

DIGITAL INDUSTRIALISATION IN DEVELOPING COUNTRIES

(A REVIEW OF THE BUSINESS AND POLICY LANDSCAPE)

PARMINDER JEET SINGH,
(IT FOR CHANGE)



The Commonwealth

© The Commonwealth Secretariat

Table of Contents

Executive Summary.....	2
Part 1: Introduction – Digital economy and e-commerce.....	7
<i>Digital transformation.....</i>	<i>7</i>
<i>What does e-commerce mean?.....</i>	<i>8</i>
<i>Placing digital start-ups in context.....</i>	<i>11</i>
Part 2: Digital start-ups – A new economic horizon.....	14
<i>Bangalore – The silicon valley of the South.....</i>	<i>14</i>
<i>Bangalore – Going digital.....</i>	<i>19</i>
<i>The digital economic re-organisation.....</i>	<i>25</i>
<i>Indian policies supporting tech start-ups.....</i>	<i>30</i>
Part 3: Public data infrastructures.....	34
<i>Digital age infrastructure.....</i>	<i>34</i>
<i>IndiaStack – A good foundation for public data infrastructures.....</i>	<i>37</i>
<i>Personal data, and core sectoral data, infrastructures.....</i>	<i>42</i>
Part 4: Different pathways to digital industrialisation.....	48
<i>The dominant US digital economy model.....</i>	<i>48</i>
<i>China's digital industrialisation.....</i>	<i>50</i>
<i>Some insights from the European approach.....</i>	<i>56</i>
Part 5: Digital economy policies for developing countries.....	63
<i>Towards a digital industrial policy.....</i>	<i>63</i>
<i>Global digital economy and the developing world.....</i>	<i>69</i>

Executive Summary¹

Digitalization can be compared to industrialisation in what would be its eventual impact on economic and social institutions. As industrialisation placed machine power at the centre of the economy, digitalisation makes digital intelligence its new fulcrum. The factory as the site of mechanised production was the central economic institution of the industrial age. For the digital age, it is sectoral platforms that re-organise entire economic activities in any sector based on digital intelligence arising from data. E-commerce is a very superficial way to designate this phenomenon. Digital economy is defined by digital intelligence services, especially as they manifest in the operation of sector-wide platforms.

Tech start-ups represent a new wave of entrepreneurship, which, if appropriately harnessed, can usher in a highly efficient digital economy, spiking economic growth. Start-ups however need to be supported by policies that address structural issues like availability of capital, building of appropriate technical and business skills, regulatory measures against monopolies and other anti-competitive behaviours, technology regulation like interoperability standards, and development of public digital infrastructures. Among the latter, public data infrastructures are most important.

Digital business must be clearly distinguished from the IT and software industry. IT-based economic phenomenon has unfolded in three distinct phases, represented respectively by IT/software, Internet and digital industries. Among the new breed of tech start-ups, a distinction should be made between those providing core technical services, now-a-days mostly in the form of software as a service (SaaS), and those that digitally transform specific sectoral services, from shopping and transportation to education, health and agriculture. These latter kinds alone are digital start-ups. Their business model consists of providing digital intelligence services, based on the data that they collect.

There are two kinds of digital businesses. One that is focussed on a narrow service segment. These normally exist in an open competitive field, and are highly innovative. Digital innovation is their competitive edge. The other kind are those aiming to own the digital platform or marketplace of a whole sector. They are monopolistic by their very nature. Their business model is to capture the data and digital intelligence of a whole sector for exclusive private use. For sustaining their monopoly, such businesses routinely suppress (and/or co-opt) innovations that can give them competition.

As things currently stand, software and Internet application layers of the digital economic structure would do well being serviced by private companies working in a single global market. All economic and other social activities today require the support of these layers, and it is not easy for most countries to develop high quality software and Internet applications domestically. Global software and Internet companies develop their products for the North and simply extend them to Southern markets without much change. In doing so they incur very low marginal costs. Software and Internet markets are therefore currently working well globally, particularly for first mover advantage

1 Parminder Jeet Singh, (IT for Change) This document is written for the Commonwealth Secretariat, London, but may be taken to reflect only the author's views

companies, without requiring any new trade agreements. This also applies to IT related global value chains in which some developing countries have significant stakes.

The digital business layer with its accent on data however is fundamentally different. Unlike software templates, data is essentially local. The more local and specific it is, the better. Which is why personal data is most valuable. The central element in digital businesses therefore is not technology services and flows (which do provide their own infrastructure); it is who has data, and who owns data? Who can derive the best value from that data in the form of digital intelligence? Who can best apply such digital intelligence to real life contexts, developing a business model around it? Digital businesses collect most data from sources outside their realms of ownership. Can they be considered to own such data, and have an exclusive right to the economic value arising from it? Some global digital social network corporations, such as Facebook, Twitter and LinkedIn have a legal enforceable right to use account holders' data in any commercial way they see fit, including marketing campaigns.

The key issue in digital economy is data rights, and the associated issues of privacy, data security, data ownership, data use and data flows. In seeking a free remit over any data that they can lay their hands upon, including 'free global flow of data', global digital corporations implicitly assert their rights over people's individual and social data. Do people need to make a formal counter-claim of their individual and collective rights over their data – both the right of protection against its misuse and the right to its economic and social value?

Corporations collect most digital data from sources that can be considered as 'commons' (personal data can also be admitted to such a framework). Similar to their role regarding natural resources, governments can potentially act as trustees of such general data as a social and national resource. Governments have traditional competence in managing large-scale society-wide data. Public data infrastructures can be as vital to a robust and equitable digital economy; just as various kinds of public infrastructures were to industrialisation.

India is taking some promising initial steps to develop public data infrastructures that are useful to study. The EU too has some policies and programs in this regard.

The required public data infrastructures can be put in three categories. One is the horizontal kind that enables general digital transactions. Second, are personal data architectures that protect privacy but still facilitate the collation of useful economic and social value from such data. Third, are core sectoral data-bases containing key data of a sector arising from diverse sources. Such data-bases provide digital intelligence for organising economic activity in that sector. Instead of one or two corporate-owned sector-platforms monopolising such data, it can be made available as a public infrastructure to a large variety of digital businesses in that sector, thereby encouraging more competitive practices.

The US currently dominates the global digital economy, with China hot on its heels. These are the world's only two successful models of digital economy. The US government's digital economy strategy is centred on global domination by its digital corpora-

tions. For this purpose, it seeks free and unregulated global flow of data. To stay consistent with its global laissez-faire approach, it even circumvents considerations of domestic digital regulation. Against this big business centric US approach is the Chinese model of state directed capitalism, whose innovative adaptations to the digital context have been extra-ordinarily successful.

A third alternative model may be becoming discernible in some developments in India and the EU. It gives a much greater role to the public sector than the US model does, but in a rule-based manner, unlike in China. This may be defined as a mixed economy approach to digitalisation. Here, the public sector has an important role to build the needed digital and data infrastructures, support efficient and open data markets, and undertake necessary regulation of the digital sector, controlling monopolistic, anti-trust tendencies, or areas of critical importance to the economy and the society.

Developing countries should urgently begin shaping digital industrial policies based on this mixed economy approach. If industrialisation was not possible in developing countries without a considerable role of the public sector, digital industrialisation also requires it. This mental shift is pertinent in the face of the globally dominant digital economy model that confines the role of the State to one of making e-transactions enabling laws and ensuring security, with limited focus on the support of the private sector and how they can use digital processes to fast track their business growth

A sound digital industrial policy will combine at least five elements; (1) providing enabling legal and regulatory frameworks, including for easy and secure e-transactions, (2) supporting a start-up ecology and other domestic digital businesses, (3) building public digital and data infrastructures, (4) shaping regulatory frameworks for digital monopolies that are set to control whole sectors, and, (5) as required, developing public/community digital platforms in some key areas.

At global trade negotiation forums, developing countries should resist the global digital economy model that, for instance, is represented in the e-commerce chapter of the Trans Pacific Partnership trade agreement. It will decimate their digital industrialisation options, by enabling global digital corporations from the two leading digital countries to completely dominate all sectors of their economy, including the traditional, non-IT, sectors.

E-commerce covers very different kinds of goods and services, each requiring different treatment in global trade discussions. E-commerce of physical goods is very different from that of fully digital goods and services. Of the latter there are at least three further categories.

Digital cultural goods should be subject to special treatment as called for in the relevant UNESCO treaty. IT enabled Services (ITeS) are to be addressed under trade in services frameworks, corresponding to the specific service sector that is implicated, like education, health, finance, etc. Software/IT services exist in a well-functioning global market, demonstrating no need for new trade agreements.

Data flows involved in ITeS and software services normally do not have issues about ownership of the data. The main public interest concern here is of access to data by authorities of the country of origin, as and when required, for privacy protection from third parties, and other kinds of regulation and law enforcement. What is needed in such cases are not trade deals but data protection, domestic privacy laws, and security agreements between countries.

The mainstay of the digital economy, on the other hand, are digital businesses based primarily on data collected from outside their business systems – from personal, social, artificial or natural sources. It is the digital intelligence obtained from such ‘outside’ data that is employed to control the larger economic ecosystem. Data collectors, however, do not own these data sources, and therefore their complete ownership over data obtained from them, and its unregulated use, is questionable. The issue becomes even more problematic and complex when such data is taken out of national borders, with no clarity about the nature of its further use.

It is such data flows pertaining to global digital businesses that is the main concern of the US led camp promoting global e-commerce deals, including at the WTO. Their great importance stems from the fact that digital businesses – involving digital intelligence services – sit at the top of new global value chains.

The nature of ownership of such digital data, and personal and collective rights over it, must first be discussed and clarified, before frameworks for ‘free flow of data’ can be negotiated. ‘Data ownership’ and ‘data flows’ are closely related subjects and must be discussed together. Until these basic political economy related conceptual clarifications can be arrived at, developing countries should avoid entering into negotiations for e-commerce or digital trade agreements.

Part 1: Introduction – Digital economy and e-commerce

Digital transformation

This paper first reviews Bangalore's start-up sector. It examines how policies of Indian governments address the larger structural context of an emerging digital economy, going beyond just supporting start-ups. Subsequently, the paper briefly explores the US, China and EU models of digital economy. Our assessment of digital economy is oriented to the learning needs of policy-makers and not centred on business management perspectives; to satisfy this objective it is important to penetrate beyond. On the basis of these analyses, the paper culminates in a series of recommendations for developing countries to shape their digital industrial policies.

The Internet's far-reaching impact on our societies and economies has entered a very significant phase. The World Economic Forum calls it the 'industrial revolution 4.0', and Chinese policy-makers 'Internet plus'. The industry refers to it as a seismic shift from IT/software and Internet phases to the digital phase. With some difference in emphasis, these descriptions address the same phenomenon. For social scientists, it represents a fundamental transformation in the economic organisation of society, and, following it, also its social institutions. The private sector sees in it disruptive business models, which extend to all domains of the economy and not just those related to information and communication.

Almost all businesses, IT-related as well as in other sectors, appear to be in agreement that the digital phenomenon fundamentally transforms the way any business is done. But 'digital' has been defined by business commentators in either technology centric or business process based ways. It is defined as application of technologies like mobile, cloud computing, data analytic, artificial intelligence (AI) and Internet of Things (IoT) in business, delineating a phase beyond the centrality of enterprise software, networking and social media. Others focus on business processes, with a McKinsey team advising that "digital should be seen less as a thing and more a way of doing things"... "We've broken it down into three attributes: [using digital technologies for] creating value at

the new frontiers of the business world, creating value in the processes that execute a vision of customer experiences, and building foundational capabilities that support the entire structure.”² Such formulations may be meaningful to corporate strategists and business management students, but they speak very little to a social analyst or a policy-maker.

Describing the transformation as “unlike anything humankind has experienced before”, World Economic Forum's Executive Chairman, Klaus Schwab, characterises it as “a fusion of technologies that is blurring the lines between the physical, digital, and biological spheres”.³ He considers it as an “inexorable shift from simple digitization (the Third Industrial Revolution) to innovation based on combinations of technologies (the Fourth Industrial Revolution)”. Schwab mentions many areas of very strong digital impact, but the definition remains technology centric, providing a limited understanding of the underlying social and economic phenomenon. Schwab does locate digital platforms as a central feature of the new economic design, but speaks of them only in a laudatory and uncritical manner as “creating entirely new ways of consuming goods and services”, as they “lower the barriers for businesses and individuals to create wealth, altering the personal and professional environments of workers”.

The Chinese conception of ‘Internet plus’ presents the phenomenon of “the integration of the Internet with the economic and social sectors”⁴ in the form of a well-developed digital industrial policy. Presented in 2015, this policy deals with a China that has already built a very formidable Internet/digital sector, due considerably to its policies of Internet/digital protectionism. China's current progress in terms of digital industrialisation is significantly different from that of other developing countries. Unlike the latter who are just entering the digital phase, China's digital sector is in an

2 Karel Dörner and David Edelman. (July 2015). ‘What digital really means’, *McKinsey & Company High Tech*. Retrieved from <http://www.mckinsey.com/industries/high-tech/our-insights/what-digital-really-means>

3 Klaus Schwab. (Jan 2016). ‘The Fourth Industrial Revolution: what it means, how to respond’, *World Economic Forum*. Retrieved from <https://www.weforum.org/agenda/2016/01/the-fourth-industrial-revolution-what-it-means-and-how-to-respond/>

4 Xinhua. (July 2015). ‘China unveils Internet Plus action plan to fuel growth’, *The State Council- The People's Republic of China*. Retrieved from http://english.gov.cn/policies/latest_releases/2015/07/04/content_281475140165588.htm

expansionist mode, both domestically and globally. China's definitions and policy frameworks in the digital area, correspondingly, fail to highlight many structural and critical features of digital economy that other developing countries must pay close attention to as they plan their digital industrialisation.

Policy-makers in developing countries sense 'digitalization' to be some kind of powerful phenomenon building up around them, and realise that it is going to be key to their economic futures. However, appropriate conceptual frameworks do not exist that can guide developing countries to make meaningful policy choices in this regard. If developing countries are to benefit from these strong economic and social changes, they must first be able to frame the nature of the phenomenon within the realities of their specific context and interests.

What does e-commerce mean?

Developing countries have struggled to comprehend the post-IT and post-Internet phenomenon of digital economy. 'E-commerce' and 'tech start-ups' are the two terms that normally get associated with it. But these terms are very inadequate to the complexity and breadth of this new kind of economy.

The currency of the term 'e-commerce' in policy discourse comes largely from the global trade scene. In 1998, when the dotcom era was in full bloom (although now recalled only with some amount of embarrassment), WTO instituted an e-commerce work program, where e-commerce was "understood to mean the production, distribution, marketing, sale or delivery of goods and services by electronic means". The mandate was not for negotiations but for exploration and reporting on various aspects of e-commerce. The US led Trans-Pacific Partnership (TPP) agreement finalised in 2016 contains an e-commerce chapter, which has since become the model for all digital trade negotiations. TPP's e-commerce chapter focusses on pre-emptive rules to ensure that any digital business can be conducted across borders with minimum hindrance or regulation.

Even as the current digital economy context is qualitatively different from what was

understood as e-commerce at the time of instituting WTO's e-commerce work program, two geo-economic interests, with different entrenched advantages, have been promoting the term 'e-commerce' globally. US leads one kind of global 'e-commerce' discourse and China another. Their content is substantially different, and at times even at odds with one another as discussed below. But neither seems willing to rock the other's boat by getting into a deeper examination of the specific nature of goods and services, and business processes, that are involved in digital economy and trade.

China focusses on global e-commerce of physical goods, with the aim to provide an outlet for its unparalleled manufacturing competence, a sector where it holds global competitive advantage. The global e-commerce opportunity comes tailor-made for it. On the other hand, China's attitude to global data flows that underlie trade in digital goods and services remains ambiguous. China's initial response to the Internet reflected strong political sensitivities to global information flows, which shaped its protectionist policies. But now it also clearly understands data as a strategic national asset, to be leveraged appropriately. Meanwhile, it has developed a strong digital cultural goods industry, with substantial export orientation⁵, and its mega digital corporations have begun to pursue global ambitions as data based businesses. But China is still not too keen to negotiate 'free flow of data' regimes, which is the central plank of the US led global 'e-commerce' pitch.

For the US, e-commerce is mostly about digital goods and services. US is the uncontested global leader in cultural goods/services as well as technology/digital services. It considers the latter as the new frontier for further global domination. The US seeks free digital and data flows globally. On the other hand, it can hardly be as keen to further liberalise trade in manufactured goods through the global e-commerce route, as it is reeling under a trillion dollar plus debt with China, largely owing to Chinese manufactured goods flooding its markets. The US recently withdrew from the TPP following a rethink on liberalisation in the manufacturing sector.⁶ In the circumstances, it is unclear how it could favour e-commerce based liberalisation of the same

5 Adam Hinter. (July 2016). 'Video games: China's best cultural export?', Business Report. Retrieved from <https://www.iol.co.za/business-report/opinion/video-games-chinas-best-cultural-export-2043878>

6 Its views on digital trade as expressed in TPP's e-commerce chapter apparently remain unchanged.

manufacturing sector. By its huge reduction in transaction costs globally, e-commerce can almost entirely negate any advantages of local-ness. It can thus adversely impact local industry's competitiveness many times more than traditional kinds of trade liberalisation.

US and China vigorously pursue their respective global e-commerce narratives, without openly questioning or challenging the other's version. This is because 'e-commerce' is increasingly globally established as a convenient term for both, even if in different senses. In the circumstances, it is left to (other) developing countries to unpack the real nature of the phenomenon, and relate it to their own interests.

Global e-commerce is sold to the developing countries by arguing that since it can greatly curtail the involved transaction costs, their small businesses – both, goods and services related – will be able to access new global markets. The examples that are provided mostly concern limited niche segments, forming a small portion of a country's economy. Access to global digital technology markets⁷ and to other important input services and goods are also mentioned as benefits of a liberal global e-commerce regime. What is omitted, however, are the negative impacts on domestic economies of new forms of import flow inundation, and the data-based digital controls that are being built by global digital platform companies across all economic sectors.

Jack Ma, head of the Chinese e-commerce giant Alibaba, is the prime ambassador of the Chinese narrative of global e-commerce. He has built close relationships with WTO, UNCTAD and other global trade policy forums. What Ma really thinks of the 'e-commerce' term, which he sells globally with such enthusiasm, may come as a surprise. He claimed recently that this term will soon vanish, because it is "just a ferry to the other bank".⁸ Rather than focussing on the 'ferry', it should evidently be much more interesting and important to understand what lies on the other bank, and seek concepts and definitions that adequately captures the emerging goal. Ma says that what is considered as e-commerce will simply be 'new retail', enmeshed in economy wide

⁷ These technologies are very important inputs into practically every business activity in present times. Continued and unhindered access to them is therefore very important for developing countries, as argued later in this paper.

⁸ Carol Ko. (Oct 2016). 'Alibaba's Jack Ma: e-commerce will vanish soon', *Computer World Hong Kong*. Retrieved from <http://cw.com.hk/news/alibabas-jack-ma-e-commerce-will-vanish-soon>

changes along with new manufacturing, new finance, new technology and new energy.⁹

Similar ambiguity between domestic and global discourses is also practised by the US. Current global digital domination by the US is constituted much more by Google, Facebook, Uber and AirBnB kind of digital corporations than the Amazon variety. But, only Amazon-like market platforms are referred to as e-commerce companies in the US. Interestingly, even Amazon, like Alibaba, is undergoing strong mutations towards economy wide activities beyond what can strictly be considered as commerce. In fact, US government's own policy documents almost always use the term 'digital trade' and not e-commerce.¹⁰

Placing digital start-ups in context

The other commonly employed term 'digital start-ups' also provides limited illumination over what is really happening. No doubt, it is the Silicon Valley start-up culture that first shaped US's software and Internet might, and now its digital leadership. Business risk taking aptitude, supported on one hand by availability of venture capital and on the other by a regulatory environment that allows easy business entry and exit, is considered key to Silicon Valley's success. However, many larger structural elements of the US economy and polity equally contributed to this revolution, by feeding its tech enterprise. Among them were strong government R&D and academic institutions' support, as well as substantial government procurements and PPPs.¹¹

In China, it is under protectionist Internet policies that many small companies copied US digital models and scaled-up quickly in the huge domestic economy. Governments have played many other important roles in this regard as well, including providing huge direct patronage to this emerging industry. After more than a decade of successful digital makeover, China now stands at a very different location. Its new 'Internet plus' policy lays great stress on untethering people's innovative spirits.¹² But this is firmly placed

9 Nina Xiang. (July 2017). 'Alibaba prepares for the future with debut of "Five-New" committee', *China Money Network*. Retrieved from <https://www.chinamoneynetwork.com/2017/07/11/alibaba-prepares-for-the-future-with-debut-of-five-new-committee>

10 Interestingly, US now seems to be using the term 'digital trade' instead of 'e-commerce' in its efforts to re-negotiate NAFTA.

11 April Dembosky. (June 2013). 'Silicon Valley rooted in backing from US military', *Financial Times*. Retrieved from <https://www.ft.com/content/8c0152d2-d0f2-11e2-be7b-00144feab7de>

12 Martin Pasquier. (May 2015). 'Internet plus: China's official strategy for the uberisation of the economy',

within larger structural policy elements. Of relevance, in this regard, also are the ‘Made in China 2025’ policy, which has significant digitalisation components,¹³ and China’s recent policy statements aiming for global supremacy in artificial intelligence (AI) in little more than a decade.¹⁴

Digital start-ups are an important phenomenon, but they should not be viewed in isolation. They are situated within larger economic and social structures, which require equal attention by policy-makers. Currently, in no other country do these start-ups enjoy the same or similar environment to what was available to US or Chinese start-ups. Fostering new forms of digital entrepreneurship is certainly very important, but policy-makers should closely consider specific contextual features of every country. One of Kenya’s best known tech investors Ory Okolloh criticizes what she called the ‘fetishization’ of entrepreneurship and neglect of fundamental problems hampering African countries. She notes, “Africa can’t entrepreneur itself out of its basic problems”, cautioning that it must not run away from “dealing with the really hard things”.¹⁵

The dominant digital economy discourse employs ‘e-commerce’ as a euphemism for indiscriminate and sweeping liberalisation of global digital commercial interactions of all kinds, without forming due distinctions between different natures of such interactions, or the differential impacts of such liberalisation on different countries. Its aim is to clear the path for global digital businesses of any current or future regulation, so that they can dominate all sectors of every country, employing new digital business models whose nature is not mentioned or discussed. The matching term ‘digital start-ups’, in turn, underlines a very limited domestic policy approach focussed on supporting the private sector, but without addressing the larger structural contexts of a digital economy.

