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Crafting the South African Digital Economy and Society: Multi-Dimensional Roles of the Future-Oriented State

A Conceptual Framework and Selected Case Analyses

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ABSTRACT

This policy paper focuses on four themes, namely, (i) the relative importance of the role of the state in the digital economy; (ii) the multi-dimensional role of the state (as regulator, innovator, distributor, and enabler); (iii) using particular roles to tackle specific aspects of the digital divide in South Africa; and (iv) advancing the capacity of the state to foster the digital economy. The state is not monolithic; it is a many-faceted entity, and it is driven by many varied influences on its behaviour. It can remain in stasis, or it can orient itself to the future, with the aim of transforming the economy and society. Transforming the economy and society requires the state to progressively transform itself in collaboration with its partners and communities. Consensus-building, not command-and-control, will need to be the order of the day, and the state will require change management to become a technocratic-collaborative, benefits-driven state. In order for the state to progress towards an inclusive digital economy and society, governance in the transforming state must address many challenges, including new forms of capture by sectional interests. Rising to these challenges requires a commitment by the state to actively engage, learn, collaborate, plan, partner, innovate, and include. These new behavioural characteristics require both state and non-state actors, market and non-market actors, to change the present mindset, in order to create the digital partner state. The economy will increasingly become digitally enabled, irrespective of contributions from the state, so the state can either participate, effectively, or simply be marginalised.

KEYWORDS

digital partner state, digital policy, capacity of the state, state as regulator, state as innovator, state as distributor, state as enabler, change management

1. Introduction and aims

In this decade (the 2020s), every aspect of the South African economy and society, its institutions, and the activities of its citizens will be affected by digitisation, either positively or negatively. Most of the discourse about the course and pace of this fundamental transformation and its effects on the economy and jobs has originated outside of Africa – in those countries that have historically been the epicentre of the production of disruptive technologies. But this is no longer the case. As African countries build and adopt their own digital applications and increasingly indigenise applications from elsewhere, the analysis and debate are strengthening and gaining an African perspective. The narrative here takes on a more urgent, intense, and harsh tone. For example, with respect to less sophisticated industries, and digitally enabled sectors focusing on repetitive tasks, the introduction of robotics has effectively led to job loss effects far exceeding those in developed countries.[1] Such effects pose additional constraints on developing economies, which are already under stress, pointing to the need for more inclusive digital strategies that enable a techno-human future.

Digitisation, whatever the nature of the socio-technical changes, will not only fundamentally influence the economy, but will also increasingly transform the contours of South African society, exacerbating the digital divide and economic exclusion, unless public policies are implemented to ensure that the inequalities in the real economy do not continue to be further replicated and amplified in the virtual world. Like many countries, South Africa has recently formulated strategies to address the requirements of this critical point in time: bundling resources and efforts to participate in the digital economy with new technologies and new organisational structures, while simultaneously safeguarding the less digitised sectors still following the traditional industrial model, with the aim of preserving jobs and exploring financing options for managing this transition. Already, the agricultural, mining, and industrial sectors are becoming engaged in digital transformation, as technology, process, and business disruption occur here as well. In general, the national digitisation strategies point to technologies and their implementation in a range of economic sectors, but these strategies are not sufficiently comprehensive in relation to the economic landscape, and do not sufficiently address the multi-dimensional role of the state in digital evolution.

While assuming private enterprise in the role as a spearhead and main actor, digital strategies – in South Africa and elsewhere – explicitly, and more often implicitly, assume that the state will play a significant role in triggering, enabling, framing, and supporting the transformation process: enter the digital partner state. A theory of the capabilities and roles of the digital partner state is still evolving.[2] Based on current understanding, some of the building blocks have become visible and will provide the analytical scaffolding of this paper's conceptual framework. In the absence of a general theory of the state in relation to digital transformation, this paper aims to review the emerging role of the state, based on an analytical model of the state as regulator, innovator, distributor, and enabler. Application of the analytical model suggests that the state, in discharging its various roles, needs reinvention and radical rethinking. In the process of reforming the state and its institutions, digitisation assumes a dual role. The state will need to assume new roles that are key in the digital transformation of the economy and society (the "what"), while its public sector institutions will use digitisation to leverage external capacities and skills to cope with these tasks (the "how") to avoid further extending its scarce resources and skills. Such change does not require a "big-bang" change approach, but rather selective digitisation and the opening of the relevant interfaces of the state towards productive forces that will contribute towards this transformation: citizens, the private sector, and civil society.

Using a few cases of various forms of state action, this paper attempts to describe the technocratic role of the South African digital partner state and the necessary capacity building this evokes, thereby complementing the current digitisation strategies with an assessment of the different contributions to, and stakeholders in, these endeavours.

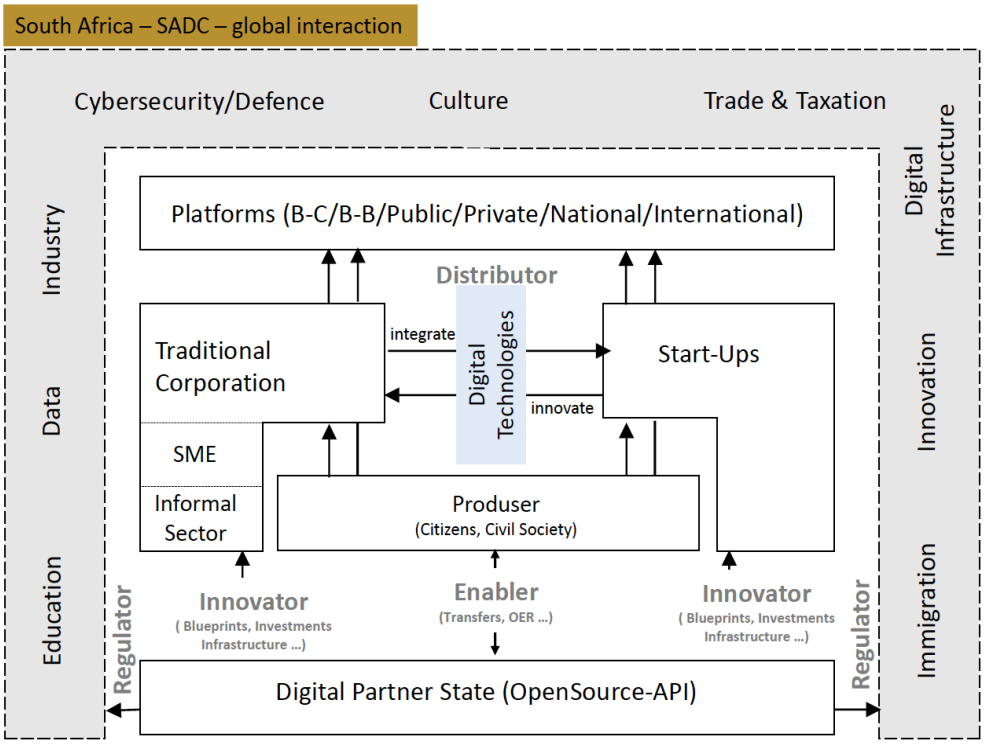
[1] The ILO estimates the current decline in employment due to the integration of robots in workplaces in emerging economies to be higher than 14%, compared to an estimated 0,5% decline in developed countries (Carbonero, Ernst & Weber, 2018, pp. 1, 8, 11).

[2] For an initial discussion of this concept in the South African context, see Al-Ani (2016), Al-Ani (2017, p. 186) and Al-Ani & Petritsch (2017). This concept is based in technological views of the state as a platform laid out in O'Reilly (2011) and ideas of a "commons based peer-production" (Bauwens & Kostakis, 2015; Benkler, 2006).

2. Analytical framework: Interpreting the roles of the state in digital transformation

The paper uses an analytical framework (Figure 1) centred around the impact of various core **digital technologies** that are either substituting physical human work in production (eg. robots) or substituting repetitive and structured human work and decision making in the knowledge economy (machine learning and automation).[3] Furthermore, digital twins can be generated for particular physical assets (production inputs and outputs) and for the entire production process (Industry 4.0 cyber-physical systems), thereby greatly reducing management, production, and maintenance efforts. The design, development, and marketing of assets can also be made more effective and efficient using augmented reality and virtual reality techniques, displaying the attributes of assets in a way that cuts transaction costs. To overcome the challenges of trust and integrity of virtual workflows and financial transactions, blockchain encryption technology using a decentralised structure (distributed ledger) can be used to transfer value (money), as well as other content (files, contracts, etc.), without intermediaries. This technical core is already the subject of the initial strategic considerations that seek to establish South Africa as a "frontier technology hub" for the Southern African Development Community (SADC) region, through the creation of technology "centres of excellence" that also focus on stimulating small and medium enterprises to become providers of these digitally enabled services.[4]

Figure 1: Analytical model of the multiple roles of the state in digital transformation



Source: Authors

The digital technologies core has triggered the formation of a **start-up** sector that is working with these technologies to develop new business models, mainly for existing products (eg. mobility, learning), using new organisational forms like **platforms** to develop and disseminate products and services in an efficient manner. The tech start-up sector is also enabling product users (produsers), crowd- and gig-workers to participate in the production process. The economic effects of start-ups are twofold. Despite their often limited direct effect on the labour market, they develop

[3] For a summary of these technologies as part of South African digitisation strategies, see the report of the Presidential Commission on the Fourth Industrial Revolution (PC4IR, 2020, p. 29 onwards).

[4] The intention must be to "(…) promote the development of a digital services small-business sector in South Africa. This would create a pool of more digitally literate small-business proprietors and employees (in South Africa often perceived to be the least 'tech-savvy' sector of the economy). The flow-through effect of digital literacy to the communities in which the small businesses are rooted would be considerable" (SADA, 2020, p. 31).

important innovations that are incorporated and used by "traditional", yet-to-be-digitised enterprises, thus serving as an innovation hub for these organisations.[5] Furthermore, start-ups can collaborate with traditional companies to utilise their skills in marketing, distribution, and finance. This intensive interaction between the two sectors could support the transformation of the traditional, hierarchical corporation and lead to new forms of hybrid organisations that seek to integrate the advantages of both organisational models (referred to as netarchies), which require new management styles (eg. agile management). Considering these important effects, a recent study by South Africa in the Digital Age (SADA) recommends bolstering the local start-up ecosystem as the number of start-ups here is relatively low compared with other countries (SADA, 2020, p. 4 onwards). An initial review of South African tech hubs and their hosted start-ups explores their modalities of scaling up and innovation entanglement (Abrahams, 2021).

The disruptive effects of the core digital technologies on the **traditional sectors** (private and public) are likely to be relatively severe in terms of effects on the job market, as automation and algorithms will play out their fullest effects on well-structured and repetitive tasks, mainly found in these industries. Despite uncertainty in predicting impact figures, some estimations suggest that up to 50% of current jobs are automatable.[6] For South Africa, quantitative and qualitative assessments and industry-specific counterstrategies are yet to be formulated (PC4IR, 2020, p. 29).

Small and medium-sized companies, and the **informal sector**, contribute significantly to employment and income in the South African economy. These entities face significant barriers to adopting digitisation, such as the acquisition of capital-intensive technologies and building the scarce skills required to assimilate these. Thus, specific policies and practices are needed to foster collaboration among these entities to collectively finance and adapt technologies. New collaboration-oriented organisational forms (eg. digital cooperative platforms) are possible solutions to avoid a situation where these companies become obsolete or dominated by large-scale – and often foreign – platforms that regulate logistics and marketing lifelines (Scholz, 2016).

Platforms, in their various forms, are intermediaries that bring together a set of parties (consumers, producers, employees, and employers) to interact online and that use data to plan and create these interactions. In the case of South Africa, transaction platforms would be essential for distributing goods and services (education, social, cultural) produced by various sectors and by citizens who participate as **produsers** (consuming but also providing or adapting goods and services distributed through platforms). Innovation platforms are distinguished from transaction platforms by connecting innovators to develop and accelerate product performance (Hagel et al., 2010, p. 144). At an industry level, innovation platforms provide ways of sharing common designs and for interactions across a sector. Relevant examples include operating systems (eg. Android or Linux) and technology standards (eg. MPEG video) (UNCTAD, 2019, p. 27). These **interaction** and **innovation platforms** are currently dominated by Chinese and US players that have initially made use of their huge domestic markets and public investments to develop quasi-monopolistic features (UNCTAD, 2019, p. 8).[7] In the production process, **industrial platforms** are being used to connect production resources and machines (Srnicek, 2017, p. 64), creating highly automated production entities, for example, the Lights-Out Factory (Markoff, 2015, p. 151) as envisioned by the Industry 4.0 concept based on self-regulating machines (Jeschke et al., 2017, p. 3).

