is one of the last last extraction zones available, and moreover that it is a diminishing source of extraction. After all, the digital economy is at least three decades old - Tapscott (1995) was one of the first to use the term in the 1990s. By around 2009 however, the digital economy's low hanging fruits had been eaten - and it had even become to be seen as a potential cause of further economic stagnation (Frey, 2015). The Internet for instance has been over-commercialized (Cheong and Shin, 2024) and marked by a decline in quality that always follows when oligopolistic firms had done their extraction - this has been called the *Enshittification* of the Internet(Verso Books, 2024).

Around 2009 was also the time when modern Machine Learning (ML) AI was pushed to the fore as the hoped-for saviour technology - to allow the big tech firms another instrument with which to extend their extraction of profits from the digital economy. The CEO of Google declared AI to be more important than fire or electricity[9], and countless pronouncements were made by industry analysts, tech aficionados and consultancy firms of the huge boosts to economic growth, productivity and ultimately that would result from AI. Perhaps the most outrageous of these were the McKinsey declaration that AI could "increase corporate profits by $4.4 trillion a year" (Chui and Yee, 2023).

[8] See `https://tinyurl.com/3v9h3a8r`
[9] See `https://tinyurl.com/yc4f67rr`

Even *AI Doomerism* - the belief that AI poses an imminent existential threat to humanity, was largely inspired by think-tanks promoting Longtermism and funded by tech billionaires amongst others to elevate the importance of AI (and the need to colonize Mars) (Wong, 2023; McGoey, 2023). One of the most (in)famous of such think-tanks were the Institute for the Future of Humanity (IFH) at Oxford University, which was however closed down by the university in 2023 and which has been described as leaving a "toxic and contested legacy" (Anthony, 2024; Robins-Early, 2024).

Despite this hype and hysteria around AI, the ability of AI as product and service to extend the extraction of profits from the digital economy by oligarchic firms faces fundamental limits. A reason is the energy problem that the broader economy is already grappling with. The use of fossil fuels has generated so much greenhouse gases (GHG) that the world is facing potentially catastrophic climate change (Bradshaw et al., 2021). Moreover, fossil fuels are limited in supply, and as this supply declines - peak oil being imminent[10] - prices will rise. As a result the net energy, or Energy Return to Energy Invested (EROI) from fossil fuels are declining, since more and more energy is needed to extract energy (Murphy et al., 2022).

Imagine how world production would plummet if the 500 virtual workers toiling day and night is suddenly withdrawn, and image the potentially inflationary consequences - to be added to the inflationary consequences of continued money printing. Unfortunately, it is the case that, as The Honest Sorcerer (2024) recognises "Mainstream economists are just as clueless about our deteriorating energy situation as our leadership class." Yes, the demand for fossil fuels is declining and the supply of renewable energy is growing, but this is not nearly fast enough to replace fossil fuels substantially (Heinberg, 2024).

In this context, it is hard to see how AI, as it is current being developed and rolled-out, can be scaled up. It is too much of an energy and water guzzler. For Heinberg (2024) AI

[10]See the prediction on this in the bp energy outlook at : `https://tinyurl.com/2th8ua5x`

is such a problem for the energy transition, that he concludes "*Artificial intelligence is an energy guzzler we managed to live without until very recently; perhaps it's best if we bid it a quick farewell.*" The reasons for this conclusion are clear. One is that, as the International Energy Agency (IEA) predict, electricity consumption from datacentres (where AI systems are hosted) will double between 2022 and 2026, requiring as much energy as a country such as Japan (Dolby, 2023). A single query on *GenAI* consumes 2,9 watt-hours, around ten times more than a *Google* search (Coskun, 2024). The energy to train a large LLM uses the amount of energy that the average American home uses in 41 years (Dolby, 2023).

This massive energy use generates significant GHGs. A 2019 study estimated that training a large NLP model emits as much carbon as six cars in their lifetime (Strubell et al., 2019). It may be even worse at the present time, and the extent of the problem may be larger than is thought - a recent Guardian investigation found that between from 2020 and 2022 the carbon emissions from Google, Microsoft, Meta and Apple's own data centres were probably 662% higher "than officially reported"(O'Brien, 2024). The water footprint is similarly huge - by 2027, AI data centres will require almost 7 billion cubic meters of water, more than that of Denmark in a year (Gordon, 2024).

