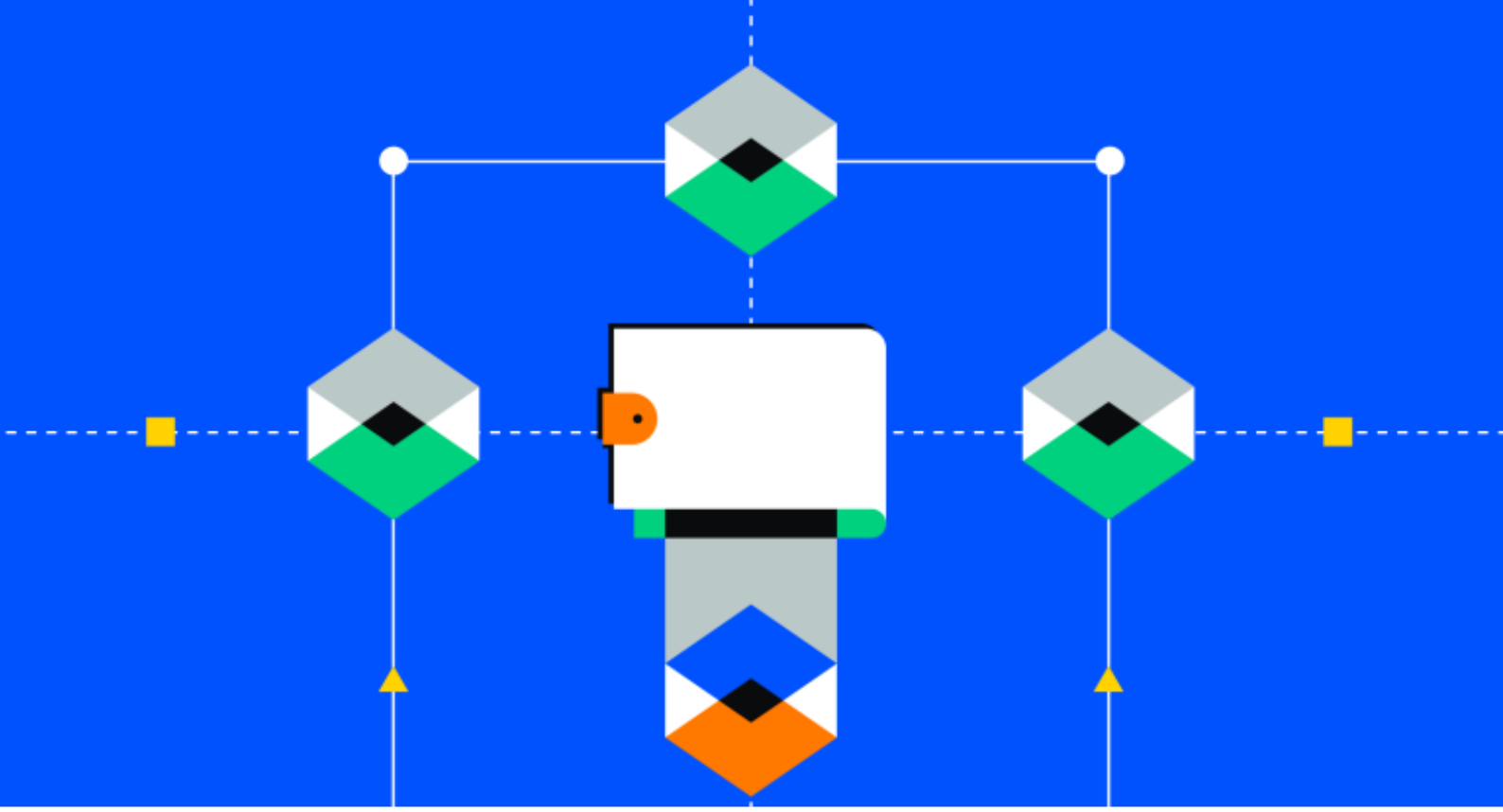

Australia's Digital Economy

Why Web3 Innovation Requires Institutional Reform

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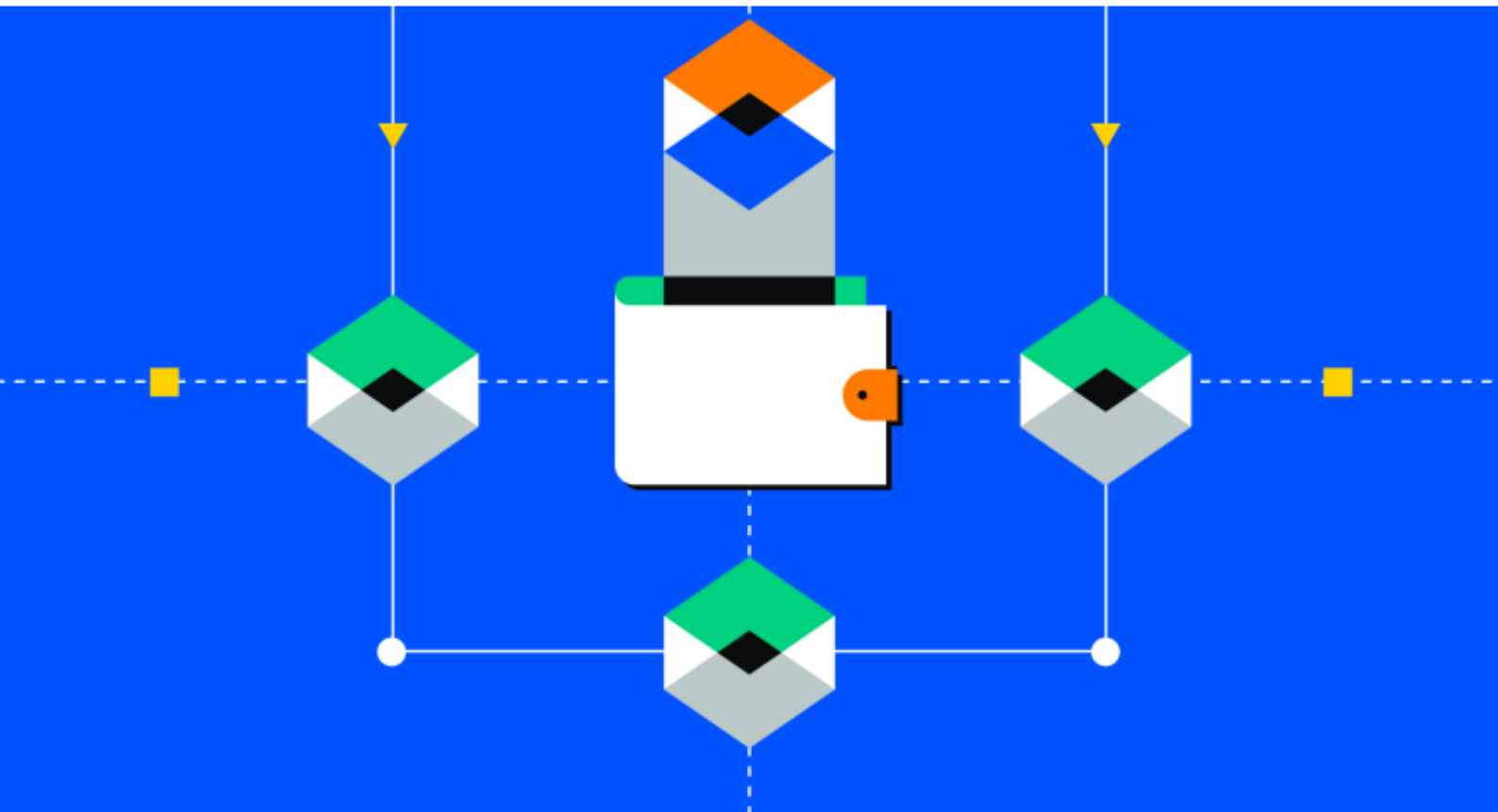

Australia's Digital Economy

– Why Web3 Innovation Requires Institutional Reform –

By Chris Berg, Sinclair Davidson, Cesare Fracassi , and Jason Potts*

September 2022

Digital technologies bring new opportunities to all economies. Yet the particular shape of these opportunities depends upon the specific industrial structure and institutional configuration of each economy. This report asks what specific opportunities web3 digital technologies brings to Australia, a well-educated, highly urbanised, prosperous and stable, property-owning democracy with a relatively small but highly open economy that is dominated by export-focused primary industries. The main benefits to Australia of web3 technology innovation will come from the mainstream creation and adoption of digital assets ('tokenisation'). These will greatly facilitate efficiencies and productivity in trade, capital and financial infrastructure, but will bring innovation at the convergence of fintech, tradetech and regtech. These opportunities will deepen Australia's competitiveness in primary goods and education and develop a new export industry in digital trade infrastructure (providing, e.g. provenance and certification, plus financial and regulatory services). To realise this opportunity, Australia needs deep institutional self-evaluation and analysis of the type successfully undertaken when well-focused political will sought to deliberately adapt Australia's economic institutions and regulatory environment to the effects of deep technological change on key sectors. We ask here - what would a Campbell report on the financial system or Hilmer Report on competition policy look like if done now for Australia's digital economy?