These international platforms pose a challenge for developing countries like South Africa. As international platforms become increasingly dominant, South African companies are at risk of being relegated to a supplier role where they will not be able to access the transaction data necessary for marketing and product development. Worse still, the South African suppliers on such industry platforms could easily be substituted by the foreign platform owners who may consider commencing their own production of successful products, if their big-data-fuelled predictions suggest this, as happened in India (Reuters, 2021).[8] Local companies must have access to data rights on relevant platforms, or, better still, create, adopt, and use local and regional platforms. In principle, African digital innovators could venture much more strongly into platform initiatives, considering some of the following critical design factors and adaptations: using humans and local call centres at the customer interface with the digital platform; physical supply-chain and

[5] The SADA strategy primer claims that crowd working could create substantial workplaces for South Africa (SADA, 2020, p. 21).

[6] For the Middle East and North Africa (MENA) region as an example, see Aus dem Moore et al., 2018, p. 8 onwards.

[7] For South Africa, Naspers with a global share of 2% is often considered the only significant platform with regional and global reach.

[8] India has therefore restricted this production role of transactions platforms, prohibiting these platforms from exercising ownership or control over the inventory of sellers (Reuters, 2021).

advanced logistics services; use of text messages and USSD[9] codes for offline orders; effective applications design and project management; Africa-specific pricing strategies, to name a few (UNCTAD, 2019, p. 109). At this point in time, few explicit and comprehensive strategies on building public platforms seem to be in place in South Africa or in the SADC region. This is despite the important role of platforms in supporting and enabling private digital initiatives, the potential to provide public services more effectively, and the need to raise general interest in these forms of communication, as they could provide robust data on consumption, input and output data, enabling prediction-based decision-making, where data analytics informs economic planning (Saros, 2014).

3. Analytical framework continued: The digital partner state

The analytical framework in Figure 1 lays out a few dimensions of the role of the state in the context of transition to a digital economy. In certain instances, institutions of the state can merely interface with other players in the digital economy, while in other instances they can play a leading role in transformation. In either case, they must understand the evolving economic landscape and they must adapt to the trends and requirements, whether as regulator, as innovator, as distributor, or as enabler.

3.1.1 *The digital partner state as regulator*: To the extent that digitisation changes supply chains, results in the formation of new markets and new forms of competition, and introduces risk for firms and consumers, the regulator plays a leading role in setting the economic rules, yet in doing so it must be highly adaptive and collaborative.

3.1.2 *The digital partner state as innovator*: This relates to the role of the state in providing public funding for start-up ecosystems, smart cities, technology hubs, institutes for fostering AI capability, and other research and innovation initiatives relevant to the digital economy, noting that the state is only one funding contributor, and the private sector is the other. State institutions can also engage in non-financial aspects of fostering innovation, by connecting state and non-state actors in digital innovation clusters.

3.1.3 *The digital partner state as distributor:* Here, the state evolves into the role of manager or facilitator of a digital marketplace, aggregating, curating, and distributing particular assets, including the knowledge, abilities, and motivations of citizens, but also data, algorithms, and code, in an efficient manner. It must use digital devices and platforms and open interfaces to do this (O'Reilly, 2011, p. 16). The distribution of these types of assets could be aided by licensing them as commons, in other words, goods and services that can be used by anybody without fees.[10]

3.1.4 *The digital partner state as enabler:* Open distribution modalities are important in enabling citizens to become *produsers*, combining aspects of using and aspects of producing technological, economic, or solutions by providing freely available (open) knowledge resources (eg. information, code, designs, algorithms). The emerging *produsers* can act as users and as producers in both the traditional and start-up sectors (eg. providing volunteerist, problem-solving, and other knowledge-based services in education, infrastructure, security, and social services), and can also interact with the public administration platforms, improving or even providing public services via standardised interfaces.[11] Such use of platforms offers new, creative ways of engaging in public, inclusive, social development.

[9] Unstructured supplementary service data (USSD) codes ie. analogue-era communications technology.

[10] See the example of the Indian "AI for All" strategy, which aims to declare data and algorithms as commons to be used by Indian companies that would otherwise have difficulties getting access (Niti Aayog, 2018).

[11] Instead of providing services all by itself, a strategy that encourages and enables peer production is advisable, creating a possible "compact between government and the public" in which government puts in place mechanisms for services that are delivered not by the government, but by private citizens: "There is a new compact on the horizon: information produced by and on behalf of citizens is the lifeblood of the economy and the nation; government has a responsibility to treat that information as a national asset. Citizens are connected like never before and have the skill sets and passion to solve problems affecting them locally as well as nationally. Government information and services can be provided to citizens where and when they need them. Citizens are empowered to spark the innovation that will result in an improved approach to governance. In this model, government is a convener and an enabler rather than the first mover of civic action" (O'Reilly, 2011, p. 14).

4. The evolution of digital policy in South Africa: Weaknesses in the capacity of the state

Nearly a decade ago, the National Development Plan (NDP) (NPC, 2012, p. 190) envisaged that by 2030 "a seamless information infrastructure will be universally available and accessible and will meet the needs of citizens, business and the public sector, providing access to the creation and consumption of a wide range of converged services required for effective economic and social participation – at a cost and quality at least equal to South Africa's main peers and competitors". The NDP set key enablers to realise this compelling vision, including a national e-strategy cutting across all sectors and government departments, underpinned by an integrated infrastructure plan, with attention being paid to (NPC, 2012, pp. 191–192):

- Public and private information and communication technology (ICT) investment in broadband, applications, and local content development to drive sectoral economic growth and innovation.
- Reviewing the market structure for the electronic communications sector, including a focus on the merits of duplication vis-à-vis sharing of infrastructure.
- Developing institutional capacity for effective regulation relevant to rapidly evolving sectoral (and technology) trends.
- Demand-side measures including digital literacy, ICT incentives, and developing ICT applications in the health, education, and other sectors.
- Addressing the digital divide through regulation to create more competitive markets, affordable pricing, and also through smart subsidies.

Next, the National Integrated ICT Policy White Paper (DTPS, 2016) outlined the building blocks of a vibrant, equitable digital economy and society, including affordable access to communication (competitiveness and equity); accessibility of services, devices, infrastructure, and content to all citizens (access); enhanced quality of life (social development); sound data governance (user protections); and economic and social inclusion. Then, in 2017, the National e-Strategy: Digital Society Africa adopted a three-pillar approach including a focus on ICT research and development (R&D) expenditure, the ICT skills gap, specific sectoral interventions, and fostering a digital industrial revolution (DTPS, 2017). The National Digital and Future Skills Strategy adopted by Cabinet in August 2020 (DCDT, 2020) sets the train in motion for digital skills development accompanied by attention to critical future skills such as creativity and problem solving. Many other strategies have been published focusing on the education sector, the health sector, the integrated justice cluster, and e-government more broadly.

The report of the Presidential Commission on Fourth Industrial Revolution (PC4IR) envisages critical roles for the South African state as regulator, enabler, distributor, and builder/innovator (PC4IR, 2020). For instance, as part of the regulatory role of the partner state, the Presidential Commission recommends the overhauling of legislation to create an environment conducive to rapid commercialisation and the scaling of new technologies and processes to fuel the knowledge economy, as well as appropriate tax and regulatory regimes to foster innovation. This would include the appropriate regulation and taxation of foreign platforms and other businesses operating in South Africa. The PC4IR also advocates new incentives to support the adoption and application of advanced technologies in manufacturing and services, including subsidies and tax breaks, while enhancing the overall ease of doing business in the country in regard to patent registration, customs, and taxes to reduce the cost to 4IR-type businesses. Government procurement is seen by the PC4IR as a critical lever in fostering the adoption of 4IR technologies. The Commission has urged the South African government, as an enabler and builder/innovator, to develop infrastructure priorities, plans, and timelines for the delivery of the mobile, physical, computational, and digital infrastructure essential to support 4IR readiness, and to integrate those with the existing economic and social infrastructure. It has advocated substantial investment in mass skills development, and the redesign of the skills ecosystem by the Human Sciences Research Council and the Digital Skills Forum to generate "stackable competences which are micro-credentialed, industry aligned and allow people to enter and exit the system at multiple points as part of a lifelong learning process" (PC4IR, 2020, p. 179). The PC4IR has also proposed that government establish an artificial intelligence institute, in partnership with the private sector, that the post of Chief Data Officer within the state be created, and that Comsec, the state's cybersecurity company, be strengthened.

As insightful, laudable, and sensible as the recommendations of recent policy documents and reports may be, they are generally predicated on the assumption that the state has the capability and incentive to discharge those roles. They

are clear about *what* needs to be done, but not on *how* these will be translated into action. As a recent National Planning Commission (2020) report points out, there has been limited progress towards real digital transformation in the economy, despite the many policy and strategy guidelines. In this regard, the report cites the failures of the broadcast digital migration process (now no longer of any discernible value, as lowering data prices would have much greater benefit than digital migration, giving more low-income households access to the Internet and multimedia content), and the mismanagement of the release of high-demand spectrum over more than a decade, as instances of weakness in advancing the digital economy ecosystem. The report argues that these and other failures have "undermined a decade of convergence legislation and regulations, leaving critical policy and regulatory actions in limbo" (NPC, 2020, p. 1). Effective spectrum regulation is necessary to enable very wide scale digital transformation, for example, in the public sector, broadband access for digital transformation in learning and teaching in public schools. These policy implementation and regulation failures are attributed to institutional dysfunction, including the high turnover of Ministers of Communications and their Directors-General, the separation of the Department of Communications (DoC) and the Department of Telecommunications and Postal Services (DTPS) under the Zuma administration, weak appointments to key institutions, lack of leadership, and corruption and mismanagement (NPC, 2020, pp. 1, 11, 15).

The result of policy and regulatory failure is that, while South Africa's electronic communications sector is one of the most developed on the African continent, it is dominated by only two integrated network and service providers, MTN and Vodacom, which have a joint market share of 78% (NPC, 2020, pp. 1, 20). The National Planning Commission notes that, even with regulated prices, the cost of services required to effectively participate in the digital economy is out of reach for many South Africans. The broader ICT sector is geared to servicing value- and quality-conscious high-end consumers (largely white), while the poor, informal businesses and women (largely black) pay relatively high prices for low-value products, inhibiting effective access to Internet resources. The ongoing coronavirus pandemic has thrown into sharp relief the costs of this egregious failure to achieve the goals of universal and affordable access to the full range of communications services by businesses and citizens, further deepening the digital divide, characterised by class, race, gender, and rural-urban differentials. Without conscientiousness in policy interventions, e-commerce and the knowledge economy are simply reproducing and exacerbating patterns of economic and social inequality and exclusion, which have been hundreds of years in the making.

Without effective change management, the current situation of state paralysis and incapacity is likely to persist, with disastrous effects on the quality of digital transformation in the economy and society. The National Development Plan acknowledged the intractable problem of state capacity in 2012 (NPC, 2012), but a decade later, progress in state institution building is virtually non-existent. As the coronavirus pandemic so vividly illustrates, whether government inertia prevails or not, digital transformation will accelerate in ways that primarily benefit private sector interests and privileged consumer interests, further exacerbating the digital divide and threatening personal rights and freedoms. All governments find the "wicked problems" of social and economic transformation challenging, but South Africa has been particularly weak at leading change during the wasted decade of state capture (Bhorat et al., 2017) and in the ensuing period. An analogous situation is the transition to renewable energy in response to the climate emergency. As with digital transformation, very little implementation has happened, largely due to lack of leadership by the state, for very similar reasons. In many policy terrains, the political economy of interest groups operates to entrench the status quo, rather than to effect change. The digital transformation space in South Africa is no exception. Change always engenders anxiety and resistance, whether it be at personal, industry/sector, or country level. Ideally, this should be anticipated and managed, with leadership illustrating the extent to which the benefits outweigh the risks of economic change. There are many exciting new opportunities for repurposing existing public institutions and opening up to disruptive new possibilities which are beyond the realm of our current policy and implementation discourses. The problems lie, however, not only in the realm of physical infrastructure, skills, and legislative gaps, but also in the mindsets of policy makers and implementers, who are unable to appreciate the scope and depth of the rapid changes taking place nationally, regionally, and internationally, and who are unable to imagine an alternative future which departs radically from the status quo, for example, introducing new forms of education that could constructively address the current crisis of quality in basic education. Institutions of the state, particularly the leadership of these institutions, need to shift mindsets towards future decades in which the state is more than policy maker, lawmaker, regulator, and service provider, and more than "old-fashioned command-and-control government".