Of course, AI can also help improve energy efficiency and combat climate change. In a recent review of this potential benefit, Cowls et al. (2023) refers to the balance between the climate change reducing and climate change worsening impacts of AI as a "gambit", concluding that "the carbon footprint of AI research may be significant" and that more research is needed "concerning the trade-off between the GHG emissions generated by AI research and the energy and resource efficiency gains that AI can offer" (Cowls et al., 2023, p.283).

5 Silicon Valley's Pivot to the War Economy

Business schools do little teaching or research on how AI has been hijacked by platform capitalism (technofeudalism) and about its relationship with the Military Industrial Complex (MIC) and Permanent War Economy.

With the hijacking of AI what is meant is that a few large - "superstar" - firms have succeeded in capturing the digital economy through large dominant - digital platform firms, concentrating industries and wealth to an unprecedented degree (see e.g. Autor et al. (2017), Bajgar et al. (2023), Qureshi (2023), Sadowski (2020), UNCTAD (2021)) - and maintaining monopolistic domination through building of "moats" around the digital economy.

The billionaires who head these digital platforms are amongst the wealthiest humans who have ever lived, constituting a global elite that has been described by Goodman (2022) as *Davos Man*, "*who wield unsurpassed influence over the political realm while promoting the notion that [. . .] when the rules are organized around the greater prosperity for those who already enjoy most of it, everyone's the winner*."

In the previous section was explained how after 2009 the digital platform oligarchy had in essence eaten the digital economy's low hanging fruits - and that the digital economy itself had even become to be seen as a potential cause of further economic stagnation. The emergence of AI - an outcome of the digital platforms' harvesting of "big data" from their online platforms - was promoted as a hoped-for saviour technology - to allow the big tech firms another instrument with which to extend their extraction of profits from the digital economy. After fifteen years however, it seems that the profit potential of AI has been largely extracted, and moreover, as discussed in the previous section, AI is facing scaling problems presented by energy and water and diminishing growth in access to data.

In this AI seems to facing a similar prospect of "winter" as in the 1970s (Umbrello, 2021). AI

winter refers to a reduction in investment and interest in AI. In the 1970s AI researchers faced such a winter because "*capabilities failed to scale as expected or when technology-empowering data proved too difficult to acquire (or both)*" (Richbourg, 2018, p.11). An immediate catalyst for the 1970s AI winter was the publication of the Lighthill Report[11] in 1973 which concluded that "*In no part of the field have the discoveries made so far produced the major impact that was then promised.*"

More recently, an analyst of the firm of Goldman Sachs made a similar conclusion stating with reference to the most advanced of modern AI systems, Generative AI (GenAI), that "*Eighteen months after the introduction of generative AI to the world, not one truly transformative - let alone cost-effective- application has been found*" (Goldman Sachs, 2024, p.11).

The problem is indeed broadly similar to the causes of AI winters in the past, as identified by Richbourg (2018) and mentioned above, namely the failure to scale sufficiently and limitations on data acquisition. As far as the failure to scale - or obstacles to further scaling is concerned, the previous section of this paper identified energy constraints in the light of climate change as such an obstacle.

As far as limitations on data acquisition is concerned, given that modern AI systems are trained on massive datasets, their quality and further development depends crucially on access to more and more data. However, and again, the low hanging fruits (or data!) have been eaten and extracted. Consumers on the Internet whose data has been harvested extensively are becoming more and more reluctant to continue to give away their data to the tech companies' web crawlers. This "data commons" is in rapid decline, as detailed by Longpre et al. (2024). The authors found "a rapid proliferation of restrictions on web crawlers associated with AI development in both websites' robots.txt and Terms of Service" (Longpre et al., 2024, p.2). I.e., websites are increasingly restricting the use of data on their websites by

[11] At: `http://www.chilton-computing.org.uk/inf/literature/reports/lighthill_report/p001.htm`

web crawlers of AI firms such as OpenAI. They conclude that these restrictions on Open Web Data, if "respected by model developers (as many claim to) or is legally enforced, the availability of high-quality pretraining sources will rapidly diminish" (Longpre et al., 2024, p.11).

