POLICY BRIEF

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Positioning the South African economy for new industries: Policy lessons from East Asia

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Introduction

The South African economy has experienced a significant decline in manufacturing sector performance since the 1980s. As a contribution to gross domestic product (GDP), its share decreased from 25% to 13%. The reasons for the decline are the lack of skills in South Africa and the highly competitive Southeast Asia. South Africa did not invest sufficiently in either the skills or technologies to retain a competitive edge. In the process, the manufacturing base has now shifted to East Asia and South Africa has ended up with a significantly services-based economy for an upper-middle-income country, and is struggling to reduce its already high unemployment rate.

The decline in performance has not been without efforts at reversal. The government has used industrial and innovation policies via the Department of Trade, Industry and Competition (DTIC) and the Department of Science and Innovation (DSI). The Industrial policy action plan (IPAP) has been the guiding framework for the DTIC, while research, development and innovation (RDI) provide the framework for the DSI. The execution of the RDI is within the concept of the national system of innovation (NSI), which South Africa adopted as an innovation policy instrument in 1996. Through the IPAP, the DTIC develops sectoral master plans to bolster competitiveness, including for export purposes. On the other hand, the DSI focuses on advances in technologies to deploy across sectors.

Considering that competitiveness in existing industries is largely lost, regaining it would prove to be a challenge. The research looks at how to organise the South African economy to launch new industries, using five East Asian countries (Japan, South Korea, Taiwan, Singapore and China) as a case study.

South Africa's industrial complex

Since the democratic transition in 1994, there have been attempts to industrialise South Africa. Under a selective policy approach, agreements have been reached with global automobile manufacturers to assemble vehicles in South Africa to meet export needs to other parts of the world has been successful. The policy includes the localisation of certain components for assembly and also for the export market. The policy has contributed positively to the GDP and employment figures. A similar policy approach for the textile industry did not yield positive outcomes.

Converting the country's nuclear reactor, previously utilised for war purposes, to

produce medical isotopes has been a success. International technology transfer and commercialisation of the German nuclear pebble bed reactor to meet growing energy demand and help avert load shedding was unsuccessful. Besides winning several international awards for the best car – the Joule, South Africa's leading electric vehicle – could not secure financing to establish a local manufacturing facility. Although a lot of progress has been made with the square kilometre array (SKA) in the Northern Cape, localising data and other capabilities remains a challenge. Efforts to industrialise South Africa show mixed outcomes.

National systems of innovation in East Asia

To enable the successful launching of new industries, it is essential that the NSI has a sectoral focus. Sectors are unique because of the different drivers, players and requirements applicable to each. Therefore, generic government policies are insufficient. For example, Taiwan focused on the integrated circuit and machine tools for export. Following the establishment of an export market, Taiwan leveraged external actors to meet export demand. At the same time, incubation was the cornerstone for launching new sectors through high-growth businesses. Singapore's sectoral approach supports the thriving of big businesses, as they already have market demand.

In Japan, smaller companies were capacitated as the carriers of new technologies and to create new sectors. The drive for Japan was to ensure the diversity of actors within the NSI. South Korea emphasised the wide deployment of new technologies across several sectors. The driver of the approach was the national desire to decentralise the NSI and achieve even and inclusive development. China struggles with uneven development, although new investments have been made for rural areas to catch up. In all the countries, and at the sectoral level, there is a strong link between research and market that which the government coordinates.

Research and development (R&D) approaches are varied. Japan centralised R&D and took control of the knowledge flow from research to market using smaller companies. The Ministry of International Trade and Industry (MITI) used technology import to complement internal R&D activities for new industries. Taiwan imported both technologies and R&D to meet export demand. South Korea focused on local company-level R&D to drive knowledge-intensive industries. The drive was to be at the forefront of modern technologies. Singapore imported its knowledge base and drove transfer to localise capabilities. China started with internal R&D and used incubation, science parks and special economic zones as knowledge carriers to drive industrialisation.

Among the five countries, there is alignment on manufacturing in that all happened within the country. Japan, Taiwan, Singapore and China incentivised multi-national companies (MNCs) to establish branches in them, while South Korea focused largely on developing local brands. For Japan, MNCs helped accelerate the development of local knowledge-intensive companies through technology transfer. In China, a group of companies lead the effort and work closely with the government.

Education is the foundation of the knowledge economy. South Korea invested heavily in education under the theme, “active learning”. China prioritises internal knowledge production. Taiwan and Singapore retain a flexible education system supported by external actors to meet market dynamics and demand. MITI was responsible for driving education to support new industries in Japan, including sending students to top international universities.