5. Selected case analyses on the future-oriented role of the state in South Africa

The cases in this section problematise only four of the possible options for the future-oriented role of the South African state, namely the state as regulator, as innovator, as distributor, and as enabler, from the perspective of digitally enabled development opportunities. Each of these is a potentially powerful role, depending on the quality of execution, and depending on the extent to which the specific state institutions engage in innovative behaviour. Those state institutions that operate as regulators have exceptional pent-up economic power to create the rules of the future economy and to monitor and facilitate how the economy evolves. The role of innovator presents the opportunity for institutions of the state to focus on applying digital technologies in ways that shift previously intractable economic realities. The state has not always taken on the role of innovator, but in the quest for long-term development efficiency and effectiveness, innovation is a key role, where the state must participate alongside its economic partners. As distributor, state institutions can unlock bottlenecks and build platforms for efficient processes. In its role as enabler, the state can provide open access to knowledge. Each case sheds light on a particular terrain of policy and practice, where implementation has been exceedingly challenging. Each case introduces a South African perspective, followed by an international perspective or reference.

a. Analysis of Case A: The state as regulator – Trade management

Historically, attempts to control what enters and leaves the territories of sovereign states focused on the management of ports of entry – maritime ports, airports, and land border posts. The terms for cross-border trade transactions are codified in international trade agreements, and in trade-related domestic laws and regulations. Trade regulation for goods includes taxation (import or export duties), measures to assure human, animal, and plant health and safety, and the certification of the national origin of a product. These services are, by their nature, regulation-intensive. Licences to establish a commercial presence in a foreign jurisdiction, and fiscal and sector-specific regulations may be required to provide services across borders. The movement of persons across borders to consume services (eg. tourism) or to supply services (eg. engineering services) typically requires visas or permits, and the recognition of professional qualifications. The growth in digitally enabled services trade, cross-border flows of data and content, e-commerce and multinational platforms, as well as the embodiment of services (in software) in goods such as motor vehicles, requires new trade regulations and management systems and practices.

South Africa's trade policy, which informs its trade management strategy and hence the digitisation of trade management, does not cover trade in services, digital trade, e-commerce, or broader digital transformation matters in the trade environment in any detail. The trade management focus is very much on trade in goods, and on the related border management functions, for which processes and instruments are still largely paper-based at many or the majority of border posts, requiring interaction with government officials. The current trade policy lags significantly behind market evolution and global developments in trade regulation and management.

In developed countries, but increasingly in developing countries too, digitisation now commonly features in trade transactions, both in the private contracts between buyer and seller and also in the implementation of trade regulations by different countries. E-commerce, whether business to business (B2B), business to consumer (B2C), or consumer to consumer (C2C), is growing rapidly in developing countries. Digitally enabled and delivered services such as insurance and other financial services, healthcare, education, telecommunication, and audio-visual services can now be supplied across borders, without the movement of services, suppliers, or consumers. Digital labour platforms are also becoming important in the cross-border supply of professional and related services, mitigating the challenges and national sensitivities associated with the cross-border movement of persons.

Trade management includes customs, standards, immigration, and state security at border posts. Digitisation makes it possible to move many of the border management functions away from border posts or ports of entry, so that clearance and compliance can be completed before goods are shipped for export. With the use of robust risk assessment tools to assure regulatory compliance, selective checks can be conducted at border posts using scanners, rather than doing comprehensive checks of all consignments.

Management of trade in goods is closely connected to the management of trade in services. This derives from the roles that transport, communication, and financial services play in facilitating the movement of goods across borders. For international e-commerce transactions, goods still need to be transported across borders and to comply with all

necessary regulations, the so-called last mile for e-commerce. Orders and payments made on e-commerce platforms use communications and cross-border payment services.

While trade management is a national concern, there is also a regional (and global) dimension. Borders have two sides. This means that, for example, digital certificates confirming the national origin of a product, issued by the South Africa Revenue Service, will have to be accepted as legitimate and authentic by trading partners. Mutual recognition of compliant traders (through Approved Economic Operator Programmes) can create efficiency gains for importers and exporters by reducing the need for compliance checks, thus expediting trade transactions. These matters, and others such as data protection, must be agreed upon in international trade agreements and elaborated upon in national regulations, as well as in regional digital transformation strategies.

Digitisation provides opportunities for the cross-border delivery of financial, education, professional, and healthcare services. Permitting cross-border supply of services (both as exports and imports) can contribute to the achievement of development objectives such as universal access to communication services and financial inclusion. To facilitate trade in these services, agreement about specific regulations is required, and market access for foreign services and services suppliers must be agreed upon and granted in compliance with the necessary domestic regulations. For education, professional, and healthcare services, agreement on the mutual recognition of the qualifications of services providers is necessary to facilitate cross-border services supply. In addition, domestic regulations must specifically permit the supply of digital cross-border services. For example, in most countries, the cross-border supply of virtual healthcare services is not permitted.

South Africa is a member of the Southern African Customs Union (SACU) and has concluded agreements with the other SACU member states for the electronic exchange of trade-related data. The electronic data interchange (EDI) operates in real time and plays a key role in the customs revenue sharing arrangement that is managed by South Africa. South Africa is also a member of the Southern African Development Community (SADC) and is a state party to the African Continental Free Trade Area (AfCFTA). The AfCFTA is a flagship project of the African Union (AU) which adopts and implements a suite of projects and other initiatives to achieve the objectives of the AU's Agenda 2063. One of these is the AU's digital transformation strategy (UNECA, 2020), which was adopted in May 2020 to support, among other objectives, the implementation of the AfCFTA. South Africa's commitments in these regional integration initiatives, related to goods and services trade management, must be factored into the national digital trade management plan. The implementation of these agreements may well require amendments to domestic laws and regulations.

Cross-border payments using mobile money solutions and payment platforms (PayPal and M-PESA, amongst others) have encouraged commercial banks (eg. Standard Bank, ABSA) to develop or enhance their digital cross-border payment solutions. Other notable developments include Afreximbank's Pan-African Payment and Settlement Platform, an initiative prompted by the Agreement Establishing the African Continental Free Trade Area (AfCFTA). Regional payment platforms are also being developed. SADC has adopted a regional payment platform, the Regional Cross-border Real-time Gross Settlement System (RTGS). A quick review of the operational guidelines indicates that there is still scope for the digitisation of payments and clearing processes, which can reduce the transaction and forex-related costs for trade transactions (noting that scanning and emailing documents is still required).

Opportunities for digitisation can be found throughout the trade regulation and management value chain, whereby the adoption of digital instruments (eg. digitised standards certificates) and digital processes (eg. online or mobile applications for export permits) can deliver efficiency gains, in terms of application and processing time, and dwell time at the border posts. Digitisation can also deliver governance improvements. In recent years, customs modernisation programmes have included developments such as "smart borders" and "single windows", to achieve the benefits of digitisation in international trade governance. The customs modernisation programme of the South African Revenue Services (SARS, 2021a) made an important shift in 2021 to align with the SARS Vision 2024, and includes strategic initiatives focusing on "SMART borders, single window, regional IT connectivity and eCommerce" (SARS, 2021b). These initiatives stand to transform trade management, especially in view of the acknowledgement in the 2020/2021 Annual Report of SARS that "Customs and Excise is grappling with manual and paper-driven processes" (SARS, 2021c, p. 70).

Ideas for the digitally enabled regulation of cross-border trade

5.1.1 The South African Revenue Service, the Department of Agriculture, Land Reform and Rural Development, the Department of Trade, Industry and Competition (the dtic), and the International Trade Administration Commission are among the key agencies involved in trade regulation and management that require orientation and insight into how digital processes and applications can advance the role of the state as regulator. In addition, digital skills development (including AI, data science) and change management capability development will be required, in order to adopt an appropriate range of regulatory technologies (regtech).

5.1.2 The adoption of digital trade solutions is urgent and should continue for at least the next decade, including the introduction of online or mobile application processes and the receipt of instruments (certificates or licences). These are essential for the establishment of a single window platform for customs and border management (see below).

5.1.3 Policy and legislative amendments are needed to facilitate the use of digital trade instruments and processes, for data protection in the trade regulation value chain, and for inter-agency cooperation and access to data. A good starting point will be a comprehensive trade policy revamp to reflect the reality of trade in the digital economy. The recent Trade Policy Statement from the Department of Trade, Industry and Competition (the dtic, 2021) is a precursor to an inclusive process to develop a trade policy and a "fit for purpose" trade management system. However, a comprehensive approach relevant to trade in goods, trade in services, and digital trade, all aggregated in a single integrated policy document, is required.

5.1.4 Coordination and collaboration among the agencies involved in border management, for the effective adoption and implementation of a safe and secure trade management system, can best be achieved when officials from all the relevant agencies have knowledge of **all** border management functions, to understand how their function fits into the overall system to facilitate trade.

5.1.5 The harmonisation of digital trade management processes in SACU, SADC, and the AfCFTA is a necessity. South Africa can play a lead role in this process. For the AfCFTA, guidelines for the implementation of the annexes dealing with border management still need to be developed. This is an opportunity to implement the AfCFTA as a digital trade agreement.

5.1.6 Mutual recognition agreements on regulatory matters, such as the qualifications of services providers, must still be concluded with trade partners.

b. Analysis of Case B: The state as innovator – Gradually transitioning to smart cities

South African cities are introducing a range of digital technologies into the urban environment, though none has yet ventured extensively into Internet of Things (IoT)[12] or artificial intelligence (AI) applications, or other data-driven applications. The City of Tshwane has partnered with a non-profit organisation, *Project Isizwe* (which advocates for free Internet access within walking distance of every low-income community), to roll out one of the largest public Wi-Fi networks in Africa (Balkaran, 2019). The Tshwi-Fi network has more than 780 free Internet zones at educational institutions, schools, clinics, libraries, and public open spaces, with 1,6 million users receiving 1GB of data daily, at speeds of up to 15 Mbps (City of Tshwane, 2021). Ethekwini Metro (Durban) started to extend its fibre optic backbone infrastructure through public-private partnerships as early as 2009. At the time, critics argued that Ethekwini's efforts were largely aimed at businesses rather than last-mile access to residential end-users (Odendaal, 2011). In Ethekwini free Wi-Fi has been rolled out to 83 municipal libraries and 828 other public Wi-Fi hotspots (Ethekwini Municipality, 2021). The City of Johannesburg's smart city initiative evolved from its Joburg Broadband Network Project, initiated around 2007, and is driven by public-private partnerships. It focuses on applications such as the online submission of regulatory approvals, smart metering, crime prevention, intelligent intermodal transport networks, water, and other services (GIBS, 2017). It includes the *Vulindelele eJozi* Digital Ambassadors programme which trained 3 000 young people equipped with tablets to train community members on how to use the City's web portal (GIBS, 2017). The City of Cape Town's first smart city strategy, adopted in 2000, was triggered by the Unicity project which merged the seven separate apartheid municipalities into a single city government, and used an enterprise resource planning (ERP) system

[12] A network of physical objects that are embedded with sensors, meters, software, and other technologies that are used to transmit and exchange data with other devices and systems over the Internet, and that can be remotely monitored and controlled.

to manage business process integration and automation. The SmartCape programme provides free Internet and computer access in public libraries, CCTV cameras in parts of the city, and includes the Open Data Portal initiated in 2015, and the design of smart grid initiatives (Green, 2016). The Urban Real Estate Research Unit (URERU) criticised the City of Cape Town for lacking detailed planning to implement its Digital City Strategy (URERU, 2019, p. 21):

> While the City may be aware of how to proceed, effective implementation mechanisms need to be decided on in order to go beyond merely identifying what needs to be done. Further, there needs to be a sense of leadership that pervades all levels of the organisation in order to create an appropriate system of institutional support based on an in-depth understanding of each department's responsibilities and how it relates to a coherent strategy. This would likely enable the CoCT to embed their strategy more effectively into the organisation.

This statement could apply equally to all South Africa's metropolitan municipalities (metros) as they struggle to articulate clear plans, approaches, and budgets for what would be a massive, expensive, long-term transition.