Added to these dismal trends are signs that the Great Stagnation is coming for AI. Most of the fundamental scientific contributions that made the digital revolution and AI possible, are already more than half a century old. These - all done before 1950 - include the seminal papers by Alan Turing on computing machines (Turing, 1936), by Warren McCulloch and Walter Pitts on neural networks (McCulloch and Pitts, 1943) and Claude Shannon's on information theory - which established bits and bytes (Shannon, 1948). Furthermore, Moore's Law, which has driven improvements in computing power, is slowly but surely reaching its limits (Shalf, 2020). And Almeida et al. (2024) discusses several channels through which AI could hamper research and scientific discovery, including through raising the mundane knowledge work in R&D, winner-take all effects and greater inequality, producing unreliable, wrong and unverifiable research outputs and producing or spreading new ideas that are dangerous.

Against the backdrop of these constraints, a cause for concern in the AI industry are the growing signals that GenAI has perhaps saturated the available market, given what the product can do. Thus consumers seems very interested in GenAI - together with the media - but are not turning out to present such a large source of effective demand as had been hoped for. As Evans (2024) describe it,

> "Hundreds of millions of people have tried ChatGPT, but most of them haven't been back. Every big company has done a pilot, but far fewer are in deployment.[...]most people who tried it didn't see how it was useful [....] why do most people say, in effect, 'very clever, but not for me' and wander off, with a shrug?"

Also, firms seem to find AI a relatively expensive technology with which to replace or augment human labour - in contrast to the technologies of the First Industrial Revolution which were cheaper than labour. Thus not many human labour tasks will be affected. As a consequence, as Acemoglu (2024, p.1) conclude, the productivity impact of AI will be small -"no more than a 0.71% increase in total factor productivity over 10 years."

With neither consumers nor businesses generating sufficient demand, AI companies are not doing well. For example, although OpenAI rakes in around $2 billion from ChatGPT and about $1 billion from access fees from the current consumer demand for its products, these does not seem to be sufficient - it is reported to be suffering losses to the extent that it is estimated to require at least US$ 5 billion per year in new investments to cover these losses (Barrabi, 2024; Shields, 2024). According to one reckoning companies would have to earn $600 billion per year to justify their current level of investment in AI: this is about six times the revenue projected for the AI industry in the best-case scenario (Shilov, 2024). At the same time, stricter regulations and a consumer backlash threatens the industry, making it even more costly to profitably sell AI products (Candelon et al., 2021; Longpre et al., 2024; Di Placido, 2024).

Whereas the extraction potential of AI from traditional markets such as consumers and firms are diminishing, there is one area left where it may still be wildly profitable: war and conflict. Silicon Valley's Tech Bro's are embracing the MIC (González, 2024). The potential for profits from war, conflict and surveillance is enormous. Total world military spending exceeded US$2,2 trillion in 2022 and is rising. In 2021, US military spending was $768 billion, around 10% higher in real terms than the spending in 1986 "at the height of the Cold War"(Duncan, 2022). González (2024) relates how

> "Years of AI hype generated by tech leaders, venture capitalists, and business reporters among others, has played a crucial role in sparking the interest of

> military leaders who have come to view Silicon Valley's newest innovations as indispensable warfighting tools [...] As Defense Department officials have sought to adopt AI-enabled systems and secure cloud computing services, they have awarded large multi-billion dollar contracts to Microsoft, Amazon, Google, and Oracle. "

He further reports that between 2019 and 2022 the top five defense department contracts to Silicon Valley tech firms was worth at least $53 billion in total and that between 2021 and 2023 venture capital firms invested more than US$ 100 billion in defense industry tech start-ups in the USA. Against this, the U$ 2 billion that OpenAI earns from ChatGPT pales into insignificance.

