BEYOND THE NUMBERS

2019

South Africa's Grade R–12 landscape is moving beyond simply diagnosing and measuring performance. Today's decisions must be powered by data with technology woven into every aspect of education.

This report is the product of a collaboration between the Michael & Susan Dell Foundation, the National Education and Collaboration Trust, and the Department of Basic Education with research, analysis, and project management support provided by A.T. Kearney.

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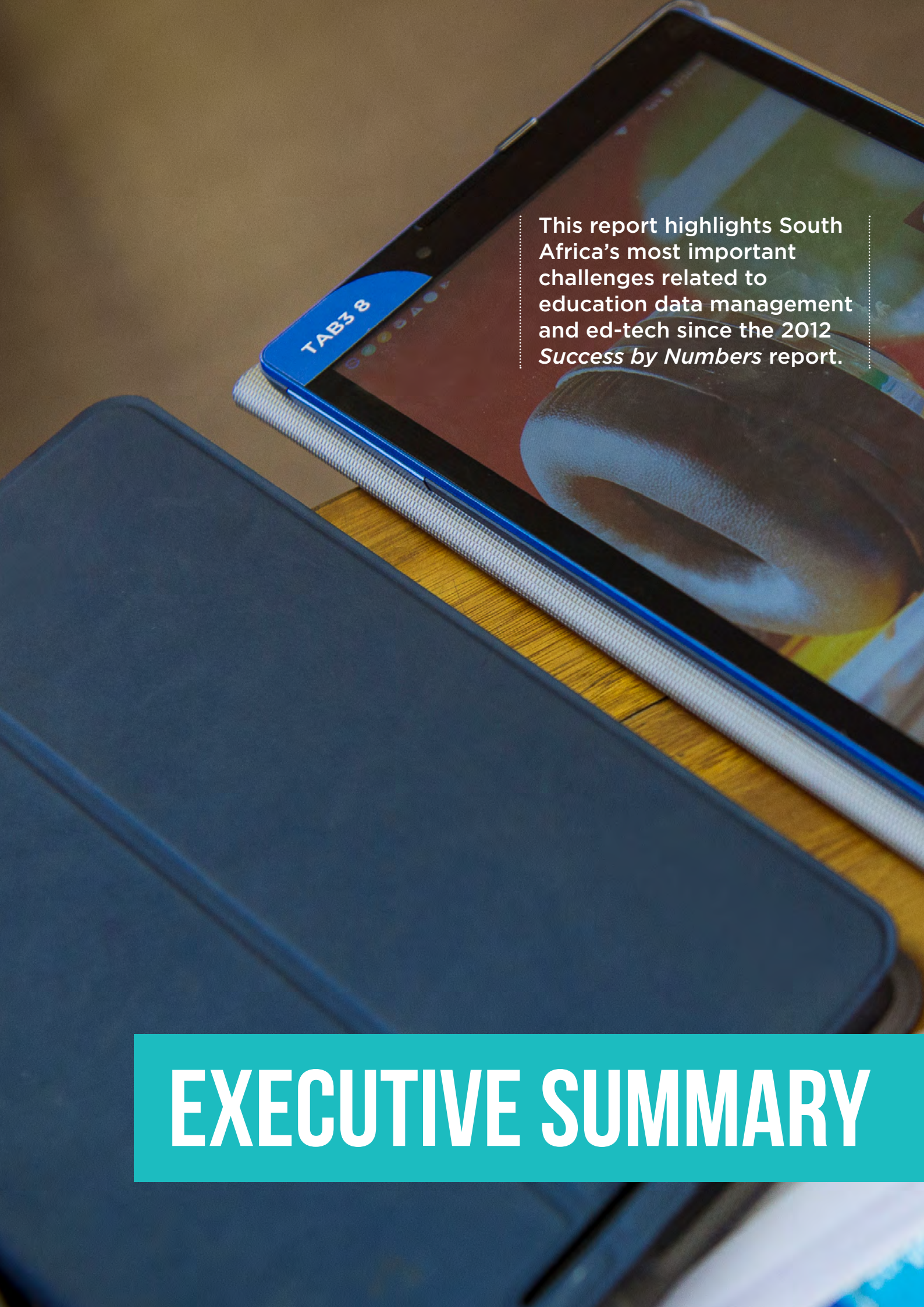
FOREWORD AND ACKNOWLEDGMENTS

This report assesses South Africa's current education data and tool landscape as well as some of the major local and global contextual changes currently underway and how South Africa should respond to them. It is not intended to be an exhaustive, detailed assessment of all aspects of information and communications technology (ICT) in education, but rather to provide a snapshot of the system today and an overview of the current trends, challenges and opportunities. The report offers up a blueprint for where further investment and analysis efforts are required to ensure the system can navigate the challenges of a changing technology landscape and leverage the opportunities on offer as a springboard to continue the progress that has been made in recent years.

This report would not have been possible without the strong support of the Department of Basic Education, the National Education Collaboration Trust and the many educators, officials and stakeholders who shared their ideas and views in interviews and surveys. These voices were instrumental in identifying the key findings, lessons and insights from the country benchmarks and informed and validated many of the recommendations.

A special thank-you is noted to the project Steering Committee members who provided strategic leadership to the research team in the development of this report. In particular, we would like to thank Ayesha Suleman and Martin Gustafsson, from the Department of Basic Education, Professor Anil Kanjee, from Tshwane University of Technology and Godwin Khosa, Dhianaraj Chetty, Shiloh Naiken and Nimrod Mbele (secretariat) from the NECT.



This report highlights South Africa's most important challenges related to education data management and ed-tech since the 2012 *Success by Numbers* report.

EXECUTIVE SUMMARY

The education sector today must embrace the effective use of education data and technology (ed-tech) to drive better decision-making and impact learner outcomes. This report highlights South Africa's most important challenges related to education data management and ed-tech since the 2012 *Success by Numbers* report.

The research conducted by the Department of Basic Education (DBE) in 2012[1], in partnership with the Michael & Susan Dell Foundation, catalysed the launch of the Data Driven Districts (DDD) programme, which today has achieved national adoption and helped to transform the education data management and information system landscape.

South Africa has reason to celebrate notable progress towards implementing the education data management recommendations of the *Success by Numbers* report. Data analysis is becoming more automated and is often accessed.

1 *Success by Numbers: How Using Data Can Unlock the Potential of South Africa's R–12 Public School System, Michael & Susan Dell Foundation, 2013*

Requests for duplicate data have been significantly reduced and data validation and centralised storage have been put in place. The DDD system has achieved near-national sharing of information through the DDD Dashboard, which over 10,000 users access each month. This places South Africa far above its peers in providing and using quality performance data. These efforts are driving culture change over the medium-to-long term, and stakeholders' mind-set is in fact changing, with the value of data being better understood.

Beyond the Numbers is the result of a 2019 study conducted to shed light on the importance of managing data to help stakeholders make more data-driven decisions and leverage ed-tech tools. In this report, we discuss the major global and local contextual changes since 2012 and offer insights into how South Africa should respond. The study draws on comprehensive research including over 120 interviews and 1,175 survey responses across the entire education sector.

South Africa has reason to celebrate notable progress towards implementing the education data management recommendations of the *Success by Numbers* report.

The findings include:

Despite progress, an evolving landscape leaves gaps in both education data management and the enabling environment for ed-tech tools.

Education data management

The link between National education goals, **key performance metrics** and **data strategy** is ineffective and not **driving data-driven decision-making at each level.**

Performance data from **national assessments at multiple stages** during the education journey is limited and infrequent.

Despite great advances in data collection, gaps remain in **data reliability** and turnaround times.

Data collected is not used or **analysed to its full potential** to improve performance.

Ed-tech tools

Technology integration into the curriculum is facing challenges largely because of the lack of support for educators.

The **private sector,** including non-governmental organizations (NGOs), **faces barriers** to delivering education solutions.

Enablers

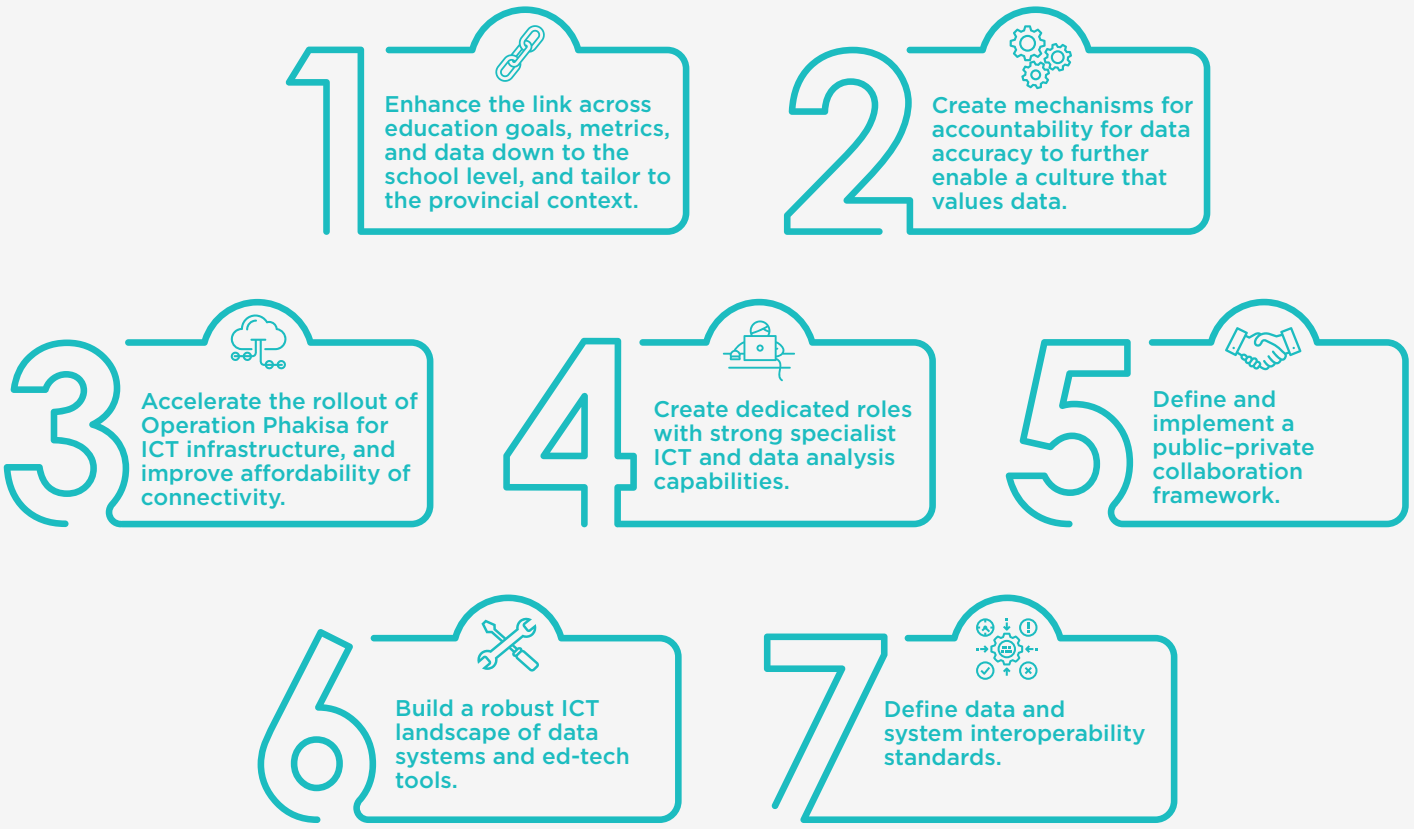
Public–private collaboration would benefit from more structure to **foster innovation and the adoption** of existing high-quality education data and technology solutions.

Education lacks not only a **data governance strategy,** but also sufficient, **dedicated ICT roles** with **clear accountability** and the appropriate capabilities.

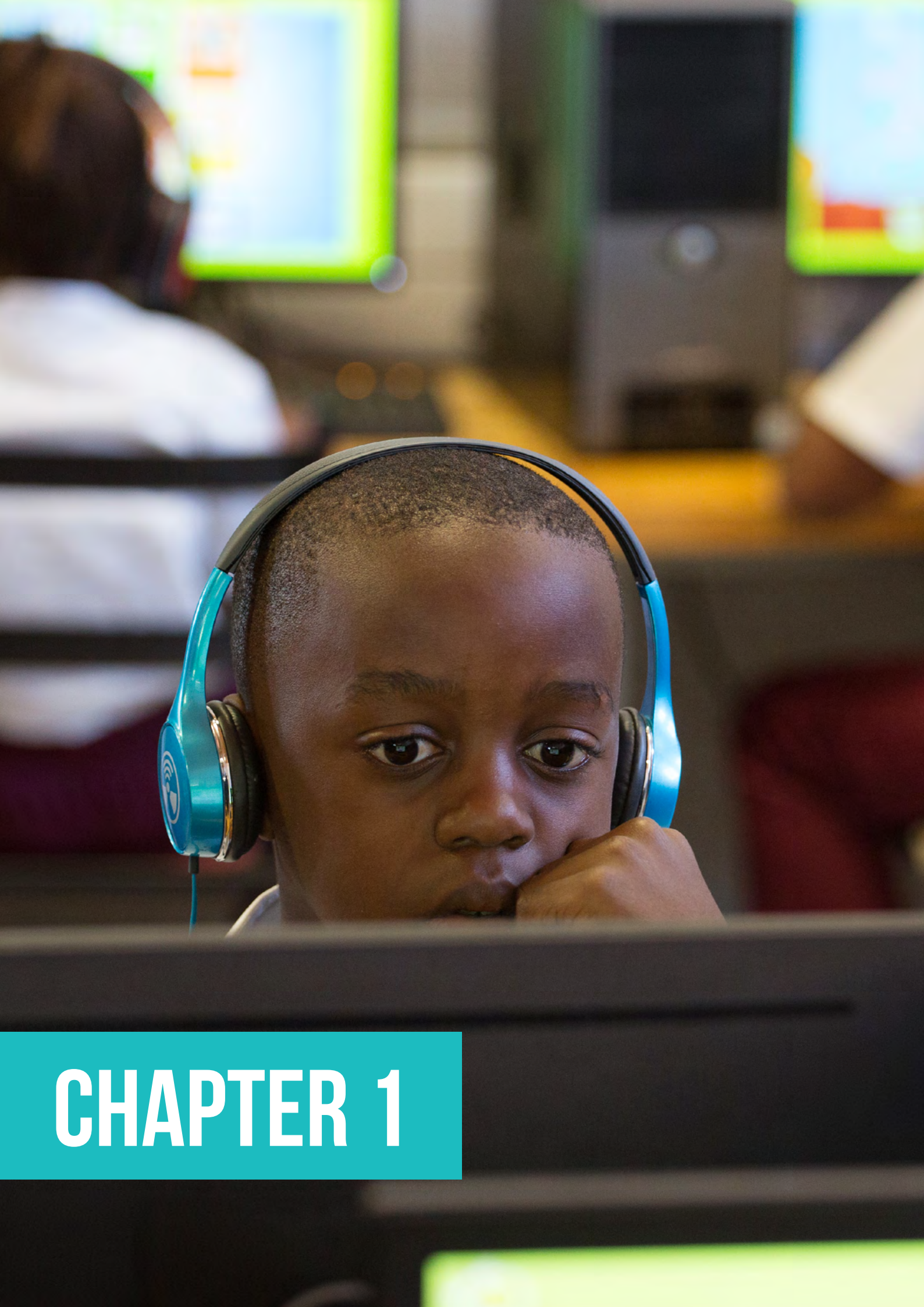
ICT infrastructure in education is incomplete, and schools face prohibitively high bandwidth costs.