There is considerable variation in the approaches taken by city governments, hence it is difficult to make generalisations. Some of the critiques of current smart city trajectories are that they are techno-centric, rather than citizen-centric (the majority of citizens suffer from digital exclusion); that they are top-down, led by the state and driven by technology vendors, rather than driven by society with grassroots participation of communities; and that they aim to make existing municipal business models and delivery models more efficient, rather than fundamentally alter governance relationships and power dynamics and move towards collaboration and co-production (SACN, 2020). This is as much a mindset and ideological deficit as it is a shortage of capacity and resources. The City of Johannesburg, for instance, only made its new smart city strategy available for public comment after it had been approved by Council (Foster, 2020, p. 25).

Smart city initiatives have been largely driven largely from the local sphere, without a clear nationwide smart city agenda. The national e-strategy, Digital Society South Africa, pays scant attention to smart cities beyond the need for municipal and citizen connectivity, the need for local research and development, and the need for low-power wireless technologies to support IoT and the formation of smart communities (DTPS, 2017). Cities themselves often lack stable leadership and coordinating bodies or regulations for smart city implementation. Balkaran (2019) cites the example of different companies trenching the same pavements to lay fibre, due to the absence of clear, sequenced implementation plans, but this is just one example of coordination failure.

Cities around the world are at different stages in harnessing digital technologies in support of urban development objectives, reduced operational costs, greater service delivery efficiency, better-informed decision-making, improved quality of life, enhanced economic competitiveness, and broad engagement with internal and external stakeholders in joint problem-solving. They are increasingly providing fibre optic networks and Wi-Fi in public places, engaging in smart metering to improve revenue management, providing integrated public safety platforms (eg. crime reporting or emergency services), public transport platforms, road maintenance apps for reporting issues like potholes, smart and energy-efficient lighting systems, and many more, smart city initiatives (Van der Waldt, 2018).

Internationally, cities are introducing IoT applications, integrating data from sensors into single virtual platforms for holistic, real-time monitoring and decision-making. They are acquiring the capacity to pool vast quantities of data, generated in real time as citizens interact in trade and commerce, socially, in local politics, and with the local physical environment – spanning both public and private sectors. Such datasets draw on varied sources such as multimedia (digital photographs, pictures, and video), mobile telephony, global positioning systems (GPS), facial recognition, and social media such as Twitter and Instagram (Van der Waldt, 2018). These new technologies also raise risks and concerns relating to the "seamless web of surveillance and power" (Balkaran, 2019, p. 11), relating to, for instance, individual privacy, digital exclusion, and democratic culture.

Increasingly there is the recognition that new governance models are also necessary to effectively manage the dynamics of smart cities ie. "smart governance", which may be defined as "the ability of government to make better decisions through the combination of ICT-based tools and collaborative governance for the purpose of achieving their developmental mandates" (Wilson & Guya, 2020, p. 5). Smart governance presupposes that there is the capacity (such as the platforms, plans, policies, procedures, and infrastructure) in municipalities for both internal coordination, and for enabling participation and collaborative decision-making, open data principles whereby data relating to the city

can be openly accessed, modified, or used without any legal restrictions, and a mindset which goes beyond consultation lip service to genuinely embrace a two-way flow of ideas, information, and resources, and collective decision-making with citizens, the private sector, and community and non-governmental organisations.

Konzo Techno City in Kenya, Eko Atlantic in Nigeria, Hope City in Ghana, and Vision City in Rwanda are prominent smart city initiatives on the African continent (Balkaran, 2019). President Cyril Ramaphosa's 2019 State of the Nation address sketched a vision of a South African smart city "founded on the technologies of the Fourth Industrial Revolution", with high-speed rail and the construction of sophisticated, modern skyscrapers, factories, and other infrastructure (Ramaphosa, 2019). Critics have called into question the utility of constructing the kind of smart cities that would pander mainly to elites, given South Africa's more urgent challenges relating to water and food security, poverty, housing shortages, and unemployment. In 2014, the City of Johannesburg attempted to partner with the Chinese development company, Shanghai Zendai, which had acquired 1 600 hectares in Modderfontein, near Midrand, Gauteng to construct a new USD8 billion smart city (then around ZAR84 billion) by 2030. Apparently, the City's more inclusive vision differed from Zendai's conception of an upmarket, luxurious, global hub. With demand for housing and office space significantly lower than anticipated, the project ran into financial difficulties (with net liabilities of ZAR216 million) and was abandoned (Balkaran, 2019). It is essential to note that smart cities can be built on a pro-poor design, addressing the needs of low-income communities, using very low-cost engineering and frugal innovation design, and advancing the skills of local communities to participate in and earn income from the build process.

Ideas for citizen-oriented, frugal smart city design

5.2.1 The formulation of a national smart city strategy is essential for providing the foundation for pro-poor smart cities, smart villages, and other smart environments.

5.2.2 Municipal government should actively create smart city policy documents based on broad consultation, including residents and businesses with digital access, and making special efforts to consult residents and small, micro-, and informal businesses who do not have digital access.

5.2.3 Municipal government should develop the institutional capacity for smart, collaborative, and inclusive governance (which requires a break from current hierarchical, top-down, dirigiste mindsets), broadening free public access, building digital skills in communities, and developing the skills for collaboration as well as digital skills, following the guidance in the National Digital and Future Skills Strategy.

5.2.4 National government and the South African Local Government Association (SALGA) should work collaboratively to provide technical support to intermediate cities and rural towns, so they they gain the capacity to utilise digital technologies in inclusive and context-appropriate ways and to share domestic and international good practices. Digital adoption must support economic innovation, but it must also support social innovation, of which the most important aspects are educational and public health innovation. Such technical support could include shared applications for smart city solutions, and data science support for the definition of data structures and the creation of data analytics dashboards. With flexible design, these platforms can offer shared use by multiple projects, greatly reducing costs.

c. Analysis of Case C: The state as distributor/curator – Single window trade management platforms

The South African Revenue Services (SARS) has embarked on a single window initiative, in pursuance of the United Nations Centre for Trade Facilitation and Electronic Business Recommendation 33 (UN/CEFACT, 2018), as part of its broader customs modernisation programme (SARS, 2021a). Recommendation 33 deals with the establishment of a single window to support the efficient exchange of information between traders and government agencies. The complex systems architecture is currently in the design phase, and the aim is to have an operational single window by 2024. Multiple government agencies are involved in cross-border trade management, and necessary inter-agency cooperation and management add to the challenges of implementing the single window. Besides SARS, government agencies with trade-related functions include the Border Management Agency, Port Health, the International Trade Administration Commission, the National Regulator for Compulsory Specifications, the Medicines Control Council, the Plant Inspector, the State Veterinary Service, the Department of Agriculture, Land Reform and Rural Development, the Department of Environmental Affairs, the Department of Health, the Department of Home Affairs, the Department of Trade, Industry and Competition, and the South African Police Service.

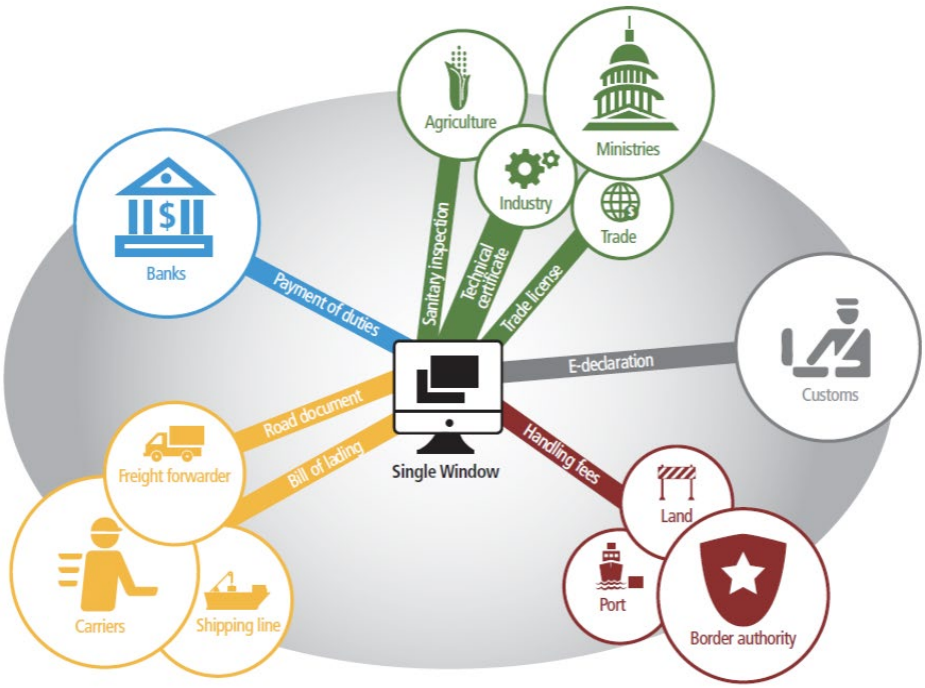
Traders (importers and exporters) and government agencies need to interact to ensure compliance with trade regulations and for the necessary payment of duties and fees. One government agency is usually designated the lead border agency. Because of the importance of revenue collection, this is often the customs authority. Border management in many countries has evolved in recent years from cumbersome, document-driven processes to smart borders and single window platforms. Smart borders use digitised trade enhancement solutions to ensure security, to minimise risk, and to enable technology-driven border management processes. Compliance processes now take place prior to the shipment of goods, reducing time and cumbersome bureaucracy at border posts. A further step to enhance efficiency, building on smart borders, is the single window border management system. Here, the state plays the role of innovator, creating digital platforms for trade management.

The single window is an integrated platform that uses distributed ledger technology (DLT). It comprises technological infrastructure and protocols that permit simultaneous access, validation, and record updates, through a network that is spread across multiple government agencies, permitting access for traders and all other parties involved in facilitating cross-border trade. Single window platforms are designed to streamline compliance and the payment of border taxes and other fees, and to facilitate trade by reducing trade costs and time, and by assuring trade transactions. Border posts play the function of validation of compliance, rather than being the focal point for compliance assurance.

A legal basis for inter-agency cooperation and the inter-operability of the single window platform is necessary. Since regulations still need to be developed for the implementation of South Africa's new Border Management Authority Act No. 2 of 2020 (The Presidency, 2020), which provides that the Department of Home Affairs is the lead border agency, there is an opportunity to set regulations for digital trade solutions and, specifically, regulations for a single window platform for border management. The appointment of the Department of Home Affairs as the lead border agency reflects South Africa's concerns about the alleged irregular cross-border movement of persons. Immigration matters have thus become a priority, taking precedence over the traditional border management practice of trade facilitation. A digital single window could include a risk assessment protocol for the cross-border movement of persons, with links to e-visa management systems, thus reducing checks and the need to issue visas at border posts.

Figure 2 shows the basic design of a single window platform that connects traders (importers and exporters), as well as services providers (including freight forwarders and banks that facilitate the payment of customs duties and other charges), with all the agencies involved in trade regulation. This representation of a national single window is similar to those that have been adopted by many developed countries and several African countries, including Kenya, Mauritius, Mozambique, Rwanda, Senegal, and Uganda (Mudzingwa & Chidede, 2021).

Figure 2: Basic trade single window design



Source: World Bank (2017, p.81)

One of the agencies (or a designated services provider) hosts the single window and provides a secure environment for the interaction of traders with all agencies, banks, and trade and logistics services providers, to complete trade compliance processes and make the necessary payments required for cross-border trade. Compliance processes are substantively completed prior to the arrival of consignments at border posts. Benefits of single windows include faster clearance times for traders at border posts, more transparent and predictable processes, and less bureaucracy, as well as better trade statistics.

China has adopted a more sophisticated single window model which also includes access to its platform for trading partner government agencies and foreign traders. Figure 3 below provides an overview of the structure of China's single window, as well as the agencies – both national and those of trading partners – that participate in border management processes via this platform.

Figure 3: China's single window

Key:
GACC – General Administration of Customs of the People's Republic of China
MPS – Ministry of Public Security
MOT – Ministry of Transport
STA – State Tax Administration
SAFE – State Administration of Foreign Exchange

Source: World Customs Organisation (2019)

Under the auspices of the State Council's Inter-ministerial Joint Conference (IJC) on Port Administration, a Working Group for the Establishment of a Single Window was set up as the decision-making and operational agency. Twenty-five ministries and commissions such as cross-border regulatory agencies (CBRAs) have been engaged in the design and implementation of the single window, incorporating business norms and technical frameworks, and formulating specifications and standards, to coordinate the basic functions of the China Single Window (World Customs Organisation, 2019).

The China Single Window is an example of the state as distributor, providing the platform for inter-agency cooperation and trade regulatory compliance to facilitate cross-border trade. The China Single Window offers a model to support the trade integration objectives of African countries, at the sub-regional level of SADC or SACU, and at the continental level through the AfCFTA and other regional trade arrangements.