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Keywords: Web3, Australia, Innovation, Regulation

* Fracassi: Coinbase Institute, and University of Texas at Austin, USA. Berg, Davidson, and Potts: RMIT Blockchain Innovation Hub, Digital3, RMIT University, Australia. This report has been prepared by a team of university affiliated economists, with a range of economic specialisations including cryptoeconomics, financial economics, economic history, economics of innovation and growth, trade theory, institutional economics and microeconomic theory. The views and opinions expressed herein are those of the authors and do not necessarily reflect the views of Coinbase or its employees and summarizes information and articles with respect to cryptocurrencies or related topics that the author believes may be of interest.

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Executive Summary

A super-cluster of advanced digital technologies has arrived in the past few decades that is disrupting the economic infrastructure of industrial nation state economies and rebuilding the base-layer infrastructure for a digital economy with internet-native ("web3") institutions for money and payments systems, asset registries and exchanges, finance and contracting, and so on. These new business administration technologies, which include cryptocurrencies, smart contracts and digital signatures (a.k.a blockchain), are highly complementary with other types of digital business automation, including cloud and big data analytics, machine learning, internet of things, hardware automation and low latency communication networks.

The arrival of this new stack of institutional technologies, which accelerates the transition to a digital economy, is a global phenomenon. Nevertheless, it presents specific challenges for a small, open, trading economy such as Australia, with a comparative advantage in primary goods exports (and education), and a range of domestic institutions geared to that export profile. Australia has a strong and credible history of deep institutional reform in response to fundamental technology driven changes that present new and sometimes sector-specific opportunities. The 1981 Campbell committee report (and the 1996 Wallis Inquiry and 2014 Murray Inquiry) set up and carried forward major reform of Australia's financial system. The 1993 Hilmer report investigated and drove much needed reform in Australia's approach to competition law. These deep and considered reforms brought long periods of prosperity to Australia. Australia needs to do the same for web3 and blockchain technologies.

The argument for reform however needs to be made carefully so that it is properly targeted. At first sight, this super-cluster of digital technology innovation would seem to require focus on institutional reform of the technology sector or advanced industry, but we will explain why that is not the correct focus. Instead, our argument is that web3 will largely disrupt the opportunities for Australia's primary goods export sector (i.e. minerals and agriculture, along with education) because of the impact on trade infrastructure. We further argue that the domestic gains will accrue via the impact of platform innovations on digital assets and exchanges for Australia's financial services and property sector. New digital web3 technologies will amplify Australia's comparative advantage in a range of globally competitive export industries, but it also opens up a new export industry in trade-tech owing to the country's position at the origin of many global supply chains. Australia is once again the 'lucky country'.

This report presents this as a strategic opportunity for Australia that arises due to Australia's particular institutional and export profile and institutional history, but also due to the way in which this super-cluster of web3 technologies is promulgating a broader global evolutionary transition in the way in which order and security is supplied to economies. As digital technologies and blockchain provide digital representation and control to more commodities and capital assets, encryp-

tion and cyber-security in trade platforms is increasingly the basis of economic order and value that is built upon that.

This report seeks to make the case for why web3 technologies are a significant economic disruption and opportunity. We make this argument at the level of a global technological innovation, and at the level of why this presents a unique opportunity for Australia due to its specific economic structure and institutional trajectory. We conclude with some broad headings for a prospective Australian digital economy reform committee report. We do this to help form expectations about the possible benefits of such a committee report, and also to indicate the terms of reference it should propose. Our proposals cover: privacy policy, labour market policy, welfare policy, competition policy, tax reform, superannuation policy and government operations.

We offer two action items: First, for Australia to continue down the path set out in the Bragg report. Second, for the government to set up a permanent taskforce to advise on policy changes that will be necessary to facilitate Australian adoption and participation within the digital economy.

I. Introduction

It is a common and widely understood lesson of history that technological revolutions (e.g. steel, railways, electricity, aircraft, petrochemicals, computers) drive deep and significant change in the industrial organisation of an economy. As Joseph Schumpeter long ago explained, economic growth and development is an evolutionary process (Schumpeter (1942)).

But history also teaches that full realisation of these innovation opportunities usually requires some degree of institutional reform.[1] A key strategic role for economic policy is to recognise the opportunities that innovative new technologies bring, and to facilitate the institutional adaptations to realise those opportunities.

The epochal innovation trajectory bearing down on the Australian economy right now is the supercluster of web3 digital technologies which include cryptocurrencies, smart contracts and digital assets, and is collectively called blockchain. These are still new and experimental technologies, and highly complementary with other rapidly advancing digital business technologies including cloud and big data analytics, artificial intelligence and machine learning, virtual and augmented reality (a.k.a. metaverse) and internet of things (digital sensors).

Yet while starting to get adoption in real economic use cases across a number of industries, many of the challenges and uncertainties are not just technical, but from the disruption to existing business models and fit with existing regulatory frameworks and institutional context. The need for institutional reform due to profound economic disruption brought by new digital technologies is paramount (Spence (2021), Haskel and Westlake (2022), Srinivasan (2022)).

The purpose of this report is to examine how these new web3 technologies are

[1] On industrial innovation and its historical economic consequences, see Freeman and Soete (1995)

likely to impact sectors in the Australian economy, and to review and analyse the types of institutional reform that might be needed. We offer a framework for understanding both the immediate and longer term impacts through a focused consideration of the specific industrial and institutional configurations of the Australian economy.

Our purpose is not to advance specific line-by-line regulatory or legislative policy recommendations. Rather, our intent is more high-level, strategic and directional. We believe that web3 technologies - blockchain-based, decentralized, and crypto-enabled- and the broader set of digital economic infrastructure and tools more generally represent a generational opportunity for Australia.

To capture that opportunity will require deep institutional reform focusing on a number of key sectors. The purpose of this report is to begin to make the case for that reform, and to propose a particular vehicle by which to advance it.

A. Content and outcomes

This report delivers both an economic analysis and diagnosis, and some recommendations for political action. Our economic analysis is high-level and intended as a diagnostic of the effects of a new class of technology on the Australian economy, in order to illustrate the ways in which the arrival of new digital technologies are of deep significance for Australia.[2] We conclude with a proposal to initiate a process that will guide the sorts of institutional reforms needed for adaptation to the challenges and opportunities of a digital economy.

When Australia has faced similar challenges in the past, which is to say when profound and deep technological change was driving structural change in key sectors of the economy, the previous institutional response has been to instigate serious, high-quality, far-reaching and ultimately impactful reports by the civil service to galvanise political action to the great benefit of the Australian economy. The 1979 Campbell Report on the Australian financial system and the 1993 Hilmer Report on competition policy are prime instances of this fine Australian tradition.

Australia needs to do the same again, but for the digital economy. This report endeavours to set out why that broadly should be done, what that might look like, and with what prospective consequences.

[2]See the 2021/2022 Prime Minister and Cabinet report, under the then Coalition government, published the report Australia's Digital Economy. In 2009, under the Labor government, the Commonwealth Department of Broadband, Communications and the Digital Economy published the first comprehensive report on Australia's Digital Economy: Future Directions. The Australian Bureau of statistics (the ABS) produces a standard methodology and regular reports measuring digital activity in the Australian economy (which is an index of Australia's digital economy) `https://www.abs.gov.au/statistics/research/measuring-digital-activities-australian-economy`. There have also been numerous private reports tracking the development of Australia's digital economy, for instance Deloitte's Australia's Digital Pulse survey, yearly since 2015. `https://www2.deloitte.com/au/en/pages/economics/articles/australias-digital-pulse.html`

II. The evolution of digital economies

New technologies reshape economies and the scale and scope of that reshaping will be a function of the novelty and power of each technological innovation. Indeed, in the long run technological change is by far the main driver of economic growth and transformation.[3] This report will examine the impact of web3 technologies on the Australian economy.

We start with a simple analysis of how a new regime of technological innovation - namely cryptocurrencies and blockchain - affects a modern economy in general. But the fundamental purpose of this report is to trace those basic insights into their implications for the Australian economy, given its historical trajectory of specific industrial development and institutional characteristics.

A. New technologies and their economic consequences

There are two basic types of innovation: industrial innovation (i.e. change in industrial technologies) and institutional innovation (i.e. change in institutional technologies).[4] Most new technologies, even general purpose technologies such as electric motors, lasers, or industrial chemicals, have economic value because they transform particular markets or sectors (i.e. the sorts of innovation that makes a product better, faster, or cheaper). This is industrial innovation and it is by far the most common type of technological change.