Education systems and tools are not guided by **interoperability standards.**

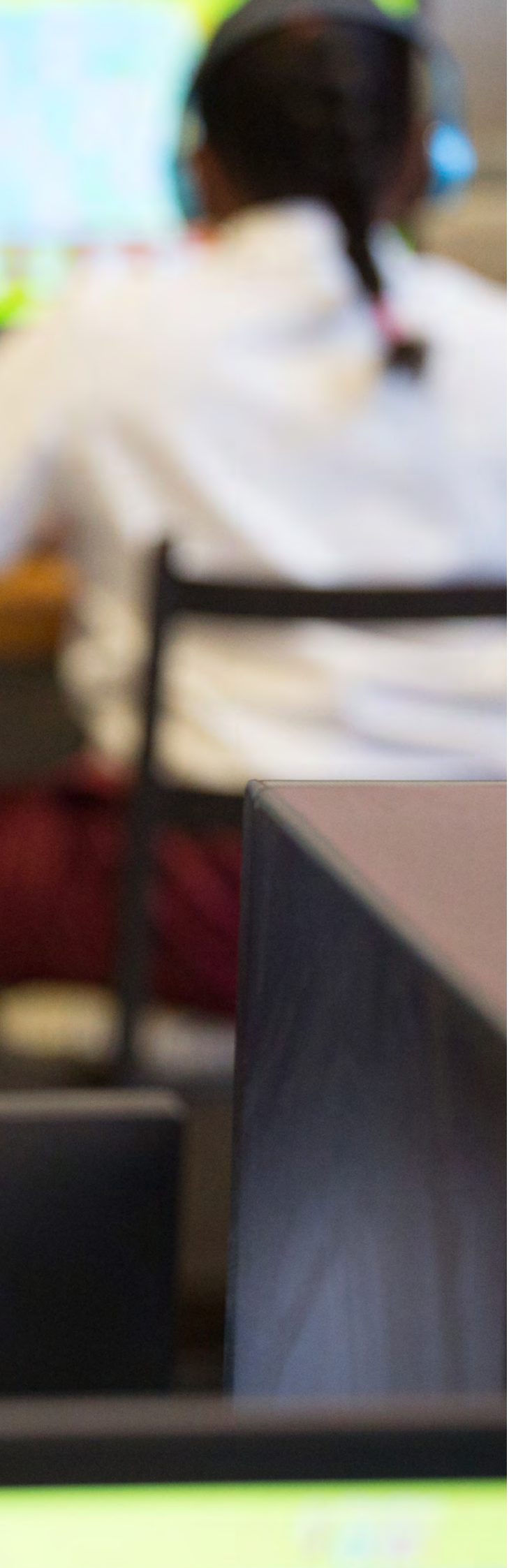
This report also offers a set of practical, high-priority recommendations for closing the gaps in data management to help South Africa improve its position in the digital transformation of the education sector. We have distilled our insights into **seven recommendations:**



The above findings are not unique to South Africa and are consistent with those found in both developing and developed country education systems. Building upon the success achieved since *Success by Numbers,* and drawing upon insights into how other education systems are tackling similar challenges, South Africa is well-positioned to move *Beyond the Numbers* and continue to build a stronger, more robust environment to ensure education data, systems and tools work to support the education system in achieving its goals.



CHAPTER 1



INTRODUCTION

Success by Numbers, a 2012 report by the DBE and the Michael & Susan Dell Foundation, shed light on how data can be used to track and accelerate the achievement of improvement goals across South Africa's Grade R–12 school system. The report offered seven practical steps that leaders can take to ensure that districts become effective drivers of data collection, analysis and use.

Now, *Beyond the Numbers* highlights the most important challenges facing data management and educational technology (ed-tech) since the 2012 report. In this report, we discuss the major global and local contextual changes since 2012. Then, we put a spotlight on the gaps in both education data management and the enabling environment for ed-tech tools, and we offer a set of practical recommendations for closing those gaps to improve South Africa's position in the digital transformation of the education sector.

The findings presented here must be understood within the context of the broader education sector, which we discuss in Chapter 2. Then, we discuss the progress that has been made since *Success by Numbers* in Chapter 3. In Chapter 4, we focus on the gaps in education data management and the emergence of ed-Tech, and then in Chapter 5, we offer a set of recommendations to close those gaps.

Research Method

To understand the importance of managing data to help stakeholders make more data-driven decisions, we conducted a high-level scan of South Africa's education data and technology landscape with the goal of identifying the most significant challenges and providing practical recommendations. The findings in this report are a **summary of three pieces of research** and analysis.

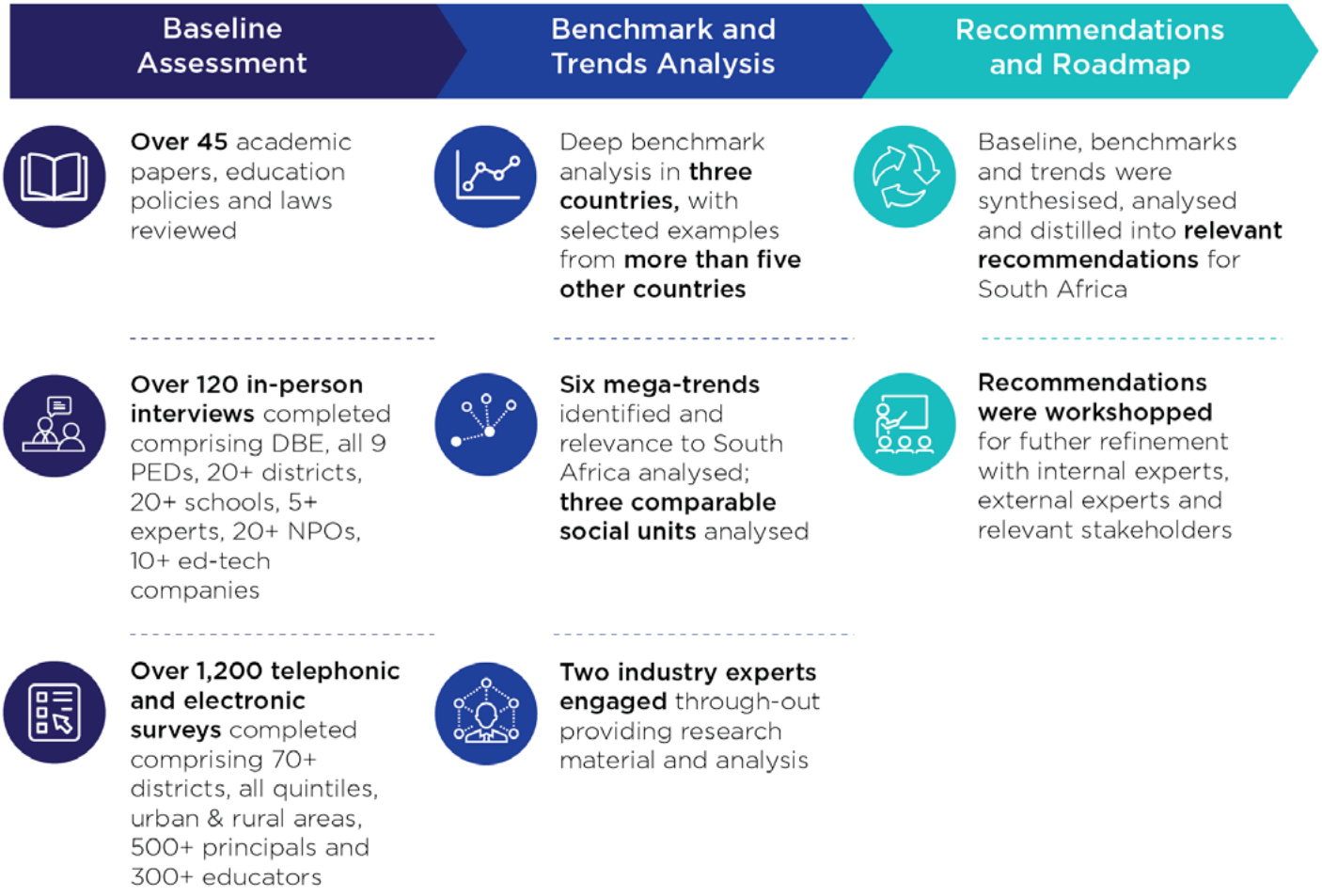


Figure 1: Research components

First, we investigated the state of the education sector from a data management and ed-tech perspective by detailing the progress since the *Success by Numbers* recommendations and identifying the most crucial challenges. The research followed a hypothesis-led approach guided by the framework in Figure 2.

ICT & data strategy

ICT and data strategy is the decision that determines the high-level course of action for determining requirements, enabling sourcing and deployment of infrastructure, systems and tools

Data collection

Data collection includes activities related to the integration across infrastructure, systems and tools to collect complete and accurate data across the education system

Data analysis & Usage

Data analysis and usage is the visualisation of data to draw conclusions, support decision-making and design interventions to improve learning outcomes

Monitoring & Evaluation

Monitoring and evaluation is the management of the impact of interventions and establishing a feedback loop to continuously improve future learning outcomes system-wide

Figure 2: Research framework

To ensure the necessary depth of investigation, each area was interrogated along five dimensions. **Governance** focuses on the assignment of roles, responsibilities, authority, and effective procedures for the creation, implementation, and monitoring of policies. **Capabilities** focus on the skills of officials to use tools and data to improve their decisions and actions. **Processes** focus on the steps laid out for the implementation of all relevant activities. **Capacity and resources** include the time and budget available to enable a data-driven education sector. Finally, **Culture** focuses on stakeholders' readiness to embrace and use education data and technology.

Second, we investigated the global trends and benchmarks. Trends were identified using desktop research with support from international education experts in digital transformation and innovation. The trends were evaluated against their expected ease of implementation, reach, and impact to inform the recommendations.

The countries were selected for benchmark analysis based on similarity in education governance structure, similarity of challenges, and a mix of economic development to cover both developed and emerging systems.

The countries chosen for in-depth analysis were Australia, India, and Pakistan. These were supplemented with targeted research in Canada, the United Kingdom, Finland, Kenya, and other selected countries.

Finally, we used the findings from our situation analysis in South Africa as well as the global trends and benchmarks to develop recommendations and create a road map for leveraging data and ed-tech to improve education learning outcomes in South Africa.

CHAPTER 2

SETTING THE SCENE:
OVERVIEW OF SOUTH AFRICA'S EDUCATION SECTOR

The findings presented in this report must be understood within the context of the broader education sector. **South Africa's education sector is large and decentralised.** According to the DBE's 2018 School Realities report, more than 12.8 million learners and 400,000 educators are being housed in more than 25,000 schools across the country. However, more than half of the learners reside in three provinces (see Figure 3).

Under the Constitution of South Africa, the DBE and the nine provincial departments of education are responsible for basic education. The DBE is required to set norms, standards, frameworks, and policies to ensure national uniformity, whilst the nine departments are responsible for implementation. A learner enters the traditional grade R–9 journey, and after completing grade 9, he or she can choose to enter a technical and vocational college or continue the higher education journey with grades 10–12.

Prior to its first democratic elections in 1994, South Africa had a long history of institutionalised inequality. Since then, **progress has been slow but steady.** For example, in 2002, less than 70 percent of six-year-olds attended school. Now, more than 95 percent are in school.

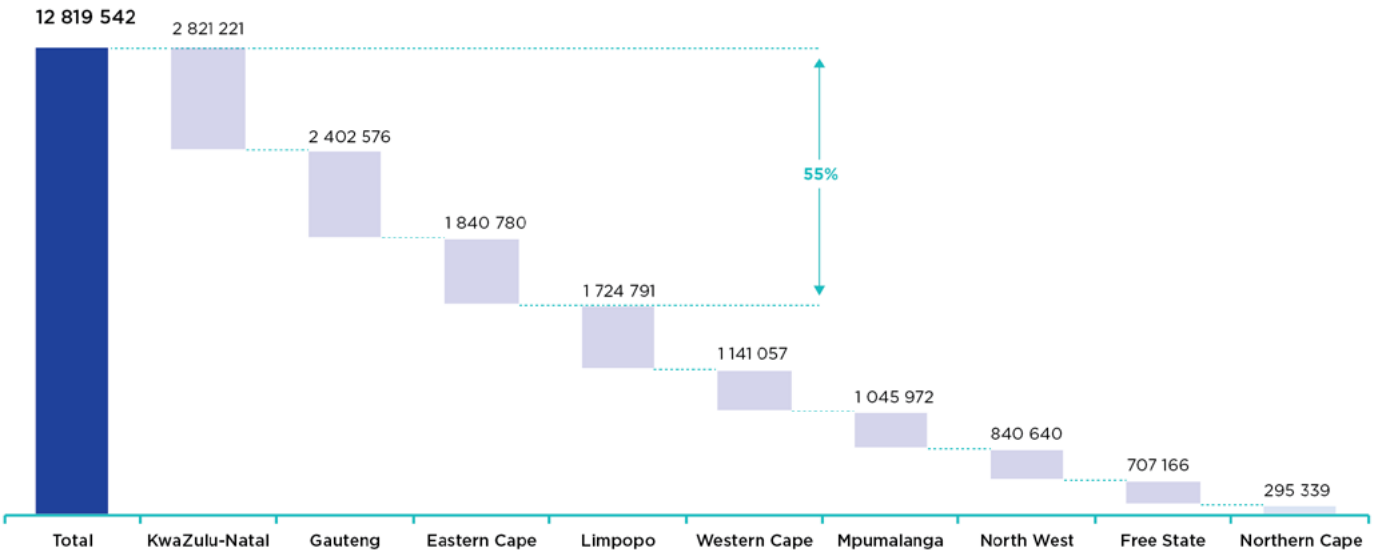


Figure 3: Number of learners per province (School Realities, 2018)

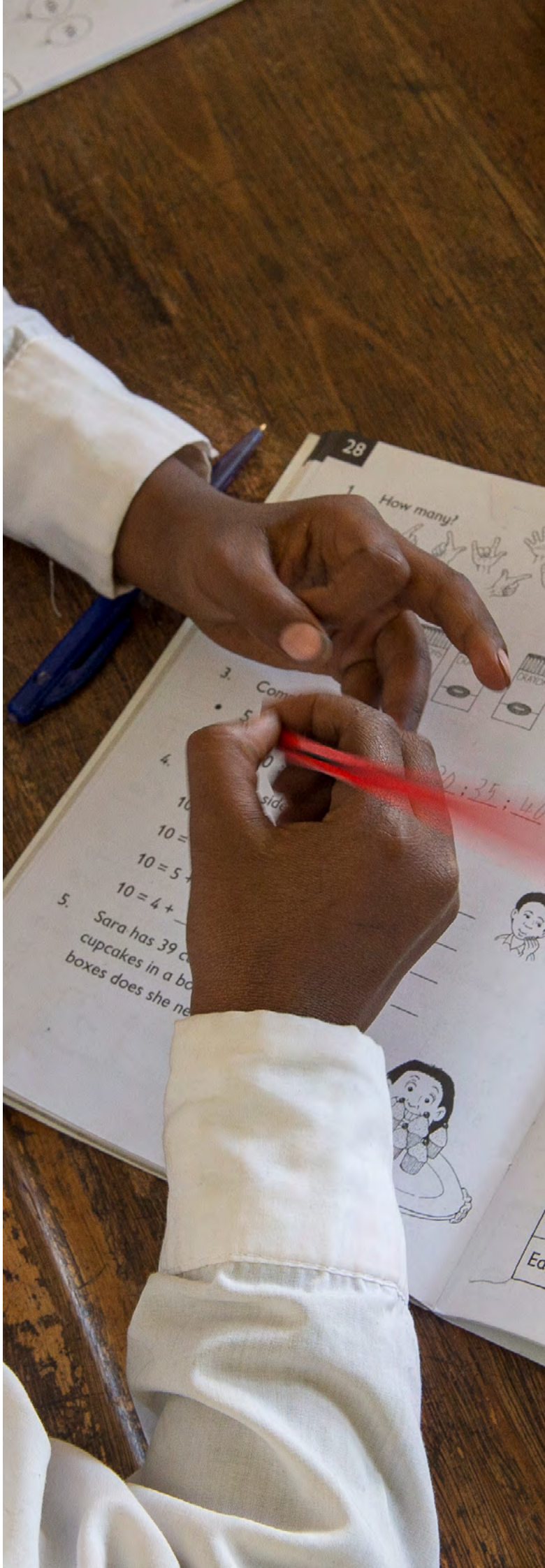
However, the sector still faces fundamental challenges to the quality and efficiency of education.[2]

These challenges include ensuring learner retention and progression, improving student achievement, the equal distribution of quality education across socioeconomic brackets, and the lack of differentiated strategies to address local challenges. Although data and ed-tech have the potential to transform the sector, officials must not get distracted from focusing on the fundamentals.