Ideas for building the platform to encourage cross-border trade

5.3.1 A single window that connects the cross-border regulatory agencies of all the Member States of the African Union could be considered as part of the overall initiative to boost intra-Africa trade, under the auspices of the African Union Commission or a designated agency, with embedded trade rules for all their trade agreements, and linked to the real-time gross settlement (RTGS) system for the SADC region (SARB, no date) and the Pan African Payment and Settlement System (PAPSS, no date) to effect the necessary payments. The added advantage would be that trade with global trade partners, especially for the large number of landlocked African countries, would benefit from the efficiency gains and improved governance.

5.3.2 Enhanced cooperation with the private sector including freight forwarders, logistics providers, and courier services can reduce trade transaction costs, for example, facilitating import duty payments via e-commerce platforms and digitising the processes that are still paper based.

5.3.3 The South African government could expedite the establishment of the platform for inter-agency cooperation in border management that aligns relevant functions and information flows across multiple agencies and allows access for traders and their service providers. This means that implementing the single window must be made a priority for all border-related agencies.

5.3.4 The regulations for the implementation of the Border Management Authority Act could provide for the necessary inter-agency cooperation and the functionalities for the single window.

5.3.5 Building the digital skills of agency staff to effectively transition to digital operations in trade management must be a priority, to ensure that officials do not retain the inefficient, clumsy paper-based system, regardless of the introduction of a digital platform.

d. Analysis of Case D: The state as enabler – Open post-school education

The need to build digital skills in response to the demand-side trends in digital transformation in the economy and society, ranging from basic functional skills to advanced competencies, is immediate. So is the need to bridge the digital divide in the interest of economic and social equity. Since South Africa has high levels of structural unemployment, demographically slanted towards black African women and young people, further exacerbated by the coronavirus pandemic, it is imperative to realise that the only skills future is a digital skills future. The Quarterly Labour Force Survey estimates that, in the fourth quarter of 2020, the South African unemployment rate stood at 42.6% (in terms of the expanded definition), varying markedly from 26.8% in the Western Cape, to 46.4% in Mpumalanga and 47.5% in Limpopo. Furthermore, also in the fourth quarter of 2020, of the approximately 10.3 million unemployed people aged 15–24 years, 29.8% were youth not-in-employment-education-or-training (YNEET) (Statistics South Africa, 2021). These high levels of unemployment co-exist with severe skills shortages due, inter alia, to the crisis in the quality of the basic education system, continuing disparities in access to and quality of post-school education, enduring fault lines in the labour market along racial, class, gender, and spatial lines, and the failure of the post-schooling system to align itself effectively with industry needs and changing labour market dynamics. In addition to pervasive occupational/job versus skills mismatch[13] (Grapsa, Mncwango & Rogan, 2011), changes in industry and in the labour market lean more strongly each day towards a digitally enabled workplace, alongside a digitally divided labour market.

The 2017 ICT Development Index ranked 176 developing and developed countries in terms of 11 variables that captured access to ICT, ICT usage, and ICT skills. Out of 176 countries, South Africa ranked 92nd in 2017, down from 88th place in the previous year, lagging behind other emerging markets such as Brazil (66th), Turkey (67th), and China (80th) (ITU, 2017). This aggregation reveals considerable disparities in ICT access and usage by income level, race, and location (urban versus rural). Digital inclusion and digital equity are daunting challenges that should not be ignored. The 2020 IMD World Digital Competitiveness Ranking benchmarked the capacity of 63 economies to employ digital technologies for economic and social transformation, based on three factors: knowledge, technology, and future-readiness (IMD, 2020). South Africa saw the greatest drop from 48th place in 2019 to 60th place in 2020, with under-performance on all factors, especially future-readiness. The country's talent rating declined from 49th in 2019 to 59th position, due primarily to the lack of digital/technological skills and limited access to foreign highly skilled staff. Business agility dropped from 40th place to 58th place due to "an ineffective private sector response to opportunities and threats, and its limited use of big data and analytics" (IMD, 2020, p. 22).

The current post-school education model is unlikely to be able to expand to meet the backlogs in skills development, much less the additional skills pipeline required for an inclusive and competitive digital economy. The National Development Plan 2030 (NDP) painted a bleak picture of the university sector in 2012. Universities largely continue to

[13] Occupational/job versus skills mismatch relates to the lack or excess of educational qualifications and/or skills that workers might experience in relation to their jobs. Workers' formal qualifications may exceed or fall short of their job requirements (ie. under- or over-education). Conversely, workers may have formal qualifications which are indeed aligned with job requirements, but they may either lack specific skills or possess surplus skills, resulting in skills deficits or skills under-utilisation. Grapsa, Mncwango and Rogan (2018) found that qualifications mismatch is pervasive in South Africa, with 27% of workers being identified as under-qualified and 26% as over-qualified. Only 40% of workers with some level of tertiary training were well matched in their current occupations. Interestingly, qualifications mismatch did not necessarily imply skills mismatch, as 20% of workers are estimated to be over-skilled for their jobs, a lower percentage than the 26% who are deemed over-educated in terms of formal qualifications.

replicate historical inequalities of the apartheid era, perpetuating a two-tier system of formerly white universities which are internationally competitive and formerly black, historically disadvantaged institutions. The NDP characterised South African universities as "mid-level performers in terms of knowledge production, with low participation, high attrition rates and insufficient capacity to produce the required levels of skills" (NPC, 2012, p. 317). The NDP set targets for raising the proportion of academic staff with a PhD degree from 34% in 2012 to over 75% in 2030, and expanding enrolment, throughput rates, and the number of Master's and doctoral graduates. However, increases in higher education funding have fallen far short of the substantial rise in university enrolments, resulting in an insufficient number of university lecturers, equipment shortages, and ageing university infrastructure, frequently exacerbated by periodic governance and leadership crises resulting in higher education institutions being placed under administration.

The 2014 Policy for the Provision of Distance Education in South African Universities in the Context of an Integrated Postschool System (DHET, 2014) recognised that the advent of the Internet had engendered a variety of blended/hybrid/flexible modalities that had supplanted the dichotomy between traditional campus-based face-to-face instruction and remote distance learning. Despite acknowledging the convergence between the programme offerings of contact and distance learning higher education institutions, for funding purposes, the Policy continued to differentiate between two binary categories, distance learning and non-distance learning. Distance learning was defined as programmes in which students spend 30% or less of the stated notional hours in undergraduate courses at National Qualification Framework (NQF) levels 5 and 6 in staff-led, face-to-face, campus-based structured learning activities, and 25% or fewer hours in courses at NQF levels 7 and 8. This distinction was attributed to "the realities of funding in the short to medium term as well as a concern to differentiate provision in order to address quality issues, particularly for remote students" (DHET, 2014, p. 9).

Despite this major weakness, which has not been effectively addressed, the Policy supports the collaborative development of quality learning programmes and the use of open education resources (OER), and proposes the adoption of an appropriate Open Licensing Framework, such as Creative Commons licensing, within a broader framework on intellectual property rights in post-school education. The Department of Higher Education and Training (DHET) undertook to publish learning resources that were wholly or partially funded by public funds under an open licence, in line with the UNESCO Paris Declaration on OER in 2012. Furthermore, teaching development grants would be employed to promote the collaborative development and use of OERs. Marin et al. (2020) point out that while several policies refer to OER, including the most recent 2017 Call for Comments on the Open Learning Policy Framework for South African Post-School Education and Training, there is still no overarching national digital content and infrastructure policy for OER in this sector or designated funding streams.

Since 2014, digital technologies have advanced by leaps and bounds, with greater penetration of broadband, mobile smartphones, and video conferencing platforms such as Microsoft Teams and Zoom, amongst the many other available options on which to build digitally enabled education. In contrast to traditional distance learning, which was wholly asynchronous and not interactive, online face-to-face synchronous teaching permits real-time structured learning activities led by academic staff, wherever the student has access to the Internet. The period after 2015 ushered in a plethora of new technologies in the digital age of mobile collaborative learning, gamification, virtual and augmented reality, big data, learning analytics, smart educational technology, and 3D printing, which were used not only in enhancing the flexibility (in terms of location, pace, and time), openness, and personalisation of teaching and learning, but also in quality assurance (eg. assessment), support services, administration (eg. admissions), and communication to equip students with the skills required for a digitally transformed labour market and society. Emergent technologies and technologies with the potential to further revolutionise the higher education space are also under development: artificial intelligence, machine learning, quantum computing, and the Internet of Things, to name but a few.

In 2020 and 2021, post-school institutions budgeted for and provided data to academics and students as a requirement for completing the academic year under multiple lockdowns due to the coronavirus pandemic. The initial hasty, unplanned transition to emergency synchronous and asynchronous online learning is not yet being managed into innovation in online education. Such innovation requires a digital-first mindset, creating new ways of learning that go beyond mere online presence, and that require academics and instructional designers to consider the various possible strata in this new digital reality of teaching, mentoring, and coaching, including the psychology of how students learn

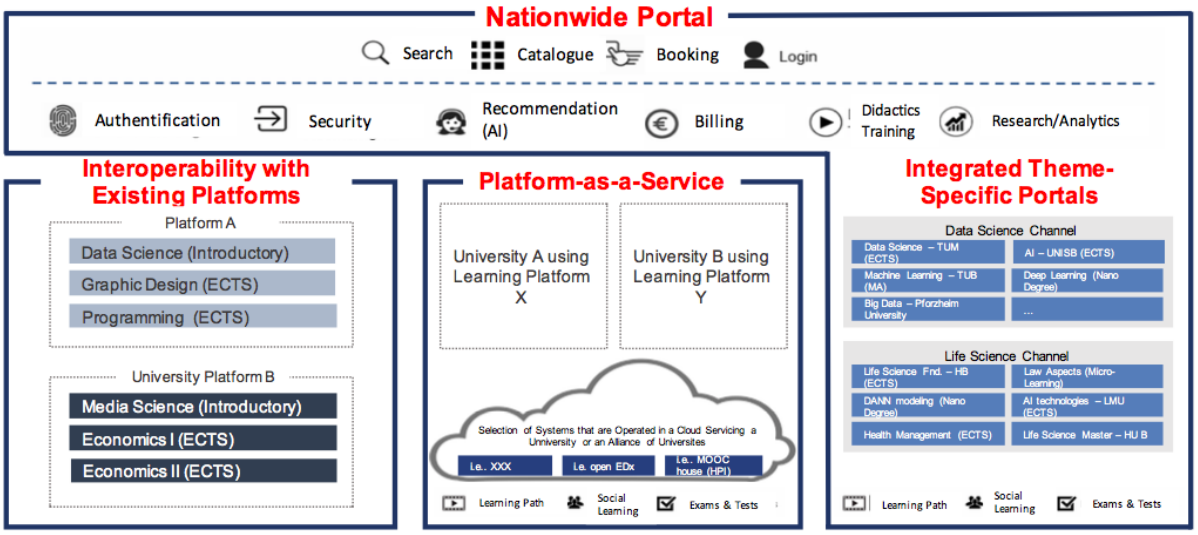
synchronously and asynchronously. Academics and students need to acquire new ways of learning, for example, how to navigate learning content and use online tools without continuous assistance; how to extract value from the creative use of learning management systems through content co-creation; how to use electronic libraries effectively; how to handle online criticism; and how to create an online learning identity (Hoosen, 2021). Under-resourced historically disadvantaged institutions with poorer student profiles have struggled significantly more than their more affluent counterparts to make this transition borne of necessity (Ndevu, 2020). Those South African universities which were already engaged in blended learning and other forms of online and distance learning (ODL) were able to respond more agilely to the sudden shift to emergency online learning than their poorer-resourced counterparts were, who relied mainly on conventional teaching approaches.

Many challenges were encountered, including less affluent students' access to devices and the Internet, the prohibitive cost of data, academic staff with insufficient training and delivery, inadequate support services, and a lack of teaching and learning resources (Armoed, 2021). A survey (CTL, 2020) of approximately 49 000 students at 24 higher education institutions conducted in the fifth month of South Africa's national lockdown indicated that 77% of the sampled students had migrated to online learning, while the remainder were already engaged in distance learning before the pandemic or did not have any modules that required remote learning. Only 4% of the sample reported not having a device to access the Internet but having to borrow one from family or friends. Of those students who had a device, 89% had smart phones, while 60% had laptops. Furthermore, 50% of respondents reported some difficulty with using a smart phone for academic purposes; 46% had accessed data from their institutions; two-thirds purchased mobile data from private providers; and 16% had Wi-Fi or fibre-to-the-home. Access to electricity was also problematic, further exacerbated by load shedding, with 20% of students reporting frequently being unable to charge their devices when needed. 54% reported not having a quiet place to study (CTL, 2020). The experience of the sudden, impromptu transition to emergency teaching and learning reflects starkly how the digital divide in the higher education domain mirrors that of the South African economy and society as a whole. Nevertheless, there is broad access to the Internet by students. While the quality of that access varies markedly, undermining the effectiveness of online teaching and learning for large numbers of students from low-income households, this is a real digital divide challenge that needs to be tackled, not just lamented. Putting time and effort into the design of a satisfactory endgame for building inclusive digital platforms for open post-school education is a worthwhile endeavour.