Incorporating AI into the MIC is but the latest deepening of a relationship between Silicon Valley and the US's security state that has been ongoing. As Foster and McChesney (2014, p.23) point out "*Edward Snowden's revelations of the NSA's Prism program, together with other leaks, have shown a pattern of a tight interweaving of the military with giant computer-Internet corporations, creating what has been called a -military-digital complex."*

While the AI tech giants regularly pontificate about their commitment to ethical AI and human-centered AI, they seem to have no qualms about their products being profitably provided to the MIC and being actively used in war, even when civilians are slaughtered and used to plausibly commit genocide. For example, on 26 January 2024 the International Court of Justice (ICJ) found[12] that Israel has plausibly violated the Genocide Convention in its war in Gaza, where at the time of writing[13] an estimated 41,118 people, including nearly 16,500 children had been killed by the Israeli military. And on 20 May 2024 the Prosecutor of the International Criminal Court (ICC), indicated that it was seeking arrest warrants[14]

[12]See the ICJ ruling at `https://www.icj-cij.org/node/203447`

[13]According to the Al Jazeera Live Tracker at : `https://www.aljazeera.com/news/longform/2023/10/9/israel-hamas-war-in-maps-and-charts-live-tracker`

[14]See the Prosecutor's announcement at `https://www.icc-cpi.int/news/`

for Israeli Prime Minister Benjamin Netanyahu and Defense Minister Yoav Gallant for war crimes.

Despite these concerns of genocide and war crimes the Israeli war machine has been reported to be allegedly receiving significant support from big tech companies, including Amazon's Cloud servers, on which the military stores "intelligence on almost everyone" in Gaza which is used "to confirm aerial assassination strikes in Gaza - strikes that would have also killed and harmed Palestinian civilians." AI in particular is being weaponized (Abraham, 2024b).The Israeli military's AI systems are reported to be known as "The Gospel" and "Lavender" and respectively targets infrastructure and people to be bombed - and are allowed to "kill up to 15 or 20 civilians" in each attack as collateral damage (Abraham, 2024a).

Similarly, the tech giants have "turned Ukraine into an AI War Lab" (Bergengruen, 2024). Here the firm of Palantir has been described as "the AI arms dealer of the 21st century" (Bergengruen, 2024). It provides AI to analyze satellite imagery, open-source data, drone footage, and reports from the ground to steer the Ukrainian army's targeting of enemy troops. Other tech companies that are involved have been reported to include Microsoft, Amazon, Google, and Starlink (Bergengruen, 2024).

In September 2024 the second Responsible AI in the Military Domain (REAIM) summit was held, during which around 60 countries endorsed a non-binding "blueprint for action" (Lee, 2024).The problem with REAIM is not only that its recommendations are non-binding - and even if it were binding on the few countries who endorsed it, a powerful military would simply ignore it - is that there is no agreement on what "responsible" AI even means (Assaad et al., 2024).

But it is not only hot, kinetic wars that are profitable to the AI tech giants. Possible competitors from outside the US are being dealt with through economic warfare, which

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helps maintain the moats around their business. Such economic warfare consists of sanctions and prohibitions against countries that presents a threat to US businesses interest. This is part of the modus operandi of the Permanent Warfare Economy. As the Washington Post reports "*The United States imposes three times as many sanctions as any other country or international body, targeting a third of all nations with some kind of financial penalty on people, properties or organizations. They have become an almost reflexive weapon in perpetual economic warfare*" (Stein and Cocco, 2024). In this perpetual economic warfare, China in particular, as the country with the second largest global AI industry, and with the only viable global competitors to the US tech giants, has become the prime target of technology sanctions (Bradford, 2023) so as to secure the global dominance of Silicon Valley (Mirrlees, 2021).

The oligarchs - or *Broligarchs* - that run Silicon Valley, have, like oligarchs everywhere, a problem with democracy (Harrington, 2024; Lingelbach and Guerra, 2023; Pillay, 2024). In the USA, billionaires frequently aim to turn their money into political power. Hartmann (2023) notes that the USA's billionaires are spending more and more influencing elections: in 2010 they spent U$31 million on elections campaign funding; by 2020 it had risen to $2,3 billion. Many US oligarchs have in 2024 indicated their support for Donald Trump as president in the 2024 US elections, expecting that Trump will reduce regulations of AI, reduce taxes, and continue the economic and kinetic warfare that helps them to have continued access to an extraction zone. The Campaign on Digital Ethics has warned that "*the unchecked influence of tech billionaires in politics threatens to undermine the principles of accountability, transparency, and fairness in technology governance. If the rules are written by those who prioritise profit and power over public good, the digital rights of individuals and communities will be at serious risk*" (Pillay, 2024).