For this overview, learner achievement will be used as an overall quality indicator. The only reliable metrics are the international assessments and matric examination results.

2 For a detailed analysis of the fundamental education challenges in South Africa, see Identifying Binding Constraints In Education by van der Berg, Spaull, Wills, Gustafsson, and Kotze (2016).

Although data and ed-tech have the potential to transform the sector, officials must not get distracted from focusing on the fundamentals.



The 2018 matric results show that only 21 percent of learners who entered the schooling system in 2007 went on to grade 12 and achieved a bachelor pass.[3]

The global benchmarks Progress in International Reading Literacy Study (PIRLS) and Trends in International Mathematics and Science Study (TIMSS) place South Africa amongst the lowest of participating countries for language and mathematics literacy.[4] In the regional Southern and Eastern Africa Consortium for Monitoring Educational Quality (SACMEQ) benchmarks, South Africa ranks eighth out of 14 countries for learner achievement in math and reading. The improvement of quality of education relies on several levers, including teacher capabilities, school leadership and management, governance, curriculum, student assessments, and learning environment. The education system must continue to focus on these fundamental levers.

The socioeconomic environment of a school has a strong influence on its performance. Using student achievement as an indicator, the 2018 matric results show a correlation between student achievement and socioeconomic conditions (see figure 4).

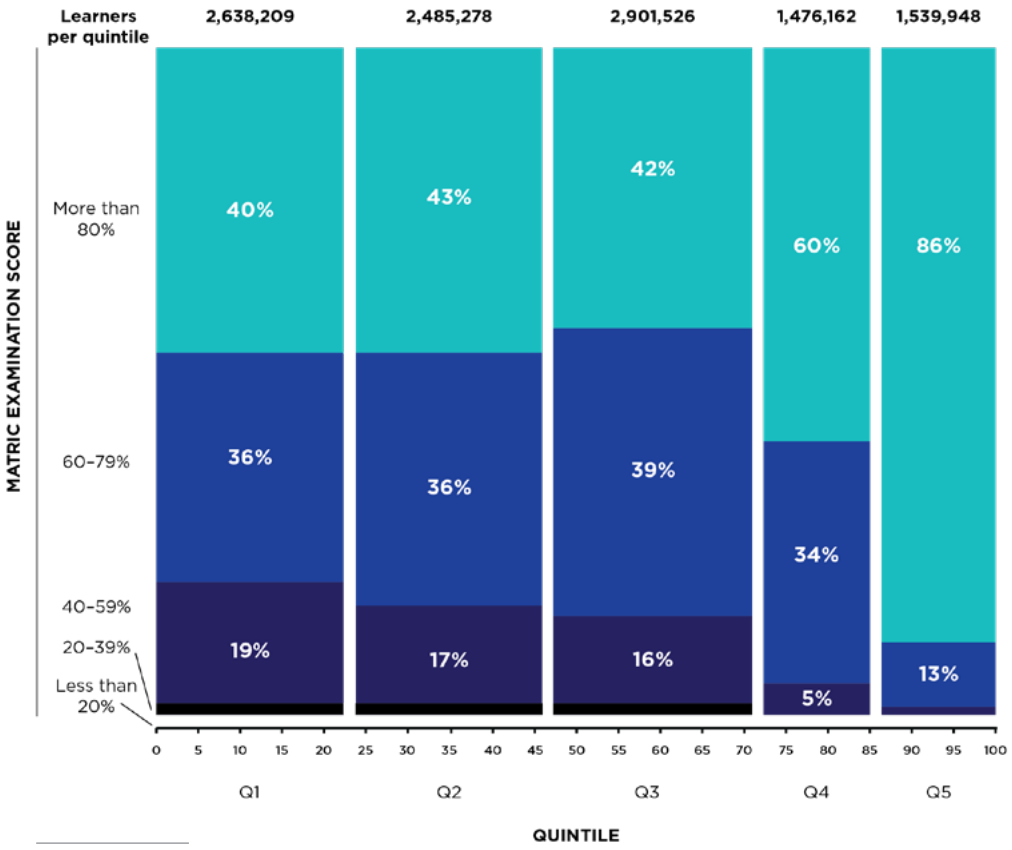


Figure 4: Matric results by quintile

3 This excludes learners who decided to enrol in technical and vocational education and training colleges after grade 9. See appendix for more details.
4 See appendix for more details.

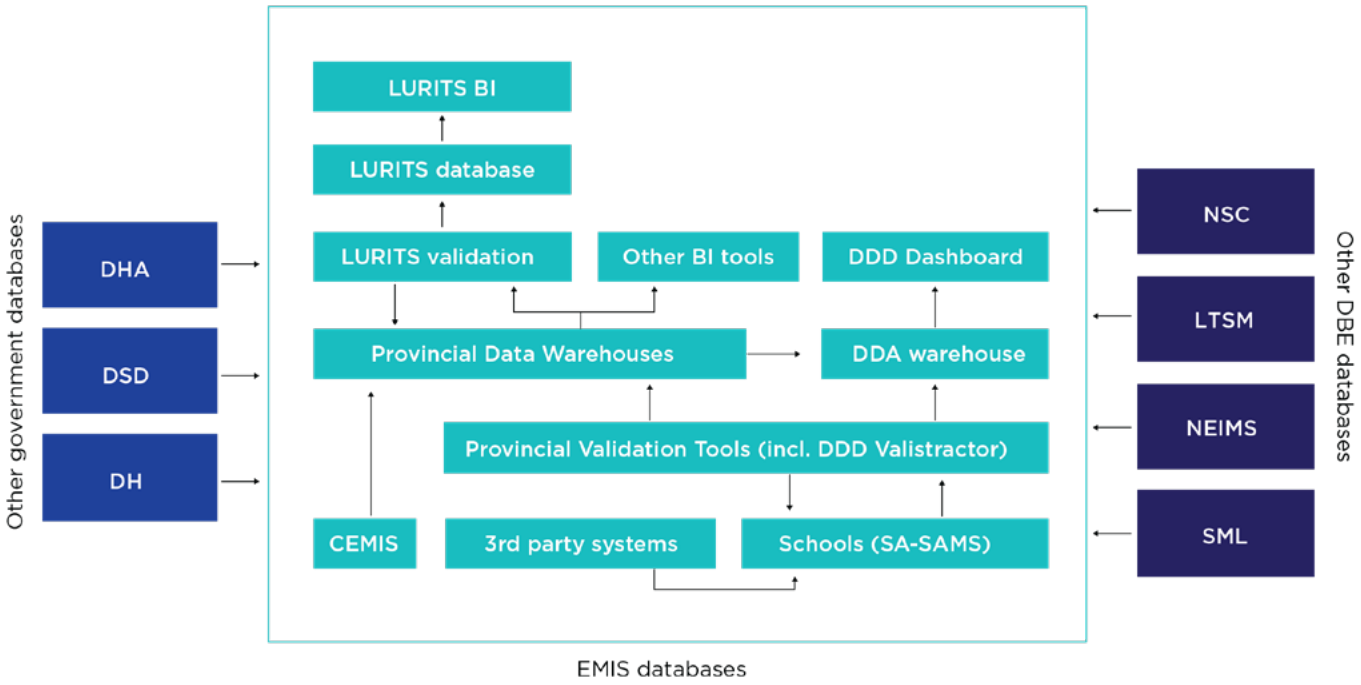


Figure 5: Education databases[5]

Further, primary and secondary research reveals that quintile 4 and 5 schools benefit from their ability to leverage school fee revenues to invest in infrastructure, management practices, and teacher capacity. From the perspective of data management and ed-tech tools, the impact of the disparity in socioeconomic conditions will be exacerbated. For example, 73 percent of respondents from quintile 5 schools say they can afford enough data bandwidth to support their internet connectivity requirements, compared with 36 percent from quintile 1, 2, and 3 schools.

Education data is managed by the Education Management Information System (EMIS) directorate with officers at national, provincial, and district levels.

The directorate's National Education Information Policy has two goals:

- Enhance the day-to-day operations of schools, circuits, districts, and provincial departments.
- Provide data needed for the DBE to plan and monitor the system as a whole.

To fulfil these goals, the EMIS focuses on five pillars:

- Management of the South African School Administration and Management System (SA-SAMS)
- Management of Learner Unit Record Information and Tracking System (LURITS)
- Data quality auditing
- Interfacing with other government information systems
- Access to business intelligence tools.

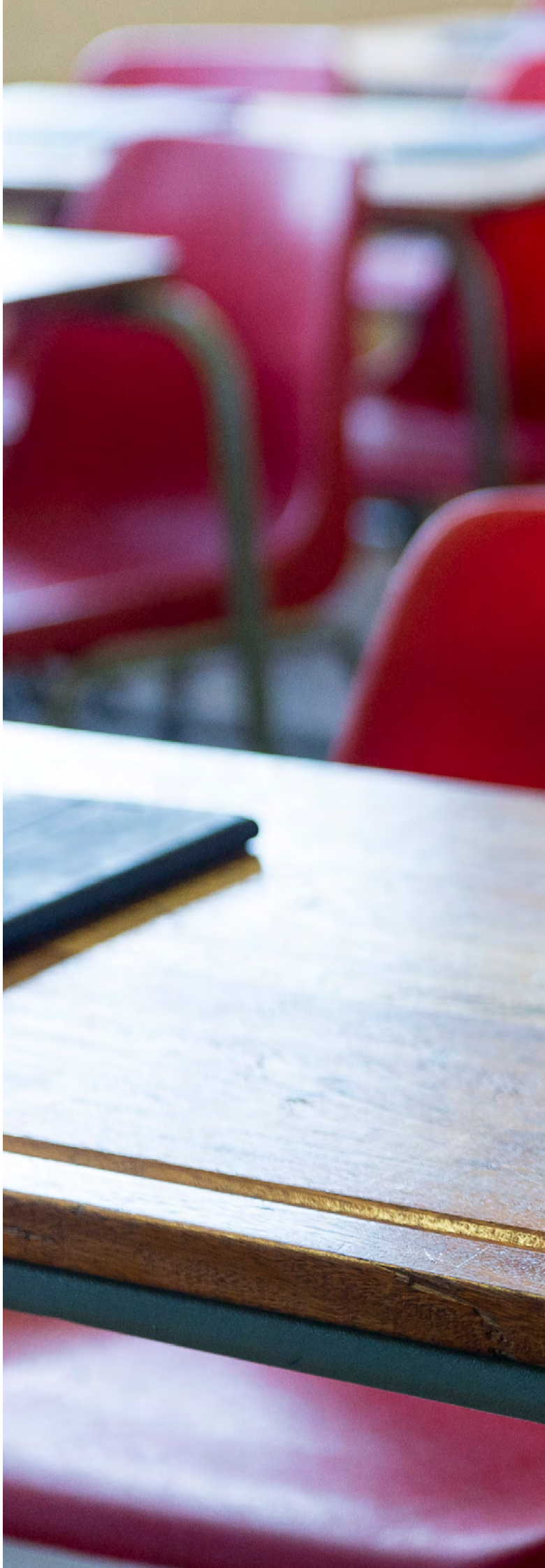
The EMIS data journey begins at the school level, where data is captured onto a local database via the SA-SAMS school information system, then collected at district level and collated into provincial data warehouses. Each province either uses DDD or other bespoke provincial tools for validation. Ultimately, the data is collated into a national database and accepted into the LURITS database. At both provincial and national levels, the EMIS provides varying degrees of business intelligence tools to access the data. Figure 5 shows the flow of data in the education sector.