There are many definitions and approaches to open education (OE), and most of them focus on broadening access by making learning and teaching accessible to all by eliminating financial, legal, and technical barriers (such as fees, admission requirements, intellectual property restrictions, enabling access for learners with disabilities) so that knowledge can be freely produced, shared, and advanced, through a range of formal and non-formal education pathways and a variety of teaching and learning approaches, frequently making use of digital technologies (European Commission, 2016). Open educational resources (OER) refers to digitised learning, teaching, and research materials in any format or medium that are in the public domain or issued under an open licence, permitting educators and learners to use, re-purpose, adapt, and redistribute to others at no cost (CERI, 2007). OER encompasses not only educational content such as e-textbooks and YouTube videos, but also software that enables teaching and learning (such as OER repositories, search engines, interactive web pages, social media, mobile and desktop apps). OE practices promote "the (use) and production of high quality OER through institutional policies, promote innovative pedagogical models and respect and empower learners as co-producers on their lifelong learning path" (Open Education Quality Initiative, cited in Nikoi & Armellini, 2012). In 2007, UNESCO's Cape Town Open Education Declaration aimed, inter alia, to promote the creation and usage of OER and to advocate for policy changes to support open culture. UNESCO's 2012 Paris OER declaration called on governments worldwide to license publicly funded educational materials openly for public use. Massive Open Online Courses (MOOCs) offered for free via the Internet to users from all over the world have proliferated, and new forms of recognition of credits and qualifications such as micro-credentials (also known as digital badges) are being developed to support shorter, more flexibly designed and delivered courses which are more responsive to the needs of the economy and society (Rampelt, Orr & Knoth, 2019). In open education, low-cost initiatives that adopt a frugal innovation approach are possible. This is an initiative that South African post-school educational institutions can implement, as they already employ the academics and they already have the content and some of the basic digital tools that constitute the foundation of open education innovation. The state, in its role as enabler, can encourage the post-school system to advance in this direction.

By way of example, a German university digitalisation platform is planned which would enable universities to upload content, templates, tools, and infrastructure (platform as a service) to assist other universities and produsers in open education delivery.

Figure 4: Platform-as-a-service (PaaS) application in the post-school environment



Source: Schmid et al. (2018)

Some will argue that, despite the potential for digitalisation to transform and democratise teaching and learning, its actual impact on teaching and learning has been superficial, even in advanced economies. However, this is largely because digital pedagogies are under-developed, and not fully integrated in teaching and learning. The policy emphasis has been more on investments in information and communications technology (ICT) infrastructure and hardware and on-campus connectivity, with much less focus on digital skilling and related professional development for academics, on the need to reinvent pedagogical approaches, and on generating appropriate courseware and other enabling software.

Ideas for fostering South Africa's transition to open post-school education

5.4.1 The open learning policy framework for South African post-school education and training proposed in the 2017 Call for Comments should be formalised with immediate effect, bearing in mind the key lessons learnt from the pandemic.

5.4.2 The implementation plan contained in the call should be revised and should directly address the specific challenges of the digital divide that would mitigate against inclusiveness and equity in online learning.

5.4.3 The current post-school education funding formula should be revised to create incentives for high quality and inclusive blended programme delivery and the adoption of educational technologies.

5.4.4 Universities and other post-school institutions, student organisations and broader civil society should exert pressure on government to desist from bailing out ailing, inefficient, and corrupt state-owned entities, and instead reprioritise funding to investments in digital equity in higher education.

5.4.5 National government should prioritise funding for investment in software innovation, in pedagogical advancement, and in the digital skills of lecturers and students, not just for investment in hardware. NSFAS funding could create incentives for online courses and e-learning formats to the extent practicable.

5.4.6 National government should prioritise funding for investment in building a South African open learning platform, where digital content from South African post-school institutions can be uploaded, accessible free of charge by any person, noting that such free content enhances rather than diminishes the attractiveness of institutions for formal study.

5.4.7 This learning platform could be linked to a job-matching platform powered by machine learning, which would advise job seekers on what online courses to take to increase their employability.

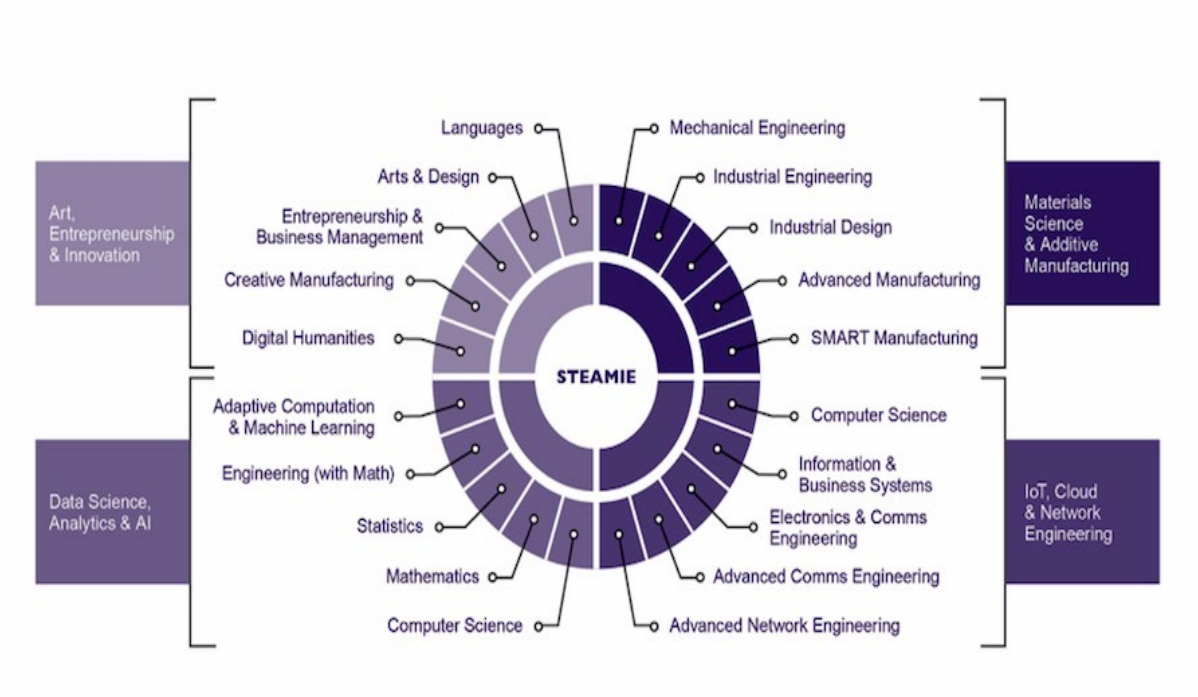
6. The state: Missing capabilities

It has been argued (Bond, 2000; Freund, 2007; Bhorat et al., 2017) that, over the past three decades, the South African state has become one that advantages political and economic elites. It is also apparent that the state, once formed during the 1990s, sought to sustain itself in its own initial image, but not to reshape itself, once it had adopted the elite transition form of power. This means that the elites had a couple of decades to accumulate significant personal wealth. Given the economic inefficiency of this model, elite transitions are generally at the cost of economic welfare and equity for the broader populace. Elite transitions are also, often, at the cost of real cross-sectoral economic transformation, because the ruling political elites are interested in conserving power, rather than in economic innovation, while the economic elites are interested in economic innovation, but generally for the middle- to high-income segments of the population. Countries have not yet consistently introduced forms of governance that create cross-cutting social and economic value from innovation "for all", despite specific slogans to this effect, as in "freedom for all" (Twala, 2014, p. 1988). South Africa has been sitting, for overly long, at exactly such an economic transition point, in the context of digital innovation, though it is still far from the desirable tipping point. Thus, in relation to the four roles of the state discussed in this paper, let us start with the role of the state as enabler. While state institutions can themselves be innovators, in the discussion below we focus on the enabling role of the state in relation to digital innovation.

In order to move beyond the elite transition of the last three decades and to reach such a tipping point, policy and practice must address real economic innovation, sustained over at least five decades, investing in a mix of broad techno-scientific and more specialised digital innovation, aimed consciously and conscientiously at key economic sectors, notably the education and health sectors. In the 21st century, digital innovation is inextricably linked to economic innovation, noting that digital innovation can substantially enhance efficiencies in agriculture (through agricultural apps and precision agriculture), manufacturing (through robotics and artificial intelligence applications), construction (through building information modelling), services (through a wide range of digital applications, including more recently distributed ledger technologies and associated applications), and with respect to the level of research itself (using digital applications to promote research and innovation). In South Africa, digital innovation is crucial to the flailing manufacturing sector, which cannot compete globally due to its low- and medium-low tech foundations. Likewise, the public sector could create significantly greater public value (and still support private value creation) if it were more adept at using digital technologies and integrating digital innovation into key business processes. In particular, digital innovation is needed in the education and health sectors, which are key to the long-term success of the effective utilisation of public funds for development, and also to long-term economic success.

One of the key types of investment in digital innovation, required because South Africa has meagre resources in this respect, is in the arena of digital skills. In the context of the public sector, digital skills should focus in particular on the following niche areas: (1) digital arts, entrepreneurship, and innovation; (2) data science, analytics, and machine learning; (3) the Internet of Things (IoT), cloud, and network engineering; and (4) materials science and additive manufacturing (Abrahams & Burke, 2021). This is because these four niche areas of knowledge and skills are enabling in such a wide range of public sector adaptations. Materials science and additive manufacturing, for example, are as useful in the public health sector as they are in aeronautical manufacturing or space science. Digital arts, entrepreneurship, and innovation are a valuable skills base for the educator profession. All four niche areas need STEAMIE (science, technology, engineering, arts, mathematics, innovation, and entrepreneurship) knowledge foundations, see Figure 5 below.

Figure 5: STEAMIE skills sets
(science, technology, engineering, arts, mathematics, innovation and entrepreneurship)



Source: Abrahams and Burke (2021)

Most important of all is the need for two mutually reinforcing dimensions of leadership, namely digital leadership, on the one hand, and broader innovation leadership, on the other hand. Digital leadership refers to guiding and steering digital transformation in the public sector and to expressing relevant public policy goals and modalities with respect to digital transformation in multiple economic and social sectors. Innovation leadership refers to encouraging multiple forms of innovation in those domains where innovation is weak and where digital innovation could be beneficial, for example, in the agricultural sector, where precision agriculture is highly desirable in conditions of resource scarcity and drought. In combination, digital leadership and broader innovation leadership can be powerful capabilities in fostering a future-oriented economy. However, in the South African public sector, the focus on these skills is weak. The Centre for Public Service Innovation, established in 2003, was placed on the periphery of the public service, granted a meagre budget, and had limited if any significant access to the heart of the public sector, namely, the Departments of Education and Health, where much innovation is required, notably digital innovation. Furthermore, the Government Information Technology Officers Council (GITOC) has been a strategy-poor entity, with no formally adopted digital strategy to guide its work, for most of its existence. The Department of Health published the National Digital Health Strategy for South Africa in 2019, while the Department of Basic Education published the Professional Development Framework for Digital Learning in 2018. Neither of these strategies has yet had time to embed or mature in their contexts, at a practice-oriented level. Significant attention is required, therefore, for building and exercising the digital leadership capabilities and qualities that will foster digital government, applied in the interests of 21st century public service effectiveness, which will reach, in reality, the bulk of the population.

In focusing on the skills and capabilities for digital government, it is noted that Cabinet adopted the National Digital and Future Skills Strategy in August 2020 (DCDT, 2020), and the related implementation programme was completed in February 2020. The implementation programme highlights the need for the public sector to focus on "(1) building the technical skills required to operate, manage and sustain the digitally mediated processes of government and the underlying technological systems and databases; (2) the growth in digital literacy with a particular focus on data management and analytics for frontline service staff; and (3) the advancement of digital leadership skills among public service leaders and managers" (DCDT, 2021, p. 30).