But sometimes new technologies revolutionise how economic activity is organised and coordinated, such as legal or organisational technologies like the joint stock company, or the factory system, or common standards for timekeeping (i.e. clocks), which made possible schedules and workdays, or technologies for administrative recordkeeping, which made possible financial accounting, which made possible capital markets, or technologies such as money. These are institutional technologies, and while far less common as innovations, due to the much greater adoption and coordination problem they must overcome to be put to use, their impact can be epochal, defining entire new economic eras.

Our starting argument is that digital technologies have started out as an industrial technology (ICT) but they have evolved into an institutional technology (web3). Specifically, digital technologies began early in the 20th century as an information and communication technology, performing the service of computation, as the result of a series of industrial innovation trajectories starting with electricity, information theory, transistors, integrated circuits, telecommunications, network computing (web1), through to the mobile and social internet (web2).

The 'first turning' of the digital economy revolution was installing electronic communication networks between everyone and embedding computers in most things. That was the industrial phase of the digital revolution. Now, a 'second turning' – the institutional phase – in which digital goes deep into the elements

[3] On the foundations of the theory of economic growth, see Solow (1956).

[4] On "institutional technologies", see Davidson, de Filippi and Potts (2018) and Allen et al. (2020).

of economic infrastructure, as natively digital money and markets, smart contracts, digital asset and identity registries, digital platforms, and soon digital organisations.

This second turning is associated with an ascendant supercluster of digital technologies – cloud, crypto, ML/AI, VR/AR/metaverse, 5G, IoT – which is currently fomenting an economic revolution that will define the coming decades. This second-turning, this third generation of the internet (web3), brings digital automation to economic infrastructure and institutions.[5] It enables native internet money, native digital identity, digital smart contracts, decentralised finance and internet native composable tools for economic coordination and organisation, and which potentially works at global scale.

But this new institutional technology didn't appear from nowhere. It is a long convergence in industrial technological innovation in computing and network technology, database engineering, mechanism design, and cryptography. It is the product of decades of insight and experimentation to create truly decentralised digital money (i.e. digital scarcity, and from that, distributed state machines). What changed was that several long standing problems (key distribution, distributed consensus, digital signatures, economic incentives against attack, among others) were solved in a way that enabled distributed digital money to finally work. The result was Bitcoin, the world's first cryptocurrency (Nakomoto (2008)), built on the Bitcoin blockchain. The extension of this technology to smart contracts, and everything that could be built with that (DeFi, NFTs, DAOs), soon followed.

B. Origin of digital economy concept

Yet the concept of a 'digital economy' predates blockchain by many decades. Rather, it emerged as an application of the expected effect of advanced industrial innovation trajectories associated with computing and telecommunications networks, or Information and Communications Technologies (ICT).

The broad concept of a 'digital economy' emerged in the 1990s from a series of leading consultancy and think tank reports (especially by McKinsey) that sought to outline the strategic implications of the new information economy for business (or what was then newly called e-business and e-commerce), with a focus on the capabilities and opportunities as well as the new types of intangible assets (especially intellectual property) and open and creative modes of production.[6] Digital economy thus overlaps with information economy, knowledge economy, intangible economy, creative economy, data economy, and other such rubrics.

[5]Web3 is the moniker for the 'third generation of the internet': after 'first generation', which is digital communication (e.g. ICT, www, email), 'second generation' is the social internet (e.g. Google, Facebook, Twitter), and third generation, synonymous with blockchain and cryptocurrencies, is 'internet of value'. Web1 is sometimes described as 'read-only', web2 is 'read-write' and web3 is 'read-write-own' (Voshmgir (2021))

[6]Digital economy was named by Tapscott (1995), in a book of that title, but its intellectual legitimacy traces to MIT MediaLab's Nicolas Negroponte on the difference between an economy made of atoms vs made of bits.

Digital economy strategy is now a major part of modern business consulting (Adner, Puranam and Zhu (2010), Brynjolfsson and McElheran (2017)).

These ideas were picked-up and further developed by a range of international economic agencies (e.g. UN, WB, UNCTAD, OECD) who were concerned with the implications for public policy, particularly with respect to industry and innovation policy, economic regulation and the types of public goods and new economic infrastructure that would be required. [7]

In the 1990s, the US (under the Clinton Administration) advanced a range of significant regulatory and legislative reforms - The Framework for Global Electronic Commerce - that ushered in the modern commercial internet, a framework subsequently copied around the world, and was precursor to the dot-com boom of the early 2000s and the ascendency of web2 businesses in late 2000s/ early 2010s.

However, these web1 and web2 concepts of a digital economy were essentially conceptualised as the outcome of an advanced industrial technology, an information and communication technology (ICT), that corresponded to a new industrial sector. For instance, in 2013, the Australian Law Reform Commission, citing a 2009 Government Report titled Australia's Digital Economy, defined the digital economy as follows: [8]

> The global network of economic and social activities that are enabled by information and communications technologies, such as the internet, mobile and sensor networks. This includes conducting communications, financial transactions, education, entertainment and business using computers, phones and other devices.

The idea that there was a burgeoning new type of economy led to dedicated efforts to measure these changes and map its size and distribution. How to do this? One way was to identify input measures, e.g. of investment in digital capital, or number of digital jobs (i.e. the 'digital workforce' or 'digital skills'). Another way focused on the output side, as the amount of value created (i.e. size of digital markets[9]). This sectoral mapping and aggregate measuring approach supported a new type of industry policy for the digital economy that integrated education policy, technology policy, innovation policy, competition policy, and new ICT infrastructure. This was everywhere politically popular, as it signalled economic revitalisation, particularly in moribound sectors or regions, and new sources of jobs (new high tech jobs!) and economic growth and development. The digital economy was future-coded.

Economic theory also developed a significant body of literature that emerged from microeconomic theory and industrial organisation to better understand markets for information goods (non-rivalrous goods, with zero marginal cost), com-

[7] https://www.oecd.org/digital/ieconomy/

[8] The Australian Law Reform Commission (2013) https://www.alrc.gov.au/publication/copyright-and-the-digital-economy-dp-79/3-policy-context-of-the-inquiry/the-concept-of-the-digital-economy/

[9] In Australia, see https://www.abs.gov.au/websitedbs/d3310114.nsf/home/abs+chief+economist+-+full+paper+of+measuring+digital+activities+in+the+australian+economy

petition in these markets, and new types of markets like multi-sided markets or platforms, which usually had zero price goods (Shapiro and Varian (2000) and Gawer (2009)). In the late 1980s, Malone, Yates and Benjamin (1987) proposed the 'electronic markets hypothesis', which advanced the idea ICT lowered communication costs, which favoured market coordination over hierarchies for economic organisation. The simple economics of digital is well-surveyed in Goldfarb and Tucker (2019), who point to five broader cost savings of a digital economy:

> Advances in digital technology lead to 'reduction in five distinct economic costs associated with digital economic activity: search costs, replication costs, transportation costs, tracking costs, and verification costs.

This cost centred approach is useful to understand the origin of value creation that comes from the adoption of this new technology. New digital technologies drive down costs, which lower prices, increase demand, increase substitution with old capital, which further drives productivity and competition. This is the standard Adam Smith/ Joseph Schumpeter model of economic evolution as the outcome of technological competition in a market economy.

But as Malone, Yates and Benjamin (1987) pointed out, some of those costs occur at the margin of different forms of organisation (markets vs hierarchies, or firms). This is the sense in which adoption of digital technologies does not only drive economic growth but also causes fundamental structural changes in the economic coordination (i.e. the set of economic institutions) and so is usefully thought of as institutional technology.

C. Digital economy revolution, or the 'full stack' digital economy

We can elaborate this insight to a stronger form of the digital economy thesis that goes beyond the rise of a new industrial sector (or a new part of the economy), to conceptualise a new type of economy that is digital not only in the industrial components but also, additionally, in the deeper institutional components. [10]

This is the interpretation of the economic significance of web3, namely that web2 is the industrial conception of a digital economy, but web3 is the full-stack institutional conception of a digital economy. This new web3 conception of a digital economy is that it is, in effect, digital 'all the way down'. To borrow from software engineering the idea of a 'full stack developer', we call this a 'full stack' digital economy. Web3 is the revolutionary meaning of a true digital economy, marking a profound and disruptive shift (i.e. a revolution) from an industrial to a digital economy. In this account, web2 is the penultimate phase of an industrial economy (i.e. industrial economy infrastructure running digital economy services), before the first phase of a true digital economy (i.e. digital economic institutions and infrastructure all the way down).

[10]The theory of a 'full stack digital economy' - called institutional cryptoeconomics - is set out in Berg, Davidson and Potts (2019).