5 DHA – Department of home affairs; DSD – Department of Social Development; DH – Department of Health; LURITS - Learner Unit Record Information and Tracking System; DDD – Data Driven Districts; CEMIS – Western Cape Department of Education Centralised Educational Management Information System; SA-SAMS - South African School Administration and Management System; NSC – National Senior Certificate; LTSM - Learning and Teaching Support Material; NEIMS - National Education Infrastructure Management System; SML – School Master List

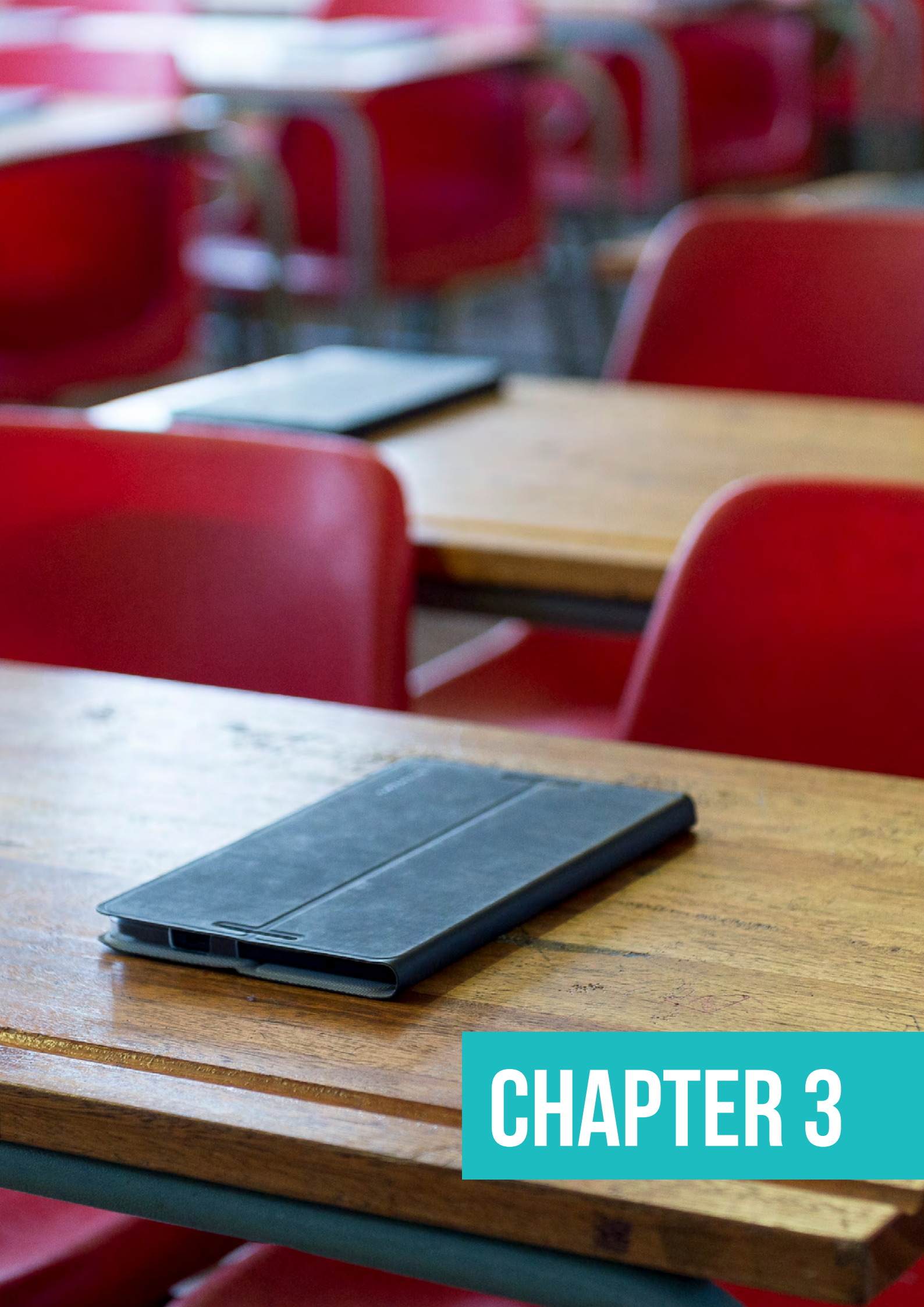
Rolling out ICT infrastructure in South Africa is the responsibility of the government initiative Operation Phakisa.[6] This cross-functional programme aims to expand school internet connectivity, provide learners with devices, improve teachers' professional development, develop digital content, and enhance e-administration. Implemented by the DBE, Operation Phakisa involves a complex set of stakeholders (including the DBE, Department of Telecommunication and Postal Services, Department of Science and Technology, Department of Communication, and Department of Planning, Monitoring and Evaluation).

Operation Phakisa has achieved several milestones:

- It has facilitated the connection of about **3,849 schools** since 2015 through the Universal Service and Access Agency of South Africa and its universal service and access obligations agreements.
- The Electronic Communications Act mandates a minimum of **50 percent discount** on bandwidth rates (called e-rates) for schools and education institutions.
- Operation Phakisa has driven the development of **705 digital content resources** for grades 1–3 and is developing digital content for grades 10–12 with the support of MTN.
- It has steered the **SA-SAMS modernisation programme,** which is managed by a project management office (PMO) at the National Education Collaboration Trust with the support of the Michael & Susan Dell Foundation, ELMA Philanthropies, and the FirstRand Empowerment Fund.
- About **100,000 teachers** have received ICT professional development through Operation Phakisa.



6 For more details, refer to the 2018 DBE publication Operation Phakisa: ICT Rollout in Basic Education.
7 Operation Phakisa: ICT Rollout in Basic Education, DBE, 2018; Universal service and access obligations require MTN, Cell C, Vodacom, and Liquid Telecoms to provide a minimum number of schools with connectivity as part of their telecommunications licensing agreements.



CHAPTER 3

PROGRESS SINCE
SUCCESS BY NUMBERS

In the six years since the *Success by Numbers* report presented its seven recommendations, South Africa has made noticeable progress. However, from a provincial perspective, progress has been inconsistent as some education departments have made more progress than others.[1] The progress against each of the seven recommendations is discussed below.

1. Limit the volume of goals a district is expected to prioritise and actively manage against.

Provincial and district officials have shown the most noticeable progress in this recommendation. At a national level, the Department of Education's Action Plan to 2019 [2] maintained its previous 27 goals (five were high-priority) and 36 indicators (13 were high-priority). As will be discussed, the link between these goals and indicators and the actual data collected from schools is ineffective.

Nonetheless, strong evidence is emerging of improved goal prioritisation and greater management focus on these goals at the provincial and district levels. The improvement has primarily been driven through the better use of SA-SAMS as well as data visualisation and analytics tools such as the DDD Dashboard. In contrast, our interviews show that only some provinces prioritise goals based on performance data; therefore, overall progress against this recommendation is moderate. Provinces that have made slower progress must act swiftly to leverage gains in data collection and take on the data collection recommendations in this study.

2. Reduce data collected from schools to the minimum amount necessary to make decisions.

Requests for duplicate data have been significantly reduced, and moderate progress has been made in decreasing the amount of data collected from schools. All schools in our study reported only some duplicate requests and did not believe duplication to be an issue. Compared with the vast number of duplicated requests in 2012, this is a significant improvement. This progress is a direct result of a better organised EMIS function, which is driving data collection systematically through SA-SAMS.

In contrast, less progress has been made in reducing data for purely reference purposes, that is, only to satisfy compliance requirements rather than to enable data-driven decisions. Further, all schools say the amount of data they must capture is burdensome. The lack of progress arises from SA-SAMS being used for two purposes: SA-SAMS is a free school information management system, but it is also used to collect national and provincial data to report and monitor performance. Although national and provincial users can leverage the data for monitoring, the data being collected should be highly targeted. The amount of data in the more than 15 SA-SAMs modules may be useful to schools for their internal management, but provincial and national governments are unlikely to need all this data. The government needs to be more focused and strategic about which data it requires.

1 Progress was determined by comparing the primary and secondary research of this study to that of the Success by Numbers report.
2 Action Plan to 2019: Towards the Realisation of Schooling 2030, Department of Education, 2015.

Despite this success, gaps remain in the national uniformity of data collection as EMIS operations differ between provinces.

3. Create a central function and local database to store, manage, and share information.

The strongest indication of significant improvement since 2012 is the progress made on this recommendation. Responsibility for data management, emanating from SA-SAMS and other sources, is assigned to EMIS, which centralised provincial data warehouses. National centralisation is progressing through the LURITS database, but faces technical and data validity challenges. The DDD system has achieved near-national sharing of information through the DDD Dashboard, which nearly 10,000 users frequently access.

Despite this success, gaps remain in the national uniformity of data collection as EMIS operations differ between provinces. Except for the DDD programme, the improvement in the sharing of data is slight and differs by province.

The government needs to be more focused and strategic about which data it requires.

4. Build methods of verification to ensure that the data collected is accurate.

Overall, moderate progress has been achieved on this recommendation, with impressive progress in deploying automated verification for completeness. The foundation of accurate data is to build completeness and basic validity checks at the point of data capture.

These have been incorporated in all provinces at the SA-SAMS level. The tools used to validate data vary by province and include Valistractor (made available to provinces by the DDD program), the Governor, the Error & Omissions Tool, and the Data Quality Assurance Tool.

Only three provinces have incorporated processes to verify the reliability of data using systematic spot checks. Most still rely on the flawed process of principals and district officials signing off on verification certificates for thousands of submissions at once. Our school interviews show that these sign-offs are done for compliance purposes only. True verification, such as sampling or random spot checks, is not done because of inadequate data processes and ownership. Enforcing the cross-functional process of data quality checks could break down the silos between directorates. However, EMIS lacks the capacity to support data policy-owners in discharging data quality checks.

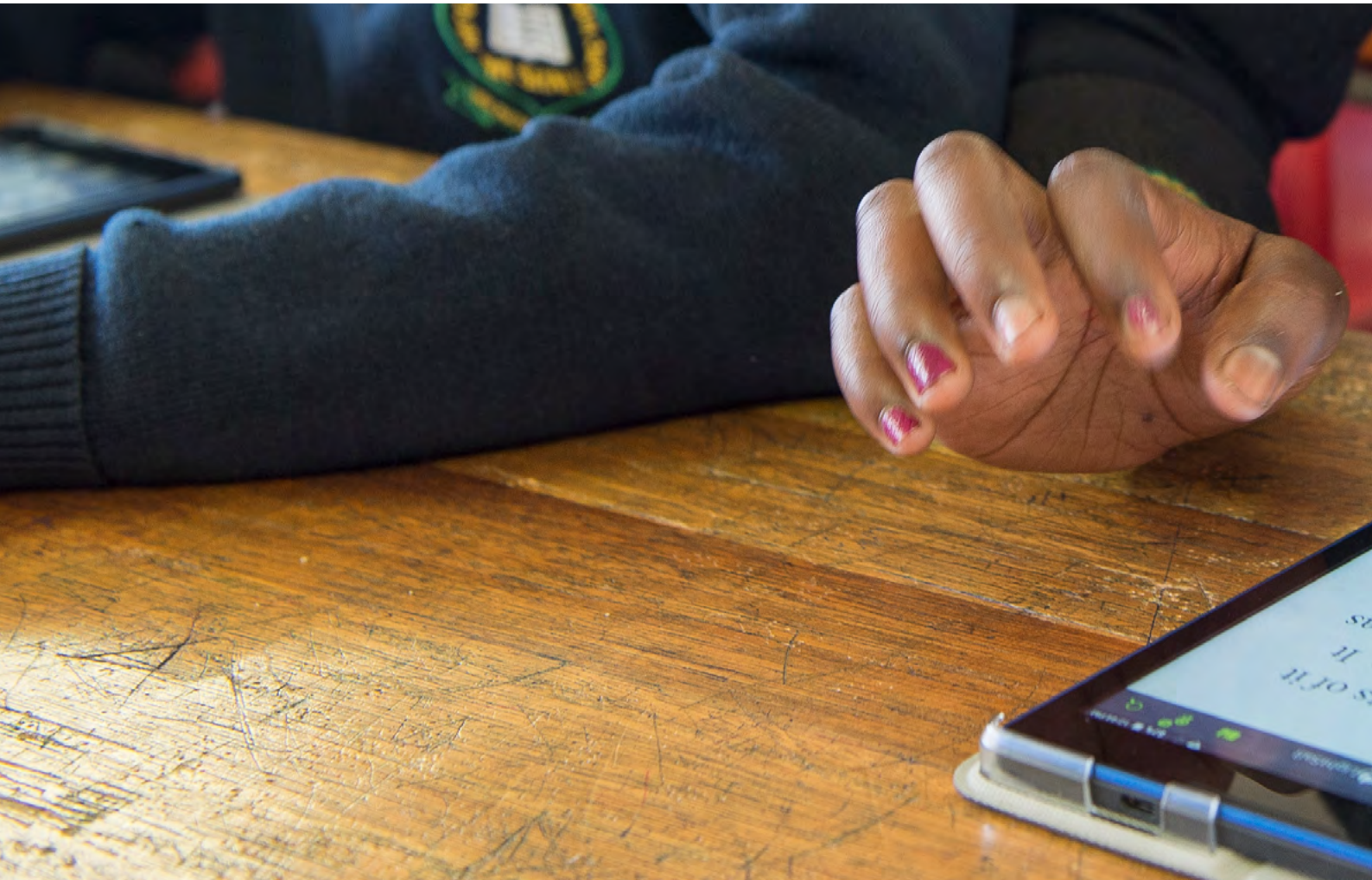
5. Design and deliver easy-to-use, automatic analyses for province, district, circuit, and school personnel.

The journey to easy-to-use, automatic analysis of data is gaining momentum with up to 43 percent of respondents saying analysed information is shared with them. This is a significant improvement as *Success by Numbers* reported that one of the most significant data management issues is that information is not shared with schools and typically only flows upwards. The achievement has been driven by seven provinces adopting the DDD Dashboard, which gives users access to data in four SA-SAMS modules and includes some automatic analysis in the form of retrievable reports. Other examples include business intelligence tools developed in Eastern Cape and Northern Cape. Nevertheless, gaps remain in tailoring reports and visualisations to stakeholder needs (analysis focused at each level from national to schools) and the capability to digest the information to create effective interventions.

6. Use new outputs as guides for performance dialogues and accountability meetings between districts and circuits.

Improvements have been made, but significant gaps remain. Our sample interviewees at district and circuit levels in Gauteng, Western Cape, Eastern Cape, Free State, Northern Cape, and North West all used data to identify high-risk schools in their area of responsibility. This was supported by the district survey results, which show that 92% of respondents believe collecting information is very important.

However, the interviews also show that these performance meetings leveraged only basic analysis. The lack of strong analytical capability and the compliance-driven culture are largely responsible for the limited use of data to support performance management and decision-making.



7. Shift the mind-set of district staff so they see themselves as agents of change, not inspectors or compliance-driven data conveyors.

District staff are beginning to see themselves as agents of change. This kind of culture change is difficult and occurs over the medium-to-long term, but stakeholders' mind-set is in fact changing, with the value of data being better understood. For example, 61 percent of school respondents and 68 percent of district respondents say data collection is a high priority. Another clear indicator of an emerging culture of data management is the amount of data used at the school level and the importance of analysis for district improvement (see figure 6).