South African national system of innovation

South Africa has a sectoral focus, driven by the DTIC. The DTIC leads sectoral industrial master plans and special economic zones. The work of the DTIC is linked mainly to incumbents and existing industries. The DSI is the custodian of the NSI concept in South Africa. The 2019 STI White Paper recognises the need to align with the IPAP to ensure wide deployment of technologies and the full functioning of the NSI. On the DSI side, the focus is largely on technology push. Recent updates of the IPAP find that the NSI is maturing, as it provides technologies via the DSI's agencies, such as the Technology Innovation Agency (TIA) and the Centre for Scientific and Industrial Research (CSIR).

The DSI prepares technologies to be ready for market, and the DTIC embeds them in the market. The decision to embed lies with the DTIC. The DTIC is highly networked with incumbents and existing industrial actors. According to Christensen (2016), it is likely that the DTIC is caught up in the "innovator's dilemma", in terms of which it prioritises its current customers – incumbents and existing industrial actors. It is much more likely to introduce technologies aligned with their needs for competitiveness and growth. To succeed in launching a new techno-economic paradigm, away from the old, requires "distancing" from the old (Freeman and Perez 1988).

Using the conceptualisations of the innovator's dilemma and techno-economic paradigm, the DTIC might not be a suitable entity to drive new and radical industries. Low R&D investment, at 0.7% of GDP, and a decline in private sector investment in R&D, were among the NSI deficiencies in 2002 (Kaplan 2004). The 2017/18 data is at 0.83% of GDP, and public sector funding is at 54% (NACI 2020). Although investment in R&D does not automatically translate into innovation (Mazzucato 2013), when it is low, innovation outcomes are bound to be lower. This is likely to hamper the drive towards competitiveness in a knowledge-based economy.

At the institutional level, there has been a lot of progress. However, investment in R&D has not followed a similar vein. The introduction of intellectual property rights (IPR) saw the rise of South African higher education institutions' patents registration (Sibanda and Straus 2020). Surprisingly, 89% of 2017 patents were granted to non-residents (NACI 2020). Although Sibanda and Straus (2020) argue that the South African government should take an active role in international technology transfer, such an effort is likely to face much resistance. There is no evidence to suggest that the patents registered by non-residents are aligned with South Africa's technology strategy.

Progress has been made on education since the lack of capable human resources was identified as a deficiency of the NSI in 2002 (Kaplan 2004). In 2018, doctoral degrees in engineering constituted only 7% of total doctoral degrees (NACI 2020). At a time when mainstreaming STI is central to the running of the government, this is a concern, as it would make it difficult to support international technology transfer and guide the launching of new knowledge-intensive industries. In 2012, a target was set to move from 28 doctoral graduates per million per year to 100 doctoral graduates per million people per year by 2030 (Perold et al. 2012). In 2018, South Africa produced 1 051 doctoral graduates (NACI 2020).

South Africa's innovation policy is within the ambit of the NSI and the DSI. The DSI aspires to and is moving towards a whole-of-government approach (DTIC 2018; DSI 2019). As it stands, there is a weak linkage between the NSI and the IPAP. The 2019 STI White Paper recognises this reality and recommends developing joint implementation plans to align with IPAP (DSI 2019). How this would happen is unclear, as cross-departmental policy coherence is a

difficult task. In a fragmented government reality, harmonisation is a challenge (Kaplan 2004).

Policy consideration for new industries in South Africa

There is evidence that South Africa lost its manufacturing base, making it difficult to reduce the high unemployment rate. The manufacturing sector is struggling to compete on the global stage. To regain competitiveness requires, among others, investment in advanced and intelligent technologies (Marwala 2020). Through incentives and other instruments, the DTIC is positioned to respond in this regard. Alignment with the DSI, in terms of which advanced and intelligent technologies could help regain competitiveness, is imperative. From the lens of incumbent industries, these technologies would help with sustenance and growth to remain competitive (Christensen et al. 2019).

Industries come and go; as such, future competitiveness would depend on new and competitive industries. In new industries, the innovator's dilemma and techno-economic paradigm offer a critical guide. In this context, new industries would be launched by disruptive technologies (Christensen 2016) and outside the current (old) techno-economic paradigm (Freeman and Perez 1988). Because new industries are new to the current and dominant industrial complex, they do not at first appear profitable and attractive to incumbents industrial actors, and thus are not pursued (Christensen et al. 2019).

Accordingly, the chances are high that attempts by the DTIC to promote disruptive technologies and new industries to incumbents would face resistance. Herein lies the constraint and limit on the part of the DTIC when it comes to driving new industries. Mazzucato (2013) reveals that incumbents, industrial actors and venture capitalists (VC) take on sufficiently de-risked technological opportunities. She argues that, historically, the government has been at the forefront of investing in disruptive technologies to create and shape new markets. This has been observed in the USA, the United Kingdom (UK) and now China. The current case study concurs with Mazzucato.