The core economic theory of a full-stack digital economy is set out in Berg, Davidson and Potts (2019), and which is centred about the implications of decentralized blockchain technology enabling the industrialisation of trust. With significantly lowered costs of trust (trust in establishing common knowledge, promises, agreements) the scale and scope of peer-to-peer economic coordination can significantly expand. The different layers of the stack correspond to different layers of operationalised trust, e.g. in consensus, security, data availability, identity management and permissioning, property rights transfer, and so on, as shown in figure 1.

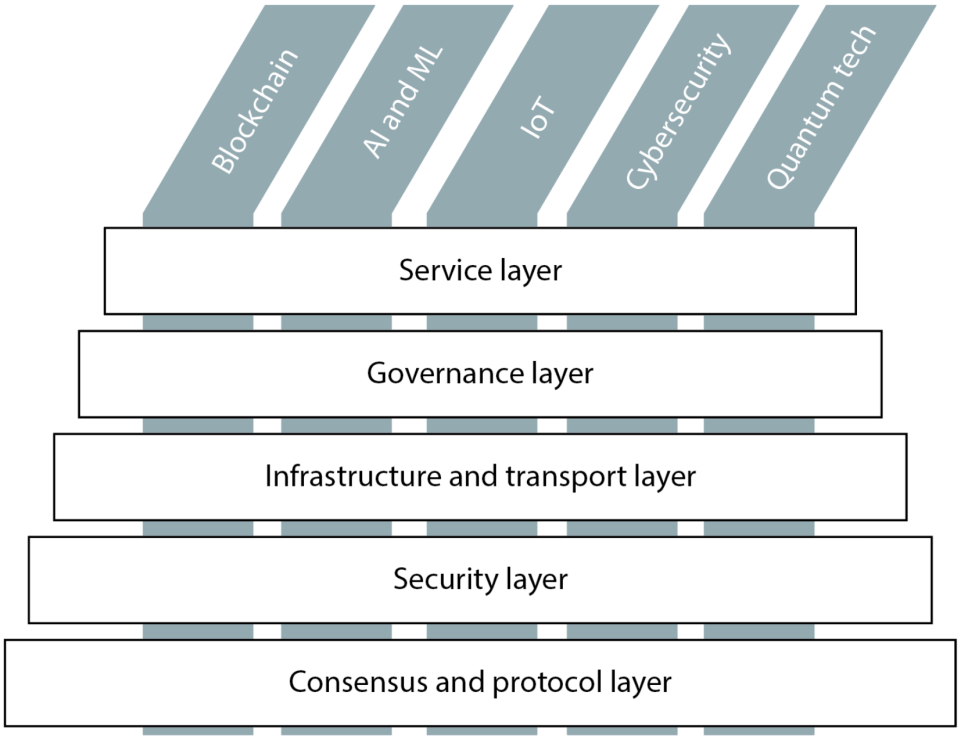

FIGURE 1. THE DIGITAL TECH STACK

D. Summary - What digital does

The technological infrastructure of a digital economy broadly corresponds to the complex global commercial ecology of networked computers, and all of the activity that economic infrastructure and capital makes possible. This was the result of decades of deep and fundamental innovation and investment.

Digital capital is often intangible and non-rivalrous, giving it peculiar economic properties. But digital is also a lingua franca: protocol standards permitting, anything digital can interact with anything else digital. The universal composability by which digital tools can be assembled has profound economic significance. Digital adoption drives costs down by enabling efficient use, and reuse, of digital capital. But it has more disruptive significance too, in massively increasing the design space of economies at all different scales. This is the prospect of bringing much of the physical, offline 'economy of atoms' in Negroponte's phrase, into the world of 'bits'.

In web3, this process is called tokenisation. It enables crypto and smart contracts to give digital representation to some, soon perhaps to much, and eventually maybe to all the components of an economy. When that happens, economic coordination can be intermediated through digital technologies, and take advantage of the affordances those technologies bring in terms of speed, low cost, global scale, and most importantly lowered cost of trust.

These are the general impacts that digital technologies, and web3 institutional technologies in particular, will bring, and indeed are already delivering right now. But each nation state economy is different, with different industrial characteristics as a consequence of its specific path of historical development and the resources it was initially endowed with, and the economic resources and capabilities it has subsequently developed. In the next section we consider the particular impact of web3 technologies on Australia.

III. The digital economy and Australia's productivity challenge

Australia is a small, trade-exposed, relatively open developed economy with a relatively high standard of living and stable democratic political system. It is a small and open economy insofar as it is affected by global macroeconomic policies and outcomes, yet its own policies have no (or little) impact on the global macroeconomy (Nimark (2009)). Australia's exposure to global macroeconomic shocks has been a consistent feature of its economy since the Depression of the 1840s was caused by a monetary crisis in Britain (Dyster, Meredith and Jackson (1993)), and has continued through the Global Financial Crisis where the Australian economy was exposed to both the American economy and supported by the Chinese economy (Makin reference here). Australia's 'tyranny of distance' (Blainey (1967)) has done little to buttress its economy from global macroeconomic waters.

This openness has provided Australia with a deep capital base to fund and sustain its resource-intensive economy. Since European settlement Australia's national wealth has been derived from primary industries due to natural resource abundance (McClean (2013)). Australia is similar to New Zealand, Canada, and Chile, for instance, which are also major primary goods exporters with world-class firms driving that development in an economy geared toward openness. While manufacturing and industry has played a part of Australian economic development - and a critical political role in the long-running debate between free trade

and protectionism - Australia is not an advanced industrial economy, but rather an advanced market economy.

Australia is a relatively rich country. It is highly urbanised and educated, with high quality institutions, a competent civil service, strong levels of political stability, a relatively open regulatory environment and low corruption. As a resource-focused economy, Australia exists at the origins of many supply chains. While Australian resource extraction relies on advanced manufactured goods supplied by countries such as South Korea, Japan, Germany, and the United States, its position as originator of critical minerals such as iron ore and high quality food products such as wheat and beef gives it a role in global trade disproportionate to the size of its economy. One illustration of this is Australia's globally competitive transport and logistics sector – with companies such as Brambles, Toll and Qantas. Another key sector for the Australian economy is education. Education and education-related services is Australia's fourth largest export sector after iron ore, coal, and natural gas. This export-quality education provides an opportunity for the small but competitive tech sector – particularly in the web3 space – to make a mark on the global technology ecosystem.

Australia is also characterised by a well-developed and supported financial sector, including deep and liquid stock markets, to service the capital-intensive export sector. An important driver and determinant of the shape of Australian finance is the compulsory superannuation policy, introduced in 1992, through which a fraction of the wages of each Australian employee are invested in a pension account only accessible at retirement age. Compulsory superannuation makes every employed Australian a participant, indirectly, in Australian financial markets.

In consequence, much of Australia's business services, including finance, insurance, accounting, law, as well as logistics and trade infrastructure, are heavily geared to servicing the local industry for scale and export. Australia has world-leading globally-dominant mining and minerals firms, but not financial firms (nor is Sydney or Melbourne, for instance, competitive with global financial centres such as London or Singapore). But Australia's financial firms and infrastructure are at a scale that reflects the globally competitive primary industries firms they support. And in turn this means that Australia has developed in order to service its domestic export industry high-quality, deep and liquid banking and financial infrastructure, and administrative services.

Australians are, for the most part, but for a considerable historical period, an asset-owning citizenry. That's part of our national culture, but it's also very pointedly part of Austalia's political culture. And that in turn means there is a high level of retail political concern with and attention to the institutional quality of this financial and administrative infrastructure. This attention is certainly good economic stewardship to support Australia's powerful primary export industries. But it is also smart retail politics that recognises that the same infrastructure that supports Australia's major corporate organisations and export industries (and therefore jobs and capital investment), also greatly benefits Australian citizens

in their significant capital holdings, both as real estate and other financial asset holdings. A similar but parallel argument also holds for Australia's third largest export industry, namely higher education, which is similarly globally competitive and disproportionately oversized, and also benefits Australian citizens by giving them access to quality institutions disproportionate to our population size.

These particular industries, each of which is outsized in Australia, all rely on high-quality asset registries and administration (i.e identity, exchanges, courts). Quality has several dimensions, from the legibility and legitimacy of titling and contracting systems, to the level of counterparty trust and transparency in dealings, to efficacy in processing. The digitisation of this infrastructure and process has the specific opportunity of taking a good system and improving the scale at which it can operate and the types of innovation that can be built on top.