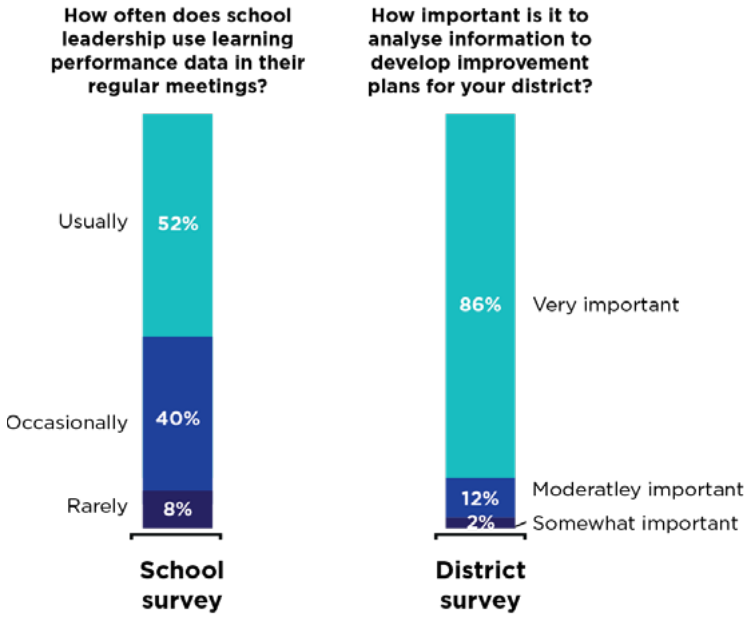
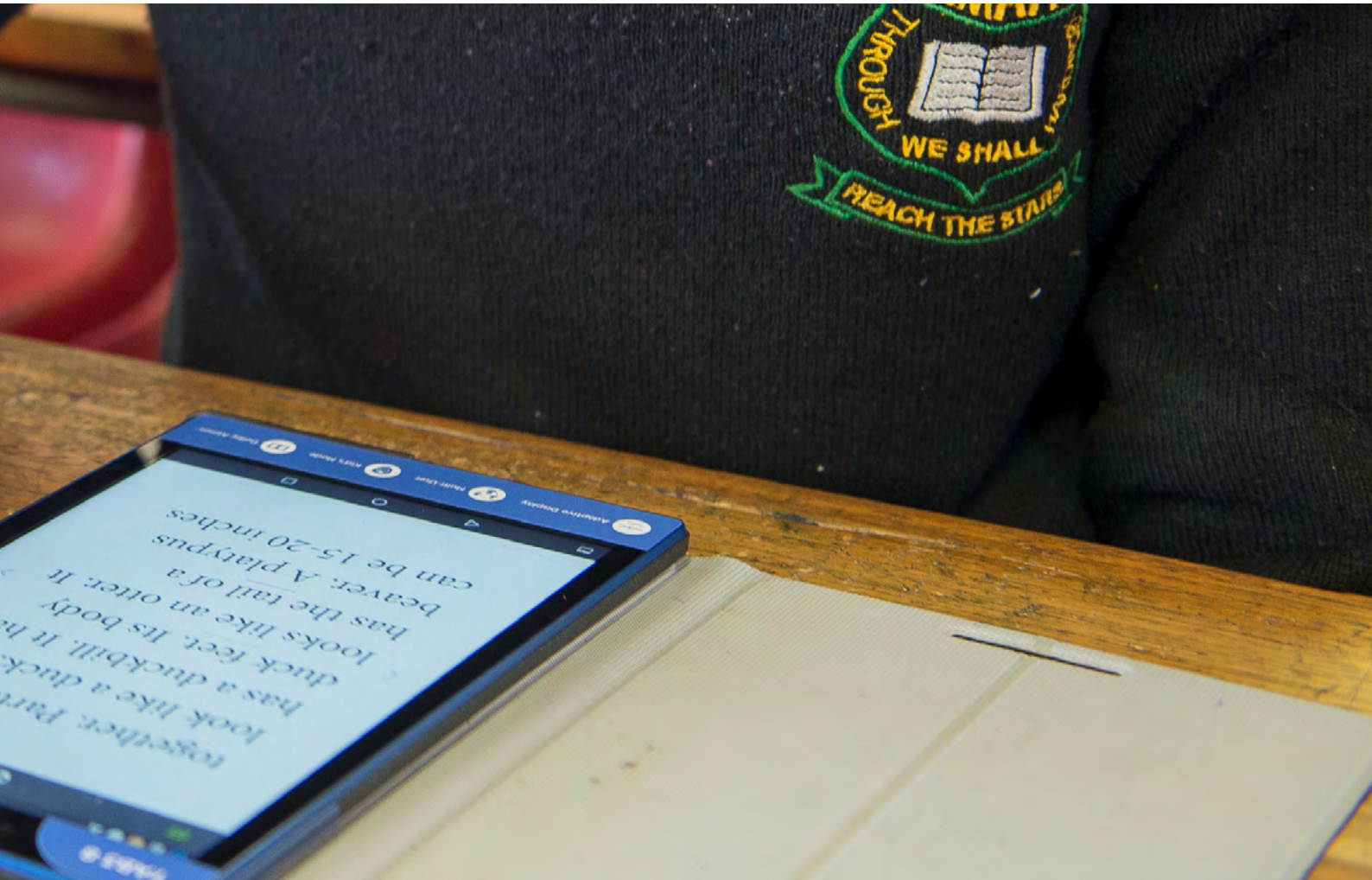


Figure 6: Selected school and district survey results



However, this shift in thinking has not yet translated into value and a results-driven data culture. A great example is the completion of school improvement plans despite district officials' belief that they are not used effectively (see figure 7).

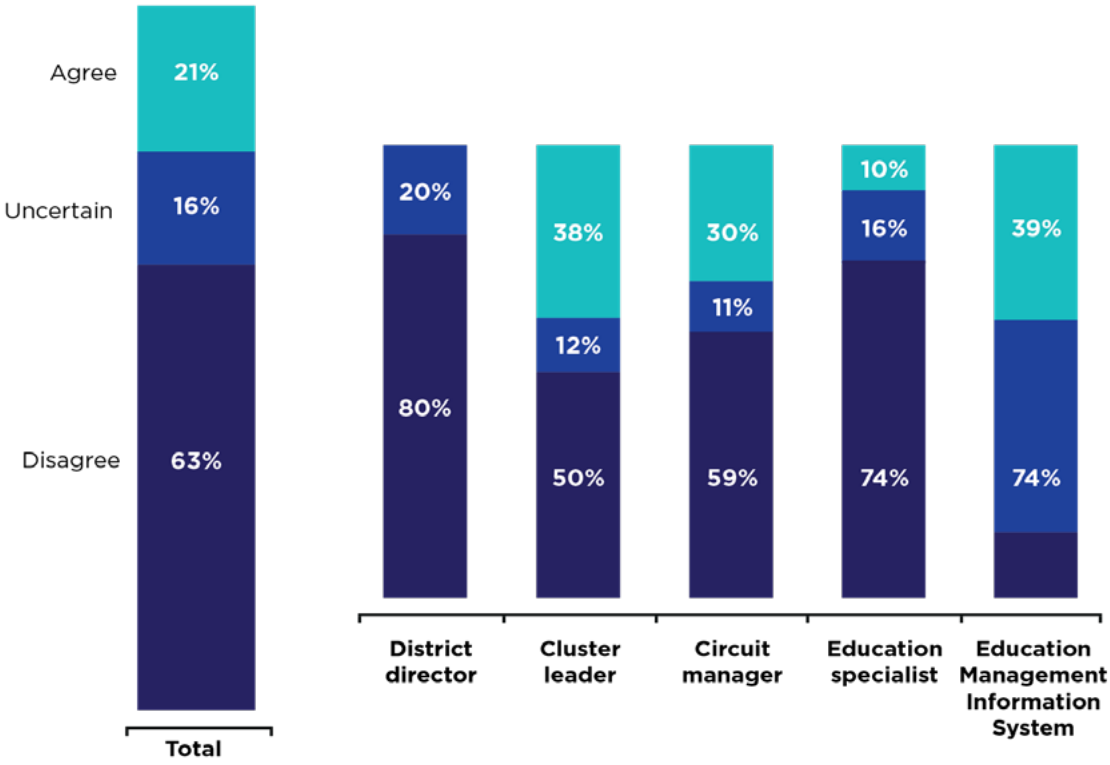


Figure 7: Selected district survey results

The compliance-based mind-set remains entrenched at the district and school level and is driven by the policies of the provincial education departments. Our sample interviews show that district officials feel they do not have the capacity or the authority to make the necessary structural changes. The strategy must shift from district to provincial-level officials creating enabling environments and acting as change agents. Overall, all stakeholders in the education sector should be proud of the progress that has been made against the *Success by Numbers* recommendations.

A strong foundation has been built, accelerated by the national adoption of the DDD system, and it is now time to address the root causes that are hindering the use of data and technology to improve system performance and learning outcomes. Next, we discuss our study's most important findings in three sections: education data management, ed-tech tools, and systematic issues that exist across both data management and the ed-tech tools.

Overall, all stakeholders in the education sector should be proud of the progress that has been made against the *Success by Numbers* recommendations.

CHAPTER 4

ADDRESSING EDUCATION DATA MANAGEMENT GAPS

From the vast number of findings that emerged from our research, we have distilled the most crucial and summarised them in three areas (see Figure 8).[1]

Education data management

- The link between national education goals, **key performance metrics** and **data strategy** is ineffective and not **driving data-driven decision-making at each level.**
- Performance data from **national assessments at multiple stages** during the education journey is limited and infrequent.
- Despite great advances in data collection, gaps remain in **data reliability** and turnaround times.
- Data collected is not used or **analysed to its full potential** to improve performance.

Ed-tech tools

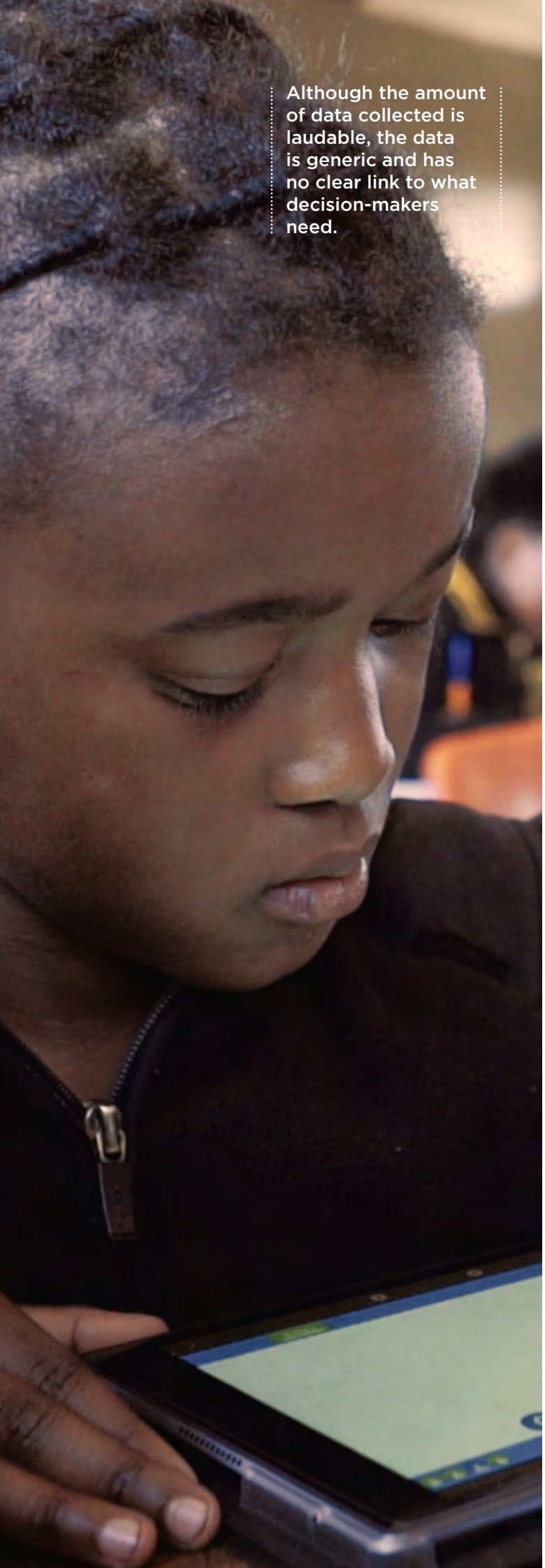
- **Technology integration into the curriculum** is facing challenges largely because of the lack of support for educators.
- The **private sector,** including non-governmental organizations (NGOs), **faces barriers** to delivering education solutions.

Enablers

- **Public–private collaboration** would benefit from more structure to **foster innovation and the adoption** of existing high-quality education data and technology solutions.
- Education lacks not only a **data governance strategy,** but also sufficient, **dedicated ICT roles** with **clear accountability** and the appropriate capabilities.
- **ICT infrastructure** in education is incomplete, and schools face prohibitively high bandwidth costs.
- Education systems and tools are not guided by **interoperability standards.**

Figure 8: The most important issues

1 *A more detailed set of findings is available upon request.*



Although the amount of data collected is laudable, the data is generic and has no clear link to what decision-makers need.

Gaps in Education Data Management and the Emergence of Ed-Tech:

1. The link between national education goals, key performance metrics and data strategy is ineffective and not driving data-driven decision-making at each level.

Stakeholders are equipped with accurate and relevant information to improve their decisions. However, using that data effectively requires a strong link between the data collected and the goals the data seeks to report on. At the time of writing, an ICT and data strategy was still in development even though the Action Plan 2019 declared a draft version would be released in 2015. Nonetheless, the education sector uses documents such as the 2004 e-education white paper, the National Education Information Policy, and SA-SAMS circulars as unofficial proxies for a data strategy. Although the Action Plan 2019 articulates the priority education goals, South Africa does not have a data strategy to ensure that the stakeholders responsible for achieving those goals have access to the necessary data to inform their decisions. Although the amount of data collected is laudable, the data is generic and has no clear link to what decision-makers need.

As seen in the benchmark analysis in figure 9, large decentralised systems should be focusing on the key decisions and the data needed to support them. Further, without a data strategy, directorates are not aligning on an efficient and effective avenue for data collection. As a result, they often operate in silos with duplicate collection efforts. In addition, key stakeholders do not clearly articulate the vital decisions being made in terms of data requirements and do not communicate them to EMIS for consolidated and efficient data collection.

The link between education goals and the data being collected is normally guided by a data strategy within a broader ICT strategy.

ICT and data strategies around the world are being defined at a national level, then tailored and executed at a local level with a strong link to the education strategy:

In **Australia, Pakistan,** and **India, data strategies are designed at the national level with most digital delivery occurring at the local level.** Importantly, at both a national and local level, dedicated senior roles are responsible for driving ICT, data, and anything else digital. In addition, agencies (acting as service providers) and other bodies play a vital role in driving data strategy and execution.

For example, in Australia, a chief information officer ensures that the technology and digital strategy is aligned with the education strategy, coordinates ICT and the digital delivery strategy to support education goals, and ensures technology services are considered in education transformation.

At a local level, where the largest portion of digital delivery happens, the governance structure is often even stronger. For example, South Australia has a chief information officer (responsible for coordinating ICT and the digital delivery plan) and a system performance division (managing subdivisions for the National Assessment Program and Data Reporting and Analytics). Both report directly to the chief executive officer. In Pakistan, provinces operate independently and drive strategies and initiatives that are tailored from a national level. For example, Punjab has its own digital plan, managed by the Punjab Information Technology Board (PITB). Digital Punjab includes education as a core area of development, and the PITB manages several services on behalf of the Punjab Department of School Education.

Further, national agencies and institutions ensure effective technology-based service development and execution of the education and digital strategy development. For example, Education Services Australia works in the interests of all education jurisdictions to provide three kinds of technology-based services:

- Development, sharing, and deployment of national technical data and assessment systems
- Digital teaching and learning resources, tools, and services
- Information and communications technology services

In India, the National Council of Educational Research and Training (NCERT) assists and advises the central and state governments on policies and programmes for school improvement. The main objectives are to:

- Undertake, promote, and coordinate research to inform ICT and data policies
- Ensure the exchange of ideas and information in matters related to school education
- Develop and disseminate innovative educational techniques and practices
- Collaborate with state educational departments, universities, NGOs, and other institutions

Two NCERT departments provide input into the ICT and data strategy. The National Institute of Education (NIE) promotes education research and policy perspectives for school education improvement, used to inform ICT and data strategy. The Central Institute of Education Technology (CIET) promotes the use of education technology in schools: providing educational opportunities and improving quality of education through technology at a school level.