Innovation is Everywhere. Retrieved from <http://www.innovationiseverywhere.com/internet-plus-chinas-official-strategy-for-the-uberisation-of-the-economy/>

13 IoT One. (July 2015). ‘Made in China 2025’, *Fondazione Idis Citta’ Della Scienza*. Retrieved from <http://www.cittadellascienza.it/cina/wp-content/uploads/2017/02/IoT-ONE-Made-in-China-2025.pdf>

14 Ma Si. (June 2017). ‘Plan to put China in AI industry vanguard’, *China Daily*. Retrieved from http://www.chinadaily.com.cn/china/2017-07/21/content_30195342.htm

15 Lily Kuo. (September 2015). ‘Video: Ory Okolloh explains why Africa can’t entrepreneur itself out of its basic problems’, *Quartz Africa*. Retrieved from <https://qz.com/502149/video-ory-okolloh-explains-why-africa-cant-entrepreneur-itself-out-of-its-basic-problems/>

The terms 'e-commerce' and 'digital start-ups' represent significant but limited aspects of the contemporary economic digitalisation phenomenon. An exclusive focus on these would more likely distract, than lead developing country policy-makers to the kind of comprehension and actions that are required at this important juncture.

In order to understand the nature and prospects of digital economy in a developing country context, it may be useful to look at how the digital phenomenon is shaping up in Bangalore, often called the Silicon Valley of the South. Bangalore is considered ahead of the curve than most places in the developing world. Its study therefore can provide valuable forward-looking insights in this fast moving area.

Part 2: Digital start-ups – A new economic horizon

Bangalore – The Silicon Valley of the South

Indian software industry developed its first strong shoots in the 1990s. It was effectively supported by government policies, especially the Software Technology Parks Scheme, with export incentives, custom exemptions for input goods, tax holidays and infrastructural support.¹⁶ The global Y2K scare at the turn of the millennium was a key turning point for the industry. It created a sudden surge in demand for India's software capacities by many US-based and other companies.

Indian software industry's mainstay has been software coding organised in large-scale software development projects for foreign companies, most of them US-based. India has found it difficult to upgrade its software coding services model towards producing global software products. Flexicube, a banking software, from iFlex, was one among very few successful Indian software products, which was eventually acquired by the US company Oracle. An associated but distinct industry segment has been business process outsourcing (BPO), which grew rapidly in India with the growth of global Internet connectivity. Here, the Internet is used to provide non IT services, like back-office work of various kinds, for foreign clients. Both software and BPO services brought in significant foreign exchange and provided considerable employment.

Let us fast-forward to the current window of time, starting from 2014 when there was a sudden rush of venture funding for Indian tech start-ups. This period is marked by the confluence of two relatively distinct phenomena leading to creation of two different kinds of tech start-ups. One kind provides cloud-based software services, whereby software is made available remotely over the Internet. Technology is the main offering here, in the form of software and applications. These can be referred to as core tech start-ups, or just tech start-ups. The other kind employs digital technologies for disruptive business models in various sectors, from transport and commerce to health

¹⁶ Software Technology Parks of India. (September 2017). 'Software Technology Park Scheme', *Ministry of Electronics & Information Technology-Government of India*. Retrieved from <https://www.stpi.in/11025>

and education. The key value proposition here relates to one or more specific sectoral services, and not just the provision of technology/ software. These can be defined as tech-plus start-ups or digital start-ups.

Distinguishing between these two new kinds of tech start-ups serves as a useful conceptual entry point to understand the digital economy. The distinction however may not be absolute. Uber, for instance, still calls itself as a technology service¹⁷ whereas regulators and courts all over the world seem keen to treat it as a taxi service¹⁸. In the case of some cloud service providers that are tightly sector-focussed, it may become somewhat difficult to distinguish whether their main service is software or a substantive sectoral one. But the distinction largely holds. Some other differences between the two types of start-ups will be discussed later.

Core tech start-ups are based on the growing popularity of cloud computing. Vastly improved connectivity is shifting the dominant computing paradigm towards remotely managed applications. It has many advantages over on-premise computing. There is less upfront cost, and improvement and upgrade of applications is much easier and quicker. Companies can therefore be agile in shifting to newer digital modes and applications, rather than be stuck for years with expensive on-premise IT infrastructures and systems. Such flexibility is most important in the current times of rapid digital evolution. New technical opportunities like data analytics, IoT and AI are emerging rapidly, carrying great potential in almost all sectors. This is therefore not the time for expensive in-house IT infrastructure, even for those otherwise able to afford them. Further, higher-end digital opportunities are being taken up not just by big companies but increasingly also by tens of thousands of smaller ones, for whom cloud based IT processes and support works best.

As mentioned, the traditional IT model in India involved IT companies like Tata Consultancy Services, Infosys and Wipro developing customised on-premise software for

17 Amanda Watson. (March 2017). 'We're a technology company, not a taxi service, says Uber', *The Citizen*. Retrieved from <https://citizen.co.za/news/south-africa/1454013/were-a-technology-company-not-a-taxi-service-says-uber/>

18 Andrew Orłowski. (May 2017). 'Uber is a taxi company, not internet, European Court of Justice advised', *The Register*. Retrieved from https://www.theregister.co.uk/2017/05/11/ecj_advice_uber_is_taxi_firm/

large businesses, with a focus on the US. India had developed great expertise in this area, and is the first choice for many global businesses seeking software support. Its companies have delivered quality work at very competitive prices.¹⁹ However, this business model begun to plateau around 2014-15.²⁰ The real hit came in 2017 with many companies undertaking big lay-offs, enough to generate a scare.²¹ Business leaders have explained this phenomenon as a worldwide shift from IT to digital,²² with an accent on mobile, cloud, data analytics and AI technologies. Established Indian software companies are currently undertaking major shifts in the focus of their businesses. Their traditional services and markets, however, have not completely become obsolete, and still retain significant viability.

Many factors have been working in tandem to change the nature of IT or computing business. First, as mentioned, are the advances in cloud computing. It greatly lowers the amount of customised software to be written and maintained for any one client, and of overall software that needs to exist in the world. Second, IT companies have begun to employ automation and Artificial Intelligence (AI), reducing the manpower needs for many functions in software development. Client businesses are shifting focus from IT to digital technologies, employing them to transform business processes and not merely support them as traditional IT did.

As the traditional IT service industry was losing its shine, start-up cloud computing companies begun to emerge in IT centres like Bangalore. Cloud computing business is based on three models, infrastructure as a service (IaaS), platform as a service (PaaS), and software as a service (SaaS). IaaS companies provide largely sterile infrastructure like storage, networking and servers remotely, over the cloud. PaaS involves

19 PwC. (2014). 'India – A destination for sourcing of services', *PwC India*. Retrieved from

<https://www.pwc.in/assets/pdfs/publications/2014/india-as-a-destination-for-sourcing-of-services.pdf>

20 Keshav Sunkara. (December 2016). 'In Charts: How India's software services exports grew in recent years',

VCCircle. Retrieved from <https://www.vccircle.com/charts-how-india-s-software-services-exports-grew-recent-years/>

21 ET Online. (June 2017). 'Layoffs scare is real, not exaggerated, finds ET's Job Distribution Survey', *The Economics Times*. Retrieved from <https://economictimes.indiatimes.com/jobs/layoffs-scare-is-real-not-exaggerated-finds-ets-jobs-disruption-survey/articleshow/58927915.cms>; BS Web Team. (March 2017), 'Job sites witness surge as layoff scare looms in IT, e-commerce sector', *Business Standard*. Retrieved from http://www.business-standard.com/article/companies/job-sites-witness-surge-as-layoff-scare-looms-in-it-e-commerce-sector-117030900503_1.html

22 Sruti Venugopal and Krishna Mohan. (May 2017). 'Layoffs in IT due to digitisation: Industry', *Telangana Today*. Retrieved from <https://telanganatoday.com/layoffs-due-digitisation-industry>

infrastructure plus operating software and such platforms over which custom applications can be built by the client companies. The SaaS model involves remote provision and management of the whole range of computing needs right up to fully-functional applications and data-based processes.

IT services provided in IaaS and PaaS models are mostly general across business sectors and processes. This enables high economies of scale; whereby large US companies continue to retain an advantage here. SaaS model is more niche, because different kinds of businesses and business processes require different kinds of applications and data processing. Such a variety is becoming more pronounced as globally almost all kinds of businesses, big and small, have begun to look at IT not just as process support but for shaping comparative business advantage. SaaS services are sites of rapid innovation, aimed at continually enhancing the effectiveness of businesses that use them.

Bangalore and a few other IT centres in India²³ have some of world's best IT talent, honed through servicing global clients over the years, and working at India-based R&D centres of global IT majors. Indians have been the top ethnic minority group in leadership positions in the silicon valley, and have participated in its start-up ecology.²⁴ Some of them were keen to return to India and explore similar entrepreneurial opportunities domestically.²⁵ Global quality IT talent and entrepreneurship came together to trigger the tech start-up phenomenon in India. Most of these are SaaS start-ups focussing on the global market. They are run by small teams that are technically highly-skilled, and business-wise very motivated.

In a cloud based model, the infrastructure is rented which meant low upfront costs. Local IT talent was comparable with the best in the US but available at a fraction of the

23 Chennai has emerged almost as important a location for Indian SaaS companies as Bangalore.

24 A Kauffman Foundation report reveals that 33% of all immigrant-founded companies in the US have Indian founders, more than any other minority ethnicity. Manu Rekhi. (August 2017). 'We're living in the golden age of Indian entrepreneurship in Silicon Valley', *YourStory*. Retrieved from <https://yourstory.com/2017/08/golden-age-indian-entrepreneurship/>

25 "Indus Entrepreneurs (TiE), world's largest network of entrepreneurs and a non-profit global community, started in Bangalore in 1999, to promote entrepreneurs. The uniqueness of TiE in India was that it consisted of Indians who had successful start-ups in the Silicon Valley, and had returned to India to make a positive impact on the Indian economy by promoting and supporting Indian entrepreneurship." Microsoft Accelerator. (June 2016). 'History of the Indian Startup Ecosystem', *Issuu*. Retrieved from https://issuu.com/msaind/docs/indian_startup_ecosystem_timeline

price. Entrepreneurial aspirations, lit by the global tech start-up boom, meant that the key involved persons were ready to work hard on rock-bottom remuneration. But even with a drastic reduction in the cost of product development, marketing and sales costs create huge entry barriers for new businesses. This is even more so when servicing offshore markets, in very diverse locations. One key factor in the Indian SaaS success has been a central – often exclusive – reliance on Internet-based marketing, largely through Google. This model was pioneered by Zoho in India, considered as the trailblazer among India SaaS companies.

Indian SaaS companies have thus been able to provide services globally of a quality comparable to those from the best foreign centres, but much cheaper. Having mostly failed to develop software products in the offline mode, India is seeing great success with SaaS based software products.²⁶ Offline products, even sector focussed ones, tend to serve relatively general software/ application needs, where economies of scale favour big players. SaaS industry, on the other hand, admits small players that can serve niche segments, arising from the existence of much more diverse software needs today. It allows cost-effective serving of even small markets by aggregating demand globally.

Smaller upfront costs in the cloud-based software model attracts greater entrepreneurship directed at innovating and serving diverse software needs. This is true at least is the current phase of transition to new software models. It remains to be seen whether they too will get consolidated into a few large businesses. This is already feared as SaaS services increasingly involve very high-end computing and AI processes, which are both resource-intensive and have a marked centralisation tendency.

SaaS start-ups service specific business processes like accounting, HR management, marketing, customer relations, and so on, or industry segments like hospitality, schools, shops, small manufacturing units, and even gyms and saloons. SaaS companies require to have a very good grasp of the business processes and the sectors that they serve, and the best way to apply software processes to them. This involves higher and more

26 Suparna Goswami. (January 2017). 'Why Indian SaaS startups are set to rule the world', *Forbes*. Retrieved from <https://www.forbes.com/sites/suparnagoswami/2017/01/23/why-indian-saas-startups-are-set-to-rule-the-world/#33e2874e1329>; Malavika Velayanikal. (July 2017). 'The unfair advantage Indian SaaS start-ups have over counterparts around the world', *Tech in Asia*. Retrieved from <https://www.techinasia.com/>

complex business management skills than were needed for on-premise IT services (where the client's expertise was always at hand at the software development stage itself).

Technology, however, remains the core competency of SaaS companies, as newer kinds of IT capabilities, such as data analytics, IoT, AI, etc, keep getting added to their services. It is for this reason that these start-ups are designated as tech start-ups, to distinguish them from a second kind whose focus is on non-technical services, in a digital context. The latter will be discussed in the next section.

Since SaaS forms a single global market, with few entry barriers, it is highly competitive. A business cannot survive on cost arbitrage alone. Much more than the IT services model, SaaS businesses require very high technical quality, and constant innovation. They need to tightly focus on a particular niche, and quickly develop enough scale riding the early mover advantage. The combined requirements of high technical and business skills of various kinds has caused a marked clustering effect²⁷ with the global SaaS industry increasingly concentrated in a very few centres. The key ones outside the US are London, China Israel and Bangalore (and lately Chennai, also in India).

Tech start-ups in India have almost entirely focussed on global markets.²⁸ Very few service local markets, and if they do it is generally large businesses. The reason is both that developed country markets are much more lucrative, and the lack of readiness of most potential domestic clients for remotely managed SaaS services.

One of the business processes supported remotely by the SaaS model is analysing business data. Many Indian SaaS companies have begun developing expertise in this area, helping their clients analyse their data and develop useful business insights.²⁹ Data is emerging as the key resource in the digital economy, and a game changer for most

27 See Online extra. (August 2009). 'Clustering', *The Economist*. Retrieved from <http://www.economist.com/node/14292202> for an explanation on online clustering effect.

28 Sanghamitra Kar. (November 2016). 'Why is India still not a key market for the SaaS cos', *ET tech*. Retrieved from <https://tech.economictimes.indiatimes.com/news/startups/why-is-india-still-not-a-key-market-for-the-saas-cos/55345108>

29 See Shrishti Deoras. (January 2017). '10 emerging analytics start-ups in India to watch for in 2017', *Analytics India*. Retrieved from <https://analyticsindiamag.com/10-emerging-analytics-startups-india-watch-2017/> for example of such Indian SaaS companies

businesses. SaaS businesses that engage in data processing therefore occupy an interesting, and alluring, position.

Indian SaaS model is mostly B2B. The client business fully owns its data even as the SaaS platform processes it. The SaaS company cannot directly leverage the value of such data for its own benefit. However, as the SaaS platform works with such client data, a large amount of meta-data is generated. It provides useful business insights which a SaaS company can employ to improve its own offering, and also explore other uses of it. This helps it build intelligence about the sector that is crucial to developing strong market advantage.

The nature of data ownership, and the manner in which the involved actors can legitimately use data and the insights built over it, currently remains rather vague. It often comes down to the relative heft of the client business versus the SaaS provider. A big business employing an HR application of an Indian SaaS provider, for instance, will take care to cover its bases on data protection. The latter too can be expected to be proactive to ensure full data safeguards and guarantees, as a measure of quality and competitiveness of its service.

But in the case of a large SaaS company serving small businesses (or individuals) the terms of services, explicit and implicit, tend to favour the SaaS company. In such situations, data could increasingly become the key value and resource for the latter's business model, more than the software fee that is collected. Smaller the SaaS client less valuable is its own data to it, because (1) considerably large data sets are required for useful insights, and (2) it is unlikely to possess the technical and business competencies to monetise the value of its data. Data then becomes the more convenient currency for a SaaS client to pay to the service provider, and the business model of the latter begins to centre around collecting client/ consumer data and monetising it. This we know is how Internet/digital companies like Google and Facebook operate, providing apparently free services to people. It brings us to the most important, and central, business model of the digital economy, one that is based on data and intelligence derived from it.

Bangalore – Going digital

The discussion about the centrality of value of data over software, and the relative power between two sides of any tech service interaction – supplier and buyer, brings us to the second kind of start-ups. Core software processes are not the most important part here. The start-ups are focussed on services addressing different sectors like commerce, transport, finance, education, health, etc, mostly presenting disruptive business models (and not just enhancing existing ones). The basic approach is to leverage data based processes and the ensuing digital intelligence to completely or considerably transform economic activity in different sectors. Unlike the SaaS model providing technology and business process services, these companies are mostly B2C, although some may be B2B. Even if B2B, the involved clients are mostly smaller compared to digital service providing companies. Such start-ups can be called ‘tech-plus start-ups’, distinguishing them from (core) tech start-ups. In different sectors these get referred to as fin-tech, food-tech, agri-tech, health-tech, and so on.

Defining digital business/industry/economy as one that involves a central role for data and digital intelligence based on data, we consider these tech-plus start-ups as properly ‘digital’. As an AI investor put it, data is the ‘secret sauce’ here.³⁰ This distinguishes these start-ups from enterprises that basically provide software services, whether on-premise or remotely over the cloud. For a cloud service provider to be considered properly digital it must have a sufficiently pronounced focus on data-intelligence.

In the current industry parlance, cloud computing business is often also considered ‘digital’ along with the data based kind.³¹ While distinct from companies providing on-premise software, cloud software/application business is also fundamentally different from businesses centred on the value of data and digital intelligence. The three kinds of businesses can respectively be referred to as IT/software, Internet/SaaS, and digital.

Such a distinction between digital and pre-digital enterprises, industry and economy is analytically and practically more useful than those discussed in the first chapter of this

30 Sam DeBrule. (September 2017). ‘Why AI companies can’t be lean startups’, *Medium*. Retrieved from <https://machinelearnings.co/why-ai-companies-cant-be-lean-startups-734a289792f5>

31 Simon Mundy. (July 2016). ‘Indian IT services groups adjust to cloud and big data’, *Financial Times*. Retrieved from <https://www.ft.com/content/9ad3b946-3d26-11e6-8716-a4a71e8140b0>

paper. It provides a more meaningful basis for developing countries to shape their digital industrial policies. This will also help them appropriately judge their global comparative advantages in the digital economy and develop positions on global digital trade.

Around the same time that many start-ups in Bangalore/India begun to employ cloud computing to provide software services globally, through the SaaS model, it was becoming evident across the world that 'digital' will transform all sectors, and not just the pure information/communication sector, as the first generation digital companies, like Google and Facebook, did. These other sectors too will move from employing software to support and enhance their business processes to fundamentally new business models based on data-intelligence. In the process, the whole economic organisation of the sector is transformed. Silicon valley start-ups turned unicorns like Uber and AirBnB had demonstrated how traditional sectors like urban transportation and accommodation-renting get re-organised around monopolistic platforms, which act as digital marketplaces linking sellers and buyers of services. These companies then siphon off valuable data arising from these interactions, employing it to develop detailed real-time intelligence about every micro aspect of the sector in order to further control it.

The 2014 IPOs³² in the US of Chinese e-commerce companies, Alibaba and JD.com, raised billions of dollars, creating quite a sensation. It announced the arrival of China on the global digital high table. It was followed by successful IPOs in the US of a few other Chinese digital companies. This did two things. One, many global venture funders who had invested in these companies suddenly made a lot of money, which was available to put elsewhere. And two, everyone sensed a big ticket opportunity in investing in the new digital sector in large, lucrative markets.³³ Being one big market, with a rising middle class, and still largely untouched in digital economy terms, India became a natural destination for these funds. Conditions in India were more 'standard' in relation to most of the developing world as compared to the somewhat unique political-social-economic situation of China. This meant that developing successful digital business models in India

32 Initial Public Offering at the stock market.

33 Interview with Kashyap Deorah, serial investor and author. See Ambika Behal. (October 2015). 'The Tale of the Hyper-Funding of Indian Startups', *Forbes*. Retrieved from <https://www.forbes.com/sites/abehal/2015/10/30/the-tale-of-the-hyper-funding-of-indian-startups/#67d11eb92ee1>

could also provide a gateway to other developing country markets.³⁴ Indian digital start-ups serving various sectors saw a sudden rush of venture capital in 2014, leading to skyrocketing of their valuation. It set-off a start-up fever in India, and thus represents an important milestone.

Tech-plus or digital start-ups, serving different sectors, can be further classified into two types. The first kind works on a relatively narrow vertical within a sector, providing the digital age version of the corresponding service. This is done by integrating the best digital possibilities with traditional elements of service provision. It could consist in developing a digital environment for connecting different actors around a relatively narrow segment of specific needs, and use of data and intelligent technologies for discerning varied and dynamic service requirements and personalising service delivery. One such example is a health app focussed on all-round needs in relation to a particular chronic disease. It can provide links to different service providers, and also employ data for improved early-alarm, diagnostic and curative services. Or, it could be a start-up servicing education and career development needs of a particular segment of the society/economy, including through use of advanced technologies like data analytics and AI for personalised learning. Many such digital start-ups in almost all possible areas have mushroomed in India in the recent years.