It is worth noting that this is a different argument from digital economic infrastructure enabling weak/underdeveloped or corrupt and broken economic infrastructure, which is a common cause of poor economic development, to be leapfrogged. The opportunity web3 brings Australia is to build on its strengths, i.e. institutional quality, an institutional capacity that has previously only serviced its domestic economy (in support of export), rather than being a direct export itself. Now that could change. Indeed, this is the opportunity for Australia to build on its current strengths a new export sector in advanced economic infrastructure, which further powers (turns the flywheel) of primary goods and education exports.

Australia's relative prosperity, however, obscures some substantial weaknesses in its economy. The most pressing is the long run slowdown in productivity, most recently explored by the Productivity Commission (Report (2022)) as part of its five year productivity review. While more Australians are in employment and are recording longer working hours, labour productivity growth - that is, what workers produce for any given labour input - has been in long term decline. Labour productivity growth is at the lowest rate since the 1970s. The Productivity Commission notes that had Australia maintained its previous productivity growth at the 60 year average, Australian incomes in 2020 would be $4,200 higher than they are.

This productivity slowdown is not limited to Australia - it is a general trend affecting all developed economies. However, it has implications that Australians and Australian policymakers need to be particularly aware of. First, it appears to coincide with a slowdown in globalisation and trade openness. The contribution of trade to Australia's GDP is lower than the OECD average (Guttman and Richards (2006)), a gap which has been diverging since the early 2000s. The KOF Globalisation Index, which measures globalisation across a range of dimensions including economic, social and political, shows the globalisation of the Australian economy steadily increasing from the 1970s until approximately the Global Financial Crisis then remaining steady. While the COVID-19 pandemic and Australia's border closures are likely to have been a unique event, the corresponding discon-

nection of parts of the Australian economy from the world economy have no doubt exacerbated this trend.

Second, the slowdown in productivity has been accompanied by indicators of slowing dynamism in the Australian economy. Innovation driven by disruptive entrepreneurship is a core driver of productivity and as a consequence economic growth, but here Australia is falling behind. Bakhtiari (2019) finds the period of 2002-2015 was characterised by a decline in entrepreneurial entry: "Fewer entrepreneurs are entering, and those that enter are increasingly likely to fail and exit." Andrews and Hansell (2021) find that labour reallocation - that is, the movement of workers from low- to high-productivity firms - has slowed down since the turn of the century, and that this slowdown is most notable since the global financial crisis.

One of the reasons for this productivity slowdown is that while Australia has a long history of economic reform, recent decades have seen a significant slowdown in reform. The 'Australian settlement' (Kelly (1992)) at the start of the twentieth century established a consensus position in Australian political economy around the twin pillars of protectionism and limited (that is, British) immigration.

Among the features of the Australian settlement were substantial government support in manufacturing industries, such as the automotive sector, through tariffs and subsidies, as well as a regulatory regime that limited the efficiency of the financial sector. Financial 'repression' created an oligopolistic and stagnant Australian financial system that was highly dependent on foreign capital in the absence of a thriving domestic system. Among the strict constraints placed on domestic banks, a range of alternative institutions evolved to provide credit to consumers (building societies, credit unions and hire purchase firms) that pushed the limits of the regulatory system.

The result of this regulatory contest was a broad-based reform agenda that began with an investigation of the capital markets and financial sector under the Fraser government (the Campbell Committee, which reported in 1981), but extended for nearly two decades until the Howard government's introduction of the goods and services tax. This reform movement was sparked by the 1983 floating of the Australian dollar, and the subsequent opening of the Australian markets to foreign banks, but encompassed labour market reform, tariff reductions, privatisation of major assets (including Qantas, Telecom and the Commonwealth Bank), a large scale reform of competition policy (the Hilmer report in 1993), and the restructuring of federal-state relations towards greater mutual recognition and regulatory consistency. Critically, support for the reforms came from both sides of the parliament. It is this reform which laid the foundations for Australia's recent economic performance and prosperity.

Thus it is not a surprise that the reduced energy towards economic reform has coincided with the productivity growth slowdown. There remain significant parts of the economy that are over-regulated. More importantly, however, the full implications of the digital transformation have not been reckoned with by policy-

makers. The reforms of the 1980s and 1990s were a necessity because of structural changes within regulated industries – and global macroeconomic conditions – that forced Australian governments to act. Less regulated building societies started to attract significant capital and soon came to dominate the home loan market, leading Australia's central bankers to fear that their monetary instruments would lose efficacy.

We are in a parallel situation now. Even as Australian economic strength is characterised by resource extraction it can be integrated with the digital economy, insofar as the 'traditional' resource industries are highly reliant on digital technology to manage data and information, coordinate economic production and exchange, to manage supply chains, to bring together workforces. Both the financial sector and education sector which underpins the resources industry are even more highly digitised. Every sector across the economy has been fundamentally reshaped over the last two decades by digital transformation. It is striking that the last major event of the economic reform movement – the goods and services tax – has had to be adjusted in an ad hoc manner to the existence of digital goods and services and to the explosion in cross-border retail imports.

The Australian regulatory framework has not adjusted well to the digital economy. Reform has been partial and inconsistent, and not addressed to the fundamental challenges thrown up by digital transformation. For example, the Australian Competition & Consumer Commission's Digital Platforms Inquiry focused not on broad based sectoral reform but a couple of major network businesses (specifically Google and Facebook). The need for holistic reform that takes into account not just the last two decades of digital transformation but also the future of the digital economy – that which is underpinned by not just communications technologies but technologies of trust, coordination, and property – is highly evident.

Web3 technology lowers the cost of trust along with a range of information processing costs. These digital innovations lower the costs of economic transactions and coordination - i.e. they are institutional technologies - which brings greater efficiencies and productivity to economic interactions, and facilitates innovation in administrative economic infrastructure (i.e. payments, recordkeeping, updating records of state, such as ownership, promises and agreements, i.e. contracts).

For example, a key question for Australian business and policy investment in new technology is the balance between innovation and adoption, or the 'make or buy?' decision. This also corresponds to what might be called the 'digital infrastructure trade balance', which is the extent to whether trade infrastructure is an import or an export industry.

In an industrial economy, this question barely makes sense, because trade infrastructure, including ports and transport networks for moving goods to banking and forex markets for settling contracts, etc, were all domestic production for the export of the good or service, i.e. an enabling capability that delivers transaction efficiency that is a source of global competitive advantage (in the specific export

sector, e.g. bulk minerals export). Australia has developed world-class logistics companies (such as Toll Ltd Pty, and Brambles Ltd Pty).

But with digital trade infrastructure, that production capability becomes a good in itself for export. Australia has built some world-class digital marketplaces for complex financial products (e.g. Synthetix, Mycelium, Maple) that service global markets directly and are not merely financial services for Australian industry. These are instances (some of which are successful unicorns) of the direction that further advances in the digital asset tokenisation will likely lead to new opportunities for the development of Australian build technology platforms for export.

Because these innovations in the base layer infrastructure of a modern economy are all in the realm of digital then they can integrate with other digital technologies, such as cloud, machine learning and internet of things, all powering a great leap in business automation, not just at the level of individual firms, but across the entire global economy.

IV. Australia's new comparative advantage

A. The coordination problem

New technologies and innovation bring what Joseph Schumpeter famously called 'gales of creative destruction' to the order of a market capitalist economy. Entrepreneur-led industrial innovation is disruptive of the activities of firms and the offerings in markets, as new consumer goods enter and displace old products, causing some firms to grow and others to shrink, and causing some wages and sources of supply to be bid up, and others to be displaced. Changes in profit guide the reallocation of resources through these innovation and technology shocks.

However, as emphasised above, web3 innovation is an 'institutional technology'. The key point of difference between institutional and industrial innovation is that institutional technologies face a much harder adoption problem because for value to be realised many different parties all need to adopt the technology together. This is a coordination problem. And it is a hard problem because there is no obvious coordination mechanism. Some of the different parties will likely be competitors, and so collusion to adopt is strategically suboptimal. Many parties will not know each other, being at different points in a value chain, and so even if they desire coordinated action, it may be difficult to organise. There are various solutions.

1) *Horizontal and vertical integration*, to bring all parties within the same organisation. But that creates new problems, including monopoly.

2) *Legislative mandate*, which amplifies the problem of knowledge - what technical standard, i.e. who decides and how - and makes fast movement unlikely.

3) *Industry-level coordination*, such as by mutual consensus and implementation through an industry association. But that assumes that the industry

exists at a level of maturity and institutionalisation to afford such organisation, which is rare in the very early stages of a radical innovative technology disruption. Indeed, industry associations are more likely to be on the other side of this creative destruction, protecting incumbents (Juma (2016)).

4) *Trusted common intermediary*, such as a technology or strategy consulting firm, or a common service provider, such as a bank, who can individually coordinate mutual adoption without the parties needing to coordinate directly (Hurder (2018)).