Figure 9: Data strategy benchmark analysis

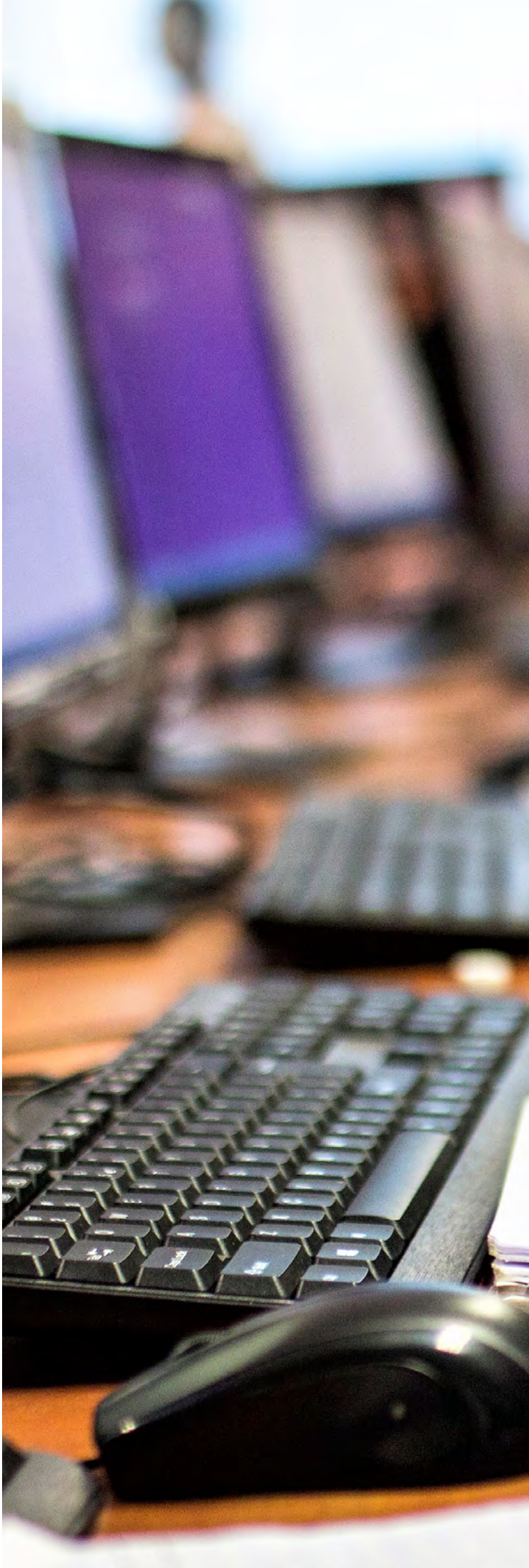
2. Performance data from national assessments at multiple stages during the education journey is limited and infrequent.

Most data being collected is administrative. Limited focus is placed on performance data and insights and the drivers that influence learning outcomes. As discussed, the only reliable performance data on learner achievement at a national level are the international assessments and matric examinations. At the time of writing, a national integrated assessment framework is under development, but details about its rollout were not available.

The Western Cape has standardised assessments, but this data is not widely shared within the government. In addition, the turnaround time is slow, and the data is not provided at a disaggregated level, both of which weaken stakeholders' ability to use the data effectively.

Further, all schools capture school-based assessment data, but this data lacks standardisation between districts and schools. The stakeholders making crucial decisions at all levels must receive timely, comparable, and disaggregated data to craft interventions to improve learner outcomes. In addition, the absence of Annual National Assessments or other performance data sources falls short of the National Development Plan (NDP) vision for reliable measures in education.

Globally, national assessments are being deployed at multiple stages of the education journey, leveraging ed-tech tools to reduce deployment costs and improve accuracy and turnaround of performance data. Figure 10 summarises the findings from the benchmark analysis related to the importance of having performance data using national assessments.



Countries are conducting standardised national assessments and examinations across the school life cycle:

Australia is collecting a wealth of data on student performance. The National Assessment Program (NAP), which includes both domestic and international assessments, is a major component of the Measurement Framework for Schooling and is used to monitor and report on student achievement. Further, all students in years 3, 5, 7, and 9 sit the NAP Literacy and Numeracy assessments, which provide:

- The government with data that can inform priority areas for curriculum development and resourcing (to ensure funds are directed to where they are needed most)
- Teachers with access to student results for each question, which teachers can use to develop appropriate intervention strategies to improve outcomes
- Parents with information on how their child is performing against national standards, not just against other children in a class
- Students with an opportunity to demonstrate their learning

Interestingly, the government is investing A$24.7 million in a national platform that will enable students to take the NAP Literacy and Numeracy test online.

India has developed its own student assessment, the National Achievement Survey (NAS), which is independently conducted across the country by NCERT. NAS is India's largest assessment survey and is amongst the largest in the world. The NAS is conducted every three years in grade 3 (early primary), grades 5 (end of primary), 8 (upper primary), and 10 (secondary) and provides insights into learning outcomes. In addition, the Central Board of Secondary Education introduced an assessment to test 21st-century skills such as creative thinking, decision making, and communication.

After concerns about the accuracy of school-based assessments, **Pakistan** relies on its annual national examinations system, which is conducted in grades 5, 8, 10, and 12 and is generally a requirement for promotion to the next grade.

Figure 10: Assessment benchmark analysis

3. Despite great advances in data collection, gaps remain in data reliability and turnaround times.

As discussed, EMIS has driven completeness and basic accuracy of data (correct format) through the tools each province has invested in, with strong support from the DDD initiative. Nonetheless, because of inaccuracy related to SA-SAMS, LURITS, and other databases, data is perceived as unreliable (see Figure 11).

How accurate do you believe the information collected is?

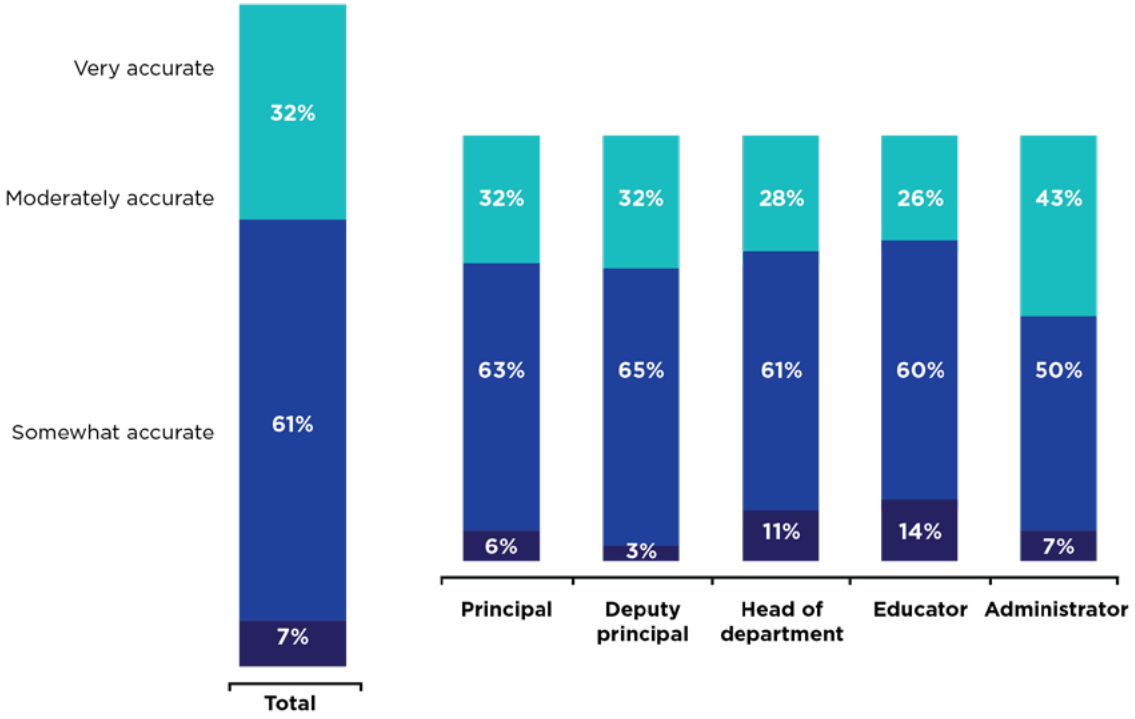


Figure 11: Selected school survey results

In addition, data collection does not manage for accuracy; only three provinces enforce circuit-level spot checks at schools. As mentioned, data policy-owners (such as circuit managers and education specialists) and EMIS must develop cross-functional capacity and processes to drive data reliability at the source.

4. The data being collected is not used or analysed to its full potential to improve performance.

Data from matric examinations, international assessments, and surveys is underused, and advanced analysis is limited. In fact, the primary research does not reveal any advanced analytics being used to tailor information to support decision-makers' interventions to improve learning outcomes. However, the DDD initiative has established itself as a centre for excellence in advanced analytics. For example, one feature uses predictive analytics to determine the likelihood of a learner dropping out of school with high accuracy. This level of analytics and a push in data science capabilities can be used across the reliable datasets to provide insights to schools and stakeholders.

The benchmarking analysis reveals that other countries are embedding analytics roles to keep pace with rapid advances in data science (see figure 12).

Dedicated roles for data analysis, the right incentives, and strong support from agencies and institutions are driving improved analysis:

In **South Australia,** the Department of Education's System Performance Division has a data reporting and analytics director who is responsible for statistical analysis and data strategy. Similarly, the Queensland Department of Education has a strategy and performance division, which includes performance monitoring and reporting, business intelligence solutions, and analysis units.

In **India,** data analysis and usage occur at all levels from the national government to teachers. Information systems and tools, run by the National Institute of Educational Planning and Administration, automatically analyse data at each level. For example, the School Evaluation Dashboard provides reports with prioritised areas for improvement. The dashboard from each school is consolidated at cluster, block, district, state, and national levels, identifying school-specific needs and common areas of improvement.

Governments around the world are providing incentives for data usage and readiness. In **Pakistan,** transparency of performance data is used to boost data usage by sharing scorecards with parents and schools. Providing results encourages parents to engage with education data and motivates schools to respond to pressure from parents.

In **India,** two avenues make data publicly available. The Open Government Data Platform, which encourages transparency and accountability, was designed so the government could publish data, documents, tools, and applications for public use. It is easy to use and access, which encourages transparency and data analysis. Likewise, the District Information System for Education website is being updated with district report cards containing performance data. Analytical reports are publicly available, making data accessible and creating transparency about school performance. Additionally, data availability creates accountability and a drive to improve performance.

In **Canada,** the government's Digital Academy aims to build digital capabilities and acumen and encourage a data readiness culture among teachers and officials. Further, a reward system incentivises data usage by giving a prize to schools that show a direct link between data usage and student improvement.

National agencies play a role in data analysis and reporting statistical analysis on schools. In **Australia,** the Australian Curriculum, Assessment and Reporting Authority collects, analyses, and reports statistical information about schools. In addition, non-profit research organizations contribute to detailed data and statistical analysis. In **Pakistan,** the Centre for Economic Research conducts studies and analysis on schooling. In **Canada,** the independent, charitable organization People for Education is working to support and advance public education through research, policy, and public engagement.

Figure 12: Data analytics benchmark analysis

5. Technology integration into the curriculum is facing challenges largely because of the lack of support for educators.

The integration of technology into our lives and classrooms will inevitably continue. This was acknowledged as far back as the 2004 DBE report on e-education. Taking guidance from the NDP's prioritisation of internet connectivity in schools, the Action Plan 2019 prioritises e-education as a key area for innovation. In his 2019 State of the Nation Address, the president of South Africa reiterated the important role of technology in education:

> At the centre of all our efforts to achieve higher and more equitable growth, to draw young people into employment and to prepare our country for the digital age, must be the prioritisation of education and the development of skills. ... In line with our Framework for Skills for a Changing World, we are expanding the training of both educators and learners to respond to emerging technologies, including the internet of things, robotics and artificial intelligence.
>
> **—President Cyril Ramaphosa**

Because ed-tech tools will become important sources of performance data, an enabling environment is essential. A global expert engaged in developing the benchmark analysis and recommendations summarised the global position of ed-tech tools:

> Although the jury remains out on the exact impact of ed-tech tools on learning outcomes, one of the most important factors is the correct and effective deployment of ed-tech tools into the education delivery.
>
> **—Donatella Solda,**
> former executive director for digital transformation in Italy's Ministry of Education, Universities and Research


Multi-User
Kid's Mode
Dolby Atmos

> The rigid curriculum and stringent alignment to CAPS are a barrier to deploy ed-tech.
>
> —NGO

The most crucial and complex integration of technology will be in delivering and assessing the curriculum. The National Curriculum and Assessment Policy Statement prescribes the speed, content, and method for assessment for each grade and subject. Our primary research reveals that the curriculum is perceived as requiring rigid implementation and being far too tight in the amount of content expected to be covered in the time provided. Interviews show that educators and school management lack clear guidance and support on how to integrate technology into curriculum delivery. Educators feel pressured to complete the curriculum and often choose not to use innovative technology as this requires a ramp-up period.

> Educators are not given sufficient support to integrate technology into the curriculum.
>
> —PED official

Figure 13: Technology and curriculum benchmark analysis

A modern and effective curriculum for the 21st century needs to integrate theory and knowledge, values, and character and skills:

Data from multiple sources can be used to adapt the curriculum to address the skills that will be needed in the future. In the digital age, knowledge is a commodity, and information is accessible at the touch of a button. In the modern world, the curriculum will need to address national and global citizenship values such as sustainability, tolerance, and responsibility. Basic skills such as literacy, numeracy, and STEM are needed now. As the world moves into the Fourth Industrial Revolution, critical thinking, creativity, communication, and fluency of ideas will become essential.

Policy makers and educators are leveraging data about future occupations and skills to refine and update the curriculum. In the **United States** and **United Kingdom,** the following are used to glean future requirements:

- Trends analysis on drivers of change
- Expert foresight workshops
- Machine-learning models that can generate predictions
- Data informing future occupations and skills

The trends in the future of occupations include a decline in some low- and medium-skilled jobs (such as administrative, sales, and manufacturing), growth in public-sector jobs, and greater demand for professional occupations in services (for example, creative, digital, engineering, architecture, and environmental). To succeed, learners will need interpersonal skills (teaching, social perceptiveness, and coordination), higher-order cognitive skills (originality, fluency of ideas, and active learning), and systems skills (judgment, decision-making, systems analysis, and systems evaluation). South Africa can explore opportunities to use data on future occupations and skills to refine and update its curriculum.

Effective deployment of ed-tech tools is a challenge across countries:

In **Australia,** stakeholder engagement and need assessment were successful through the OneSchool application, which was developed with potential users, was easy to use, and addressed users' needs. In **India,** the High-tech School Programme conducted a situational requirements analysis of ICT equipment, which created a detailed understanding of the environment for effective deployment. In **Kenya,** more regular site visits and teacher trainings were conducted to ensure ongoing implementation of the Tusome National Literacy Program.

The best case for capability development and resource provision was found in **Italy.** The National Plan for Digital Schooling (PNSD) developed a training plan for school staff. Before full rollout, the staff acquired the skills to manage the schools' digital transformation and ensure effective deployment. This was accompanied with structural investment for new physical settings (such as ICT labs) envisioned by the PNSD and enabled effective technology deployment.

A great example of good governance is in Punjab **Pakistan,** where monitoring roles were hired and assigned to assist in deploying tech-based solutions. The deployment was closely managed, and risks were mitigated (for example, with district monitoring officers). In **Italy,** clear roles were assigned to implementing the PNSD (for example, digital ambassadors and catalysts). These roles were responsible for ensuring effective deployment.

France is a great example of phased implementation, where a large-scale digital plan was piloted over three years, which aided effective deployment as sufficient preparation and resourcing was conducted before full rollout. Likewise, in **Kenya,** the Tusome National Literacy Program was successful thanks to pilots producing analysis of whether the conditions essential for national implementation were present to determine where intervention was required before national rollout.

Effective deployment requires a comprehensive approach focused on value, ease of use, and affordability. Five practices are essential to success:

- Stakeholder engagement and need assessment
- Capability development and training for deployment
- Sufficient funding and resource provision for deployment
- Clear governance for deployment
- Phased deployment approach (pilot first, then full rollout)

The way in which other countries are grappling and succeeding with implementation is summarised in the benchmark analysis in figure 14.