This start-up category involves significant innovation, and value creation, in every sector. The basic orientation is to ‘solve a key problem’ in a sector through innovative application of one or more digital opportunities. While the business model can have certain stickiness,³⁵ owing to the network effect (arising from connecting users to service providers)³⁶ and data related effects (using personal data for personalised services), it does not fully close out competition. Such a business generally has limited market power and any competitor with more innovative and valuable offerings can out-compete it. Emergence of such new business models also forces incumbent traditional (non-digital) companies, if they were to remain relevant, to either re-imagine

34 Sharad Sharma, co-founder of iSPIRT, observed that “entrepreneurs in the silicon valley built products for the 1st billion people on the planet, India is poised to serve the next 6 billion people!” Microsoft Accelerator. (June 2016). op. cit. 26.

35 A business term implying a captive customer base.

36 Network effect means that as more people join a network the value of the network keeps increasing for everyone.

themselves digitally or work in partnerships with digital start-ups. This latter can be a useful arrangement in these early digital times. In India, banks and health service providers have been exploring such partnerships with digital start-ups.^{37 38}

Of the total number of the digital or tech-plus start-ups, a big majority is made up of such small but very innovative players. The sector however get overwhelmed both in clout and publicity by a very few second kind of tech-plus start-ups, those who own digital marketplaces or sector-wide platforms. Globally it is Uber, AirBnB and Alibaba, and among Indian companies, Flipkart, Ola and MakeMyTrip, that hog the limelight.

Unlike the narrow service segment based tech-plus or digital model, the focus of the marketplace/ sector-platform model is to own the sector's digital marketplace itself. The market may first be captured on the basis of considerable innovation, but soon innovation is no longer the main game. It is to develop monopoly and preserve it, by whatever means. Digital marketplace of every sector has unique monopolistic tendencies that such an effort works upon. It is this marketplace start-up model that attracts the highest venture funding. The funding is aimed at taking and cementing the first-mover advantage and developing market monopoly. The somewhat speculative risk factor in such investment is of judging correctly which start-ups will become monopolistic and which will die out.³⁹ Focus on innovation and real value creation, being secondary, is correspondingly less in this model.

These platforms start as simple exchange points. A directory of suppliers and buyers is their key asset, and profits accumulate from the network effect. These could be general e-commerce players like Amazon or Alibaba, taxi services like Uber, or businesses

37 Salman SH. (April 2016). 'Apollo Life & Jiyo to launch corporate wellness platform', *MediaNama*. Retrieved from <https://www.medianama.com/2016/04/223-apollo-life-jiyo-to-launch-corporate-wellness-platform/>; Tarun Balla. (March 2016). 'Why this Indian bank is partnering with startups', *YourStory*. Retrieved from <https://yourstory.com/2016/03/hdfc-bank-fintech-startups/>

38 These sectoral services focussed digital start-ups can be considered as an evolution of tech start-up model, as the latter is more engaged with the substantive side of the service beyond just technical support. The distinction between the two is the extent to which the service is oriented towards networking and data-based innovations to directly solve some 'problem(s)' of a particular sector.

39 Japan's SoftBank, one of the world's largest digital investors, has invested in both Uber and its competitors in different countries like Didi in China, Ola in India, Grab in South East Asia, and 99 in Brazil. This shows the kind of monopolistic stakes that exist in the digital sector. See Sherisse Pham. (October 2017). 'Why SoftBank is investing in Uber – and its big rivals', *CNN tech*. Retrieved from <http://money.cnn.com/2017/10/04/technology/softbank-uber-investment-didi-ola-grab/index.html>

providing accommodation-renting, food delivery, etc. However, soon what becomes even more valuable than the network effect is the data that is continuously generated through digital interactions over these platform. Its value lies in it providing deep and real-time sector intelligence which becomes key to consolidating the business' control across the sector's value chain. The business edge earned through the initial network effect is cemented by data-intelligence effect. The platform becomes an exclusive data mine for the concerned sector. A powerful cycle gets generated whereby greater sectoral presence means more data which converts into greater intelligence to further control the concerned sector.

Any successful digital marketplace business therefore has a natural monopolistic tendency. Control over a sector's data leads to creation of private digital intelligence – the prime business resource in the digital economy. The resulting very high asymmetry of information between the platform owner and all other actors in a sector is used to extract profit both on the sellers' and buyers' sides. This problem is well represented in the phenomenon of non-transparent flexible pricing, first done by Uber but now also by Amazon.⁴⁰

The business model here is to own the 'marketplace'. But it goes much beyond simple old-fashioned transaction brokerage. Exclusive access to detailed intelligence about all actors and activities in a sector is employed not just to connect suppliers and buyers but to closely control the entire range of behaviour of all actors. This is done in a way that ensures the highest profit for the sector-platform owner.

In submitting its opinion on the business model of Uber, the Advocate General of European Court of Justice (ECJ) describes it well:

ECJ Advocate General Maciej Szpunar has submitted an opinion to the court, saying Uber is not an intermediary matching supply with demand but "a genuine organiser and operator of urban transport services". "Drivers who work on the Uber platform do not pursue an independent activity that exists independently of

40 Shumpeter. (January 2016). 'Flexible Figures', *The Economist*. Retrieved from <https://www.economist.com/news/business/21689541-growing-number-companies-are-using-dynamic-pricing-flexible-figures>

the platform," the advocate general wrote. "On the contrary, the activity exists solely because of the platform, without which it would have no sense." Uber, Szpunar argued, creates and controls the supply by setting prices and rules for drivers that allow it to "manage in a way that is just as – if not more – effective than management based on formal orders given by an employer to his employees."⁴¹

The digital platform model therefore is less about running new kinds of marketplaces, or 'e-commerce', and more about setting up data mines and building deep sectoral intelligence of a given sector, acting almost like the sector's 'brain'. This is the central feature of the digital economy, and the starting point to begin understanding it.

In the digital economy, it is not so much the market signals (which in principle are 'public') that organise economic activity, but sectoral digital intelligence that is privately owned by the platform company. To that extent, digital economy can even be seen as a post-market phenomenon.⁴² Digital intelligence can indeed be extremely efficient at organising economic activities in any sector; the problem is its private and monopolistic ownership. This not only results in unjust economic relationships and distribution, in the mid- to long-term it also reduces overall productive potential and growth of an economy.

In order to establish monopoly, the main objective of the owner of a digital marketplace is to quickly hook as many users onto its platform as possible. Subsidizing both the sellers' and buyers' sides is one prominent method employed for this. The model thus depends considerably on how much upfront losses the business can take, and for how long. Another method is to buy-out smaller competitors, and also successful complimentary businesses to dominate the entire value chain, which activities are also very capital intensive.

41 Leonid Bershidsky. (May 2017). 'Why Uber's struggling to remain a tech company', *Bloomberg View*. Retrieved from <https://www.bloomberg.com/view/articles/2017-05-11/why-uber-s-struggling-to-remain-a-tech-company>

42 Market signals based economic organisation is considered by the dominant economic thought today to be superior to centrally planned organisation (like in Soviet Russia). But digital intelligence based centralised organisation of every economic sector is the new digital economy model which, in that respect, considerably supplants the free market approach.

Amazon, Flipkart, Uber, Ola, PayTM, Snapdeal, Oyo, etc, are all currently bleeding cash in India, backed by corporate or venture capital, in an attempt to monopolise the respective markets. Such an exercise can end up in negative value creation, as resources are spent to entrench monopoly positions through predatory pricing and buyouts, thus suppressing competition and innovation. In an article on Indian digital markets, Anand Prasanna, the Shanghai-based director of private markets at Morgan Creek Capital Management, is quoted to say:

“Some 80-90% of the money made in the last 10 years from tech investing has actually been made by No 1 guys in the space and not No. 2s. And to be the No. 1, you have to go out there and capture the market before anyone else does. If it means you have to burn a lot of money to get there, that has to be done.”⁴³

Protesting against ‘capital dumping’ by foreign companies, Indian B2C digital platform companies recently set up a lobby group, to advocate for policy support to ensure that home-grown companies dominate the local Internet market.⁴⁴ The CEO of Flipkart, who heads the group, had earlier remarked:

A significant amount of capital is being dumped in India to win market share. We should create a digital economy. But not by creating an unfair playing field for local companies against those companies coming from other countries.⁴⁵

Ola, an Uber competitor in India, is a member of the new lobby group. Its CEO argues:

What's happening in ... our industries (is that) there is narrative of innovation that non-Indian companies espouse but the real fight is on capital, not innovation. The markets are being distorted by capital.⁴⁶

43 Shrija Agrawal. (April 2015). ‘Can you burn your way to startup success?’, *VCCircle*. Retrieved from <http://techcircle.vccircle.com/2015/04/07/can-you-burn-your-way-to-startup-success/>

44 Binu Paul. (September 2017). ‘Flipkart, Ola, others launch lobby group for Indian e-commerce firms’, *VCCircle*. Retrieved from <https://www.vccircle.com/flipkart-ola-others-launch-lobby-group-for-indian-e-commerce-firms/>

45 Money Control. (September 2017). ‘Founders of Flipkart, Ola, MakeMyTrip to launch a nationalist lobby group’, *Money Control*. Retrieved from <http://www.moneycontrol.com/news/business/startup/founders-of-flipkart-ola-makemytrip-to-launch-a-nationalist-lobby-group-2400289.html>

46 Madhav Chanchani. (December 2016). ‘Flipkart’s Sachin Bansal, Ola’s Bhavish Aggarwal seek government’s help in battle against Amazon & Uber’, *ET Rise*. Retrieved from <https://economictimes.indiatimes.com/small-biz/startups/flipkarts-sachin-bansal-olas-bhavish-aggarwal-seek-governments-help-in-battle-against-foreign-rivals/articleshow/55862027.cms>

The digital economic re-organisation

Just as the factory was the key site around which value chains were organised in the industrial society, in a digital society this central role is performed by digital platforms. If done appropriately, economic re-organisation around this central digital economic institution provides very high efficiencies and value.

The extent of economic re-organisation triggered by digital platforms is evident from how, as they acquire greater control over data based intelligence of a sector, they extend themselves not just horizontally, as a connecting platform or marketplace, but also vertically. Employing privately-owned data-intelligence of the concerned sector, they begin to control the entire 'digital ecosystem' (a term increasingly employed by digital business) of a sector.⁴⁷ Both Alibaba and Amazon are extending their controls across the consumer goods value chain, from production to logistics on the supply side and delivery to payment on the consumer side. Platforms also move into adjacent or complementing businesses. Uber, for instance, is spreading its control over urban transportation, moving into the area of deliveries, from parcels to food.

With a view to further consolidate its reign over the consumer goods value chain, Alibaba recently approached mom-and-pop stores in China to take up their supply chain and logistic back-ends, leaving the consumer interface to the store owners.⁴⁸ Evidently then, selling is not necessarily Alibaba's core competency. It is monopoly over the digital intelligence of the sector. This demonstrates most clearly how Alibaba is really not an e-commerce company but a sector-wide digital intelligence business.

In this manner, more or less, a single intelligent system is created that orchestrates economic activity across the entire sector. With benefits such as just-in-time and customised production, most efficient logistics, and near zero inventories, on the supply

47 A 'digital ecosystem' could be controlled by a single actor (Amazon with regard to its own extensive e-commerce value chains), considerably dominated by a single actor (Google Jobs in online employment services), or loosely dominated (emergence of Baidu's Apollo as a platform for automated transport).

48 Yimian Wu. (August 2017). 'Alibaba to transform China's mom-and-pop shops in massive offline expansion', *China Money Network*. Retrieved from <https://www.chinamoneynetwork.com/2017/08/31/alibaba-transform-chinas-mom-pop-shops-offline-expansion>

side, and with very little transaction costs plus personalised service on the consumer side, there is great value to be obtained through such intelligent across-the-sector re-organisation and orchestration. The ‘sectoral brain’ analogy made earlier is relevant here. Most intelligent systems possess a natural tendency to centralise and be monopolistic, as contributing to better coordination towards the greatest efficiency. It is therefore not the somewhat centrally-coordinated intelligent orchestration of economic activities in any sector that is the real problem; is it the private control of a monopoly business over it.

Some important questions arise from a policy point of view: Can societies allow privately owned platforms/ ecosystems, that are poorly regulated, and often controlled from other countries, to be in such complete charge of sector-wide digital economic re-organisation and orchestration? How does centralisation of digital controls harm innovation in a sector, which thrives best in open competition? In order to decentralise control over data-intelligence, would it be worthwhile to even risk a reduction in overall system intelligence and efficiency? And finally, are some aspects of sector-platform business, which apparently have a core infrastructural nature, better managed by public actors? It is important that digital economy policy-makers address such structural issues, in addition to making the more obvious pro-digitalisation efforts.

As e-commerce companies begin dominating the entire consumer goods value chain, Indian retailers who sell on these platforms have formed an association to represent their collective interests against them. Highlighting the unequal power relationship, the association recently sought government's intervention to set up “an adjudicating authority to settle disputes in the sector”.⁴⁹ In Bangalore, and other cities, Uber and Ola drivers have taken to the streets to protest unilateral and arbitrary control by these companies over fare levels and drivers' incentives.⁵⁰ These are not just teething problems in times of rapid change. The problems are structural, based on very unequal

49 Pranav Mukul. (March 2017). ‘E-commerce payment disputes: Commerce ministry tells sellers group to approach consumer affairs ministry for resolution’, *The Indian Express*. Retrieved from <http://indianexpress.com/article/business/companies/e-commerce-payment-disputes-commerce-ministry-tells-sellers-group-to-approach-consumer-affairs-ministry-for-resolution-4572399/>

50 Alnoor Peermohamed. (March 2017). ‘Hunger strike on: Ola, Uber drivers protest in Bengaluru over reduced pay’, *Business Standard*. Retrieved from http://www.business-standard.com/article/economy-policy/hunger-strike-on-ola-uber-drivers-protest-in-bengaluru-over-reduced-pay-117030100703_1.html

relationships, and information asymmetries, between platform owners and the other actors in the ecosystem, as well as the former's monopoly positions. To address these problems requires new kinds of regulation that are appropriate for the emerging digital realities. Some cab drivers in Bangalore and other cities are trying to set up a cooperative venture for a taxi-app to compete with incumbent ride-hailing companies.⁵¹ However, without some government support, it is very difficult for such efforts to succeed against the might of big digital businesses.

Platform or marketplace owning businesses keep buying out successful tech-plus start-ups in their sector that are specific services focussed (the category discussed earlier). As mentioned, the idea is to own the whole eco-system as one integrated intelligent business. This trend is very much visible in Bangalore/India, with most start-ups positioning themselves for such eventual buyouts. E-commerce companies buyout payment and logistic start-ups (Flipkart and Zomato respectively have done this), with a view to dominate complete ecosystems. Amazon leveraged access to business and financial information of its supplier to get them credit through a partnership with Bank of Baroda.⁵²

We are currently witnessing the first stage of economic re-organisation around digital platforms/ ecosystems, covering sectors like shopping, transportation, travel/ accommodation booking, and finance. Similar changes will soon come to all other sectors, from manufacturing and agriculture to health and education. Initial developments are already discernible in all these areas.⁵³

We will now briefly recount important insights from this section based on studying digital economy developments in Bangalore, and elsewhere. Tech start-ups can be

51 Christin Mathew Philip. (March 2017). 'Protesting cab drivers in Bengaluru may start new service', *The New Indian Express*. Retrieved from <http://www.newindianexpress.com/cities/bengaluru/2017/mar/05/protesting-cab-drivers-in-bengaluru-may-start-new-service-1577788.html>

52 Rashi Varshney. (September 2017). 'Amazon India and Bank of Baroda partners to offer micro loans to sellers', *MediaNama*. Retrieved from <https://www.medianama.com/2017/09/223-amazon-india-ties-with-bank-of-baroda-to-offer-loans-to-its-sellers/>

53 It is basically a question of market power and its potential abuse that must be guarded against. Marketplace platforms for niche narrow segments like: providing handyman services (UrbanClap in India) or sale of used cars (CarDekho in India) could have less of a monopoly problem, and may continue working in a competitive field and innovating.

classified into two kinds. The first kind provides cloud based software/applications supporting various business processes. This sector is mostly B2B, and largely export-oriented in India. Bangalore, and also Chennai, have developed considerable global advantage in this sector of core tech start-ups, combining cost arbitrage with high technical excellence and business acumen. This advantage is expected to continue and possibly consolidate further. Such industry clustering in very few locations is even greater for cloud start-ups than existed in the traditional software industry.

Seeing their original business model weakening, large software service companies are also shifting focus towards cloud based services and products. They are currently in an important period of such transition. Whether they succeed to reposition themselves or not would be evident in a few years. This, and the stabilisation of global business models of core tech start-ups, will determine India's global future in IT services area.

The second kind of start-ups focus on non-tech services in different traditional sectors. These start-ups may begin as simple networking platforms but data-intelligence quickly becomes central to their business models. These are thus properly 'digital' start-ups. They are mostly B2C, and almost all of them in India are focussed on the domestic market. (Food-tech company Zomato is the only one with a substantial presence in some non Indian markets.⁵⁴)

Digital start-ups are further of two kinds. One kind are focussed on specific service segments, digitalising them with disruptive models. These are very innovative, creating a lot of digital value, and generally operate in an open and competitive field. The business model of other kind of start-ups is based on ownership of marketplace/ platform/ ecosystem. They seek to control and re-organise entire sectors through data-intelligence. They have attracted hundreds of millions of dollars of investments, aimed at creating monopolies. While Bangalore has a fair share of these, more of them seem to be emerging in the National Capital Region around Delhi.⁵⁵ This may have to do with their

54 OfficeChai Team. (March 2017). 'How Zomato has quietly become India's first truly international startup', *OfficeChai*. Retrieved from <https://officechai.com/startups/zomato-quietly-become-indias-first-truly-international-startup/#sthash.g8A10Os5.Tvcnwr8R.dpbs>

55 Itika Sharma Punit. (August 2016). 'Atleast 50 Indian startups have the potential to cross a billion dollars in valuation', *Quartz India*. Retrieved from <https://qz.com/763368/at-least-50-indian-startups-have-the-potential-to->

need to connect closely with corresponding traditional industry segments, whose presence is much greater in this region.

While the number of core tech start-ups and specific services focussed digital start-ups is much higher, big money always goes to the platform/ marketplace start-ups. Out of 11 Indian unicorns⁵⁶ in 2016, 9 were such platform companies, and two core tech start-ups, with no narrow-focus digital company.⁵⁷ Huge amount of foreign investment is going into platform/ecosystem companies – mainly from the US, Japan and China. This means control by foreign actors of what are emerging as the key sector-platforms or ecosystems of the digital economy. As these monopolies get entrenched, value outflows from the domestic economy will be very huge, and highly disproportionate to the initial value created by these investments.

The first kind of digital start-ups or companies (narrow service segment based) derive their competitive advantage from innovating new ways of ‘how’ data-intelligence can be employed to add value in a sector. Others can innovate a better ‘how’ and out-compete them. These start-ups, therefore, must keep innovating and delivering real value. The platform/ ecosystem owning model, on the other hand, builds its economic advantage by hoarding sectoral data-intelligence, and retaining exclusive access to it. By not allowing open access to the most important social and economic resource of big data for a wider set of economic players, it is more likely to suppress rather than promote data-intelligence based digital innovation. Similar arguments have been made with regard to intellectual property (IP) rights, but in that case there may at least be a creative process that is temporarily rewarded and compensated. Further, IP rights are given basically to ensure wider availability of IP resources (even if fee-based) and avoid its hoarding for exclusive use, like it is with most data and digital intelligence today. Most of this data comes from outside sources – people's and IoT activity on digital platforms. The basis for retaining exclusive access to data collected from non-proprietary sources, and to intelligence built from it, remains unclear.

[cross-a-billion-dollars-in-valuation/](#)

56 Companies with valuation exceeding one billion US dollars.

57 ‘India's has eleven startups belong to Unicorn Club: Tracxn’, *Skill Outlook*. Retrieved from <http://skilloutlook.com/top-news/indias-eleven-startups-belong-unicorn-club-tracxn>

Once a monopoly position is set, the platform owner has limited incentive for innovation. Its activities then focus mostly on controlling the largest possible slice of the economy by developing vertical and horizontal linkages and consolidation. Platform/marketplace model is like building an infrastructure for own exclusive use and leveraging it as one's core business advantage. Such examples are known from the early days of industrial revolution, and latter technology revolutions. Business advantage was sought by mining and manufacturing companies through exclusive control of rail-roads, and by telephone companies through disallowing interconnection to other service providers. Regulators had to finally step in to ensure open access to such infrastructures. In many cases, the public sector begun to directly provide these infrastructures. Such measures were found necessary to ensure equitable opportunity to all economic actors, and the best economic growth.

As we enter a post-industrial digital economy, core data and digital intelligence of different sectors may also need be to considered as economic and social infrastructure. This calls for their close regulation, open access regimes, and a role for the public sector in their management. Such a case will be made in latter sections, building on some promising policy and project initiatives that are emerging in a few places.

Indian policies supporting tech start-ups

As the tech start-up phenomenon exploded suddenly in India around 2014, governments have become very active to develop policies and programs to support it. Those qualifying as 'start-ups' and registered under the Indian government's start-up program are eligible for some tax exemptions.⁵⁸ They will also be exempt from various inspections requirements (labour, environment, etc), and subject to a liberalised patent regime with 80 percent reduction in patent costs. Start-ups are provided easy entry, related to registration of business, and other licences, as well as easy exit, allowing them to wind-up within 90 days. A corpus has been set aside for funding start-ups.

Many state governments have come up with their own start-up policies, including setting up venture funds and incubators. These incubators are often developed in partnership

⁵⁸ 'Start Up India', Department of Industrial Policy and Promotion, Ministry of Commerce and Industry-Government . Retrieved from <https://www.startupindia.gov.in/>

with industry associations. Governments have roped in prestigious technical and business academic institutions to play a role in their start-up support programs. State governments are competing with one another to be seen as the most start-up friendly. An index is being developed by the central government to rank start-up policies and programs of different states.