5) *Trusted public report*, which acts as a kind of 'Schelling point' for a synchronous individual firm and industry coordination with respect to the direction of technology adoption. This model also sends a clear credible signal with the production and delivery of a public report that each party can coordinate with respect to, but which then lays out the follow up legislative and regulatory action to sweep laggards.

Needless to say, our preference and recommendation here is for the fifth option. The advantage is that it does not foreclose any other options, but instead may actually accelerate private ordering once it becomes clear the direction that legislative and regulatory enforcement is heading. The key advantage is that it treats as a public good the discovery work in analysing the opportunity.

B. The discovery problem

In a Ricardian 'cloth-or-wine' textbook sense, a country should in order to maximise overall social welfare pursue its comparative advantage in developing its economic specialisations, and then trading for all other goods. But as Hausmann and Rodrik (2002) explained, comparative advantage rarely presents at that 2-digit SIC code level (i.e. cloth, or wine). Rather, because comparative advantage is calculated from details of particular resource availability and distributions in the world, the specific technologies and capital goods in the market, the exact matrix of prices over inputs, and the global patterns of demand, the fact of the matter is that actual comparative advantage invariably exists at higher SIC codes (e.g. brushed towelling cloth for hats, but not for pyjamas). Moreover, because these variables move around, Hausmann and Rodrik (2002)'s point was that there is also a discovery problem in comparative advantage.[11]

A similar problem arises with institutional technologies as a new source of comparative advantage. Even though the massive fall in the cost of trust points to a likely source of comparative advantage in digital trade infrastructure for an open trading economy such as Australia, that's analogous to a 2-digit SIC code answer. Which particular platform deployed at what scale with what settings,

[11] It is not always obvious where exact comparative advantage lies and there are costs in discovering that (which Hausmann and Rodrik (2002) identified as a new source of market failure connecting innovation and international trade).

under what institutional rules? Much more information is needed to identify exactly what technologies and capital deployed constitute a new comparative advantage in trade infrastructure. The actual innovation policy problem is in supporting and facilitating that discovery process, and in communicating those findings (that information) to the market.

C. New comparative advantage

The 'simple economics of digital' are focused on its impact on costs, and particularly information costs associated with search, verification and networking. Digital technologies lower a bunch of costs in production and distribution, which lowers costs to producers, facilitating enhanced productivity and competition, which then lowers costs to consumers, which drives gains through increased consumer surplus. From the microeconomic perspective, that's a compelling account of dynamics. But from an international trade perspective it tells us nothing, because that effect happens everywhere there are firms and markets and consumers.

To understand the Ricardian (i.e. Heckscher-Ohlin) and strategic trade implications, we need to integrate not only dynamics in prices and factors, but also the evolving structure of the economy and the disruptive shifts in the comparative institutional structure of global value chains.

A general analytic model is not developed here, but the basic argument can be outlined simply, with two premises:

1) The adoption of new digital technologies, including blockchain, are working to shift Australia from industrial economy to digital economy (not to a post-industrial economy) through a process of increasing digitization of its economic infrastructure, including digital asset registries, digital trade platforms, tokenised digital representation of trade goods, and so on.

2) As in all Heckscher-Ohlin trade models, when prices, factors change, so does comparative advantage. Comparative advantage therefore determines export profile. The theory of comparative advantage determines the patterns of trade and the overall structure of an economy.

Historically, Australia has a comparative advantage in primary goods, which is why we export them. We have never had a comparative advantage in manufacturing, which is why Australia has not followed the UK, US, Germany, Japan, Korea or China in climbing the standard ladder of industrialisation.

But Australia also historically lacks comparative advantage in trade services – such as shipping, insurance, finance, accounting and law (including compliance and regulation) – as these industries tend to locate in trade interchange zones – the nodes in the global trade networks, where administrative commercial activity takes place, places such as London, Chicago, New York, Shanghai, Singapore and Hong Kong. In this world, trade services in Australia are largely derivative services or branch offices.

But a digital economy will change how trade platforms work because contracting begins with the origin of supply chains (e.g. Melbourne), not at the interchange zones (e.g. Singapore). Australia's new comparative advantage can be in originating global supply chains and the verified information content and smart contracts that move together with the goods and services (this works for education exports too, which originate new skills).

The implication is that Australia's new comparative advantage is in primary goods and education exports with significant value added in what in engineering are called 'digital twins' but here we just call tokenisation (a blockchain connected digital representation of the good or service, with continually updated 'state' of information).

By this reasoning, Australia will not subsequently develop into an advanced manufacturing economy (i.e. following the path of Japan, Germany or the UK). As Australia becomes a more digital economy, we will actually export more primary goods, not fewer. But our comparative advantage will develop in trade infrastructure as an export industry.

This large scale structural shift in the global geography of business services is due to the effect of Web3 technology shifting locus points in global supply chains from interchange manufacturing hubs (Singapore, London, New York, LA, Shanghai), where goods were off-loaded for processing and manufacturing, and at which point most property transfers occurred, but instead to origins (Melbourne, Perth, Dunedin, Auckland), where information is first added to the digital twin (or NFT) of the trade goods, as shown in figure 2.

This is an evolutionary disruption ('creative destruction') of the location of business services (property transfer, verification, accounting, insurance, finance) to align with the major locus of business information in trade. In a colonial/industrial global economic order, those were the manufacturing hubs and often ports. But in a digital economy, the most efficient location for those services is at the beginning of the supply chain, rather than at the interchanges.

Australia's new comparative advantage is that lots of supply chains originate here combined with the additional factor that high-quality economic, regulatory, legal and political institutions, market data and contracts can also originate in Australia. Australia will export primary goods and trade administration and contracting platforms. This is the shape of Australia's digital economy.

D. Policy

As such, to pursue this opportunity, we have no urgent need for new industrial, innovation, technology, nor education policy. What we do need, however, is an Australian dollar stablecoin and a vigorous backburning of legislation and regulation that inhibits innovation for trade, payments, auditing and compliance infrastructure; a commission, in other words, into advanced regulation technologies (a.k.a. regtech) and digital trade platforms (a.k.a. tradetech).

As an economic vision for our collective future, over the next decade or so, a

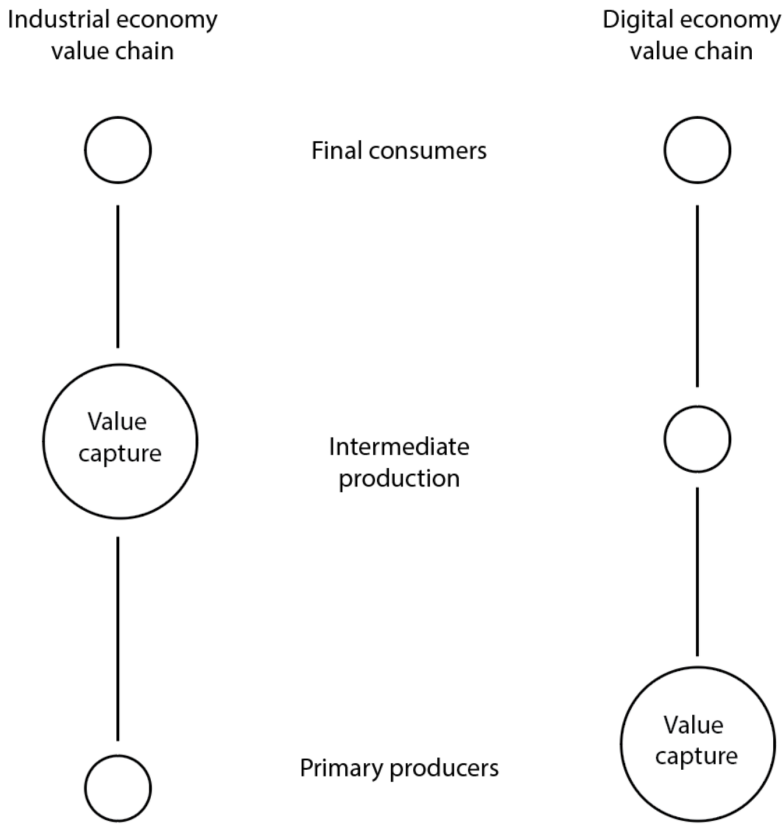

Figure 2. Value capture in an industrial and digital economy value chain

specific and clear direction emerges: Australia should not rejoin the road to industrialisation, or advanced manufacturing, or the post-industrial service economy (or Industry 4.0 as the WEF calls it). Australia's exceptionalism should continue, but under the new global trade security and trust umbrella of digital economic infrastructure.

V. Digital economies and the global trading order

The road to prosperity has traditionally been industrialisation. For most countries, at least. But Australia has been an exception; leveraging bountiful resources, good institutions, a well-educated population, and the security of Pax Britannia, then Pax Americana, into a modern global-trading economy built around high-value primary exports (McClean (2013).