In public healthcare, attention needs to be given to digital skills and organisational capabilities for online patient record administration, clinic administration, precision medicine, and interactive digitally supported family healthcare, to mention a few key items. In schools, a crucial future focus needs to be on the use of dynamic software for language,

maths, and science teaching and learning, as well as on building the specialised digital pedagogies required to effectively introduce technologies to be transformational to the learner experience, rather than simply substituting the laptop for the textbook. In public safety, skills for the use of geo-location apps and databases will be essential. All these skills require foundational knowledge of privacy and cybersecurity. At a broader scope, since everything from A (agriculture) to W (water affairs) can be digitised and digitally enabled, digital skills and capabilities must be fostered on a long-term basis.

Let us turn our attention to another set of missing capabilities, as important as the above, namely, the role of the state as regulator. We briefly discuss three key capabilities, namely data-driven regulatory decision-making, collaborative regulation, and future-oriented regulatory practice. In the early 2000s, some state institutions adopted evidence-based approaches to policymaking (National Treasury is an example), implying attention to data as a valuable source of insight to inform decision-making. However, this initial adoption was not fostered, was inconsistent across state institutions, and has not been widely adopted by regulators. Regulators often operate on the basis of information asymmetry, particularly in markets where they rely on the regulated entities to provide information (eg. pricing information) and where those regulated entities do not readily comply. In the current period, where so much data is available, from such a wide range of sources, regulators could partner with data analytics service providers and university data science experts to enhance their capacity for effective regulation.

In November 2021, the National Energy Regulator of South Africa (NERSA) hosted a national regulators' workshop, the first of its kind in South Africa. The stated purpose of the workshop was (NERSA, 2021, p. 2):

> [to encourage] cooperative governance between regulators at national and provincial level. The workshop would also allow for the harmonization of regulatory approach and procedures on cross-cutting issues and further enable regulators to discuss issues related to competition as a mechanism for encouraging the efficient delivery of infrastructure services. … Regionally, there are cross cutting challenges such as high poverty levels; water and energy sectors which are under increasing pressure due to population growth and agricultural and industrial development; climate change and so on. Regional development and integration are underpinned by water, energy security, transport and communication as these are resources that are transboundary in nature. This therefore underscores the need to have a coordinated approach on national policies aimed at delivering economic and social development goals, which impact on the regional goal of greater integration.

This understanding of the need for collaborative approaches to regulation offers a clear opportunity for regulatory renewal, where regulators see and exercise their power in concert for the benefit of the whole economy, rather than just the respective sectors in which they operate. In some instances there may be legal or regulatory impediments to collaborative regulation which may require review, but in many instances a culture of collaboration could be forged through practice and convention in an ecosystem approach, where domestic and international regulators collaborate with each other, and with the regulated entities, to identify inconsistent regulations, streamline regulatory processes, deal with bottlenecks, build regulatory capacity, experiment, and promote innovation. The change management project requires an openness to technology, and a radical change in mindset, from current large-scale, centralised, hierarchical, top-down, state-driven models, to more collaborative, problem-driven iterative adaptation (PDIA) (Andrews, 2013).

Creating a suitable regulatory environment for the digital economy requires future-oriented regulatory practice, a shift from command-and-control style regulation to adaptive forms of regulation. Adaptive approaches to regulation are important where the outcomes of regulatory decision-making are uncertain, or where novel regulatory decisions are required, whether in relation to novel data-driven price regulation for the data services market, or to reduce risk in fintech adoption. Regulatory experimentation can be fostered through the design of regulatory sandboxes, where the relevant regulators and regulated entities experiment with novel approaches, then adopt the best approach based on the results of the experimental process. Many central banks have adopted regulatory sandboxes as a tool to deepen understanding of the outcomes of regulatory decisions, with live trials conducted in Canada, Denmark, Mauritius, Malaysia, Sierra Leone, and Thailand by 2018 (Eggers, Turley & Kishnani, 2018, p. 13). These are just a few of the countries to look to for lessons in adaptive regulation. In the telecoms sector, the Communications Authority Kenya took a similarly adaptive approach to the regulation of mobile money service M-PESA when it was first introduced (Abrahams, 2017, pp. 15–16). South African regulators engaged with regulation relevant to the digital economy must

explore future-oriented forms of regulation, as a means to leading in creating novel approaches to spectrum management, competition, data pricing and consumer protection, some of the key foundations for the current phase of digital economy evolution.

7. A change management approach for the state

It is generally assumed that, although the state has a leading and critical role in promoting digital transformation, these roles – regulating, innovating, distributing, and enabling – can only be fulfilled if the state seeks a more cooperative approach, integrating the talents and capabilities of citizens and other relevant stakeholders (civil society, economy, science), and rendering them co-producers. This integration can be facilitated by using social media and cooperative spaces that allow for the orchestration of resources to produce meaningful outcomes, in other words, a meaningful endgame. In this paradigm, a change management approach which sees the opportunity for the state to act as a platform, in each of its different roles, is desirable, noting that there are a few important matters requiring attention.

7.1 In order to avoid overreach by institutions of the state, participation by citizens and stakeholders must be further integrated into the processes of public service delivery, including the development of policies. This is over and above the participation requirements for municipal level integrated development plans. While this participatory approach can serve to upgrade the efficacy and effectivity of policy design, it can also serve as a means to promote a meritocratic and pro-democratic approach to fostering the digital economy. In a more advanced view, state institutions would outsource service delivery to produsers, thereby avoiding overreach and capacity shortages.

7.2 In order to ensure this platform capability, open processes, software and digitisation of critical service delivery processes are necessary. For the purposes of collaboration, public processes and public data must be opened up or shared using APIs as standard interfaces and open software to allow for a seamless and easy integration with produsers and their electronic tools.

7.3 With this upgrade of the role of citizens as produsers, it is important to provide citizens with access to the necessary skills and information to fulfil the envisaged role.

The South African cases sketched above begin to illustrate how some elements of these change management approaches may be appropriate to a variety of South African policy domains.

In summary, the current deficit in the transformation capabilities of the state can only be compensated for if digital processes and platforms are developed that allow for the integration of and collaboration with citizens and shareholders who possess an interest in and the resources to collectively build the digital economy. While wide-scale digitisation of the public administration is not feasible in a big-bang scenario, selective digitisation of economy-critical decision-making and collaboration spaces is within the realm of possibility. Thus, the public platforms outlined in the cases above could multiply the benefits derived from scarce transformation resources, while ensuring that technologies, skills, and experiences are allocated to relevant areas of attention, or development challenges (change by platform). Furthermore, the role of the state in the digital age is not to solve all the problems of the society, but rather to enable citizens and stakeholders to work on and solve issues that are pressing for them. This style of government clearly shifts in the direction of a technocratic, rational, transparent, enabler, while the institutions of the state change in an incremental way. Successful collaboration processes and platforms can then be multiplied, drawing lessons from the initial selective digitisation and adapting to other contexts and contingencies.

In conclusion, the South African state presides over many weak regulatory institutions, it has played a limited and increasingly ineffective role as distributor and enabler, and it is newly emerging as innovator. The challenge lies in shifting this reality.

References

Abrahams, L. (2017). Regulatory imperatives for the future of SADC's "digital complexity ecosystem". *The African Journal of Information and Communication*, *20*, 1–29. https://doi.org/10.23962/10539/23578

Abrahams, L. (2021). Innovation and scaling up by tech hubs and their hosted startups: Three South African cases. Open AIR Working Paper No. 26. https://openair.africa/innovation-and-scaling-by-tech-hubs-and-their-hosted-startups-three-south-african-cases/

Abrahams, L. & Burke, M. (2021, March). STEAMIE illustration. In Department of Communications and Digital Technologies (DCDT). (no date). Implementation programme guide for the National Digital and Future Skills Strategy of South Africa, 2021–2025, 10.

Al-Ani, A. & Petritsch, W. (2017). Open source conflict prevention: Using the crowd to detect and resolve conflicts. *Administratio Publica*, *25*(3), 9–33. https://www.researchgate.net/publication/344398980_Open_Source_Conflict_Prevention_In_Administratio_Publica_VOLUME_25_ISSUE_3_2017_pp_9-33

Al-Ani, A. (2016). Government as a platform? Public virtual structures for service delivery and participation as elements of a renewed public administration. In G. Minderman, & P. S. Reddy (Eds.), *Innovation for the urban age: Innovative approaches to public governance for the new urban age* (pp. 225–246). Eleven International Publishing. https://www.barnesandnoble.com/w/innovation-for-the-urban-age-goos-minderman/1138543626

Al-Ani, A. (2017). Government as a platform: Services, participation and policies. In M. Friedrichsen, & Y. Kamalipour (Eds.), *Digital transformation in journalism and news media: Media management, media convergence and globalization* (pp. 179–196). Springer International Publishing. https://doi.org/10.1007/978-3-319-27786-8

Andrews, M. (2013). *The limits of institutional reform in development: Changing rules for realistic solutions*. Cambridge University Press.

Armoed, Z. (2021). The Covid-19 pandemic: Online teaching and learning at higher education institutes. *IOP Conference Series: Earth and Environmental Science*, *654*. https://doi.org/10.1088/1755-1315/654/1/012026

Aus dem Moore, J. P., Chandran, V., & Schubert, J. (2018). *The future of jobs in the Middle East*. World Government Summit in collaboration with McKinsey & Company. https://www.mckinsey.com/~/media/mckinsey/featured%20insights/middle%20east%20and%20africa/are%20middle%20east%20workers%20ready%20for%20the%20impact%20of%20automation/the-future-of-jobs-in-the-middle-east.pdf

Balkaran, S. (2019). Smart cities as misplaced priorities in South Africa: A complex balance of conflicting societal needs. *Journal of Management and Administration*, *2019*(2), 1–30. https://hdl.handle.net/10520/EJC-19c1cb06f9

Bauwens, M. & Kostakis V. (2015). Towards a new reconfiguration among the state, civil society and the market. *Journal of Peer Production*, *7*, 1–6. http://peerproduction.net/issues/issue-7-policies-for-the-commons/peer-reviewed-papers/towards-a-new-reconfiguration-among-the-state-civil-society-and-the-market/

Benkler, Y. (2006). *The wealth of networks: How social production transforms markets and freedom*. Yale University Press.

Bhorat, H., Buthelezi, M., Chipkin, I., Duma, S., Mondi, L., Peter, C., Qobo, M., Swilling, M., & Friedenstein, H. (2017). *Betrayal of the promise: How South Africa is being stolen.* https://pari.org.za/wp-content/uploads/2017/05/Betrayal-of-the-Promise-25052017.pdf

Bond, P. (2000). *Cities of gold, townships of coal: Essays on South Africa's new urban crisis.* Africa World Press.

Carbonero, F., Ernst, E., & Weber, E. (2018, October). *Robots worldwide: The impact of automation on employment and trade*. (Research Department Working Paper No. 36), International Labour Organisation. http://dx.doi.org/10.13140/RG.2.2.10507.13603

Centre for Educational Research and Innovation (CERI). (2007). *Giving knowledge away for free: The emergence of open education resources.* OECD Publishing. https://www.oecd.org/education/ceri/38654317.pdf

Centre for Teaching and Learning, University of the Free State (CTL). (2020). *Students' access to and use of learning materials: Survey report 2020*. Department of Higher Education and Training (DHET). https://www.usaf.ac.za/wp-content/uploads/2021/02/DHET_SAULM-Report-2020.pdf

City of Tshwane. (2021). *Tshwi-Fi information leaflet* [Brochure]. https://www.tshwane.gov.za/WIFI%20Documents/TshWi-Fi%20Information%20Leaflet.pdf

Department of Communications and Digital Technologies (DCDT). (2020, September 23). *National digital and future skills strategy*. Government Notice No. 513 of 2020, Government Gazette No. 43730. https://www.gov.za/documents/national-integrated-ict-policy-white-paper-national-digital-and-future-skills-strategy#

Department of Communications and Digital Technologies (DCDT). (2021). Implementation programme guide for the National Digital and Future Skills Strategy of South Africa, 2021–2025.