An article explains “What does it mean for a state to have a start-up policy?”:⁵⁹

“For one, this would involve each state defining start-ups as per its own criteria and hosting digital platforms that will make it easier for companies to do business. States are also being encouraged to form the so-called Section 8 companies – Invest India is one – that will have executive powers to oversee implementation, aggregate incentives for start-ups and create a unified application system. Besides, it would allow for identifying anchor start-up incubators – support systems for very young companies – such as Telangana’s T-Hub.”

It is important first to have an e-transactions enabling legal framework which recognises e-documents, e-signatures, e-contracts and e-payments, and protects the rights of various parties involved in these processes. This was achieved to a good extent quite early in India through its Information Technology Act legislated in 2000, which was based on the United Nations Model Law on Electronic Commerce, 1996. Further work of developing actual applications, like in area of e-payments, continues to be done in a pro-active manner by the government. Some of these proactive measures will be discussed in the next chapter.

Governments in India are promoting start-ups in all sectors with an emphasis on new technologies, but IT and digital start-ups are the obvious trigger and nucleus of start-up policies and programs. It is interesting, and heartening, to note how new opportunities of great innovation and entrepreneurship in the digital sector could catalyse a society-

59 Taslima Khan. (October 2017). ‘What different states are doing to help startups succeed across India’, *ETCIO.com*. Retrieved from <https://cio.economicstimes.indiatimes.com/news/government-policy/what-different-states-are-doing-to-help-startups-succeed-across-india/60969585>

wide entrepreneurial culture in all sectors. Indian governments have responded to this new context and opportunity in full earnest.

With data-intelligence set to re-organise the whole economy, it is a good opportunity to develop new economic and business promotion policies towards reinvigorating overall business activities. It can help release new entrepreneurial energies, upturning the economic growth curve. However, entrepreneurship alone cannot transform economies. It equally depends on many structural factors of the economy and society.

Start-up policies and programs of Indian governments followed the start-up explosion rather than caused or contributed to it. Their impact on the future of the start-up sector is yet to be known. Someone closely associated with start-up policies and programs cautions that “state policies will take at least three-four years to show signs of success”.⁶⁰ Meanwhile, some improvement certainly seems underway as India recently jumped 30 places in World Bank’s ease of doing business index.⁶¹

A top venture funder in Bangalore commented to us that he is yet to see a really successful company come out of an incubator, putting more emphasis on the native skills of the entrepreneur and the general business climate. Others observed that the start-up policies are not yet working on the ground and business entry (for instance to register the name of a company) and exit (which still took many months) remains difficult. Another very important issue for globally operating SaaS companies is the difficulty in receiving money from across the world when located in India, due to its many financial regulations.⁶²

These few points are mentioned here to underline the need for extensive and demanding policy and cultural shifts. Governments will need to go beyond scratching the surface. Even established IT centres like Hyderabad, despite very friendly policies and programs,

60 Ibid

61 TimesofIndia.com, (October 2017). ‘India jumps 30 places in World Bank’s ease of doing business rankings’, *The Times of India Business*. Retrieved from <https://timesofindia.indiatimes.com/business/india-business/indias-jumps-30-places-in-world-banks-ease-of-doing-business-rankings/articleshow/61360578.cms>

62 The entrepreneur who raised this issue with us shifted his start-up’s headquarters to the US largely because of this one reason.

are finding it difficult to attract start-ups away from the key digital industry centres like Bangalore and the National Capital Region around Delhi.⁶³

It is important not to get caught in a start-up hype, employing it as a relatively convenient response to the digital challenge. Appropriately harnessing this unique opportunity requires considerable work on many fronts including larger economic and social policies and development of new public infrastructures. There is also a need to change the nature of high school, college and professional education systems to inculcate an understanding of the digital phenomenon, innovation culture and business opportunities and risks.

Digital start-ups are routinely cannibalised by large digital companies, either by simply copying their innovations and out-competing them on the strength of market power,⁶⁴ or, relatively more benignly, through buy-outs. An appropriately protective environment is therefore required which does not allow misuse of market power by large digital businesses. New regulatory approaches that include checks against predatory pricing and anti-competitive vertical/horizontal integrations, and enabling of data-portability and inter-operability of digital applications, are required to promote and protect a vibrant start-up sector.

Digital industrialisation therefore requires policy thinking and interventions well beyond (1) liberalising and facilitating all kinds of digital commercial transactions, and (2) supporting a domestic start-up ecosystem. These are the two main policy prescriptions offered by the dominant global e-commerce discourse to developing countries (apart from improving core connectivity and access infrastructure, the need for which is uncontested).

In traditional industrial policies, removing constraints for business activities and

63 Taslima Khan. (October 2017). 'What different states are doing to help startups succeed across India', *ETCIO.com*. Retrieved from <https://cio.economictimes.indiatimes.com/news/government-policy/what-different-states-are-doing-to-help-startups-succeed-across-india/60969585>

64 Olivia Solon. (October 2017). 'As tech companies get richer, is it 'game over' for startups?', *The Guardian*. Retrieved from <https://www.theguardian.com/technology/2017/oct/20/tech-startups-facebook-amazon-google-apple>

entrepreneurship was just one part. As important was to build industrial age infrastructure – roads, ports, power utilities, banking system etc., and also education, health and governance systems. Digital industrial policies too must go beyond enabling private enterprise, important as such support is. It is critical to develop digital age public infrastructures, especially data infrastructures. This important area currently remains almost completely unaddressed.

Part 3: Public data infrastructures

Digital age infrastructure

Digital age infrastructures that are required to be built can be placed in a few categories. At the first level is the connectivity and access infrastructure. It has been of universal focus globally for many years, *inter alia* because it serves the interests of all actors in the digital sector. A digital economy is impossible without it. As a physical layer, it needs to be developed and provided locally. It is a much-discussed policy area, and this paper will not deal with it.

Next is the general or mass-market software layer that supports digital activity, like operating systems, office suites, browsers, etc. Built over it are mass-market Internet applications like search engines and social media. Both general software and application layers are currently provided by global digital businesses, largely US based. Considerable public interest issues have arisen about their monopoly nature, and the corresponding need for their regulation. In the future, some critical mass usage software and generic applications may need to be offered as public utilities. But we will also not get into a detailed discussion of this layer.

Connected to the mass market applications layer is cloud computing infrastructure. Internet companies like Google and Facebook also basically offer cloud based applications. However, this term has acquired greater currency recently with the new IaaS, PaaS and SaaS services. These are aimed at relatively niche segments, and can cover a range of computing needs from raw computing power to specific applications. These models are replacing on-premise software as the dominant software mode.

Cloud computing infrastructure provides computing power and processes – including software, platforms and applications – on a cloud as a general service. Computing needs in the digital age change too quickly for it to be advisable to remain stuck with

inflexible on-premise software/ applications. Further, especially for smaller players, the amount of computing power required may be too high to own privately. This infrastructure layer at present is being serviced by global corporations, mostly US based. Competition is emerging in the cloud applications layer from SaaS start-ups in countries like UK, Israel and India, whose business models are also global. Only EU has initiated some efforts to provide cloud computing as a public utility, beginning with academic users and MSMEs, but the stated policy intention is to extend it across the economy and society.⁶⁵

Since, like mass software and applications, cloud computing mostly involves generic forms with relatively little local specificity,⁶⁶ they can effectively be provided in the form of global templates. This translates into very high economies of scale. It becomes difficult for start-ups to compete with large global companies, unless niche competencies that are globally competitive can be created. This has been achieved by a very few centres outside the US, like Bangalore, and it is not going to be easy for most other locations in developing countries to do so. The opportunity level in this regard for most locations, unfortunately, is lower than what existed for developing globally-competitive software coding services centres (the earlier software industry model). However, as the digital phenomenon seeps deeper and deeper into every society, there exists space to explore domestic and regional markets oriented cloud applications, serving very local contexts and needs.

Availability of diverse and high-quality cloud services is key for developing digital capabilities in all countries. Such technology services are not easy to develop domestically. A single global market enables economies of scale, profits from which are invested in maintaining cutting-edge quality. If a sufficiently competitive global market

⁶⁵ European Commission. (April 2016). 'European Cloud Initiative - Building a competitive data and knowledge economy in Europe', *European Commission*. Retrieved from <https://ec.europa.eu/digital-single-market/en/news/communication-european-cloud-initiative-building-competitive-data-and-knowledge-economy-europe>

⁶⁶ IaaS and PaaS are clearly generic services. SaaS applications support business processes, and indeed would change with different kinds of business processes. But there exists a great amount of homogenisation of businesses processes across the world, at least in formal economic sectors. Global software and applications themselves, no doubt, further contribute to such homogenisation.

for cloud computing can be ensured, its private provisioning at this stage appears fine. Such private provisioning may need to be complemented by public infrastructures in some areas, like high-end computing, which is difficult for small players to source from the market. EU is taking some steps in this direction.⁶⁷

On the top of all these infrastructure layers lies the very important data infrastructure. This layer is fundamentally different from other layers, and must be understood well in order to comprehend the digital economy phenomenon. First, value of data also exhibits economies of scale like software, applications and cloud computing layers. In fact, such is the rapid enhancement of value of data in combination with more data that its economies of scale surpass those of other layers. This disposes data management towards a monopoly character even more than the other layers. We earlier discussed the logic and nature of monopoly data and digital intelligence platforms in different sectors.

On the other hand – and this is the most important point to note, unlike software technology, data is directly and minutely about actual social and physical facts – people, behaviours, interactions, machines and other artefacts, and natural things. One can abstract technology into global templates, but data is obviously situated and ‘local’ by its very nature. More local it is the better, because that makes it truer to particular facts. This is why personal data has one of the highest values. A data infrastructure, therefore, has necessarily to be built locally (though its combination with similar data from outside enhances its value), unlike ‘computing infrastructures’, which includes software, Internet applications and cloud services.

An important issue is the nature of ownership of data as a valuable economic resource. One can claim to have *created* a technical artefact and thus fully own its economic value, as a SaaS provider can claim about its globally supplied products. A similar claim is much more difficult to be made by a data collector/controller about data, which arises from social or physical processes normally lying outside its realm of ownership.

67 Grand Duchy of Luxembourg. (November 2015). ‘European Data Forum 2015 – Marc Hansen believes that ‘Europe has a unique opportunity to invest in the development and deployment of HPC technology and big data to ensure the competitiveness of its research and industries’, *Presidency of the Council of the European Union Grand Duchy of Luxembourg*. Retrieved from <http://www.eu2015lu.eu/en/actualites/articles-actualite/2015/11/17-conf-data-forum/index.html>

Nature of data ownership is currently highly unclear, and it serves the dominant interests in the digital economy to keep it that way. Currently, whoever gets data, by whatever means, is in most cases able to use it indiscriminately, hoard it for exclusive private use, and also sell it.

But discussions have begun in this regard. A recent EU policy document on digital economy sought clarification about ownership of IoT data.⁶⁸ Similar questions can be raised about ownership of personal and social data collected by digital platforms. An analogy may be made here with subterranean minerals (and other natural resources) which are considered collective public resources in most countries, irrespective of who mines them. A public licence is often required to mine them, with stipulated conditions about their use. It may be pertinent to explore if data – which is ‘mined’ from non-proprietary and collective processes and spaces – social, physical and natural, can be similarly considered as a common ‘social resource’. Treating it as a national public resource, can data be allowed to be used only in certain ‘licensed’ manners by its ‘miners’, with clear public interest conditions? One such public interest condition could be of providing open (though secured) access to important core or infrastructural data to all. Such licences could be explicit or implicit.

Data combines with data to create value in form of digital intelligence. As it is considered inadvisable to build two parallel electricity lines to any locality, it is even more under-optimal to isolate data sets and not have them freely talk to each other, when the objective is to maximise development of intelligence.⁶⁹ The data layer therefore has a pronounced ‘natural monopoly’ nature. Society’s basic data systems act as infrastructures supporting all digital age business and other activities. The necessary local-ness of data and vagueness around its legitimate ownership, together with the fact that public data and statistics have always been a public sector function, makes it important to explore the appropriate role of the public sector in building and

68 It is not clear why it does not also argue the same for data from people's interactions over digital platforms. It is perhaps because IoT is an emerging area, and commercial interests not fully entrenched around it. Raising questions about ownership of data collected on platforms where people interact, on the other hand, would be rocking the boat of the current mainstay of digital economy.

69 There can be other considerations to avoid some data linkages, like those related to privacy, and centralisation of power. We are here only expounding the basic principles of digital economy model.

maintaining public data infrastructures.

The benefits of developing public data infrastructures are as follows:

(1) Like all public infrastructures, they will ensure common and open access for everyone to some fundamental digital resources thereby maximizing latter's contribution to creation of economic and other values. (2) They can provide the necessary leverage for governments to appropriately regulate the digital industry, including foreign owned businesses, as all of them require access to key social and economic databases. (3) Governments can employ their upper-hand in the data ecology to favour domestic industry, especially in the nascent stages of its growth before it may be able to compete globally.

IndiaStack – A good foundation for public data infrastructures

This section visits some promising Indian initiatives on developing public data infrastructures. These are interestingly not the result of any coherent, or even at all explicit, digital industrial policy. The EU for instance has more formally articulated policies and programs in this regard. However, unlike in the EU where such efforts are still largely at the level of projects and limited sectors, India has gone ahead with their society-wide implementation, which with its more than a billion population is quite a stupendous task.

Just over the last few years, India has built a set of public digital and data infrastructures that are global pioneers. They are certainly a trail-blazer for developing countries as they consider their digital industrial polices. These are early times, but these public sector efforts already present a good view of what is possible. This section attempts to connect the dots, and present the emerging big picture, with a purpose of gleaning lessons for developing countries in general.

With hardly any precedents available,⁷⁰ it is perhaps excusable that these efforts in India took place in a phased experimental manner, without clear policy and programmatic

⁷⁰ Countries like Estonia do provide some, but at a much smaller scale, and at a very different level of economic development.

blueprints. For instance: The first such infrastructure, *Aadhaar* or Unique ID, for digital identification was created to properly target beneficiaries of welfare programs. But now it underpins the business model of many digital start-ups.

Aadhaar is a part of IndiaStack, a promising initiative of the Indian government that is likely to play a critical role in digitalisation of the economy and the society. A set of open Application Programming Interfaces (APIs),⁷¹ IndiaStack is a unique public digital infrastructure that allows government entities, businesses, start-ups, and developers to provide “presence-less, paperless, and cashless service delivery”.⁷² It has applications for identity management, digital payment gateway, e-authentication, e-storage and e-consent. These applications perform key horizontal supporting functions necessary for a digital economy, and other digital social interactions. IndiaStack is termed as “a set of digital infrastructure platforms as public good to allow solutions to be assembled by the ecosystem”. Nandan Nilekani, co-founder of Infosys, one of India's largest IT companies, considers IndiaStack as “India’s single most important innovation to formalise India’s domestic economy through digital services”.⁷³ After a briefing on IndiaStack, Bill Gates observed that “there are few countries which can boast of a digital infrastructure as sophisticated”.⁷⁴

Bangalore based non-profit iSPIRT (Indian Software Product Industry Round-Table), a think-tank associated with software product or SaaS companies,⁷⁵ partnered with the government to develop IndiaStack. iSPIRT’s promoters had broken off from India’s main software association, NASSCOM, which largely represents traditional IT companies and software multinationals operating in India. iSPIRT presents a nationalist spirit, and wants to see India not just write code for US software products but develop its own world-beating software products. One of its main objective is to develop ‘digital public goods’.

71 APIs are protocols and tools which enable other applications to work with a given application, and this can include data exchanges within given conditions.

72 iSpirit Foundation. (2017). ‘Annual Letter 2017’, *iSpirit*. Retrieved from <http://www.ispirit.in/Media/Documents/iSPIRT-Annual-Letter-2017.pdf>

73 Vishal Krishna. (July 2016). ‘India Stack – A change agent for government, startups and corporates to serve citizens’, YourStory. Retrieved from <https://yourstory.com/2016/07/india-stack/>

74 Ibid

75 iSpirit Foundation. ‘Rewiring the script of the nation’, *iSpirit*. Retrieved from <http://www.ispirit.in/who-we-are/Why-we-exist>

iSPIRT's annual letter for 2017 observes:⁷⁶

Products, especially software products, are built on technology platforms. For instance, SaaS leverages cloud infrastructure providers (like Amazon Web Services). Without the cloud infrastructure providers, SaaS products might have been possible but would have been either too expensive or too complicated. The new infrastructure allows application developers to reach a little farther; to create something new. New global platforms for data, AI and Machine Learning are emerging. They are based on the concept of free flow of data and a new regime of data ownership. A few MNCs own most of these platforms. There is a political economy of these platforms.

iSPIRT wants India to ensure that its “core technology platforms will be public goods”. Interestingly, even as it stresses the importance of cloud computing platforms to India's SaaS industry, for building as public goods iSPIRT focusses not on such core technology platforms but on data platforms.⁷⁷ This it does in partnership with government of India, taking benefit of the latter's unique access to rich social and economic data. As argued earlier, governments hold strong native advantage in the data infrastructure layer. For this reason it is relatively easier and cheaper for governments to build data infrastructures than it would be for them to build computing/software infrastructures. It is also a command over this layer that provides governments the greatest policy leverage to; (1) push rapid digitalisation of the economy and society, (2) achieve digitalisation equitably, (3) encourage and support domestic digital industry, and (4) effectively regulate large digital businesses against monopolistic and other unfair business practices.

The identity management element of IndiaStack is *Aadhaar*, or Unique Identity (UID), which is a biometric digital identity system. More than 95 percent of Indians now have an *Aadhaar* unique number that can associate their fingerprints, iris scan and photograph with their name and address. A mobile application *M-Aadhaar* has been developed to

⁷⁶ iSpirit Foundation. (2017). ‘Annual Letter 2017’. op. cit. 73.

⁷⁷ This confirms the distinction we made earlier between these two infrastructures and how in current circumstances while software/cloud infrastructure can be global and private but for data infrastructure, national level public goods thinking and strategies should be applied.

obviate the need to carry an *Aadhaar* card. Originally created for social welfare delivery, *Aadhaar* is now made available through IndiaStack to private businesses for digital identification.⁷⁸

A whole industry of fin-tech (financial technology) start-ups, like Bangalore based Capitalfloat, has begun to employ *Aadhaar* to identify their customers seeking short term credit, and obtain their credit histories. This has enabled quick short term loans without even physically meeting the customers. Coupled with instant business and financial flow information from other public sector databases, like UPI and GSTn, discussed later, such credit facilities can transform Indian business, especially small businesses that have great difficulty in accessing credit.⁷⁹

Businesses are also using *Aadhaar* for KYC (know your customer) requirements. Mobile companies are legally required to obtain a government provided identity document before providing their services. This part of the cost of customer acquisition used to be around 200 Rupees.⁸⁰ With *Aadhaar*, these companies have cut it down to just a few Rupees, and what used to take a few days can now be done in minutes. *Aadhaar* based easy authentication enabled the new telco Jio acquire more than 100 million customer in a few months.⁸¹ Today 87 % of KYCs of PayTM, India's biggest digital payment company, are *Aadhaar* based.⁸²

Start-ups in areas like health and education have begun to show interest in *Aadhaar*

78 *Aadhaar* is the subject of much controversy and political discussions in India. It has faced strong opposition on privacy count, and with regard to what is feared as giving the Indian government an extremely potent weapon for unconstrained digital surveillance on all aspects of lives of citizens. Many of these concerns are legitimate, and *Aadhaar* requires much better institutional checks. It were *Aadhaar* related controversies that recently resulted in a nine member bench of the Indian Supreme Court instituting privacy as an explicit constitutional right. Another bench of the court will now apply this test to *Aadhaar*'s policy framework and implementation. Instead of looking at *Aadhaar* and the privacy judgement as forces in opposition, we must look at them holistically as evidence of a society that is actively taking control of its digital future, both its rights related and economic aspects. Both these processes together will contribute to developing appropriate new digital institutions.