Figure 14: Ed-tech deployment benchmark analysis

6. The private sector (including NGOs) faces barriers to effectively participate in delivering education solutions.

The private sector globally is supporting the integration of ed-tech tools. For certain aspects of development and deployment, this sector has established agile development capabilities and can share the financial capital outlays.

Interviews with the DBE reveal that although the governance frameworks exist for public–private interaction, they are either outdated or inappropriate for the education sector. The result is minimal national or provincial guidance on how to enter and execute public–private collaborations. Incentives to promote the correct behaviour are also lacking. Players are uncertain about how to scale their solutions and often find better opportunities in other markets. As a result, South Africa is losing out on the benefits of locally developed innovations, leaving products optimised for developed markets.

The strongest area of concern is the government's ineffective procurement processes for ed-tech tools. Primary interviews show that technology-related procurement in education generally faces delays of up to 18 months. In the fast-paced technology market, such slow procurement can result in ineffective tools. Further, from a private-sector perspective, ed-tech players are unable to see the opportunity of scale and thus will hold back investment. Our global benchmarks show that procurement in large decentralised systems typically happens at the school level.

However, most schools in South Africa lack the necessary budget and expertise. Hence, the focus should be on striking a balance between offering coordinated support to provide expertise and economies of scale and providing more diversified support to schools with the budget and expertise to procure on their own.

> "Innovation in education and education technology is an extremely complex and delicate task which requires an appropriate platform enabling all stakeholders to contribute to improving the education sector and ultimately learning outcomes."
>
> —Damien Lanfrey, former chief innovation officer in Italy's Ministry of Education, Universities and Research

> "The private sector cannot continue purely funding at-risk projects and needs clarity on its role.
>
> —Ed-tech company

7. Public–private collaboration would benefit from more structure to foster innovation and the adoption of existing high-quality education data and technology solutions.

The research reveals a vibrant and emerging ed-tech ecosystem from incubators to advanced data analysis solutions. However, this ecosystem is at risk of losing momentum or being extinguished because of the lack of clarity about the extent to which private-sector players are responsible for participating in education technology. Private-sector interventions are also not aligned with government actions, resulting in duplicate interventions. One ed-tech player gave an example of a school that was providing a grade 4 maths lab from the government and two more from NGOs. The labs were only used in grade 4 while learners in other grades could have benefited from programs to improve their learning outcomes.

The uncertainty of the current environment is a real risk to the sustainability of the South African ed-tech market. A benchmark analysis on public–private collaboration reveals that governments are partnering with the private sector in strategic areas to promote and grow a vibrant ed-tech ecosystem (see figure 15).

8. Education lacks not only a data governance strategy, but also sufficient, dedicated ICT roles with clear accountability and the appropriate capabilities.

The organisational structure of South Africa's basic education departments relies on an ICT steering committee with cross-functional directorate expertise. However, interviews with the DBE and the Department of Postal Services and Communications reveal that this committee is not coping from either a capacity or a capability perspective, and it lacks consistent support from other government departments.

As a result, the last ICT strategy published was the 2004 white paper on e-education. (An updated strategy is under development.) One of the root causes of the stagnation of a comprehensive education ICT strategy lies in the lack of a high-level dedicated institutional role which can drive the complex cross-functional expertise into action and govern and manage the system's data strategy.

Countries are engaging with the wider education ecosystem to leverage private-sector capabilities through various models and incentives:

The government's role in procuring data and ed-tech solutions varies according to several factors:

- Size of the education sector
- Type of product procured (for example, the school management system or classroom learning tool)
- Autonomy and maturity level of the government
- Funding system (at what level the funding is allocated)
- Technical capabilities of the system

Typically, countries with a large education sector and capable schools will source solutions at a school level given the variety of needs and autonomy present across the system (for example, Italy, France, and the United Kingdom). Smaller countries, such as Estonia, with a more centralised system tend to source solutions at the national level to leverage scale. However, a one-solution-fits-all approach is often poorly executed in large systems and will not be applicable to diverse environments that require tailored solutions.

In **India,** the government typically uses two models to partner with the private sector. The Build Own Operate Transfer (BOOT) model is adopted when schools do not have the technical knowledge or capacity to implement ICT infrastructure and solutions. The private sector builds, owns, and operates the ICT programme and transfers implementation at the end of the contract. The concern with this approach is that schools have little to no control over the process. Conversely, the Purchase model is adopted when schools have the technical knowledge and capacity to manage the sourcing, deployment, and maintenance of the ICT program. For the Purchase model to be adopted, schools must have advanced capabilities to manage ICT programmes.

In **Australia,** the digital education industry has expanded rapidly in the past five years with more than 1,000 digital education providers generating about $A3.3 billion in revenue. As a decentralised system, the national government plays a significant role in producing internal frameworks and developing stakeholder strategies for interaction with the private sector. At the local level, the various digital strategies have their own tools and approaches for engaging private-sector players guided by national frameworks and strategies.

In **Pakistan,** the national government sets all frameworks, standards, and processes to manage the public–private partnerships. Further, given the pressing need to address a fast-growing young population, the Ministry of Federal Education is seeking collaboration and assistance from global ICT actors such as Microsoft, Oracle, and Cisco, directly mentioned in the National Policy for Education. The provincial governments develop and source solutions at a local level in line with the national government's procedures.

Another form of collaboration is co-investing to bring together public- and private-sector interests. For example, in **Pakistan,** the Ministry of Information Technology established the Universal Service Fund to stimulate the development of telecommunication services, infrastructural investment, and ICT in education. The fund operates on a commercial model with no government funding and a board representing private and public interests. NGOs serve as a bridge between the government and the private sector, providing local expertise and financial and technical assistance, while promoting public–private partnerships that incentivise and stimulate investment.

Generally, governments are encouraging the private sector to participate in the education technology space. For example, **Australia** hosts an annual ed-tech conference. Gathering various players in the sector brings several benefits: it creates a conducive space for the interaction between stakeholders, it increases awareness and exposure to the ed-tech market, and it raises private-sector interest to invest in education technology. Australia also provides tax credits and grants to create strong relationships between business and research. The **United Kingdom** hosts LearnED roadshows to incentivise private-sector investment through free one-day ed-tech training roadshows for school and ICT leaders. The roadshows connect the schools and private sector to align education needs and the private-sector offering. The UK also hosts The GREAT Tech Awards, which encourage high-growth technology companies around the globe to select the UK as a place to set up and grow their businesses.

In **Israel,** the government plays a key role in the development of ed-tech in Tel Aviv, including with loans of up to half a million dollars and state-backed incubators that can invest up to $750,000 over a one-year program. Likewise, investing in and developing digital education incubators ensures greater support when implementing technology in education. **France** has allocated €30 million to the e-FRAN programme, aimed at identifying new digital teaching and learning practice projects.

Figure 15: Public-private collaboration benchmark analysis

9. ICT systems and infrastructure in education is incomplete, and schools face prohibitively high bandwidth costs.

A crucial issue that surfaced early in the research is the lack of a comprehensive view of ICT infrastructure. Operation Phakisa has programmes for school connectivity (including projects in patronship with the Department of Telecommunications and Postal Services, such as SA Connect), the Department of Rural Development and Land Reform, Provincial Education Department projects, and corporate social investment initiatives. Interviews with the directorate of infrastructure development at the Department of Postal Services and Communications and the ICT Steering Committee reveal that all were working towards the same objective, but in silos. Significant challenges exist in projects such as SA Connect, including procurement, lack of auditing of service delivery, and poor project planning. Some of these challenges have been overcome by appointing the State Information Technology Agency and Broadband Infraco to procure or deliver the necessary products and services. Nonetheless, the project remains in phase 1 with piloting full delivery in only eight government districts.

Furthermore, where ICT infrastructure exists, the next issue will be the cost of bandwidth (see Figure 16).

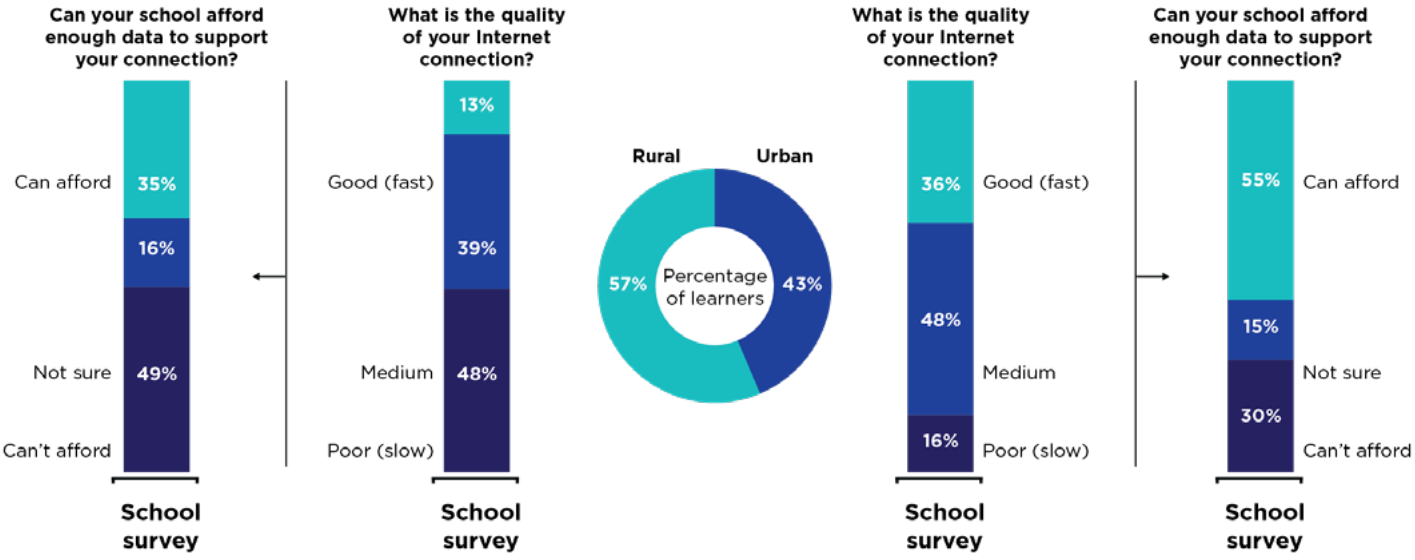


Figure 16: Quality of connection and bandwidth affordability

Although the Electronic Communications Act secures a 50 percent data discount for all schools and education-related institutes, there is a gap in enforcement. None of the stakeholders interviewed had a view on if schools were properly receiving this benefit and, if they weren't, how the school could ensure receiveing it. Also, the benefit does not speak to the socioeconomic environments. For example, quintile 1, 2, and 3 schools should be receiving discounts of more than 50 percent.

10. Education systems and tools are not guided by interoperability standards.

The 2004 white paper on e-education provided guidance by requiring minimum interoperability standards to guide the purchase of hardware, software, and other technologies. Likewise, the National Education Information Policy states the need to establish and maintain effective standards for education statistics, data, and information systems. Although standards are available for statistical data, the closest in terms of system interoperability and education data are the SA-SAMS circulars. Further, all interviews on third-party school administration systems and ed-tech tools reveal a lack of interoperability standards.

If the standards are delayed until uptake reaches critical mass, retroactively implementing standards will be expensive and complex. Globally, most governments are seeking to adopt data interoperability standards rather than prescribe or build systems in-house.

In **Australia,** the National School Interoperability Program is a framework to guide the development of the following:

- A national school data model to aid consistency
- Data exchange standards and formats
- Industry standards and models that enable the marketplace to provide suitable software product and offerings
- Consistent student identity management systems, within and across schools, as a precursor to improving the mobility, utility and appropriate security of information about students and learning

Various interoperability processes as part of the National School Interoperability Program further drive private sector investment through the following:

- A framework ensuring the private sector has a deeper understanding of the environment requirements and standards (for example, the Systems Interoperability Framework)
- Mechanisms that allow private-sector developers to test for effective deployment of their solutions before full rollout (for example, Hub Integration Testing Services)

Similarly, the Systems Interoperability Framework is an open, industry-supported standard used to link data systems within the education sector. Application of the standard enables systems to interact and share data efficiently, securely, and cost effectively regardless of the application and technology platform. The standard is maintained in Australia by a data standard working group, which includes agency representatives from all states and territories as well as developers of a wide range of ICT products used in schools.

Similarly, the Hub Integration Testing Services (HITS) is designed to model the interactions that jurisdictions and vendors will need for simple and complex integrations. HITS acts as an assurance test for developers. If development teams can fulfil the use cases that HITS support, then they can be confident their products will work when deployed into a jurisdiction's production environment. HITS allows jurisdiction and vendor teams to achieve a level of technical assurance that interoperability will succeed without having to undertake this discovery process as part of a formal project.
In this way, interoperability costs for private vendors are greatly reduced and certainty in effective deployment is enhanced, thus incentivising investment.

Figure 17: Interoperability benchmark analysis

CHAPTER 5

WHERE TO NEXT

CLOSING THE GAPS AND BUILDING FOR THE FUTURE

The final aspect of the study was to develop and prioritise recommendations. The baseline report, benchmark report, global trends summarised in Figure 18, and South Africa strategic vision (for example, NDP and the Action Plan 2019) formed the foundation for gathering insights from key stakeholders.