Department of Higher Education and Training (DHET). (2014, July 7). *Policy for the provision of distance education in South African universities in the context of an integrated postschool system.* Government Notice No. 535, Government Gazette No. 37811. https://www.gov.za/ss/documents/higher-education-act-policy-provision-distance-education-south-african-universities

Department of Higher Education and Training (DHET). (2017, April 7). *Call for comments on the open learning policy framework for post-school education and training*. Government Notice No. 335, Government Gazette No. 40772. https://www.gov.za/documents/higher-education-act-open-learning-policy-framework-south-african-post-school-education

Department of Telecommunications and Postal Services (DTPS). (2016, September 28). *National integrated ICT policy white paper.* https://www.dtps.gov.za/images/phocagallery/Popular_Topic_Pictures/National_Integrated_ICT_Policy_White.pdf

Department of Telecommunications and Postal Services (DTPS). (2017). *National e-strategy: Digital society South Africa.* https://www.dtps.gov.za/images/phocagallery/Popular_Topic_Pictures/National-e-strategy.pdf

Department of Trade, Industry and Competition (the dtic). Trade policy statement. www.thedtic.gov.za/wp-content/uploads/SA_Trade_Policy.pdf

Eggers, W., Turley, M., & Kishnani, P. (2018). *The future of regulation: Principles for regulating emerging technologies*. Deloitte Center for Government Insights. https://www2.deloitte.com/insights/us/en/industry/public-sector/future-of-regulation/regulating-emerging-technology.html

Ethekwini Municipality. (2021). Integrated development plan 2017/8 to 2021/22 review. http://www.durban.gov.za/City_Government/City_Vision/IDP/Documents/EthekwiniMunicipality2021_22_IDP.pdf

European Commission. (2016). *Open education: OpenEdu framework*. https://ec.europa.eu/jrc/en/open-education

Foster, K. (2020). Smarten up: Paths to bottom-up smart cities and the risks of top-down smart governance. In SACN, *Smart cities paper series: Smart governance in South African cities* (pp. 23–28). https://www.sacities.net/wp-content/uploads/2020/10/Smart_Cities_Papers_Volume_1_Final-Draft.pdf

Freund, B. (2007). South Africa: The end of apartheid and the emergence of the "BEE elite". *Review of African Political Economy*, *114*, 661–678. https://doi.org/10.1080/03056240701819533

Gordon Institute of Business Science (GIBS). (2017). *Smart cities and smart grids: A vision for South Africa*. https://www.researchgate.net/publication/316890542_Smart_Cities_and_Smart_Grids_A_Vision_for_South_Africa

Grapsa, E., Mncwango, B., & Rogan, M. (2018). Education and skills mismatch in the South African labour market. In M. Rogan (Ed.), *Post-school education and the labour market in South Africa* (pp. 223–242). Human Sciences Research Council Press.

Green, J. (2016). *The smart city playbook: Smart, safe, sustainable.* Machina Research Strategy Report. Nokia. https://open-ecosystem.org/assets/smart-city-playbook

Hagel, J., Brown, J. & Davison, L. (2010). *The power of pull: How small moves, smartly made, can set big things in motion*. Basic Books.

Hanna, N. (2018). A role for the state in the digital age. *Journal of Innovation and Entrepreneurship, 7*(5), 1–16. https://doi.org/10.1186/s13731-018-0086-3

Hoosen, N. (2021). A critical review of academic practice and integrated educational technology use at a South African University: The "real" level. [Draft PhD thesis]. University of the Witwatersrand.

IMD World Competitiveness Centre (IMD). (2020). *IMD world digital competitiveness ranking 2020.* https://www.imd.org/wcc/world-competitiveness-center-rankings/world-digital-competitiveness-rankings-2020/

International Telecommunication Union (ITU). (2017). *Measuring the information society report 2017.* https://www.itu.int/en/ITU-D/Statistics/Pages/publications/mis2017.aspx

Jeschke, S., Brecher, C., Meisen, T., Özdemir, D., & Eschert, T. (2017). Industrial Internet of things and cyber manufacturing systems. In S. Jeschke, C. Brecher, H. Song, & D. Rawat (Eds.), *Industrial Internet of Things* (pp. 3–20). Springer. https://doi.org/10.1007/978-3-319-42559-7_1

Marin, V., Bond, M., Zawacki-Richter, O., Aydin, C., Bedenlier, S., Bozkurt, A., & Conrad, D. (2020). A comparative study of national infrastructures for digital (open) education resources in higher education. *Open Praxis, 12*(2), 241–256. https://dx.doi.org/10.5944/openpraxis.12.2.1071

Markoff, J. (2015). *Machines of loving grace: The quest for common ground between humans and robots*. HarperCollins.

Miller, A. (2019). *Open educational resources (OER): An exploratory study on implementation methods.* Doctor of Education Dissertation, Union University. https://www.oerknowledgecloud.org/record2582

Mudzingwa, E. & Chidede, T. (2021, July 31). *Trade facilitation in Africa: Solutions and recommendations*. tralac Trade Brief No. G21TB09/2021. https://www.tralac.org/publications/article/15323-trade-facilitation-in-africa-solutions-and-recommendations.html

Muller, S. F. (2018, January 25). *Free higher education in South Africa: Cutting through the lies and statistics.* Mail and Guardian. https://mg.co.za/article/2018-01-25-free-higher-education-in-south-africa-cutting-through-the-lies-and-statistics/

National Planning Commission (NPC). (2012, August 15). National Development Plan 2030: Our future – make it work. https://www.gov.za/issues/national-development-plan-2030

National Planning Commission (NPC). (2020, August). *Digital futures: South Africa's digital readiness for the "fourth industrial revolution"*. https://researchictafrica.net/wp/wp-content/uploads/2021/01/021220_Digital-Futures_SAs-Digital-Readiness-for-4IR_01.pdf

Ndevu, Z. (2020). Understanding the effects of COVID-19 on universities in South Africa: An evidence-based approach. *Alter*nation *Special Edition, 32*, 275–293. https://doi.org/10.29086/2519-5476/2020/sp32a11

Nikoi, S., & Armellini, A. (2012). The OER mix in higher education: Purpose, process, product, and policy. *Distance Education, 33*(2), 165–184. https://doi.org/10.1080/01587919.2012.697439

National Institution for Transforming India (NITI Aayog). (2018). National strategy for artificial intelligence #AIFORALL. https://smartnet.niua.org/content/2bc031e8-955b-46dd-a722-6513236d9635

Odendaal, N. (2011). Splintering urbanism or split agendas? Examining the spatial distribution of technology access in relation to ICT policy in Durban, South Africa. *Urban Studies*, *48*(11), 2375–2397. https://doi.org/10.1177/0042098010388951

O'Reilly, T. (2011). Government as a platform. *Innovations*, *6*(1), 13–40. https://doi.org/10.1162/INOV_a_00056

Orr, D., Weller, M., & Farrow, R. (2019). How is digitalisation affecting the flexibility and openness of higher education provision? Results of a global survey using a new conceptual model. *Journal of Interactive Media in Education, 5*, 1–12. https://doi.org/10.5334/jime.523

Pan African Payment and Settlement System (PAPSS). (no date). https://papss.com/

Perrotta, C. (2018). Digital learning in the UK: Sociological reflections on an unequal marketplace. *Social Sciences, 7*(10), 170. https://doi.org/10.3390/socsci7100170

Presidential Commission on Fourth Industrial Revolution (PC4IR). (2020). *Summary report and recommendations*. https://www.gov.za/documents/report-presidential-commission-4th-industrial-revolution-23-oct-2020-0000

Ramaphosa, C. (2019, February 7). President Cyril Ramaphosa: 2019 State of the Nation Address. https://www.wcpp.gov.za/sites/default/files/SONA%202019.pdf

Rampelt, F., Orr, D., & Knoth, A. (2019). *Bologna digital 2020: White paper on digitalisation in the European higher education area.* https://www.researchgate.net/publication/333520288_Bologna_Digital_2020_-_White_Paper_on_Digitalisation_in_the_European_Higher_Education_Area

Reuters. (2021). Amazon copied products and rigged search results to promote its own brands, documents show. A Reuters special report. https://www.reuters.com/investigates/special-report/amazon-india-rigging/

Saros, D. E. (2014). *Information technology and socialist construction: The end of capital and the transition to socialism*. Routledge.

Schmid, U., Zimmerman, V., Baessler, B., & Frietag, K. (2018, May). Machbarkeitsstudie fur eine (inter-) nationale plattform fur die hochschullehre. (Arbeitspapier Nr. 33). Hochschulforum Digitalisierung. [Translation: Feasibility study for an (inter-) national platform for university teaching.] https://hochschulforumdigitalisierung.de/sites/default/files/dateien/HFD_AP_Nr33_Ergebnisbericht_Machbarkeitsstudie_Hochschulplattform.pdf

Scholz, T. (2016). Platform cooperativism: Challenging the corporate sharing economy. https://rosalux.nyc/wp-content/uploads/2020/11/RLS-NYC_platformcoop.pdf

South Africa in the Digital Age (SADA). (2020). Pathways to digital work: A strategy primer for South Africa's digital economy. https://www.genesis-analytics.com/uploads/Pathways-to-Digital-Work-SADA-Strategy-Primer-full-report.pdf

South African Cities Network (SACN). (2020). *Smart cities paper series: Smart governance in South African cities.* https://www.sacities.net/wp-content/uploads/2020/10/Smart_Cities_Papers_Volume_1_Final-Draft.pdf

Southern African Regional Universities Association. (SARUA). (2021). *OLC is coming to South Africa*. https://sarua.africa/olc-is-coming-to-south-africa/

South African Revenue Service (SARS). (2021a, December 3). Customs and excise national stakeholder forum [Presentation].

South African Revenue Service (SARS). (2021b). Modernisation. https://www.sars.gov.za/customs-and-excise/about-customs/modernisation/

South African Revenue Service (SARS). (2021c). *2020/2021 annual report*. https://www.sars.gov.za/about/annual-reports-strategic-plans/

South African Reserve Bank (SARB). (no date). Payment and settlements. https://www.resbank.co.za/en/home/what-we-do/payments-and-settlements

Srnicek, N. (2017). *Platform capitalism*. Wiley. https://www.wiley.com/en-us/Platform+Capitalism-p-9781509504909

Statistics South Africa (StatsSA). (2021). *Quarterly labour force survey quarter 4, 2020*. Statistical release P0211. http://www.statssa.gov.za/publications/P0211/P02114thQuarter2020.pdf

The Presidency. (2020). *Border Management Authority Act*, No. 2 of 2020. Government Gazette No. 43546. https://www.gov.za/sites/default/files/gcis_document/202007/43536gon799.pdf

Twala, C. (2014). The African National Congress (ANC) and its ideological shifts over time: Attempts to define or re-define its ideological identity? *Mediterranean Journal of Social Sciences*, *5*(20), 1988–1992. http://doi.org/10.5901/mjss.2014.v5n20p1988

United Nations Centre for Trade Facilitation and Electronic Business (UN/CEFACT). (2018). *UN/CEFACT Recommendation 33, Establishing a Single Window to enhance the efficient exchange of information between trade and government*. https://digitallibrary.un.org/record/548326?ln=en

United Nations Conference on Trade and Development (UNCTAD). (2019). Digital economy report 2019: Value creation and capture: Implications for developing countries. https://unctad.org/en/PublicationsLibrary/der2019_en.pdf

United Nations Economic Commission for Africa (UNECA). (2020, August 31). Digital transformation should be top priority for Africa's leaders. https://archive.uneca.org/stories/digital-transformation-should-be-top-priority-africa%E2%80%99s-leaders

Urban Real Estate Research Unit (URERU). (2019). *URERU smart city series part 1: Overview and analysis of Cape Town's digital city strategy*. http://www.ureru.uct.ac.za/sites/default/files/image_tool/images/383/Final%E2%80%93%20Overview%20and%20Analysis%20of%20Cape%20Town%27s%20Digital%20City%20Strategy.pdf

Van der Waldt, G. (2018). City government resilience, smart cities and Big Data. In M. van der Steen, J. Burger, & W. Burger (Eds.), *The governance of transitions: Cases from Southern Africa* (pp. 209–231). African SUN Media.

Wilson, J., & Guya, J. (2020). Introduction. In SACN, *Smart cities paper series: Smart governance in South African cities* (pp. 3–8). https://www.sacities.net/wp-content/uploads/2020/10/Smart_Cities_Papers_Volume_1_Final-Draft.pdf

World Bank. (2017). *Doing business 2017: Equal opportunity for all*. World Bank. http://www.doingbusiness.org/~/media/WBG/DoingBusiness/Documents/Annual-Reports/English/DB17- Report.pdf

World Customs Organisation. (2019). Case study: China international trade single window. www.wcoomd.org/-/media/wco/public/global/pdf/topics/facilitation/activities-and-programmes/sw-initiatives/china/pm0482e1_annexii.pdf?la=en