79 Venkatesh Hariharan. (July 2017). 'GSTN and UPI will help expedite financial inclusion', *LiveMint*. Retrieved from <http://www.livemint.com/Opinion/N51DpQA4bQBLpxOf7M2uhM/GSTN-and-UPI-will-help-expedite-financial-inclusion.html>

80 It is currently about 65 Indian Rupees to one US Dollar.

81 IANS. (February 2017). 'Reliance Jio crosses 100 mn customers: Mukesh Ambani', *Business Standard*. Retrieved from http://www.business-standard.com/article/news-ians/reliance-jio-crosses-100-mn-customers-mukesh-ambani-117021501291_1.html

82 Sanjay Jain. (March 2017). 'Increasing trust by protecting personal data', *IndiaStack*. Retrieved from <http://indiastack.org/tag/ekyc/>

based identity management. It has also attracted the attention of venture capital. Khosla Labs arranged a hackathon to develop *Aadhaar* based applications, and Unitus Seed Fund has a special program for funding start-ups that employ *Aadhaar*.⁸³

The second most popular element of IndiaStack is the Unified Payment Interface (UPI). It enables instant payments to be made digitally between two parties using their respective bank accounts but without requiring bank account numbers etc, thus forming a unified digital payment system. This is achieved directly over a mobile platform and does not require mediating services from credit or debit card companies. PhonePe, a Bangalore based mobile payments company, recently acquired by Flipkart, has built a UPI-based app to provide a cashless payment experience. Its co-founder, Sameer Nigam observes: “Cash management is a multi-billion dollar activity. With payment on delivery you are solving a massive problem.”⁸⁴ Major ride-hailing companies, Uber and Ola, recently connected their payment systems to UPI. Google, Facebook, WhatsApp and Amazon are in the process of doing so.⁸⁵

UPI is owned by the National Payment Corporation of India (NPCI), a non-profit set up under the guidance of the central bank, with 10 promoter banks, most of them public sector undertakings. It largely follows and applies government policy. NPCI also runs RuPay, a domestic payment card network that provides an alternative to international payment cards. NPCI has launched a digital wallet called BHIM⁸⁶ to make digital payments convenient and popular, with the target to reach those who are yet to get into cashless payments. The government is providing incentives to people to begin using BHIM, and the initial figures of usage have been promising.⁸⁷

83 Unitus Seed Fund. (Dec 2014). ‘Unitus to invest 5 crore in Aadhaar UID startups’, *Unitus Seed Fund*. Retrieved from <https://usf.vc/updates/unitus-seed-fund-to-invest-5-crore-in-aadhaar-uid-startups/>

84 Peerzada Abrar. (October 2016). ‘Start-ups find fuel in digital banking project’, *The Hindu*. Retrieved from <http://www.thehindu.com/business/Industry/Start-ups-find-fuel-in-digital-banking-project/article14242396.ece>

85 Tech Desk. (July 2017). ‘Google, Facebook, Whatsapp, Uber could soon support UPI-based payments: All you need to know’, *The Indian Express*. Retrieved from <http://indianexpress.com/article/technology/tech-news-technology/google-facebook-whatsapp-uber-could-soon-support-upi-based-payments-all-you-need-to-know-4745115/>

86 BHIM stands for Bharat Interface for Money. Bharat is another, older, name for India.

87 Navneet Dubey. (April 2017). ‘How penetration of BHIM app is growing in rural India’, *Financial Express*. Retrieved from <http://www.financialexpress.com/money/how-penetration-of-bhim-app-is-growing-in-rural-india/632287/>

IndiaStack also offers e-signature, which can help authenticate any contract, application process, electronic bid, etc, remotely, effortlessly, and quickly. A venture fund manager mentioned to us how, using this service, he could sign a contract while travelling in a cab. If properly implemented, such services can greatly transform ease of doing digital business. The shift is not just quantitative but can be qualitative. Highly reduced transactions costs for making contracts, sharing authenticated documents and making payments, can result in businesses developing linkages and partnerships that were not possible earlier. This opens up entirely new business possibilities, for many new actors. Start-ups in India have begun to take advantage of this new business landscape.

Another service provided by IndiaStack is Digital Locker, “a platform for issuance and verification of documents & certificates in a digital way, thus eliminating the use of physical documents”.⁸⁸

Indian citizens who sign up for a DigiLocker account get a dedicated cloud storage space that is linked to their *Aadhaar* number. Organizations that are registered with Digital Locker can push electronic copies of documents and certificates (e.g. driving license, Voter ID, School certificates) directly into citizens lockers. Citizens can also upload scanned copies of their legacy documents in their accounts. These legacy documents can be electronically signed using the eSign facility.⁸⁹

The IndiaStack team is now working on an ‘electronic consent architecture’, which would enable “data to move freely and securely to democratize the market for data”.⁹⁰ Such e-consent will work through “consent tokens that are time-bound and identity-verified”.⁹¹ *Aadhaar* based verification already obtains SMS based consent from the concerned individual. A secure e-consent architecture can be extended to various kinds of personal data stored in the DigiLocker, or similar publicly secured e-spaces. This could range from financial data to data related to governance, health and education, and

88 ‘About Digital Locker Api’, *IndiaStack*. Retrieved from <http://indiastack.org/digital-locker/>

89 Ibid

90 ‘What is India Stack?’, *IndiaStack*. Retrieved from <http://indiastack.org/about/>

91 Sasi Desai and Nipun Jasuja. (October 2016). ‘The bedrock of digital India’, *Medium*. Retrieved from <https://medium.com/wharton-fintech/the-bedrock-of-a-digital-india-3e96240b3718>

more.

Personal data, and core sectoral data, infrastructures

Among various data resources, personal data is one of the most valuable. It also requires the greatest protection against political, social and economic exploitation. Current discussions about personal data, which are most prominent in Europe, largely do not consider privacy rights together with data's economic value and utility.⁹² This has led to very inconsistent policies and solutions about data privacy in the context of an emerging digital economy that is fundamentally based on exploiting the economic value of data. The EU, among others, is struggling with this contradiction.

It is generally accepted in principle that people should be able to control how their personal data is used, and for what purpose it is used. The real issue is to implement this principle, in a manner that protects people's privacy while eliciting the best economic and social value from personal data, for the individual and the society. Important data systems are generally huge, often society-wide, and very complex. The corresponding institutions for their effective use with privacy protections therefore have to be large-scale and sufficiently resourced.

One arrangement that suggests itself is that the state ensures data protection and consent-based limited access to personal data. In default, we will have society-wide corporatist control through taking over the management of society's data and digital intelligence systems. That is patently problematic, but it is unfortunately the current model. Providing bodily or personal security has been a core duty of the state, and so it should also protect personal data – which can be considered as an extension of one's person-hood. And as it provides legal frameworks for, and safeguards, private property, the state should enable and protect economic ownership of personal data by the concerned individual.

92 These concepts are now entering data related discussions in India. See, for instance, India's IT minister's statement-Press Trust of India. (September 2017). 'India's data protection law will set global benchmark, Ravi Shankar Prasad says', *The Times of India*. Retrieved from <https://timesofindia.indiatimes.com/india/indias-data-protection-law-will-set-global-benchmark-ravi-shankar-prasad-says/articleshow/60439396.cms>

Such a new role for the state requires innovative and strong new institutions, perhaps at the constitutional level, that guarantee people's civil/ political as well as economic/social rights. The recent judgement of the Indian Supreme Court instituting privacy as a constitutional right was triggered by *Aadhaar* related privacy concerns. Another bench of the Court will now apply this constitutional test to *Aadhaar*, and, possibly, to other personal data related activities of the government. This process promises to lead to useful institutional developments in India for public management of key data infrastructures, especially to provide credible and effective checks against data abuse.

Government of India has announced that personal health data of senior citizens will be put on an *Aadhaar* linked smart card. This will ensure their effective access to health services, including insurance. The recently approved National Health Policy 2017 envisages an *Aadhaar* linked Health Information Network that will enable safe sharing of patient data. By 2020, the government will ensure a “district-level electronic database of information on health system components”, and “strengthen the health surveillance system and establish registries for diseases of public health importance.” By 2025, it intends to establish a “federated integrated health information architecture, Health Information Exchanges and National Health Information Network”. The health information architecture will “link systems across public and private health providers at state and national levels consistent with Metadata and Data Standards & Electronic Health Record”.⁹³

Similar society-wide information systems can be devised by governments for education. Educational records and certificates are currently being linked to *Aadhaar*.⁹⁴ Government of India is set to launch a program that “aims to track the educational journey of close to 250 million school students from Class I to Class XII across 1.5 million schools in the

93 Nikhil Pahwa. (March 2017). ‘National Health Policy suggests Aadhaar linked Health Information Network’, *MediaNama*. Retrieved from <https://www.medianama.com/2017/03/223-aadhaar-ehr-health-information-network/>

94 IndiaToday.in. (March 2017). ‘Aadhaar number made mandatory for students to get degrees: UGC’, *India Today Education*. Retrieved from <http://indiatoday.intoday.in/education/story/ugc-makes-aadhaar-number-mandatory-for-students-to-get-degrees/1/911002.html>; Prashant K. Nanda. (Aug 2015). ‘Govt considers linking educational records to Aadhaar’, *LiveMint*. Retrieved from <http://www.livemint.com/Politics/Pyeimf2T6R19R8SabSpsmO/Govt-considers-linking-educational-records-to-Aadhaar.html>

country”. “In other words, this online database will carry information about student attendance and enrolment, mid-day meal service, learning outcomes and infrastructural facilities, among other things, on one platform for both private and government schools.”⁹⁵ An *Aadhaar* linked national labour market information system is also being set up.⁹⁶

(Through the above examples we seek to demonstrate how governments in India are stepping into building digital data infrastructures, including those that involve personal data, and have not left that role to corporate players alone. Whether all of them need to be linked to a single digital identity like *Aadhaar* or not, is a very important question. The various involved trade-offs are likely to be addressed in the *Aadhaar* related judgement of the Supreme Court which will come out in early 2018. It is expected to provide guidelines and seek new institutional developments so that the right of privacy is ensured in governments' data related activities. It is possible that a decentralised way of developing data infrastructures, with multiple rather than single digital identity, may eventually be considered as a better method to ensure appropriate privacy protections. However, these discussions are beyond the scope of this paper.)

A continuum exists between personal data relevant to a specific sector and the more general non-personal data about it. Such data when important across a sector may be called as infrastructural or core sectoral data. In the above discussed areas of health, education, and labour, as also in the ones we will discuss later, both these kinds of data are important, and function together. Sectoral data is often something that is abstracted from relevant personal data, or it could relate to other social, natural or physical features and activities of a sectoral system. In some contexts it is the personal data aspects that are more significant, and in others it is the larger collective data and insights that are central. While these two kinds of data often go together, they need different treatments, and therefore categorisations, which we will come to soon.

One of the most extensive data systems in the country arises from the recently launched

95 Express News Service. (May 2016). ‘HRD Ministry to launch student tracking system’, *The Indian Express*. Retrieved from <http://indianexpress.com/article/india/india-news-india/hrd-ministry-student-tracking-system-shala-asmitha-yojana-smriti-irani-2817574/>

96 Prashant K. Nanda. (Aug 2015). ‘Govt considers linking educational records to Aadhaar’. op. cit. 95

country wide single goods and service tax, GST. Every business, above a threshold level of turnover, has to now regularly submit its transaction accounts. Although it can be done in paper forms, the government encourages online submissions. Most filings are expected to be done online. Even paper forms will be entered online by the government. The GST Network, or GSTn, which collects, stores and analyses GST data can provide a very granular real time picture of the Indian economy, making it very valuable data. This data at present is closed to be accessed only by the concerned individual/ business, and the tax and audit authorities. However, it produces extremely valuable economic insights that governments can use for themselves, and also provide publicly.⁹⁷ If shared and used properly, such data and insights can greatly help businesses make real-time intelligent decisions.

NPCI's earlier mentioned Unified Payment Interface is another massive source of economic and social data. NPCI has also set up a bill aggregation facility called the Bharat Bill Payment System. Initially developed for payment of utility bills like telecom, water, electricity and DTH service, the service will be extended to other payments like school fees, insurance premium etc. The facility is available both offline and online. This system also contains economic and social data that can enrich governments, public and businesses with significant insights.

India's central bank, the Reserve Bank of India (RBI)⁹⁸, recently begun exploring setting up a public credit registry which will be a database of credit information that is accessible to all stakeholders.⁹⁹ The Deputy Governor of RBI claimed that such an arrangement will "improve the credit culture in our country".¹⁰⁰ He especially noted its benefits for MSMEs as many of them lack the required proof to qualify for credit. Apart

97 Regularly picking up valuable insights from a protected database without accessing or transferring the involved data at any stage is a useful innovation presented recently by Google in its concept of 'federated learning'. Governments too can pick such insights from the discussed data systems, and share them publicly for everyone's benefit. In this way we move from public data infrastructures to public digital intelligence infrastructures. This opens up whole new possibilities that we are unable to discuss here due to constraints of space.

98 India's Central Bank

99 Press Trust of India. (August 2017). 'RBI to form panel for setting up public credit registry', *The Economic Times*. Retrieved from <https://economictimes.indiatimes.com/news/economy/policy/rbi-to-form-panel-for-setting-up-public-credit-registry/articleshow/59884472.cms>

100 Press Trust of India. (July 2017). 'RBI mulls an agency to improve credit culture', *The Economic Times*. Retrieved from <https://economictimes.indiatimes.com/news/economy/policy/rbi-mulls-an-agency-to-improve-credit-culture/articleshow/59490773.cms>

from these positive effects, such a public database hits at the business model of those digital finance companies that seek to profit from exclusive access to privately held credit databases. A broadly accessible credit database will lead to more competition and greater innovation among fin-tech start-ups.¹⁰¹ This is a good example of how public availability of core sectoral databases is most beneficial for the economy, rather than their privatisation.

The Indian government is planning to set up a cloud-service called 'FarmerZone' which would be “a shared resource framework.... where(by) right kind of agri data will be collated, analysed and then distributed to take care of day-to-day needs of farmers”.¹⁰² “Data related to weather prediction, disease and pest surveillance & control, soil nutrition, irrigation needs, seed selection, credit linkages and market access will be used for developing the cloud-based platform.”¹⁰³ It should be noted that collecting and privatising large-scale agriculture-related data is emerging as the key business model of big agriculture services companies like Monsanto and John Deere. They are at an advanced stage of rolling-out agriculture services oriented digital platforms in the US and other developed country markets.¹⁰⁴

India has a long tradition of government support for procurement of agriculture produce. The electronic agriculture trading model was pioneered by the state of Karnataka, whose capital is Bangalore. A total of 105 markets spread over 27 districts of the state were brought under the Unified Market Platform by 2016. Private traders including large companies are also allowed to register on this platform. This model became so successful that it was emulated by many other states. The central government has now

101 We are avoiding a discussion here on the important issues of privacy and possible social and economic discriminations that such databases may bring up. Similar problems also exist with corporate held databases. In any case, the paper's focus is on the possibilities and advantages of public data infrastructures.

102 Vishwa Mohani. (August 2017). 'India to set up cloud-based digital platform to provide agriculture solutions to farmers at their doorsteps', *The Times of India*. Retrieved from <https://timesofindia.indiatimes.com/india/india-to-set-up-cloud-based-digital-platform-to-provide-agriculture-solutions-to-farmers-at-their-doorsteps/articleshow/60296401.cms>

103 Ibid

104 Mike Stern. (November 2015). 'Digital Agriculture', *Monsanto Company*. Retrieved from https://monsanto.com/app/uploads/2017/05/digital-ag-stern_2015.11.17.pdf; Dan Charles (January 2014). 'Should Farmers give John Deere and Monsanto their data', *The Salt*. Retrieved from <https://www.npr.org/sections/thesalt/2014/01/21/264577744/should-farmers-give-john-deere-and-monsanto-their-data>

launched an electronic trading platform called the National Agriculture Market (e-NAM). Beginning with 21 agri-markets from eight states, the initiative is proposed to be taken to 585 markets across the country by March 2018. 25 crops, including wheat, maize, pulses, oilseeds, potatoes, onions and spices have been included for trading on the platform.¹⁰⁵ This is an important public initiative for developing the digital marketplace of a key sector. Owning these kinds of sectoral markets has been described earlier to be a key business model of large digital corporations. This initiative could hold lessons for other important sectors too.

We went to a considerable length to present Indian governments' forays into building and managing key data infrastructures, and in one case a sector's digital marketplace. This was done because it is one of the most important areas to attend to by developing countries in preparing their digital industrial policies. This area remains completely neglected in current digital economy discourses.

In conclusion, there are three kinds of data infrastructures that governments need to work on. This should be accompanied by full institutional safeguards for data privacy and protection, preferably formulated at the constitutional level.

The first kind is the horizontal layer of enabling technology-cum-data infrastructure, represented in IndiaStack. It basically ensures easy and secure digital transactions of all kinds. Such a well-developed public digital infrastructure is required to bolster digital economy, in a secure and equitable manner. This is a significant step beyond simply liberalising and deregulating digital interactions, as advocated by the dominant global e-commerce narrative. It is ill-advised to handover this infrastructure layer exclusively to private business, as sought by this narrative, although businesses certainly retains an important role here.¹⁰⁶

A second kind of public data infrastructure involves the sensitive personal data layer. It needs to be managed through sophisticated new institutional and technical

105 Ramesh Chand. (July 2016). 'e-Platform for National Agricultural Market', *Economic & Political Weekly*.

Retrieved from <http://www.epw.in/journal/2016/28/commentary/e-platform-national-agricultural-market.html>

106 EU's common ICT product security certification scheme is a good example of an enabling role of public authorities in cyber-security.

architectures, as India has just about begun to work towards. The primary purpose of such new arrangements will be to put the concerned individual really and fully in control of her/ his personal data,¹⁰⁷ while ensuring the best utilisation of economic and social value of this data, individually and collectively. This has to be achieved without compromising privacy, security and other interests of people.

The third kind of public data infrastructure concerns core sectoral data. This could be abstracted from personal data relevant to a particular sector, and/or contain data from social/ economic interactions, machines, other physical objects, natural environment, etc. Again, India has taken some promising leads in this area. As competencies of governments mature, such data can be subject to data analytics and AI to develop digital intelligence and insights for the use of all economic and social actors. Provision of socio-economic data and information has been a traditional role of the state, which must be upgraded to digital age opportunities and requirements.

Although considerable groundwork has been undertaken in some of these areas, as previously mentioned, India has not followed a clear policy vision or programmatic blueprint. Facing novel emergent digital conditions, such an experimental orientation may have been appropriate in the initial stage. But enough has been tested on the ground by now through various initiatives by India and other countries, and much is known about the general directions that the digital economy and society are taking. It is time for developing countries to pull together a coherent digital industrial policy combining five approaches focussed respectively on; (1) developing enabling legal and regulatory frameworks, including for easy and secure e-transactions, (2) supporting a start-up ecology and other domestic digital businesses, (3) building public digital and data infrastructures of various kinds, (4) shaping frameworks for regulation of digital monopolies that are set to control whole sectors (including regulating data ownership and use, and against problematic vertical and horizontal integrations) and, (5) where required and possible, developing public/community digital platforms, at least in some key areas.

107 Nandan Nilekani. (July 2017). 'Why India needs to be a data democracy', *LiveMint*. Retrieved from <http://www.livemint.com/Opinion/gm1MNTytiT3zRqxt1dXbhK/Why-India-needs-to-be-a-data-democracy.html>

Part 4: Different pathways to digital industrialisation

The dominant US digital economy model

The US envisages big business-led development of a single global digital market, with unencumbered technology and data flows, and the least possible regulation. The role of the state is consigned to core security aspects, and facilitating private business activities. This is currently the globally dominant digital economy model. Competing with this 'US model' is the 'China model'. The latter turned what begun as political control of its Internet/digital space to great economic advantage. China has adopted its unique state-directed capitalism to digital conditions in a novel, and rather successful, manner.

These two digital economy models are currently the most successful ones. Global digital economy is beginning to be seen in terms of a race between the incumbent US and the powerful challenger China.¹⁰⁸ The latter is rapidly making spectacular advances, even cornering some key structural advantages over the US, as is discussed in the next section. Against the big business centric US model and the state centric China model can be posited an emergent, and still rather vague, 'EU-India' model of digital industrialisation. It represents a somewhat mixed economy approach to digital economy, which has an important role for the public sector – unlike the US model, but one which is rights and rules based and not open-ended – as it tends to be in China.

The US took early leadership in IT and digital sectors and has since maintained and consolidated it. To a good extent, this early start was due to its excellent technical education institutions and government's keen interest in promoting science and technology, including in military applications.¹⁰⁹ The US has the world's most favourable cultural and political climate for free market enterprise. It is also the single biggest

108 Saheli Roy Choudhury. (Sept 2017). 'China's artificial intelligence technology is fast catching up to the US, Goldman Sach says', *CNBC*. Retrieved from <https://www.cnbc.com/2017/09/01/goldman-says-china-has-talent-data-and-infrastructure-to-embrace-ai.html>

109 April Dembosky. (June 2013). 'Silicon Valley rooted in backing from US military'. op. cit. 12.

market globally, with people having an easy and open attitude to adopting new technologies in business and their lives. These various factors came together to give rise to the silicon valley phenomenon, which is too well-documented to require a detailed discussion here.

The first phase of the IT economy saw US dominate the stand-alone software market, with heroes like Microsoft, Apple and Oracle. This success was built upon in the emergence of Internet giants like Google and Facebook, marking the next phase of networked software/ applications. It can be called the Internet phase. These companies provided Internet based mass-market applications, that benefited from the first-mover advantage and network effect to establish monopolistic positions globally.

These Internet application companies slowly realised that their platforms were not just monopoly networks in their respective areas, exercising network power¹¹⁰. They were even more useful as monopoly mines of personal and social data, which had immense economic value. With this shift in the principal source of economic power – from controlling digital networks to sitting over exclusive access to personal and social data of a sector, we move from the Internet phase to the digital age. Big data, and digital intelligence drawn from it, becomes the central economic phenomenon here. It is beginning to transform every economic and social activity and institution.

In the Internet phase, it were largely the information and communication sectors that were transformed. This is best represented by Google as the organiser of world's information,¹¹¹ and Facebook of digital social communication globally. Sectors closely related to information and communication, like media, also felt a strong impact. But the digital phase is transforming every single economic sector, with traditional-sectors-oriented US start-ups like Uber and AirBnB (and before them, Amazon) quickly becoming giant global corporations. The phenomenon of digital start-ups has begun to take shape in most other countries as well. This is because unlike general information and communication applications, servicing 'physical' sectors requires business activities

110 Manuel Castells. (March 2011). 'A network theory of power', *International Journal of Communications*. Retrieved from <https://faculty.georgetown.edu/irvinem/theory/Castells-Network-Power-2011.pdf>

111 Chief Executive. (November 2014). 'Google's mission statement evolving as CEO looks to future goals', *Chief Executive*. Retrieved from <https://chiefexecutive.net/googles-mission-statement-evolving-ceo-looks-future-goals/>

beyond the virtual space, with a considerable amount of local specificity.

The key public interest and regulatory issue in the software/Internet phase was monopolies and the associated phenomenon of vertical integration of diverse information/communication sector businesses. US has a tradition of very strong anti-monopoly laws and policies. Regulators had broken AT&T's monopoly in the telephony market, and pursued anti-trust proceedings against IBM for attempting to monopolise business computers market. But with the growing global domination first of its software monopolies and then the Internet ones, the US has changed its stance.