Christensen et al. (2019) categorise innovation as sustaining, efficiency and disruptive. Incumbents lead both sustaining and efficiency innovations to command higher prices and reduce operating costs respectively. On the other hand, disruptive innovations create new markets. Profits in new markets start significantly lower, making them unattractive to incumbents (Christensen 2016). In this context, sustaining and efficiency innovations are attractive to incumbents, while disruptive innovations are not. This thinking is developed as a proposal for industrialisation in Figure 1.

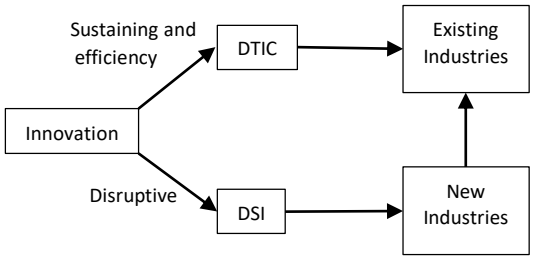

Figure 1: Proposed framework for industrialisation

The proposed framework is aligned with MITI in Japan leading industrialisation efforts. A clear direction from the case study is the need to import technology to kickstart industrialisation. The proposed framework could be leveraged in alignment with Sibanda and Straus's (2020) recommendation for international technology transfer to bolster local manufacturing in South Africa. Beyond the IPR Act, South Africa could do with an international technology transfer strategy. There are elements of it in the 2019 STI White Paper and the 2021 - 2031 decadal plan. The strategy could be executed as part of the whole-of-government approach, catering for technological needs across each government department. Positioning the strategy to address the skills gap equally is recommended,

thus harmonising efforts toward creating new industries.

Although the DSI is charged with the national responsibility to drive commercialisation and innovation, its R8.9 billion budget (DSI 2021) is too small to direct and shape new industries in a tangible sense. As Mazzucato (2013) emphasises, there is a requirement for the government to sufficiently de-risk technological opportunities in South Africa to consider alternatives to raising the investment for R&D. The DSI has worked on the innovation policy, but not on the industrial policy. As such, it lacks specific competencies to succeed, as indicated in the proposed framework.

Innovation policies are largely supply-side driven, thus entail a technology push, while industrial policies are demand-side driven, thus involving a market pull (Oughton et al. 2002). In both, innovation activities are promoted to meet the driver. When it comes to new industries, there is no market, as it first needs to be created. Industrial policies were founded on low- to medium-tech industries such as coal and steel in Europe. In contrast, the emergence of high-tech industries demanded a focus on the broader system of innovation (Soete 2007). Industrial policies are effective when there is clarity about industries to focus on, meaning the industries must exist first (Noland 2007).

Accordingly, there is greater uncertainty when it comes to launching new industries. As reflected in the previous paragraph, industrial policies may not be adequate. Incubation was used in the case study to navigate the uncertainty. South Africa has an incubation programme through the Small Enterprise Development Agency (SEDA), under the Department of Small Business Development (DSBD) (SEDA 2018). The focus appears to be less on managing uncertainty when introducing high-tech to the market. The approach to incubation needs to be revisited to support the DSI as per the proposed framework.

Concluding remarks

The proposed framework suggests including industrialisation in the current RDI scope of the DSI, and this could translate to RDI^2. Although industrial policies may not be the best candidate for new industries, they are the closest available tool. Essentially, on the part of the DSI, the proposed framework integrates both innovation policy and industrial policy as a policy approach to launching new industries. Other elements, such as an international technology transfer strategy for technology and R&D import, revisiting incubation as a knowledge and technology carrier for high-tech industries and closing the skills gap, must be prioritised equally.

The proposed framework has implications for the DSI and DTIC. There are now two handover stages: for technologies to support sustaining and efficiency innovations for existing industries, and for new industries that later form part of existing industries under the DTIC. As suggested by the proposed framework, the expanded scope of the DSI is in the same vein as the MITI of Japan. Because the DTIC shields the DSI from incumbent industrial actors, it is positioned as the innovation disruptor of the South African economy towards new industries. The proposed framework provides ground for the DSI to act in this manner.

The shift from RDI to RDI^2 by the DSI requires different capabilities. The DTIC appears to be the starting point to gain these capabilities. Further research is needed to expand on how the DSI could gain capabilities to succeed as per the proposed framework. Lastly, the implications of integrating innovation and industrial policies need to be studied further.

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