When considering the dystopia that is the integration of Silicon Valley into the MIC and the US's Permanent War Economy, and considering Bertrand Russell's warning (Wheeler, 1952)

that "*If war is not impossible, every advance in scientific technique means an advance in mass murder*" then the conclusion that Heinberg (2024) made with respect to AI's impact on the climate is equally applicable here : "*perhaps it's best if we bid it [AI] a quick farewell.*"

6 Concluding Remarks

In this paper, I discussed four critical, interrelated dimensions of the economics of AI that business schools and universities particularly neglect in their teaching and research. These four dimensions constitutes an agenda for teaching enrichment and research.

First, students are not being taught that there is no 4th Industrial Revolution; on the contrary, the narrative of the inevitability and wonders of the 4IR is a key staple of the curricula. Second, students are rarely told that we do not live in a technologically disruptive era; on the contrary, the mantra of "disrupt or else be disrupted" in a world of ceaseless innovation is drummed into students. Third, little is discussed with students about AI has a scaling problem - it faces ecological constraints due to being an energy and water guzzler. Fourthly, business schools largely fail to create awareness that AI has essentially become a project of platform capitalism (techfeudalism) and that the last extraction zone it is being applied to is the Military Industrial Complex (MIC), in furtherance of the Permanent War Economy.

In summary, the narrative in this paper is that the world economy and the economies of the West cannot continue to grow as in the past and that the gradual diminishing of economic growth has been on the cards since the 1970s. This is reflected in declining innovation and scientific productivity. As such, the extraction zone that all capitalist firms require for continued profits, lest they collapse, has been continually shrinking. The digital economy, which provided a small respite from the Great Stagnation in the 1990s and early 2000s,

has been taken over by an oligopolistic elite. Most of the value extracted - the digital economy and internet- are over-commercialized and face many falling quality problems, such as an oligopolistic over-exploited market in time shows. To this has to be added the growth constraints from energy, which has been structurally becoming more expensive, and the need to limit fossil fuel consumption given that it emits significant amounts of greenhouse gases (GHGs). In this context, AI emerged when the digital economy was already well on its way to decline, and the economies of the West were more and more being propped up by massive printing of money and issuing of debt (financialization).

Hence, AI was offered as a new hope - a new extraction zone - to boost economic growth and firm profits. It became one of the most hyped technologies of all time. However, now, as it seems most of the advances and value have been squeezed from this extraction zone, and even some AI backlash is setting in, there remains one area where the oligopolistic digital platforms - the Silicon Valley tech companies - see the potential for profit extraction remaining: the Military Industrial Complex (MIC). This paper described how Silicon Valley and the MIC have increasingly been collaborating and how, in the process, current war zones - in Gaza and Ukraine - have become AI War Labs.

Both the Internet and AI were greeted with great optimism when they started to be commercially used in the 1990s and 2010, respectively. However, neither has fully lived up to its promise. This is not because the technology is inherently flawed but because of the capture of the digital economy by a few dominant firms that continue to build moats around their sphere of extraction, stifling competition and innovation and abusing their oligopolistic power. Varoufakis (2021) labels this *Technofeudalism*, pointing out that "*Today, the global economy is powered by the constant generation of central bank money, not by private profit. Meanwhile, value extraction has increasingly shifted away from markets and onto digital platforms, like Facebook and Amazon, which no longer operate like oligopolistic firms, but rather like private fiefdoms or estates.*"

Business schools do well to teach their students advanced data science, including the techniques of modern AI and the ethical principles that should be applied in its use. This is however not enough. Within the bigger picture as sketched in this paper, AI is a much more modest product and service than it is mostly portrayed at business schools and in the media, but moreover a product which, although it does not pose an existential threat, can be used by the wrong agents and firms to help perpetuate a digital dystopia. Properly governing AI requires a good understanding of this big picture, which includes as discussed here, a deep knowledge of the relation between energy-ecology and the growth spiral to which modern capitalism is committed. These perspectives are necessary if current and future business leaders are to save the digital revolution - if it is not too late. In this, as Foster and McChesney (2014) argued, the "*digital revolution must be demilitarized and subjected to democratic values and governance, with all that entails. There is no other way.*" This may even entail, among other things, as Heinberg (2024) advised, that it is perhaps if we bid AI "a quick farewell."

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