US's current policy orientation to the IT/digital sector is centred on maintaining and consolidating its domination of global technology and digital markets. To this end, it seems even willing to sacrifice domestic regulatory considerations, if required to maintain the appearance of consistency. Standing by its monopoly companies globally is more important to the US government than raising questions about their market power and its possible pernicious effects. As the US strongly resists regulatory interventions by the EU against its digital corporations, as has happened for Microsoft and Google, it refrains from effective action against their abuses at the domestic level.¹¹²

The key policy issue in the digital age is data regulation. Here again, the US has taken a hands-off or 'light touch' approach to privacy and data protection,¹¹³ to enable its digital corporations to prosper by capturing global markets. Facilitating cross border digital business by promoting a single global digital market with unconstrained technology and data flows, and minimum regulation, is the prime feature of US digital industrial policy. This view of digital economy is represented in TPP's e-commerce chapter, now a model for most global trade deals.

112 Nancy Scola. (November 2016). 'Sources: Feds taking second look at Google Search', *Politico*. Retrieved from <https://www.politico.com/story/2016/05/federal-trade-commission-google-search-questions-223078>; Kirk Victor. (July 2017). 'FTC urged to reopen Google probe after record EU fine', *MLex Market Insight*. Retrieved from <https://mlexmarketinsight.com/contact-us/ftcwatch/selected-2017-articles/ftc-urged-to-reopen-google-probe-after-record-eu-fine>

113 Rober D. Atkinson. (July 2016). 'Expanding U.S. Digital Trade and Eliminating Barriers to Digital Exports', *Information Technology and Innovation Foundation*. Retrieved from <https://waysandmeans.house.gov/wp-content/uploads/2016/07/20160713TR-Atkinson-Testimony.pdf>

For most other countries this model will not serve the digital industrialisation purpose; simply because the model is aimed at continued domination of all markets by US digital monopolies. It props up US's digital industrialisation at the expense of that of other countries. The US model offers clearly defined low-end roles to enterprises in other countries, like software coding and managing local physical ends of global digital value chains. These peripheral roles serve US digital corporations, that sit at the top of global value chains, as they develop and monopolise digital-intelligence about all sectors in all countries. The resulting global control ensures enormous and sustained profits.

US's silicon valley is a shining exemplar of technical excellence and entrepreneurship for the whole world. It understandably serves as the role model for every IT centre and every tech entrepreneur. Software and digital sectors everywhere largely owe their basic technologies and business models to the US. These inspirations and learnings are important to take, but that does not necessarily mean that the policy models promoted globally by the US are the best ones for other countries.

China's digital industrialisation

China is the only country that has been able to stand up to US's global digital might. China's initial policy response to the Internet can be characterised as arising from political panic, fearing uncontrollable political dissent or socio-political disharmony, depending on who frames the issue. But standing on the strong shoulders of its manufacturing revolution that had transformed China, the leadership understood that pushing away such a powerful technology wave would be a mistake. It focussed instead on closely managing it. A big problem in this regard was the global nature of the Internet, its applications and information flows. A lot of early Internet related technology work at the government level was aimed at circumscribing or closely filtering Internet's global connection. The principal objective of this effort was political and social, but China reaped windfall gains on the economic front from it. Its walled Internet space allowed China to become the only non-US country to develop home-grown digital infrastructure and applications. It has its own equivalents of Google, Facebook, Whatsapp, Amazon, Uber and AirBnB.

The strategy was simple; to copy US's globally successful applications and let them grow rapidly in the protected Chinese Internet space. These Chinese applications adapted to unique Chinese situations and needs. China has the world's largest newly rich and aspirational population because of its manufacturing and infrastructural revolution. Keen to experiment with new ways of life, they eagerly welcomed the new facilities that the Internet/digital brought. Governments also provided considerable support to these initiatives.

China shift to the digital stage has been even more spectacular than its successes in the Internet applications space. This transition built over the success of Internet companies, which themselves became digital by bringing data and digital intelligence to the centre of their business models. Online trust is key to a successful digital shift, and it has been high in the Chinese society *inter alia* because of its Internet's closely controlled, and thus 'secure', nature. The first wave of Internet application corporations like Baidu and Tencent were followed by businesses that catered to traditional sectors, like Alibaba, JD.com, Didi, and numerous others. Their business models correspond to US global digital corporations like Amazon and Uber. Many digital businesses unique to the Chinese conditions are also emerging, like bike sharing applications, which have become a big hit.

Success breeds success, and produces self-conviction. China's Internet and digital achievements have given great confidence to its policy-makers, whose current globally cutting-edge thinking and approach are unlike the norm in developing countries. Its academic institutions and think-tanks today produce top-class technical outputs and policy insights in the digital arena.

China has understood that more than the software layer, it is the data layer that is key in the digital age. It focusses on building its capabilities in the data layer. The state of Guizhou, for instance, identifies data as its unique competitive advantage.¹¹⁴ A joint event between Guizhou authorities and Indian industry associations was held in June

114 'See <http://www.eguizhou.gov.cn/>

2017 in Bangalore for promoting “communication and cooperation between Bangalore and Guizhou”. A full-page advertisement by Guizhou state in Indian newspapers on the eve of the meeting observed; “Different from Bangalore, where technology and software development is the key, in Guizhou, ‘application’ is top priority”. This underlines how China understands the difference between IT industry and digital industry.

This data- or digital-centric approach is anchored in the development of Guizhou-Cloud by the state of Guizhou, which functions as a digital service company. This cloud contains vast troves of governmental and private data, which is made available to private enterprises helping them shape new business models.

Guizhou Cloud Big Data Industry Co. Ltd. is dedicated to the development of Guizhou’s big data industry, by constructing ecosystem, building and operating GuizhouCloud system platform, constructing the investment and financing platform, operating the fund and incubating the startups in big data and electronic information industry in Guizhou. We provide solutions to our clients including Chinese government departments at different levels and differentiated demand of business clients, by having all services of big data infrastructure, providing services such as data processing and storage, data mining and exchange, business investment and fund management, information technology consultation, lease of communication network equipment, internet access, software development, information system integration, and professional cloud platform and applications.¹¹⁵

This represents a comprehensive public infrastructural approach to the most important digital and data layer. Guizhou-Cloud’s commercial operation is so successful that its facilities are used by Chinese Fortune 500 corporations. Apple now employs this government owned cloud company for data storage to comply with new personal data localisation rules.¹¹⁶

115 ‘Introduction to Guizhou-Cloud Big Data Industry Co., Ltd’, *Guizhou-Cloud Big Data*. . Retrieved from <https://english.gzdata.com.cn/c101/index.html>

116 Paul Mozur, Daisuke Wakabayashi and Nick Wingfield. (July 2017). ‘Apple Opening Data Center in China to Comply With Cybersecurity Law’ *The New York Times*. Retrieved from <https://www.nytimes.com/2017/07/12/business/apple-china-data-center-cybersecurity.html>

Artificial intelligence (AI) is widely considered to be key to digital future. AI basically depends on the amount of data available to feed it. China has a relatively promiscuous culture of data sharing, with very few privacy safeguards (safeguards that really work, especially with respect to the State's dealing with data). Although the US is also developing its digital strength on weak privacy regulation, there do exist considerable legal protections for users, that equally bind governments. Allegations of data related compacts between the US government and its digital corporations often surface in relation to security matters. But the state is not directly involved in provisioning its corporations' data lakes. EU's digital business, meanwhile, considers itself positively hamstrung by its strong data protecting regimes. When Google-Alphabet owned DeepMind accessed data from the National Health Service in the UK to develop an intelligent disease alert, diagnosis and detection system, both entities were hauled up by UK's privacy regulators.¹¹⁷

Compare this with how at a health data conference officials of the Chinese city of Fuzhou openly offered troves of personal health data for development of AI applications.¹¹⁸ SenseTime, a visual recognition AI company, built its video analysis software using footage from the police force in the city of Guangzhou. Xu Li who heads SenseTime notes that most Chinese mega-cities have set up institutes for AI that include some data-sharing arrangements. "In China, the population is huge, so it's much easier to collect the data for whatever use-scenarios you need," he said. "When we talk about data resources, really the largest data source is the government."¹¹⁹

With an Internet savvy population that trusts online spaces and is engaged in diverse online activities, and governments' easy and helpful attitude to data gathering, sharing and use – regarding both government and private business data (with an increasingly explicit purpose of developing high-class digitally intelligent applications and services),

117 Timothy Revell. (July 2017). 'Google DeepMind's NHS data deal 'failed to comply with law', *New Scientist*. Retrieved from <https://www.newscientist.com/article/2139395-google-deepminds-nhs-data-deal-failed-to-comply-with-law/>

118 Mark Bergen and David Ramli. (August 2017). 'China's plan for world domination in AI isn't so crazy after all', *Bloomberg Technology*. Retrieved from <https://www.bloomberg.com/news/articles/2017-08-14/china-s-plan-for-world-domination-in-ai-isn-t-so-crazy-after-all>

119 Ibid

China is building a very formidable data/ digital advantage. When Microsoft declared last year that they have crossed a major AI threshold by using it for language recognition that exceeded human capabilities, Baidu's representative responded; "We had surpassed human-level Chinese recognition in 2015; happy to see Microsoft also get there for English less than a year later."¹²⁰ China's emerging unique data and AI advantage is set to rival or even surpass the US in this field.¹²¹ In a recent policy paper, the Chinese government states its objective of becoming a world leader in AI by 2025. China already leads the US in super-computing, with faster and a larger number of super-computers.¹²²

Employing the business and financial muscle developed from their domestic success, Chinese digital majors are now going global. They are taking on US corporations, not only inside China, if they exist, but also in global markets, especially in the developing world. Chinese digital companies have a major presence in South East Asia, and growing investments in India. Some companies are venturing into West Asia and Africa. Chinese corporations have also been eyeing the US and EU. But unlike in Asia where their main objective is to capture digital marketplace or platforms based business space, the focus in the US and EU is still on acquiring technology enterprises, especially of high-end technologies like AI and robotics.¹²³

Governments' role has been key to the growth of China's digital economy. Uber withdrew from the Chinese market last year, selling its Chinese operations to the Chinese company Didi. Various kinds of government directed support and pressures are often key to such 'successes' of Chinese corporations. A market observer commented:

120 Paul Mozur and John Markoff. (May 2017). 'Is China outsmarting America in AI?', *The New York Times*. Retrieved from <https://www.nytimes.com/2017/05/27/technology/china-us-ai-artificial-intelligence.html>

121 Reuters Staff. (July 2017). 'Australia's ASX selects blockchain to cut costs', *Reuters*. Retrieved from <https://www.reuters.com/article/us-asx-blockchain/australias-asx-selects-blockchain-to-cut-costs-idUSKBN1E037R>; Patrick Tucker. (November 2017). 'China will surpass US in AI around 2025, says Google Eric Schmidt', *Defense One*. Retrieved from <http://www.defenseone.com/technology/2017/11/google-chief-china-will-surpass-us-ai-around-2025/142214/>; Meng Jing and Amanda Lee. (October 2017). 'Where is China's Silicon Valley?', *South China Morning Post*. Retrieved from <http://www.scmp.com/tech/start-ups/article/2106494/where-chinas-silicon-valley>

122 Liam Tung. (November 2017). 'Now China outguns US in top supercomputer showdown', *ZDNet*. Retrieved from <http://www.zdnet.com/article/now-china-outguns-us-in-top-supercomputer-showdown/>

123 Frank Tobe. (November 2017). 'Another two China acquisitions of international robotics companies', *The Robot Report*. Retrieved from <https://www.therobotreport.com/another-chinese-acquisition-european-robotics-manufacturer/>

Uber hasn't just been outcompeted by Didi in China, it has been outflanked by an ecosystem that worked both overtly (by blocking off Uber from WeChat and Alipay – dominant chat and payment platforms in China) and covertly by the Chinese regulators and government.¹²⁴

To their credit, governments have played this 'supporting role' in a sophisticated manner, minimizing explicit interventions and not rocking the 'open and free market' image as far as possible.

The same commentator describes the unique Chinese method of dealing with monopoly digital platforms or marketplaces in this manner:

What China has essentially done is that it has created a giant utility out of Didi-Uber, a near monopoly, highly regulated – yet driven by the profit motive – unlike an inefficient bureaucracy-laden utility.

The logic behind this economic model is simple: the government knows that a state-controlled enterprise will not be able to harness the energy of its entrepreneurs, so it carves out markets for them to play in, provides a cushion of state debt and benign regulations, and allows them to build scale rapidly.

.... the objectives of its strategy are remarkably clear: protect a few domestic firms, allow them to build efficient near-monopolies and in fact, actively encourage them and then govern them with a benign eye to ensure that they don't abuse their power. You get the best of both worlds – a bunch of entrepreneurs who are driven to compete and make billions, and an efficient utility for your consumers that cuts down transaction costs and friction in your economy.

Some aspects of China's digital industrialisation model are good and worthy of

124 Harsh Chawla. (August 2016). 'Uber-Didi deal more about China than about Uber, Didi', *LiveMint*. Retrieved from <http://www.livemint.com/Companies/2IgmPdgh4cP0D8hdbCQWqO/UberDidi-deal-more-about-China-than-about-Uber-Didi.html>

emulation; like, (1) government's strong vision and policies, supporting top-class public academic and R&D institutions, and public investments in technology and data infrastructures, and (2) a strong entrepreneurial culture among the Chinese people and MSMEs, and governments' active support and incentives for them.

Some other elements of the model are good but hard, if not impossible, to reproduce; (1) China is one very big market, and has a very large new middle class, (2) whole of this market functions with one non-English language, and (3) its manufacturing success, and early Internet successes, have meant that a lot of capital is available to both large established corporations and start-ups.

And a few factors in China's digital success may neither be desirable, nor possible to emulate in rules-based liberal-constitutional states, such as; (1) tight political control of the Internet and digital space, that enabled China's early Internet business successes, (2) permissive practises of data collection, sharing and use, with governments and big corporations engaging in them together in a non-transparent manner, and (3) extensive, and largely unchallengeable, practises of *ad hoc* government support to some companies over others.

It still remains useful to study how China's digital protectionist policies and government's strong role in the data space can be selectively applied to other developing countries; to garner economic advantages, while at the same time respecting and promoting people's civil and political rights, including privacy. This has to be achieved in a rules-based manner without relying on a system of *ad-hoc* interventions by the state.

Some insights from the European approach

The EU has been very unhappy with US's near complete domination of the Internet/digital sector. In other economic sectors EU retains a fair global share, while often being dominant domestically. When major Internet companies like Google and Facebook swept Europe taking more than 90 percent of the concerned markets,¹²⁵ there was much protest and noise, and some action. European alternatives were tried, including through

¹²⁵ 'Search Engine Market Share in Europe', *StatCounter GlobalStats*. Retrieved from <http://gs.statcounter.com/search-engine-market-share/all/europe/2016>

public funding, like the European search engine project which failed. Some regulatory measures have also been undertaken, such as against Microsoft's bundling of Internet Explorer with its operating software, Google on the right to be forgotten, and, more recently, Facebook on integrating its data with WhatsApp. However, EU weathered the Internet applications phase without breaking with the US led model of globally free technology flows, with minimum regulation, and keeping the public sector away from any active technology-related role.

The Internet applications phase mostly affected information and communication related industries, like media. In 2014, in an open letter to the CEO of Google, Mathias Döpfner, the CEO of Axel Springer, one of Europe's largest media publishers, said, "we are afraid of Google" because of the power it had accumulated, and worry that the search giant is "becoming a 'superstate' immune from regulation".¹²⁶

In the new digital phase, such strong US domination is extending to every sector, including those where Europe has had traditional advantages. Referring to US digital companies seeking partnership with EU automakers, Dieter Zetsche, the chief executive of Daimler, the maker of Mercedes vehicles, expressed it well: "We do not plan to become the Foxconn of Apple", referring to the Taiwanese-owned company that manufactures iPhones in China. "What is important for us is ... the brain of the car...".¹²⁷ Brain is an appropriate analogy for intelligent processes in the digital age, whose domination over any set of business activities far exceeds that by software or applications. After all, we have lived for years with Microsoft OS running practically on every personal computer worldwide, with just a few murmurs here and there. It is data based intelligence that can provide levers of total, brain-like, control, increasingly extending to all economic sectors. It becomes even more alarming when such centralised controls over various sectors reside outside a country.

Added to such concerns is the fact that the key resource of digital economy is data,

126 Olivia Solon. (April 2014). 'Major media publisher admits it is 'afraid of google'', *Wired*. Retrieved from <http://www.wired.co.uk/article/open-letter-to-google-axel-springer>

127 Jack Ewing. (September 2015). 'Apple and Google create a buzz at Frankfurt Motor Show', *The New York Times*. Retrieved from <https://www.nytimes.com/2015/09/18/automobiles/apples-auto-inroads-create-a-buzz-at-frankfurt-motor-show.html>

including personal data, which is something that European societies have historically been very sensitive about. The extent of consternation in the EU therefore is much more this time around.

Snowden's revelations about how EU's data was being handled in the US precipitated matters. Many in the EU led by German Chancellor Angela Merkel begun advocating for an 'European Cloud', to protect citizen data. It has since become an EU project, although its current stage of implementation is unclear, especially in terms of its mainstream deployment. Right now, it seems to be oriented to researchers and the scientific community.

EU's new General Data Protection Regulation (GDPR), with very stringent data protection provisions, will come into force in May 2018. This could be a game changer. How the US digital model will fully align with it and still remain viable is unclear. The GDPR requires data portability, which means that people can seek access to their data in portable forms, making it easier to switch between service providers and platforms. There are complicated requirements for user consent at every stage of use, and reuse, of personal data. Users also have a right to algorithmic transparency, especially regarding important decision-making processes affecting them. All of these can put a spanner in the works of the US digital model. However, for it to be effective, such data regulation requires constant revisiting to address new developments, like anonymisation of personal data now becoming increasingly reversible.

The US has the advantage of a huge domestic market, while EU's market is fragmented across many national regulatory systems. EU is working on a European Digital Single Market strategy to correct this disadvantage. The GDPR can enable European business to develop unique business models to cater to the EU's digital market, and compete with US companies. There will be a single Data Protection Authority for the single market, ensuring free flow of data across it.¹²⁸ A common digital security architecture is also being developed for the digital single market.¹²⁹ US business alleges such efforts to be

128 European Commission. (2017). 'Building a European data economy', European Commission. Retrieved from http://ec.europa.eu/newsroom/dae/document.cfm?doc_id=41205

129 European Commission. (September 2017). 'State of the Union 2017 – Cybersecurity: Commission scales up EU's response to cyber-attacks', *European Commission*. Retrieved from http://europa.eu/rapid/press-release_IP-17-

protectionist.¹³⁰

In the current traditional-sectors-oriented digital phase, where the digital combines with the ‘physical’ of these other sectors, the EU has come up with what has been called the ‘insider’ strategy. It aims at existing European industrial champions in different sectors building the digital platforms that will dominate the concerned sector. “Industry in Europe should take the lead and become a major contributor to the next generation of digital platforms that will replace today’s Web search engines, operating systems and social networks”, observed Günther Oettinger, European Commissioner for the Digital Economy and Society.¹³¹ This ‘insider model’ is contrasted with the US’s ‘outsider model’ where outsiders – digital start-ups and larger digital companies – are “disrupting established industries from without”. “Or the Chinese version of the same ‘outsider’ model, in which Beijing bars American digital companies from operating and replaces them with Chinese equivalents: Alibaba for Amazon, Baidu for Google.”¹³² A key expression of the ‘insider model’ is the Industry 4.0 initiative of Germany which seeks to leverage its manufacturing might and excellence to lead in the area of digital manufacturing.¹³³

European policy-makers recognise that monopoly digital platforms and ecosystems can be detrimental to public interest and their market power needs to be checked.¹³⁴ They have been undertaking consultations and policy initiatives on regulating such

[3193_en.htm](#)

130 Mark Scott. (September 2016). ‘E.U rules look to unify digital market, but U.S sees protectionism’, *The New York Times*. Retrieved from <https://www.nytimes.com/2016/09/14/technology/eu-us-tech-google-facebook-apple.html>

131 Günther Oettinger . (April 2015). ‘Speech at Hannover Messe: Europe’s future is digital’, *European Commission*. Retrieved from https://ec.europa.eu/commission/commissioners/2014-2019/oettinger/announcements/speech-hannover-messe-europes-future-digital_en

132 Stephen Fidler. (May 2015). ‘Europe Seeks a Model to Repel U.S. Internet Giants’, *Commoditiescontrol.com*. Retrieved from <http://www.commoditiescontrol.com/commodity-market/dowjonescommoditiesnews/europe-seeks-a-model-to-repel-us-internet-giants-20150521DN011950.html>

133 Henning Banthien. (January 2017). ‘Implementation of an Industry 4.0 Strategy - The German Plattform Industrie 4.0’, *European Commission*. Retrieved from <https://ec.europa.eu/digital-single-market/en/blog/implementation-industry-40-strategy-german-plattform-industrie-40>

134 The French National Digital Council report on platform neutrality, see Alexandre Bénétreau. (July 2014). ‘French Digital Council publishes report on platform neutrality’, *European Digital Rights*. Retrieved from <https://edri.org/french-digital-council-publishes-report-platform-neutrality/>; German Ministry for Economy White Paper on Digital Platforms, see Jennifer Boudet and Miranda Cole. (April 2017). ‘German Ministry for Economy publishes white paper on Digital Platforms’, *Inside Tech Media*. Retrieved from <https://www.insidetechmedia.com/2017/04/10/german-ministry-for-economy-publishes-a-white-paper-on-digital-platforms/>

platforms.¹³⁵

The EU has also begun to take a more direct role in protecting its citizen's personal data, while ensuring availability of its economic and social value to the concerned individual and the society. This is expressed in development of public digital platforms in key sectors, such as health and transportation. EU's eHealth Digital Service Infrastructure and Cross Border eHealth Information Services enable EU-wide safe exchange of health data, like Patient Summary and ePrescription.¹³⁶ EU has established a Cooperative Intelligent Transport Systems, which is a multi-stakeholder platform, towards "cooperative, connected and automated mobility". This data sharing platform was developed in pursuance of an EU regulation that calls for development of an "interoperable, standardized, secure, open-access platform" for the sharing of transport data. Such a public digital transport platform or ecosystem has to seen in relation to similar efforts by global digital companies – like the Apollo platform promoted by Baidu, as the 'Android of the autonomous driving industry'.¹³⁷

Europe increasingly understands public digital infrastructures to be a key need for digital economy and society. EU's policy perspectives in this regard are well worked out in many documents, providing useful insights. Unfortunately, their practical implementation is still only at a project level or limited to select sectors. Unlike India, it has not yet gone for society wide creation of such infrastructure. (This may be due to political foot-dragging about disengaging from the US-led neoliberal global digital order that has no place for public digital infrastructures.)