Fundamentally, industrialisation is an economic process powered by technolog-

ical innovation and investment in new capital to deploy that innovation. The result is continuous economic transformation along multiple value chains (or industrial sectors) by developing and applying ever more advanced technologies. But the development of capital and investment in new knowledge (i.e. technological change and innovation) is only possible, or well incentivised, when building on an underlying framework of order and security that supplies trust. These high-quality institutional rules that secure property and provide law and order, as well as economic policy rules that govern the monetary, fiscal and trade order., are a crucial foundation for all economic growth and development.

Indeed, economic historians such as Douglass North and colleagues emphasise the critical importance of high-quality and low-cost provision of order and security of property rights, including the protection of property from appropriation and providing low cost and reliable methods for establishing ownership, contract enforcement and dispute resolution (North (1990), North and Weingast (1989), and Shleifer and Vishny (1998)). Political economists, such as Buchanan and Tullock (1962), Olson (1982) and Olson (1993) emphasise the importance of high-quality well-designed institutions in minimising the creation and capture of rents, and the value of periodic institutional disruptions to reform economic systems of accumulated privilege and rents. [12] On a time frame of centuries, we can track changes in the institutional basis of an economic order from ancient regime feudal economies (built around a kingdom), to the industrial revolution and industrial market economies (as the economic systems protected and supported by a nation state, with the bureaucratic order provided by the state), to now digital economies, with web3 technology furnishing the underlying economic administrative order. [13]

A digital economy lowers a range of significant costs for a large class of economic activity (Goldfarb and Tucker (2019)). This is the industrial model of digital. But the deeper theory of the evolution of a digital economy is the way a supercluster of web3 digital technologies offer a new way of providing security, creating and enforcing contracts, resolving disputes, facilitating governance that work to establish continuously live economic facts (i.e. 'common knowledge' of economic state). The effect of these new technologies is to structurally change the organisation and architecture of the economic system, and the way in which coordination and cooperation works to create value due to lower institutional and governance costs in coordinating economic activity.[14]

A. The benefits of a digital economy

The arrival of web3 technology greatly accelerates the worldwide evolution of the digital economy and will transform the global trading order and Australia's

[12] See also Caballero and Hammour (1991) on the 'cleansing effects of recessions'.

[13] See Williamson (2000) on four levels of institutional effect.

[14] A further benefit of digital is that it is a path to resolution of ecological problems and environmental externalities caused by industrial economies.

role in that - owing to our special place at the origin of many global supply chains.[15] Australia's comparative advantage in global trade is our position at the origin of many global supply chains. Australia is first to write the economic facts of many goods as they enter the global economy. That is the new reality we must seek to capitalise on. Web3 is a generational opportunity to further develop Australia's primary goods and education export industries with digital trade infrastructure.

The evolutionary transition from an industrial to a digital economy will continue to be a source of economic growth and productivity gains for the Australian economy in the coming decades due to general benefits that accrue from substitution toward digital capital, institutions and infrastructure. While the actual way these gains will accrue will be the result of millions of entrepreneurial actions to bring new goods to market and new business practices to organisations, along with the myriad minor and major adaptations in the economy (and in business regulation), there are nevertheless several high-level directional changes that can be elucidated. In a digital economy, some specific things will work better:

- *Common knowledge will work better.* The primary benefit of blockchains to an economy is they allow information about 'state' i.e. true social facts about identity, ownership, agreements and so on, to be observable and verifiable at very low cost and at great scale to anyone. This works with arbitrarily complex information sets. Common knowledge is expensive to create and maintain in an industrial economy, but works much better in a digital economy.

- *Trust and promises will work better.* The major consequence of common knowledge working much better is that trust and promises then work much better. This is the major source of productivity gains due to lowered costs of monitoring and verification and auditing (costs of trust), and with promises working better, then cooperation works much better at scale and scope, and especially into the future (this is the benefit that smart contracts bring).

- *Property rights will work better.* Because common knowledge, trust and promises work better, property rights work better on two margins. First, because they are cheaper and faster to identify, trade, unbundle and reconfigure - and so are a much easier to use and more flexible tool for economic coordination. Second, because they are able to be digitally represented (tokenisation), they can be attached to many more things.

- *Markets will work better.* Because property rights, trust and common knowledge work better, and because property rights attach to more things, markets now work better and go far deeper into the economy. This is a further consequence of money working better (cryptocurrencies) and being able to

[15] See Allen et al. (2019) on blockchain supply chain opportunities in the Australian context.

be easily used by machines (which can now have economic agency). Markets will also become more competitive, as open-sourced and permissionless networks drastically lower barriers to entry, and more efficient, as smart contracts and digital oracles reduce asymmetric information among market participants.

- *Local knowledge will work better.* A consequence of markets working better is that, because markets are decentralised mechanisms that make use of local knowledge (as Hayek 1945 explained), that local knowledge will be better harnessed and used by society. This development of this latent resource (local knowledge) is the digital surplus.

- *Commons will work better.* It is not just markets that work better in a digital economy, but commons - in the Elinor Ostrom (1990) sense of common pool resources with private order governance - also work better, and enable more resources to be created and used in the commons. This also includes innovation commons and digital toolkits.[16] This is a consequence of common knowledge and local knowledge both working better, combined with improved (lower cost, more accessible) tools to facilitate cooperation and coordination through smart contracts, DAOs and other blockchain affordances.

B. Peace and security

The wealth of nations always rests on the order of peace and security that is provided by the institutional order. But peace and security work differently in a digital economy compared to an industrial, or even feudal, economy. In pre-digital economies, peace and security is supplied by the central order, i.e. the Monarchical power and their army, the Empire and its network of military alliances, or by the nation state government, with its monopoly on violence and rights of total surveillance applied to its own citizens, and the mutual expectation (the social contract) of protection against outside bandits (i.e. other nation states). These arrangements require vast public expense in judicial and legislative institutions, and in standing armies and defence. But these public expenditures and the private freedoms they cost are in general worth it for the order, security and peace that they can furnish, which then becomes the foundation for safe and secure economic activity, which begets the wealth of nations.

A digital economy furnishes peace and security somewhat differently, and on different margins, by focusing directly on property and assets, and massively raising the cost of violations of property. This is sometimes described as a shift from moral code and violence enforced 'dont be evil', to software code and platform enforced 'can't be evil'.

[16]See Potts (2019) on how innovation commons work more effectively for digital common pool resources, including software and data.

Rather than constructing and enforcing complex rules for humans, a digital economy works directly at the level of digital objects and their access and permission control. This shift in the level at which source of power and control issue has a great many social, political, cultural and even philosophical consequences, but an overarching one is that it is profoundly less violent, or a more peaceful, way of producing foundational order and security over property in society.

Assets and information that are instead cryptographically protected and secured with encryption, and that are accessed and controlled, or transferred, through digital signatures, ushers in a new global regime of economic order and security of trade. The digitization of institutional infrastructure brings peer-to-peer counterparty identity, assertions, settlement, promises, conflict management, contractual enforcement in which cybersecurity provides economic security. Moreover, this is a global economic effect that will disrupt and realign a range of geopolitical arrangements, including trade treaties, intellectual property arrangements, security treaties and alliances.

C. National pathways to a digital economic future

All nation states - including Australia - will need to navigate this evolutionary transition to a 'full-stack global digital economy' in which economic order and trade security is in significant part furnished through new digital, cryptographic technologies. There are broadly two pathways forward from here:[17]

1) *Digital Nation State with Free Trade.* Each existing nation state develops its own digital and cybersecurity capabilities, transitioning its economic institutions and infrastructure to digital capabilities. Because each nation will develop different capabilities in this, there will be opportunities for trade in exporting (or importing) economic infrastructure. This can be called digital Westphalianism.

2) *Digital Commonwealth.* A second pathway is through supranational cooperation. Such a 'digital commonwealth' is made of new digital trade regions and cybersecurity alliances, built on existing trade or mutual security treaties. This pathway is more likely with powerful scale effects in digital infrastructure, e.g. from significant breakthroughs in computing powers.[18] This also applies to the deployment of AI capabilities at scale, with algorithmic decision-making using vast pooled data assets. The globally stable equilibria will likely be a duopoly, and thus most nations will need to choose a protectorate.

[17] A possible third pathway is non-territorial exit. Srinivasan (2022) outlines a range of scenarios about how this might play out, including fracturing nation states into what he calls the 'network state'. MacDonald (2019) outlines non-territorial exit from nation states with each household choosing their own jurisdiction from a range of competing offerings. In this hybrid model, physical nation state economies and digital economies are separate and coexist.

[18] For instance, through advances in quantum computing that can be used both offensively and defensively to attack and control digital assets, or to protect them through advanced encryption (Rohde et al. (2021)).

VI. Our Proposal

A. Summary

The supercluster of web3 technologies, centred around blockchain but also highly complementary with cloud and data analytics, machine learning and internet of things sensor data, is bringing a major disruption to the technologies of business transaction and trade infrastructure. In particular, many more parts of the economy will be digitally connected, greatly facilitating search, verification, contracting, settlement, payments, and automating complex business and trade services, including finance and insurance, and administrative data support, such as certification, provenance and compliance.

This macro-structural shift in economic infrastructure brought by web3 brings global disruption to the architecture of international trade. This report has argued that these general technological shifts will have specific and characteristic effects on the Australian economy, owing to its particular features and historical trajectory. These effects will impact on its patterns of specialisation and its comparative advantage. This has follow on implications for broader financial regulation and also Australian business models and capital allocation.

B. Reform proposals

The 1979 Campbell Report on the Australian financial system and the 1993 Hilmer Report on competition policy were serious endeavours to understand how new technologies were driving structural changes in key sectors of the Australian economy. What sort of institutional reform agenda might a 2022 Digital Economy Report propose?

To fully prepare Australia to benefit from the forthcoming digital economy revolution, far-reaching reform needs to occur in several areas.[19] In addition, particular effort needs to be given to transitions from an industrial style regulatory framework to a digital economy framework. The industrial revolution and the consequences of those changes unfolded over a period of years and decades. The digital revolution is unfolding far more quickly and on margins that are not always possible to anticipate.

It is our view that policy reform needs to occur in several areas and needs to occur in a coordinated whole-of-government framework that does not result in short-term unanticipated perverse outcomes.:

- *Privacy Policy* - the development of a sensible and viable digital identity that is fully portable and can be used to develop and enhance data markets where individuals have full control of their own data is necessary. In particular, the development of zero-knowledge proofs that ensure that the

[19] See also Haskel and Westlake (2022), who frame their argument about the digital economy and the urgent need for large-scale institutional reform in terms of 'intangible capital'.

government can be confident that individuals are compliant with legislation and regulation without compromising their privacy is imperative.

- *Labour market reform* - at present labour market regulation is predicated on the assumption that most workers are employed by large organisations. In a digital economy we expect that large organisations will continue to exist in the presence of supply-side economies of scale. All other large organisations will break up into smaller component units, mostly structured as decentralised autonomous organisations (DAOs). Most work arrangements will be flexible, temporary, and borderless. That means that the current large human resource overhead cost that is currently borne by large businesses will not be viable in future. Labour market policy will have to be re-focussed on the assumption that most workers will be employed by smaller organisations and/or will be self-employed.

- *Welfare policy* is currently designed on the assumption that individuals cannot access various insurance markets, either because the prices charged in those markets are too high, or that, at present, those markets do not exist. Welfare policy is predicated on the notion of market failure and missing markets. Large government bureaucracies currently exist to administer welfare policy. Furthermore, information is kept within departmental silos making 'whole of government' welfare policy difficult, if not impossible, to administer. Transactions costs and, in particular, communication costs are dramatically reduced in digital economies. As such, we can expect to observe dramatic changes in how the welfare system is administered and integrated into life choices as individuals move in and out of labour markets and paid employment. In the Australian context of means testing, we would also expect to observe more targeted applications of welfare - especially if combined with a digital identity that is adequately portable and privacy enhancing (see immediately below for a discussion of government operations).

- *Reform of government operations* - the emergence of the digital economy is an opportunity for the government to rationalise and streamline its own operations. For example, the development of a portable digital identity system could mean that duplication in government records and databases could be eliminated. The payment of welfare could be better managed - this is especially so in the Australian context of mean-tested welfare. The ability to track welfare needs in real time could avoid debacles such as the Robodebt program of several years ago. Government operations in measurement and standards (as oracles), in public data records (including economic statistics), and border security and inspection protocols and platforms could also benefit from greater adoption and coordinated use of blockchain technology. An important aspect of government operations is the collection of revenue. Blockchain enabled technology could track tax liabilities and potentially

collect taxation (especially in value-added tax situations) in close to real time. This could also streamline a lot of disputes between taxpayers and tax authorities as arbitrary enforcement and interpretation of tax law is reduced within the economy. See below for additional discussion on potential tax reform.

- *Trade Policy Reform.* Related to the reform of government operations, much of trade activity relates to compliance with government regulations and the requirements of trade finance. Both trade compliance and trade finance can be simplified with blockchain technology providing a trusted environment where information moves up and down a supply chain informing all participants of the provenance of goods and services being exchanged across the Indian-Pacific region. This could include, for example, payment rails denominated in Australian dollars and dispute resolution mechanisms that are enforced in Australian courts (if necessary).

- *Platform business friendly competition policy* - Competition policy currently exists to prevent market power from being deployed to undermine competition and/or from exploiting consumers. Competition policy has emerged, over the last 100 years or so, in an environment of large industrial economy type organisations. Market power, as currently understood, is driven by size which, in turn, is related to the existence of supply-side economies of scale. Digital business, however, relies on the equivalent demand-side economic phenomena - network effects. The exploitation of network effects, however, can appear to be anti-competitive behaviour but is not necessarily so. Similarly, legitimate business activity to drive network effects - for example, cross-subsidies in platform economies - can appear to be anti-competitive (as competition policy is currently understood). The predominant business model in a digital economy is the two-side platform - where cross-subsidy is required to equilibrate each side of the platform (Gawer (2009), Duch-Brown, Martens and Mueller-Langer (2017), Brynjolfsson and McElheran (2017), Brynjolfsson et al. (2019), Jones and Tonetti (2020)). At present these business models are not well understood and very often appear to be anti-competitive. Having a competition policy framework that explicitly recognises these digital economy business practices as being consistent with competitive markets would enable entrepreneurs to focus on building new businesses without worrying that their business will be subject to investigation for anti-competitive behaviour.

- Tax reform. Similarly to the welfare system, the current tax system is designed to operate in an environment where most workers are salary earners and work for large organisations. In a digital economy we expect to observe a greater proportion of workers being self-employed or employed by organisational forms that are less able to bear the burden of tax administration. Australia is particularly vulnerable to tax disruption as it relies heavily on

direct taxation to raise government revenue. Currently, the economy is dominated by established and large organisations. In a digital economy many workers will likely work in start-up organisations and are likely to be paid in stock-options and crypto-tokens. The current Australian taxation system is poorly equipped to manage those practices. Updating the philosophy and practices of the Australian tax system to manage and understand a digital economy transformation will ensure that existing tax practices do not stifle the emergence of the digital economy, while ensuring that the tax system generates sufficient revenue to cover legitimate government spending. Furthermore, a digital economy would greatly automatize tax compliance, auditing, and payments.

- Superannuation policy in Australia is also predicated on the notion that most workers are employed by large organisations. In a digital economy environment two changes will impact on the current superannuation policy settings. First many workers will be self-employed and second many currently listed public corporations will likely shrink in size and/or go private. Superannuation policy will be to be reimagined where many workers may have interrupted contributions. The Superannuation fund industry itself will need to be reimagined. At present, the industry consists of large funds that accumulate large portfolios of listed assets (both domestically and internationally) and some unlisted assets such as large infrastructure projects (for example, airports, harbours, toll roads). We anticipate that the universe of traditional securities will decline over time - certainly the notion of 'shares' being traded on a stock exchange will be challenged by the emergence of DAO tokens trading on crypto exchanges. Many superannuation funds will have to take on more of a 'venture capital' type role as opposed to passively investing in a large universe of publicly listed financial assets.

C. Action items

Australia is well-placed to address many of these issues. The 2021 Bragg Senate Report, for example, contained many ideas and recommendations that are well-worth pursuing.[20] In addition, the primary government agency for economic policy - The Australian Treasury - is aware of many of the issues associated with and related to the digital economy. The first action item is for Australia to continue down the path set out in the Bragg report.

The second action item is for the government to set up a permanent taskforce within the Treasury (or the Productivity Commission) to advise on policy changes

[20]The Final Report on 'Australia as a Technology and Financial Centre' (the 'Bragg report') is available at `https://www.aph.gov.au/Parliamentary_Business/Committees/Senate/Financial_Technology_and_Regulatory_Technology/AusTechFinCentre/Final_report` They recommends, among other things, a licensing regime for digital asset exchange, a custody or deposit regime for digital assets, and a new DAO company structure. Further recommendations to clarify excess burden around AML and CGT, and to explore further the purpose of an Australian CBDC.

that will be necessary to facilitate Australian adoption and participation within the digital economy. This taskforce should consist of a secretariat (provided by government) with government officials and private industry working on creating policy advice. These industry partners should be drawn from individuals within the digital economy and also individuals within the broader economy that are likely to deploy digital economy solutions to their business practices. In particular those actors of the economy that are export-orientated or trade exposed should be included in the taskforce.

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