The recent 'European Cloud Initiative to give Europe a global lead in the data-driven economy' plans to begin with an 'open science cloud' for European researchers,

135 European Commission. (January 2016). 'Public consultation on the regulatory environment for platforms, online intermediaries, data and cloud computing and the collaborative economy', *European Commission*. Retrieved from <https://ec.europa.eu/digital-single-market/en/news/public-consultation-regulatory-environment-platforms-online-intermediaries-data-and-cloud>

136 Ehealth Network. (November 2015). 'Governance model for the eHealth Digital Service Infrastructure during the CEF funding', *European Commission Public Health*. Retrieved from https://ec.europa.eu/health/sites/health/files/ehealth/docs/ev_20151123_co02_en.pdf

137 Darrell Etherington. (July 2017). 'Baidu's Apollo platform becomes the 'Android of the autonomous driving industry'', *TechCrunch*. Retrieved from <https://techcrunch.com/2017/07/05/baidus-apollo-platform-becomes-the-android-of-the-autonomous-driving-industry/>

providing cloud based computing and open data services. The “user base will over time be enlarged to the public sector and to industry”,¹³⁸ which is a very significant aspiration and promise. This underlines EU’s appreciation of the need for public digital and data infrastructures, and it may be leaning towards such a model.

‘Data commons’ is an important paradigm for EU’s Open Science Cloud project.¹³⁹ EU also supports a pilot project in the cities of Amsterdam and Barcelona for city managed ‘data commons’. The aim of this project is “to create local open and decentralised data platforms, where people can use data to guide meaningful decisions and actions”.¹⁴⁰

EU’s emerging perceptions on the public value of data are evident in the new policy document “Building a European Data Economy”.¹⁴¹ Its data related observations are centred on IoT or machine generated digital data (which can also be of a personal nature), but they have equal relevance to data generated by people on various digital platforms.¹⁴² This document asserts that with “sharing, reuse and aggregation, machine-generated data becomes a source of value creation, innovation and diversity of business models...effective access to data (must be ensured), taking into account, for example, possible differences in bargaining power between market players”. It seeks clarifications around ownership rights to data, and proposes that “‘data producers’ could be granted a right to use and authorise the use of non-personal data”. “All this will help unlocking the value of data for a larger number of actors, also leading to better data markets.”

To improve data sharing and re-use, frameworks based “on certain key principles, such as fair, reasonable and non-discriminatory (FRAND) terms¹⁴³, could be developed for data

138 European Commission. (April 2016). ‘European Cloud Initiative to give Europe a global lead in the data-driven economy’, *European Commission*. Retrieved from http://europa.eu/rapid/press-release_IP-16-1408_en.htm

139 EGI Foundation. (August 2015). ‘An Open Science Cloud to realize the data commons’, *EGI*. Retrieved from <http://go.egi.eu/OpenScienceCloud>

140 See <https://www.decodeproject.eu/pilots>

141 European Commission. (2017). ‘Building a European data economy’. op. cit. 129

142 As mentioned earlier, there is a certain contradiction in EU’s greater focus on ownership patterns, and the need for sharing, of IoT data, but not with regard to people generated data. It may have to do with not wanting to rock the already well-established commercial models based on the latter. It may also be connected to the fact that the EU is seeking to focus on digital manufacturing, *a la* Industry 4.0. However, this contradiction is theoretically as well as practically difficult to sustain.

143 This term has been used to mandate universal access to proprietary standards. Here too, as in case of a lot of data, there is recognition of a publicly valuable resource whose value is in sharing but the original creator needs to be provided ‘fair’ remuneration. It can also be compared to the phenomenon of compulsory licensing in public interest.

holders, such as manufacturers, service providers or other parties, to provide access to the data they hold against remuneration after anonymisation”. The document ‘Building a European Data Economy’ further speaks of public authorities to be “granted access to data where this would be in the ‘general interest’ and would considerably improve the functioning of the public sector, for example, access for statistical offices to business data, or the optimisation of traffic management systems on the basis of real-time data from private vehicles”. “APIs can help firms and public authorities to identify, and profit from, different types of re-uses of the data they hold.” As discussed earlier, APIs¹⁴⁴ are also key to how the Indian government has been providing guarded access (from security and privacy point of view) to public databases, for wider benefit of the economy and society.

These are some very interesting policy perspectives on data ownership and data architectures, the nature of which define digital economy models. Different architectures could result in different levels of effective use of data resources for society's benefits including economic growth, and of data-related social and personal harm. They would also determine how different countries are placed in the global digital economy. Meanwhile, globally, EU still fully backs the US-led neoliberal approach to digital economy – with no digital infrastructural role for governments and extremely limited digital regulation, even as it continues to blow hot and cold on the data protection issue.¹⁴⁵

But the EU has begun to face tough choices on continuing with such a *laissez faire* approach to digital economy. Following a national controversy on takeover of a German robotics firm by a Chinese company, Germany has instituted new rules to block such takeovers if they go against country's strategic interest.¹⁴⁶ “The enterprises that might raise German public order or security concerns are dealing with critical infrastructure, especially software in the fields of telecommunication, cloud-computing, energy and

144 Application Programming Interfaces

145 This gets well-represented in EU's internal struggles on data related provisions of the Trade in Services Agreement that is being negotiated. Catherine Stupp. (October 2016). ‘European Commission paralysed over data flows in TiSA trade deal’, *Euractiv*. Retrieved from <https://www.euractiv.com/section/trade-society/news/european-commission-paralysed-over-data-flows-in-tisa-trade-deal/>

146 Reuters. (July 2017). ‘China worried over Germany's new takeover rules’, *The National*. Retrieved from <https://www.thenational.ae/business/markets/china-worried-over-germany-s-new-takeover-rules-1.608826>

water, finance and insurance, healthcare, transport and food industry.”¹⁴⁷ In a sign of the emerging internal contradictions in the Northern digital economy approach, the Federation of German Industries (BDI) responded to these new rules by asserting that it “rejects a law on foreign trade that increasingly blocks investments”.¹⁴⁸

Taking a cue from Germany, a similar regulation is being considered at the EU level. Quoting from a Reuters article;

The proposal could give the EU – which can already block takeovers on antitrust grounds – power to scrutinize “investments in the EU of strategic importance both from an economic and security perspective”. That would include defence, transport infrastructure and critical and cutting-edge technologies and could be extended to deals that put at risk a vaguely defined ‘economic prosperity’, according to the proposal from the European Commission’s industry department seen by Reuters. The paper makes several references to China, citing, as one hypothetical example of an undesirable deal, a company receiving funds from the Chinese government to enable it to buy a European company to make a “strategic penetration of the EU market”.¹⁴⁹

Intelligence infrastructures (involving data and digital intelligence) in all key sectors could soon face similar scrutiny, because they are evidently the most critical elements or layers for all sectors, exercising a ‘brain-like’ controlling influence on them. Capturing the critical data and digital intelligence layer of every sector is the central business model of sectoral-platform owning corporations. The phrase ‘strategic penetration of the market’ perfectly fits this business model. Going by the EU rules under discussion, in the future domestic protections against marketplace/platform owning foreign companies cannot be ruled out.¹⁵⁰

147 Beiten Burkhardt. ‘Germany tightens its rules on foreign corporation acquisitions and proposes an EU regulation’, *Lexology*. Retrieved from <https://www.lexology.com/library/detail.aspx?g=82609c3b-dc1f-4898-859f-aaf9d8b4c519>

148 Pamela Barbaglia, Rene Wagner and Arno Schuetze. (July 2017). ‘Update 3 - Germany sets EU tone with tighter curbs on foreign takeovers’, *CNBC*. Retrieved from <https://www.cnbc.com/2017/07/12/reuters-america-update-3-germany-sets-eu-tone-with-tighter-curbs-on-foreign-takeovers.html>

149 Francesco Guarascio. (March 2017). ‘EU plans measures to block foreign takeovers of strategic firms’, *Reuters*. Retrieved from <https://www.reuters.com/article/us-eu-trade/eu-plans-measures-to-block-foreign-takeovers-of-strategic-firms-idUSKBN16H1DZ>

150 China has been careful to avoid getting into platform owning businesses in the EU and the US, where it has focused

Emergent digital economy/society approaches of both India and EU operate within, and with great sensitivity to, the strong magnetic field of the dominant US model. This is understandable, and a practical approach. EU is US's close geo-economic partner, and India's IT/software sector was built around the US industry, and still remains considerably dependent.

EU's new approaches stem from its fear of losing out in the digital economy, especially as it penetrates and transform all sectors. It is also worried about data privacy issues with the US model. India's efforts, on the other hand, come simply from being a developing country most of whose citizens are resource poor. The Indian government can see that an exclusively (global) market-driven digital economy/society model is just not going to reach them all, or even a sufficiently large number, in any foreseeable future. Indian efforts do not challenge the dominant model, mostly not even with regard to critical technologies and data infrastructures. They are public initiatives to extend digital economy/society benefits to the un-reached, seeking universal digital coverage. Aadhar, UPI and e-consent framework, and the e-agriculture marketplace, are all designed to ensure universal reach, and the development of the digital economy in an inclusive and equitable manner.

Some promising convergences can be detected between the emerging Indian and EU approaches, although the full picture is far from well-developed. Most important is that both have begun to form useful perspectives (explicit or implicit) on private versus commons or public nature of data and digital intelligence. Connected to it are explorations about the role of the public sector in the digital economy; such as, directly running some digital infrastructures, supporting and underpinning efficient data markets, and, regulating private digital businesses, especially those with monopolistic tendencies, as well as those that are recognised to be critical to the economy and society.

on high tech business acquisitions. It now faces regulatory opposition in this regard. Were it to get into platform business, the clamour and opposition are only going to be much greater. This point should be noted by Asian countries where China mainly eyes the platform owning business model, often in competition with US companies.

The last part of the paper will sum up various insights emerging from the discussions till now, in the form of (1) some directions towards formulating digital industrial policies by developing countries, and (2) the positions that they can take at global trade venues discussing 'e-commerce'.

Part 5: Digital economy policies for developing countries

Towards a digital industrial policy

Digital must be considered as distinct from the IT/software and Internet sectors or phases, even as it builds over them. The term ‘e-commerce’ does stress this shift, of digital being about the actual economy, and not just the technology, or information and communication, parts of it. But ‘e-commerce’ covers only trading and market exchanges in the new context. That is what Amazon or Alibaba can be said to do. But digital economy is not just about trading, even as it transforms trading as well. It concerns very considerable changes in all aspects of all economic sectors – from transportation, hotel and tourism, to finance and logistics, to health, education, agriculture and manufacturing. The term ‘e-commerce’ is inadequate to capture these diverse changes.

We discussed how even the e-commerce companies like Amazon and Alibaba have gone much beyond selling goods to re-engineering the entire consumer goods economy, and controlling it digitally. Online marketplaces transcend traditional definitions of open markets by manipulating prices dynamically among buyers, and across buyers and sellers, as also the access for sellers to different buyers. Further, they penetrate the entire value chain from manufacturing to inventory management to logistics to delivery and payments. They are therefore far from just neutral platforms for buying and selling. The area that needs focus as their main business asset is sector-wide digital intelligence across the consumer goods value chain. They may more appropriately be treated as monopolistic digital intelligence service businesses rather than e-commerce. This makes an Amazon quite like a Uber, or a Monsanto setting up a digital agriculture services platform. We saw how it is not necessary for a digital intelligence business to be monopolistic in our study of narrow service segment focussed digital start-ups. We also briefly explored how public or ‘commons’ data infrastructures in a sector can enable a competitive play for digital businesses.

Economic value chains once used to be centred on manufacturing capabilities, and then

in the last many decades intellectual property ownership has risen to the top of these value chains. Digital economy is the next stage, where economic value chains become centred on digital intelligence services in each sector. Core digital intelligence services extending across a sector have a natural monopoly characteristic. The current digital economy model is of a sector's core intelligence to be privately owned, by one or two monopolistic corporations, based on exclusive control of core sectoral data, even if it is collected mostly from 'commons' sources. Alternatively, core sectoral data and digital intelligence could be in the form of public infrastructures. Employing it, a set of digital businesses could develop further private data and digital intelligence and provide digital intelligence services in an open and competitive manner.

Use of the term 'e-commerce', in the larger meaning that it is employed at global trade venues, and for domestic digital sector-platforms, should be discontinued. 'Digital businesses', 'digital trade', and 'digital economy' are the appropriate terms. Instead of e-commerce policies, we should be discussing and formulating digital economy and digital trade policies. Understanding digital trade can only follow from understanding digital economy. Like with earlier phases of industrialisation, developing countries must first focus on digital industrialisation, where they are severely lagging behind, before entering into commitments on global digital trade.

A digital industrial policy begins with developing enabling legal and regulatory frameworks to support easy and legally-recognised digital interactions, and protecting the interests of all actors in this regard. The importance of this is well-recognised by most countries, and necessary frameworks are either already in place or being developed.

One aspect of any digital industrial policy would be to build a supportive environment around tech and digital start-ups that have begun to emerge in most developing countries. This new sector must be recognised in its peculiarities and unique needs, and its great national importance. Meeting its capital requirements, including through venture funds, is vital. As important is to undertake ease-of-doing-business measures, especially quick and easy entry as well as exit for these businesses. Developing and

supporting incubators and accelerators, in association with industry groups, will have a significant impact on shaping a local start-up ecosystem.

Effective start-up supporting policies depend on the policy-makers' understanding of the tech and digital start-up sector, and the various kinds of involved start-ups. A typology of them was offered earlier in the Indian context, which is useful for all developing countries. With cloud based SaaS industry, a further consolidation has happened in the software space with even fewer viable industry centres globally than existed for the on-premise software (coding) model. A proper assessment should therefore be made whether any particular location has comparative advantages to globally compete in this area, in a market which is highly globalised,¹⁵¹ or whether such advantages can be created. In the current conditions, it may not be easy to do so for most locations.¹⁵² But, as discussed earlier, there does exist space for cloud based companies catering to niche domestic and regional software needs and markets, especially if these markets are given some protection. This space will expand as the digital phenomenon seeps deeper into all parts of the economy and society.

Meanwhile, even as cloud based solutions are becoming the mainstay, considerable on-premise IT/ software related work, outsourced from abroad and also aimed at the domestic economy, is still required. There continues to be business opportunity in this area for many relatively established as well as emerging software centre across the developing world, and for smaller companies and new entrepreneurship.

The other kind of start-ups, that we typified as digital start-ups, need special attention and new policy orientations. This is because they have a unique characteristic of localness of their key resource i.e. data, as discussed earlier. But they still need to compete with global businesses, with huge financial muscle, that are entering every country's digital space. They also need to be protected from being sucked into monopolistic platform/ ecosystem owning businesses, on unfair terms – for them, and for the larger economy. Public management of some digital/data infrastructures can

151 It has structural features that makes it most suitable to be a single global market.

152 As discussed earlier, a few centres in India have developing such a global advantage, but it is not easy to replicate it. Even within India it is highly concentrated in 2-3 centres.

provide significant support to domestic digital industry. Some such possibilities will be mentioned presently.

Digital transformation has come at a good time for many developing countries experiencing a big surge in the number of educated and aspiring youth, seeking to break away from shackles of under-development, for themselves and their societies. The current digital ferment can trigger new entrepreneurial energies and cultures, helping shape a new phase in economic and social development. Entrepreneurship is as much cultural, a matter of a certain kind of individual and collective spirit and behaviour, as its conditions are institutional. Both these aspects need to be promoted simultaneously by appropriate strategies and policies. A lot of digital innovation is currently being tried out in almost all sectors in India (among other countries), and the landscape here is useful to study and learn from for other developing countries.

But the innovation and start-up discourse needs to be carefully moderated. While innovation is important, much late industrialisation in most countries has always involved just copying successful business models and technologies from outside, and applying them to the local contexts. This holds true for digital industrialisation as well. Not every start-up needs to set out to become the next global unicorn. It is important both to manage expectations, and keep the focus considerably domestic (or to regional markets). It may be noted that even with relatively favourable conditions, there is hardly any traditional-sectors-oriented digital start-up in India that has made a prominent global mark.

As traditional sectors go digital, much of early innovation in technology and digital business models has already taken place in the US and elsewhere. A major part of the digital challenge is to adapt these to local conditions. In this regard, some established domestic traditional businesses can take a lead on digital efforts in their respective areas.¹⁵³ As we saw, EU is focussing on such an ‘insider model’. It is also worth looking at

153 Ashok Leyland, a goods transport company in India, is building a digital platform for end-to-end needs of goods transport sector, see Pankaj Maru. (September 2017). ‘How Ashok Leyland built its digital marketplace to create new revenue streams’, *ETCIO.com*. Retrieved from <https://cio.economictimes.indiatimes.com/news/corporate-news/how-ashok-leyland-built-its-digital-marketplace-to-create-new-revenue-streams/60356777>

by developing countries.

Traditional businesses have the advantage of sectoral expertise. They can also come up with the needed funds (beyond venture capital), willing to take some amount of risk within the sectors that they understand and have a foothold in. Such alternative sources of finance need to be explored because venture capital is scarce in developing countries. There is the problem however that digital seeks to disrupt and transform existing business models which is not easy to do from within. To meet the requirements of innovation and 'disruption', it may be useful to get start-ups to partner with traditional businesses, especially involving young leaders from the latter. Banks and health companies in India have been developing partnerships respectively with fin-tech and health-tech start-ups. Special strategies and initiatives need to be devised in this regard.

Governments can provide incentives to people and businesses to undertake a digital makeover, and also nudge them in other ways. The Indian government has taken a lot of very useful, and far-reaching, steps in this direction. However, individual and social behaviour, as well as every social/ economic system, has considerable inertia. Any large-scale change carries a cost, especially if done quickly. As is with any other economic and social change, interests of different people, groups and businesses may be affected differently in any digital makeover. Digitalisation tends to favour the formal sector over the informal sector, and where there exist competitive overlaps between the two it can be of considerable detriment to the latter. It is therefore advisable not to take any blunt social-engineering approach in this respect, and chart out the way forward carefully. Pilots and phased roll-outs are useful methods, although the appropriate way of implementation would depend on the context. All the involved trade-offs should be carefully evaluated, especially the impact on weaker sections of society.

As industrial development centrally required public investments in infrastructure, a digital industrialisation policy must also focus on building public digital and data infrastructures. This is the single most important, and yet neglected, area for governments to urgently address. It goes beyond connectivity/access, and the

IT/software layers, that are often discussed. These pre-digital infrastructures remain important; digital cannot exist without them. But, whichever stage a country may be in terms of these pre-digital infrastructures, it needs to concurrently begin developing digital and data infrastructures as well. Taking a relaxed sequential approach could result in a debilitating exclusion from key digital economy/society developments.

Being successful in developing digital/data infrastructure may be less difficult for governments than generally thought. The barriers are more of conceptual understanding and political will than physical and resources related. Unlike connectivity/access infrastructure which is a physical layer, and thus takes considerable resources and time to universalise, digital is a soft layer and can be developed much more quickly, and relatively cheaper. And unlike the IT/software layer, where the offerings of global digital corporations may be difficult to beat or replace,¹⁵⁴ data infrastructures have a very strong local character, and governments have traditional competence and advantage in the area of large-scale data systems. This would have become evident from our discussions on how the Indian government is taking path-breaking steps in this area.

As discussed, the public sector must explore its role in three kinds of data infrastructures; (1) horizontal, digital transactions enabling, (2) personal data architectures, that are safe while providing the best social and economic value for the individual and the society, and (3) core sectoral data for different sectors (here may also be included important society-wide data sets).

Appropriate public digital and data infrastructures can ensure a robust, competitive and inclusive digital economy, that supports new and diverse digital business models. It also enables easy access to social and economic data required to meet various public interests objectives, like of policy making and governance. It can also provide leverage for governments to effectively regulate digital businesses. Apart from India, we saw that some initiatives and policy frameworks in the EU provide good lessons in this regard.

¹⁵⁴ Many national efforts to develop software like operating software (in India for instance), and applications like search engine (in the EU), have not been very successful.

Promising new thinking is emerging in the EU regarding appropriate regulation for data, digital, and platform businesses. Data regulation is one of the most important regulatory issues right now. Developing countries need to understand both privacy rights and economic value/ownership aspects of data, and their interplay. Digital platforms that dominate and shape complete sectors urgently require new regulatory approaches. They increasingly constitute the all-powerful intelligence infrastructure of every sector. From economic, social and security/strategic/political points of view, digital sector-platforms represent extremely critical infrastructures. All these standpoints should inform their regulation.

An important way to support domestic digital industry is through government procurement. Alibaba's e-commerce platform relied considerably in the initial stages on government purchases.¹⁵⁵ Where needed, governments may themselves have to get into developing some digital services, possibly in partnership with domestic industry. We saw the Indian government set up the rather successful e- agriculture marketing platform.

Unlike it was for the IT/software industry, technical skills by themselves are not sufficient or very useful in the digital phase.¹⁵⁶ Technical, business and other educational processes need to focus on understanding the digital phenomenon, and development of appropriate digital business, social, and policy skills. Chinese governments and its academic institutions have made a quick and extremely remarkable transition to centrally promoting digital knowledge and skills. Some of the world's cutting-edge work in the digital area today comes from China. A lot of such effort involves public sector partnerships with Chinese digital corporations.¹⁵⁷ This area requires urgent public investments in all developing countries. It is important to see business, social and policy skills in the digital area as quite different from the relevant technical skills, and all should be promoted.

155 Paul Carsten and John Ruwisch. (June 2015). 'Still an underdog, but China government deals help Alibaba's cloud ambitions', *Reuters*. Retrieved from <https://www.reuters.com/article/us-alibaba-cloud/still-an-underdog-but-china-government-deals-help-alibabas-cloud-ambitions-idUSKBN0OY2TC20150619>

156 It is such basic technical skills, available in large quantities, that first established India in the global software market.

157 Dave Gershgor. (February 2017). 'China is funding Baidu to take on the US in deep-learning research', *Quartz*. Retrieved from <https://qz.com/916738/china-is-funding-baidu-to-take-on-the-united-states-in-deep-learning-research/>

Digital policy and programmatic requirements are so new, intense and cross-sectoral that considerable institutional change will be required within governments. It is not adequate for IT ministries to keep dealing with this sector in a technology-centric manner. On the other hand, commerce and industry ministries remain too focussed on industrial age thinking, and normally do not possess enough digital knowledge and orientation. There is a need to create a new ministry or department for ‘digital economy’ – preferably for ‘digital society’, with ‘digital economy’ as a specialisation within in. It is possible for IT ministries to evolve in this direction, but the thinking, orientation and expertise must undergo considerable change. As digital economy represents the application of digital to all sectors and industries, including manufacturing, (the phenomenon of “Industry 4.0” and “Internet plus”), commerce and industry promotion ministries too must make a conscious transition to a new skill set. IT and industry ministries need to work together on developing digital industrial policies.

As an urgent starting point, developing country policy-makers need to begin obtaining appropriate knowledge and policy perspectives in this area. They cannot remain dependent on global venues where knowledge seems to be determined by Northern interests. This is even more so in crucial emerging areas like digital economy where economic models and global comparative advantages are still being formed and entrenched.

Unfortunately, a singular narrative on digital economy has been established, and depending on whether one subscribes to it or not one is taken to be either for a digital economy or not. Digital economy is a given, as much as industrialisation was inevitable on invention of means of incorporating steam and later fossil fuel and electric power into manufacturing.¹⁵⁸ It is not a matter of being for or against it. It is about what kind of digital economy we should have. And, exploring the different possible pathways, along with mapping differential interests that are involved. ‘Development agendas’ in trade and intellectual property areas were about differential contexts and interests of developing countries vis a vis those of developed ones. A development agenda for digital

¹⁵⁸ If industrialisation was about disembodiment of physical power from human and animals to machines, digital revolution is about disembodiment of intelligence from humans and human systems to machines.

economy needs similarly to be articulated, based on an alternative narrative that takes proper account of developing country interests.

It is not easy for individual developing countries to build and maintain the required knowledge competence in this complex and fast moving area. Institutions of South-South cooperation in economic areas, like UNCTAD and the South Centre, should therefore step in to meet their knowledge and policy needs.

Global digital economy and the developing world

Developing countries are facing great pressure at global trade forums to opt in to the dominant US-led global digital economy model,¹⁵⁹ which still goes under the name of ‘e-commerce’ at these forums. The 1998 e-commerce work program at the WTO, developed at a very different time, is currently sought to be revived for new purposes. As mentioned, TPP’s e-commerce chapter remains the model for similar insertions in all new trade deals. Problems with the TPP’s e-commerce chapter have been highlighted from the liberal civil rights and ‘openness’ perspective,¹⁶⁰ as well as economic and social rights standpoint.¹⁶¹

The strong transformative winds of digital economy however cannot be denied, and not engaged with. Resistance to the dominant US model can only be effective if it moves from a reactive phase – finding problems with its proposed trade rules, to a proactive one – where developing countries present their own vision and model of a digital economy. This should be based on new thinking at domestic levels towards an appropriate digital industrial policy.

It is important to unpack and critically analyse what goes in the name of e-commerce at global trade venues. Very different kinds of goods and services get traded electronically,

159 The global trade policy imperatives of this model are expressed well in the US’s Digital Two Dozen principles. See ‘The Digital 2 Dozen’, *The Office of the United States Trade Representative*. Retrieved from <https://ustr.gov/about-us/policy-offices/press-office/reports-and-publications/2016/digital-2-dozen>

160 Jeremy Malcolm and Maira Sutton. ‘Release of the Full TPP Text After Five Years of Secrecy Confirms Threats to Users’ Rights’, *Electronic Frontier Foundation*. Retrieved from <https://www.eff.org/deeplinks/2015/11/release-full-tpo-text-after-five-years-secrecy-confirms-threats-users-rights>

161 Jane Kelsey. (October 2017). ‘The Risks for ASEAN of New Mega-Agreements that Promote the Wrong Model of e-Commerce’, *Economic Research Institute for ASEAN and East Asia*. Retrieved from http://www.eria.org/publications/discussion_papers/DP2017-10.html

and these need to be treated distinctly from one another.

The first kind are electronically traded physical goods – such as manufactured or agricultural goods. These goods still have to actually travel across borders. The normal wisdom should be that irrespective of the means by which the deal is made, they remain subject to the trade rules and tariffs applying to the concerned category of goods. However, e-commerce greatly changes global transaction costs in a manner that locally made goods can lose existing cost advantages that they may have enjoyed. Great caution therefore needs to be exercised in any discussion even on ‘facilitation’ of electronic exchanges of this kind because of its likely impact on importing countries.¹⁶²

Domestic markets for many kinds of ordinary goods may earlier have remained protected simply because these are cheap goods that are manufactured and consumed locally, the transactional and logistics costs for importing them being too high relative to the cost of manufacturing. This kind constitutes a very large proportion of goods in small local markets, especially in poorer economies. Their production supports much of the MSME sector. With giant global e-commerce companies re-organising the whole goods trading ecosystem, the involved transactional costs are drastically changed, disproportionately threatening such local markets of cheap goods.

For example, a Chinese e-commerce company, Kikuu, operates in six African countries, focussing on selling Chinese goods.¹⁶³ It also organises complementary services like logistics, payment and delivery. Alibaba is discussing and setting up special border arrangements with the Malaysian government for speedy custom clearance of its goods entering Malaysia.¹⁶⁴ One can very well envision a Kikuu like platform doing the same in

162 Many new proposals promoting e-commerce agreements at the WTO lately have focussed on the more palatable appearing approach of ‘facilitating e-commerce’.

163 KiKUU. (November 2016). ‘KiKUU, quietly positioning itself to become Africa’s first mobile commerce unicorn’, *Cision PR Newswire*. Retrieved from <https://www.prnewswire.com/news-releases/kikuu-quietly-positioning-itself-to-become-africas-first-mobile-commerce-unicorn-300358163.html>

164 Benjamin Cher. (May 2017). ‘Alibaba signs agreement with Malaysian and Chinese governments to encourage ecommerce and SME growth’, *The Drum*. Retrieved from <http://www.thedrum.com/news/2017/05/15/alibaba-signs-agreement-with-malaysian-and-chinese-governments-encourage-ecommerce>; Sainul Abudheen K. (May 2017). ‘Alibaba to facilitate cross-border e-commerce trade between Malaysia and China’, *e27*. Retrieved from <https://e27.co/alibaba-facilitate-cross-border-e-commerce-trade-malaysia-china-20170512/>

Africa and other places. It will aggregate local demand in a locality, and every few days big containers will land from China with all the individual small deliveries, quickly cleared by customs. Efficiency of the whole supply/ logistics chain will be so high that the platform will be able to sell cheaper than locally manufactured goods, even the mundane cheap variety. It will be able to serve even small dispersed markets. Additionally, as Alibaba has now begun to do in China, a Kikuu kind of platform can potentially also take up supply chain and logistics management for small shops, further channelling cheap Chinese imports. Since the digital context allows effortless and inexpensive combining of mass manufacturing with customisation, these supply chains can easily take into account the specificities of such small and dispersed markets.

Promoters of the dominant e-commerce narrative concerning physical goods like to cite examples of MSMEs producing niche goods, often with cultural-artisanal value. But the fact is that a very large proportion of any economy, especially in its poorer parts, and also of MSME production, consists of mundane goods of regular use. These can be produced almost anywhere by practically anyone with some capital and expertise. Mass manufacturing of such goods in a few specialised centres like in China will easily flood any well-oiled open market system with very low transaction costs, as global e-commerce seeks to provide. Developing countries need to carefully weigh their options in this regard. The extremely disruptive digital phenomenon needs to be understood well and then negotiated with considerable caution. The huge efficiencies of digitalisation must first be utilised to strengthen the domestic economy, which requires a sound digital industrial policy, before opening it up globally.

Very different from physical goods, even if traded electronically, are goods and services that can exist fully in a digital form. These are of five kinds; (1) cultural goods; (2) traditional services that are provided physically on-premise, but can also be delivered digitally from afar, like back-office services, transcription, tuitions, medical or other professional consultations, etc; (3) core technology services – software and applications over the cloud (or through downloads); (4) services involving data flows within a business system, with full clarity on data ownership (this category could include some services from categories 2 and 3 above); and, (5) global digital services, centred on data

and digital intelligence. All these electronically-transmitted intangible goods/ services are very different from one another, and require different treatments in trade regimes.

UNESCO's Convention on Protection and Promotion of the Diversity of Cultural Expressions declares that "cultural activities, goods and services have both an economic and cultural value....and must therefore not be treated as solely having commercial value".¹⁶⁵ An observer notes this treaty as granting "nations the sovereign right to protect and promote the diversity of cultural expressions within their territory against the sweeping tide of globalization (Articles 5 and 6)".¹⁶⁶ Perspectives from this convention, and other similar ones, should be brought to digital cultural flows, which are more intense cross-culturally than ever before.¹⁶⁷ Video games are a major new digital addition to cultural goods. Cultural goods have their specific regulatory context, and cannot be treated as normal commodities of global trade.

The second category above is of IT enabled services (ITeS) involving electronic transmission of traditional services that can exist physically on premise – like back-office services, transcription, tuitions, medical or other professional consultations, etc. These need centrally to be looked from the lens of GATS¹⁶⁸ and other services agreements, as applicable.

Core technology services – software and technology applications over the cloud (or through downloads), currently constitute a well functioning global market without any specific trade deals around them. Issues of monopolies and excessive profits, and denial of user rights, exist in many cases, which require regulatory solutions like interoperability rules. In general, however, it serves developing countries' interest to retain relatively free global technology flows, in as far as they involve core technology services. These should be subject to necessary domestic regulation, especially in the

165 Tania Voon. (July 2006). 'UNESCO and the WTO: A Clash of Cultures?', *The International and Comparative Law Quarterly*. Retrieved from https://www.jstor.org/stable/4092643?seq=1#page_scan_tab_contents

166 Joost Pauwelyn. (November 2005). 'The UNESCO Convention on Cultural Diversity, and the WTO: Diversity in International Law-Making?', *American Society of International Law*. Retrieved from <https://www.asil.org/insights/volume/9/issue/35/unesco-convention-cultural-diversity-and-wto-diversity-international-law>

167 UNESCO. (December 2016). 'Diversity of cultural expressions facing the digital challenge', *UNESCO*. Retrieved from <https://en.unesco.org/news/diversity-cultural-expressions-facing-digital-challenge>

168 WTO's General Agreement on Trade in Services

area of critical technologies. Governments should also be able to favour domestic industry in its procurements and partnerships. High quality software and applications are crucial to functioning of all sectors today, and their requirement will only go up. It is not easy for most countries to develop them domestically, although such efforts should be made.

Software/Internet services mostly follow global templates, with little attempt or need for local customisation. For this reason, once they are established in the North it does not cost much to extend these services to developing country markets, while earning huge additional profits. There is no danger therefore that Northern suppliers of such technologies will withdraw them if they do not get further liberalisation commitments or other sacrifices from developing countries. Developing countries can continue to benefit from the global technology market without negotiating any new trade agreements, which will only take away important domestic policy options from them. And for countries like India that see a great opportunity to export in these global technology markets, there is not much to gain either from exploring new trade deals.¹⁶⁹

The remaining two categories involve considerable data flows, but of very different kind. This difference is most important to recognise. The fourth category of services, from the above list, involve global data flows where there is full clarity about who owns the data, and various values arising from it. Data largely stays within a specific business system, and its ownership is clear and uncontested between the business parties interacting across the border.¹⁷⁰ For example, a company sending out its data to another company for back-end processing, including possibly to help analyse it and obtain insights, or a multi-national company moving data globally across its operations. This includes data flows involved in global cloud computing service interactions, a model that is increasingly becoming mainstream.¹⁷¹

169 The issue about BPO and SaaS companies processing foreign data is a data flow issue and not about technology flow. It will be discussed presently.

170 This holds for back office processing industry, about which, for instance, India has great global stakes. But such data services must be distinguished from the second kind discussed later, and need different trade rules treatment.

171 When a business uses a cloud computing facility of another business there should be no confusion or doubt about who owns the involved business processes and data. Here, it is only the technology facility that is rented.

The element of public interest in such data flows is mainly about legal and regulatory remit over it, and the corresponding need for unhindered access to it by the concerned authorities. Adequate privacy protections are required to be ensured as per the domestic law of the place where the data originates. Access to data may be required for criminal investigations, or simply because the concerned business activity is of critical importance, and subject to special regulatory oversight. What is needed for these purposes are global or inter-country data protection and access agreements. The matter does not directly concern digital trade regimes. Agreements may need to be reached on issues like; standard minimum data protection and security regimes, categories of critical industries requiring special data protection and regulation, conditions and means for cross-border regulatory or law enforcement access, and so on.¹⁷²

The fifth category is of global digital services, defined as those whose business model centres on data and digital intelligence as the key economic resources. These services work on data that is collected mostly from sources outside the concerned business' strict ownership realms. Such data also gets transported across borders. These are extremely large collections of very detailed data about a sector – data about people (including personal data), social processes and conditions, machines and other artefacts, and natural things and environment. Employing this 'outside' data, from all possible sources, digital businesses develop deep and granular digital intelligence about the complete ecology of a particular service, or a whole sector. This business model tends towards sector-wide operations, and monopoly formation, in the shape of sector-platforms that we discussed as the centre-piece of digital economy. Such monopolistic digital intelligence services are increasingly oriented to all diverse sectors. It is with regard to these globally-operating businesses that global 'free flow of data', and related issues like data localisation, become key. These are currently the main bones of contention in global digital trade forums.

172 India's view on free flow of data aspects of trade rules discussions is often influenced by the requirements of its BPO, and now cloud computing, industry which processes foreign data. Considerable problems have arisen in this regard with EU because of the latter's very high privacy standards. But trade deals with free flow of data rules may not solve India's problem. EU is increasingly making it clear that it will apply its privacy rules regardless, and these triumph trade considerations. What India needs from EU is a data-secure status, which it should work on bilaterally, and perhaps, at some stage, multi-laterally.

The real cross border data issue that directly concerns global trade is when data is collected, and retained, by global corporations from outside their business systems, and for time periods, much beyond what may strictly be required for specific narrow business interactions. And when this is done with unclear data ownership and data use rights. ‘Global free flow of data’ is really a euphemism for global digital corporations asserting the right of unhindered global collection, privatisation and economic appropriation of such general social or ‘commons’ data. It is not a trade facilitating concept, as projected. It is about expropriation of the most valuable resource in the digital economy, without clear legal rights to do so. Global data flows must first be discussed in a political economy framework, before talking about their trade facilitating role.

Unlike the earlier discussed category of business data flows,¹⁷³ the national interest in this case is not so much legal and regulatory access to data (which concern may concurrently exist), but the ambiguity around ownership rights over data collected from ‘outside’ or non-proprietary sources, and the nature of its possible further use. Source of such data may be ‘personal’ – related to dispersed individuals, or ‘social/public’. This possibly renders such data as a collective national resource – directly if the sources were ‘public’, and in trusteeship for the dispersed individuals if ‘personal’.¹⁷⁴ In the latter case, the concerned individuals have no way to leverage their ownership of such data other than through a collective agency like the state. The central problem with the current digital economy model is the economic (as well as social and political/strategic) appropriation of a key resource, without clear rights to do so, and its subsequent transfer outside the country. Such extraction of valuable national data by foreign corporations will result in various kinds of economic/social/political control and exploitation, and corresponding dependencies of the target countries. Once collected, data retains very long-term value, and therefore these controls and exploitations are not

173 It is important to distinguish business data flows (internal to a business, and its partnerships ecology) from flow of personal and social data, that does not belong to the concerned business involved in its collection.

174 Interestingly, India has used the term ‘data sovereignty’ both in terms of a citizen’s right over her data,(see Press Trust of India. (September 2017). ‘India’s data protection law will set global benchmark: Ravi Shankar Prasad’, *LiveMint*. Retrieved from <http://www.livemint.com/Politics/shkot8Pd24QprSzs4mQvQM/Indias-data-protection-law-will-set-global-benchmark-Ravi.html>) as well as in the sense of a country having full rights over data originating from the country even if residing outside (a position beginning to be articulated at some global Internet Governance related forums).

just for now but for decades to come.

It is this kind of general data, with unclear ownership rights, which is important to protect from cross-border 'free flows of data' regimes. It is the most significant economic and social resource in the digital economy. Oddly enough, this aspect of data flows has not even been identified properly in global e-commerce or digital economy discourses. Concerns about data flows that get usually cited, including by developing countries, almost entirely relate to regulatory and law enforcement issues. It is up to developing countries to anchor a new discourse centred on the relationship of 'global free flow of data' to 'economic value' and 'national ownership' of data.

Such general data can be considered to be a national resource. Corresponding frameworks regarding its ownership, use and economic value appropriation need to be developed and enforced nationally. Before any negotiations of trade rules around data can begin, much less a commitment for unhindered flow of such data across borders made, discussions must be held at national and international levels on:

1. Developing appropriate frameworks for individual and collective ownership of such general data (including, but not limited to, personal data);
2. Understanding and conceptualising the nature of economic flows that are implicated when such general data is (1) privatised, and (2) transferred outside a country, and;
3. Recognising the nature and importance of digital intelligence built from such data, as the key economic resource that is globally used to control whole sectors, and entrench rent-seeking positions.

Work needs to be done at international and national levels to identify, separate and describe different categories of electronic transmissions that are, very problematically, clubbed under one term 'e-commerce'. This should be followed by exploring different corresponding treatments that they require in terms of business development, regulation, trade, etc. UNCTAD and other such global organisations that have a development-friendly mandate are appropriate to take up such work. The simplistic TPP's e-commerce rules framework must be discarded forthwith, as largely meaningless if not misleading.

The term 'e-commerce' employed at global trade venues needs to be replaced with 'digital trade' as better representing this vast field. Digital economy's key valuable resources and business models must be examined and understood first, along with the contexts and interests of different countries in this regard. Cross-cutting issues of a general enabling nature, the kind that TPP's e-commerce chapter purports to represent, can only be taken up after that. The same can be said for the new terminology of 'facilitating e-commerce' that is now being proposed at the WTO by some countries. It is difficult to facilitate something without knowing sufficiency well its basic nature and substance. Commitments sought under TPP like rules or e-commerce facilitation frameworks will render it very difficult, if not impossible, to develop the necessary public digital/data infrastructures and various digital regulatory powers. Both are key to successful digital industrialisation by developing countries.

China is the only country that has been able to stand up to the global digital dominance of the US, which was the first mover in this area. It did so by following very protectionist policies, whether disguised as security interests or not. This holds an important lesson for every late starter on how difficult it is for a domestic digital industry to develop unless some amount of protection, and appropriate government support, is provided. This is true for most industries, but it is even truer for the digital industry because of its special structural features that we have discussed throughout the paper. Even with its formidable technical skills and business muscle, the weak position of EU in the global digital economy provides good evidence of this. Protection for domestic digital industry does not have any necessary trade-off with freedom of expression, an ideological cover that the 'free flow of data' narrative often hides behind.

EU is discussing ways to check Chinese takeovers of its digital and tech companies that are considered strategic for security or economic reasons. This makes it evident that digital is no ordinary sector, in terms of its structure as well as strategic significance. Developing countries need to make a careful assessment in this regard, and accordingly shape digital policies.

The digital sector requires a critical mass of a large enough market to be successful. This can present a problem for countries, especially small- to medium-sized ones, in developing a strong domestic digital industry. Europe is creating a Digital Single Market, with a single policy and regulatory space, and some emerging common public digital infrastructures. Developing countries should also explore regional digital single markets as an important part of their digital industrial strategy. African countries are in talks to develop a free trade zone for Africa,¹⁷⁵ and its digital aspects should be seriously, and perhaps separately, examined. Such sufficiently large, but somewhat protected spaces, are vital for development of a health digital economy in the South. Within these, a set of countries with similar or complementary digital positioning and advantages can promote their digital businesses.

This does not mean disengaging from global digital value chains. Digital technologies are fast evolving and complex, and require continued smooth global flow and exchange. These technologies work on data to give rise to digital businesses, and, as discussed, the data end of this amalgamation is more locally oriented. This data side or aspect is what needs better management for common good as well as greater protection, at least initially. Developing countries must work with global value chains but simultaneously protect enough local market space and degrees of freedom for their domestic industry. What this means, at the very least, is that the current global technology and digital markets are working well without any new binding trade commitments by countries. Any premature agreements in this area will simply compromise technology and data regulation powers of governments. In these times of great ferment, the latter are very important to retain in order to appropriately shape the domestic and global digital economy.

175 Calestous Juma. (November 2017). 'How Africa can negotiate an effective continental free trade area agreement', *African Independent*. Retrieved from <https://www.africanindy.com/business/how-africa-can-negotiate-an-effective-continental-free-trade-area-agreement-12021724>