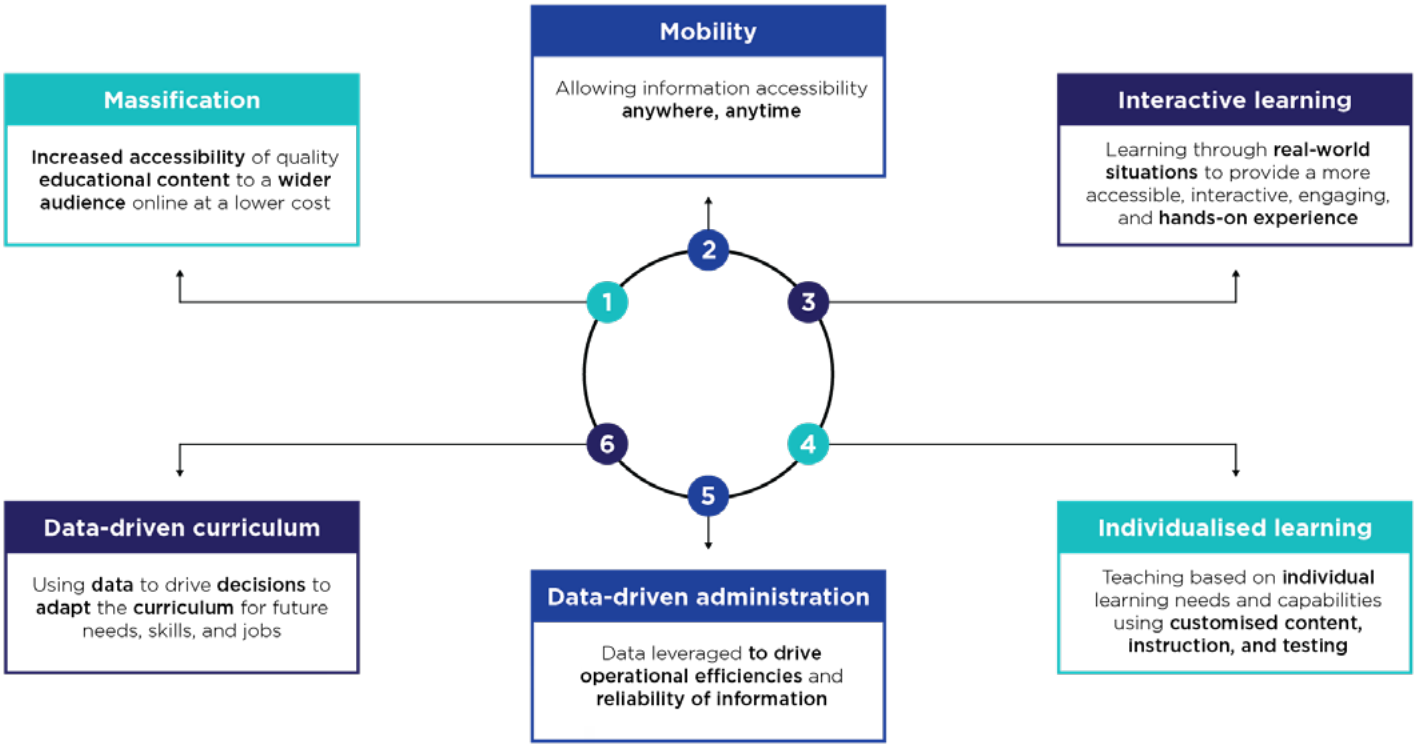
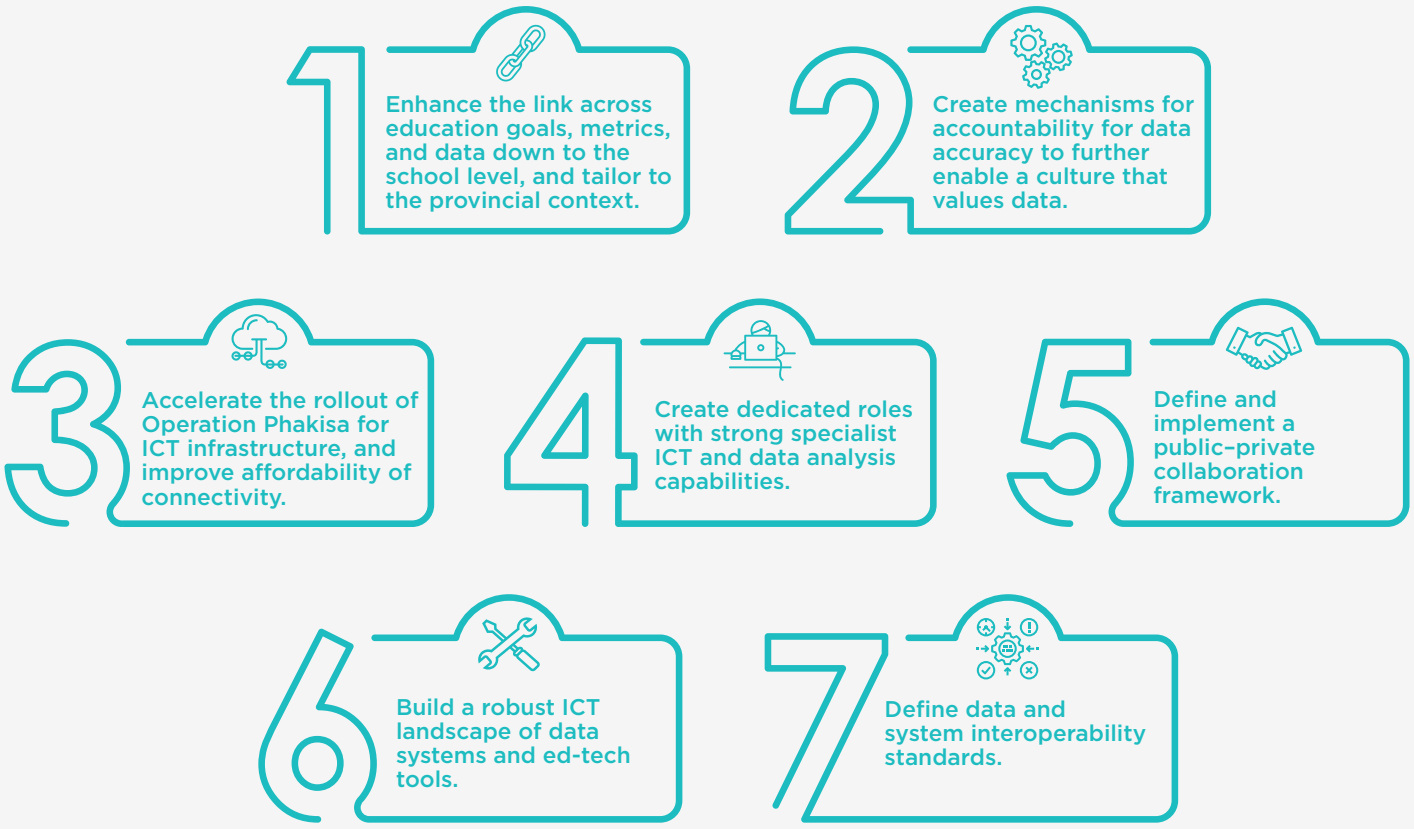


Figure 18: Global trends

The future of education will be shaped by six mega trends derived from extensive research and input of subject matter experts. Education delivery will increasingly become available online through content and platforms, accessible at any time at a low cost from anywhere through mobile devices. Advances in technology and the understanding of human development will promote interactive and individualised learning solutions and experiences.

Finally, education data will be used to drive administrative decisions as well as to define and refine the curriculum on a regular basis. Globally, these six trends are emerging and gaining rapid adoption, and will over time become more prevalent in the South African context. In particular, massification and mobility are expected to gain traction in the country, together with the use of data to determine the curriculum of the future and drive administrative decisions.

The global trends and undeniable importance of data and technology for the future of the South Africa education system were taken into consideration to develop a list of recommendations, which was examined in a series of workshops with experts and stakeholders from the public and private sector. Based on their input, **seven high-priority recommendations were identified:**



1. Enhance the link across education goals, metrics, and data down to the school level, and tailor to the provincial context.

To improve the use of data to support stakeholders' decisions and enhance education outcomes, the link across goals, metrics, and data needs to be strengthened from both a strategic and planning perspective for the national DBE and an operational perspective for provincial departments and lower. From a strategic perspective, the priority goals need to be measured by performance metrics that use the EMIS infrastructure to capture data that can empower officials.

The data collected should clearly link to education metrics to support officials across levels of the education system in making key decisions that make an impact on the achievement of education goals. An increase in the amount of reliable performance data can be achieved by collecting multiple and more regular national assessments to provide a uniform source for data-driven decision making. A comparable framework that could ensure a strong link between goals, metrics, and data is the Indicators and Monitoring Framework for the UN Sustainable Development Goals.

This framework uses a tiered system based on three dimensions: concept, definition and data availability. Applying a similar system in South Africa would prioritise areas where metrics need to be developed to be conceptually clear with agreed-upon national definitions. Therefore, the DBE should develop a tiered metric system mapped to goals and prioritise standardisation and the production of relevant data.

The DBE needs to develop differentiated strategies capturing South Africa's vast socio-economic disparities and unique local challenges. Appropriate structures (including processes) need to be put in place to create a formal method to tailor or include additional metrics to address the local context. This should extend to the targets. To reflect the unique local challenges, the DBE should consider using archetype analysis based on a set of criteria, including but not limited to the below:

- The number of schools in a district
- The proportion of rural to urban schools in a district
- The number of learners per educator in a district
- The proportion of quintile 1–3 schools to quintile 4–5 schools in a district
- The number of schools connected to the internet[2]
- The quality of the internet connection, and the matric pass rate.

From an operational perspective, the goals and related targets set by national and provincial departments need to be mapped against the decisions required to achieve the goals. These decisions can then be used as inputs to define data requirements for SA-SAMS, other education systems and form the basis of data inter-operability standards.

2 *Connectivity in this instance represents connectivity beyond just the principal to teachers and classrooms.*

2. Create mechanisms for accountability for data accuracy to further enable a culture that values data.

Data reliability must be improved with mechanisms that enhance accountability for accuracy, thereby unlocking more value in the data management cycle. The data process needs to become cross-functional to ensure policy owners are part of checking data reliability. A strong mechanism would be performance contracts with incentives linked to accurate data. Other mechanisms to stimulate accountability for data accuracy include non-financial measures, such as data transparency, appropriate sampling and spot checks and enforcing legal repercussions against the provision of false or inaccurate data. Lessons learned through the DDD implementation and its change management processes can be drawn upon to further build a culture in the education sector that values data-driven decision making.

3. Accelerate the rollout of Operation Phakisa for ICT infrastructure and improve affordability of connectivity.

The planning and auditing of ICT infrastructure in education is ad-hoc and requires a focused and comprehensive strategy. Nonetheless, various initiatives have made progress. An example of a centre of excellence is the Western Cape government's e-learning Game Changer initiative, which has achieved impressive results with a comprehensive strategy to ensure that infrastructure and tech-enabled devices are delivered to schools.

The initiative has

- connected **85%** of schools
- with a minimum of **10mb/s** Internet line
- and has delivered **28,870** devices
- **6,461** smart classrooms
- and **1,160** ICT labs

Given the importance of an ICT environment, additional research should be undertaken to create a clear and detailed view of the current situation. The resulting program should include several key dimensions, including stakeholder engagement and need assessments, capability development and training for deployment, sufficient funding and resources, clear governance, and a phased deployment approach (pilot first, then full rollout). This should be managed through a central project management office (PMO) with the authority to guide interdepartmental interventions and the appropriate cross-cutting capabilities (such as ICT specialists, education specialists, and communication specialists). Its mandate should include managing research and creating a comprehensive and integrated connectivity plan to drive ICT infrastructure improvements. Importantly, it should drive differentiated strategies to deploy ed-tech to prioritise socioeconomic environments (for example, by quintile) and different provincial and district contexts (discussed in more detail below).

Further, the relevant departments should review private-sector ICT partnerships and renegotiate e-rates (as per the Electronic Communications Act) by school quintile to ensure that schools are charged for and apportioned sufficient data in line with their socioeconomic context. The private sector can support those in need by providing tiered and larger discounts to quintile 1, 2, and 3 schools. At the time of writing, the Department of Telecommunications and Postal Services and DBE were engaging with the Independent Communications Authority of South Africa to review the school payment model for bandwidth. Ideally, this too should be driven by an interdepartmental PMO.

4. Create dedicated roles with strong specialist ICT and data analysis capabilities.

To overcome the complexities at the nexus of education and technology, dedicated specialist roles are needed at national and provincial levels. The roles should have the necessary data analysis capabilities and resources to improve the information available to all stakeholders and enable them to make data-driven decisions to improve performance.

The new roles should be high enough in the organisation to ensure engagement across directorates and government departments and drive data management and ed-tech tool development and deployment. The role will need to be defined within the organizational structure and given enough power and accountability to fulfil the strategic mandate. Further, the role will need to be filled by someone with skills in data management and ICT systems.

To enable the implementation of any interventions, the CIO must have enough resources to fulfil his or her mandate, which includes an appropriately sized and skilled team. Over and above the CIO role, the EMIS must have the appropriate analytical capabilities (as seen in the benchmarks in figure 9) to fully utilise the data collected. A centre of excellence to rely on is the analytics team at the DDD programme, including its emerging use of predictive analytics.

In parallel to the hiring of this dedicated team, a transformation program should be implemented at the highest levels of leadership to drive the necessary changes (including a new tech-enabled operating model, organizational structure, and governance framework), break the approach of working in silos, and ensure collaboration of cross-functional teams.

5. Define and implement a public–private collaboration framework.

As seen from the global benchmarks, the public and private sectors share responsibility for creating and maintaining a digital education sector. Building on the Education Collaboration Framework and the National Education Collaboration Trust, a similar approach should be developed to assist in the public–private collaboration in the digital education sector. A new digital sister organization could be created, or increase the NECT capacity and capabilities, to drive the development of appropriate frameworks and collaboration.

Importantly, the organisation should create and implement a public–private collaboration framework for education technology and data management to encourage and leverage private-sector participation in strategic areas. The framework should define the key areas and the roles and responsibilities between the government and private sector and provide financial and non-financial incentives to the private sector. The benefit will be an accelerated inclusion of existing capabilities and investments made by the non-government sector, in line with the NDP goal for collaboration in the education sector, to avoid duplicating high-quality solutions (for example, DDD and EduStat).

6. Build a robust ICT landscape of data systems and ed-tech tools.

Creating a robust landscape of agnostic ed-tech tools and data management systems can ease the burden on the public sector. Further, it gives schools the opportunity and flexibility to select the school management system and ed-tech tools that best suit their needs.

Progress is being made by the DBE through various ad-hoc programmes, including the following:

- The DDD Dashboard, summarised in figure 20, as a centre of excellence in this area
- The SA-SAMS modernisation project in partnership with the provincial departments of education and private-sector funders
- The School of the Future project with six schools in partnership with Hewlett-Packard
- Full9Yards project in partnership with Samsung
- Various e-examination projects such as the Item Banking System (which provides a portal for the review and testing of items before being stored for summative Examinations) and Exam Marking System (a web-based technology that allows either for instant marking or decentralize manual marking)
- Interactive content and digital assessment tools in partnership with Uchi Dragon Learn
- An education-based web portal for learners, educators, parents, and school administrators, called the DBE cloud
- Participation in the BRICS Mathematics online Olympiad
- The advocacy and implementation phase of a professional development framework for digital learning for teachers, subject advisors, school management, district officials, provincial officials, and national officials

Figure 19: Ad-hoc programmes

The DBE must determine the appropriate ICT landscape for South Africa. As such, the role of the most prevalent data systems in schools, SA-SAMs, third-party school information systems, and particularly the widely adopted DDD system must be defined and given a clear position in their role and obligations in the data landscape. **The DBE must shift its focus from system deployment to infrastructure and data management.**

The role of the most prevalent data systems in schools, SA-SAMs, third-party school information systems, and particularly the widely adopted DDD system must be defined and given a clear position in their role and obligations in the data landscape. The private sector and its innovative solutions must also have a clear position in the education data landscape.

The correct balance needs to be found between creating space for the private sector on the one hand, and ensuring the government retains sufficient control over education system data, on the other. Given the complexity of this recommendation, further research should be conducted on the ideal structure and a comprehensive strategy for South Africa.

DDD Case Study

The Data Driven Districts (DDD) initiative has developed an easy-to use dashboard that allows education officials to visualise their SA-SAMS data immediately and creates access to advanced analytical reports that deliver actionable insights. Further, a validation toolset was also introduced to measure and improve data submission quality. The combination of high-quality submission controls, immediate feedback, and measured and reported data quality scores has given education stakeholders renewed ownership of and confidence in their data. The initiative's goal is to support the government to improve learner outcomes through increased data quality, availability and usage.

To date, the DDD has achieved traction with 75 districts in eight provinces, with more than 22,000 schools uploading data. Because of the initiative's scale, numerous NGOs are making use of the tools and data to inform and drive their education programs in particular schools or areas. To date, more than 10,000 schools are uploading their SA-SAMS data via a data efficient validation and extraction tool every week, with more than 6,000 users repeatedly accessing the dashboard to augment their decision making processes. The use of the system drastically improves data accessibility as some of the provincial EMIS processes used to take up to a term to achieve what DDD now enables in a week.

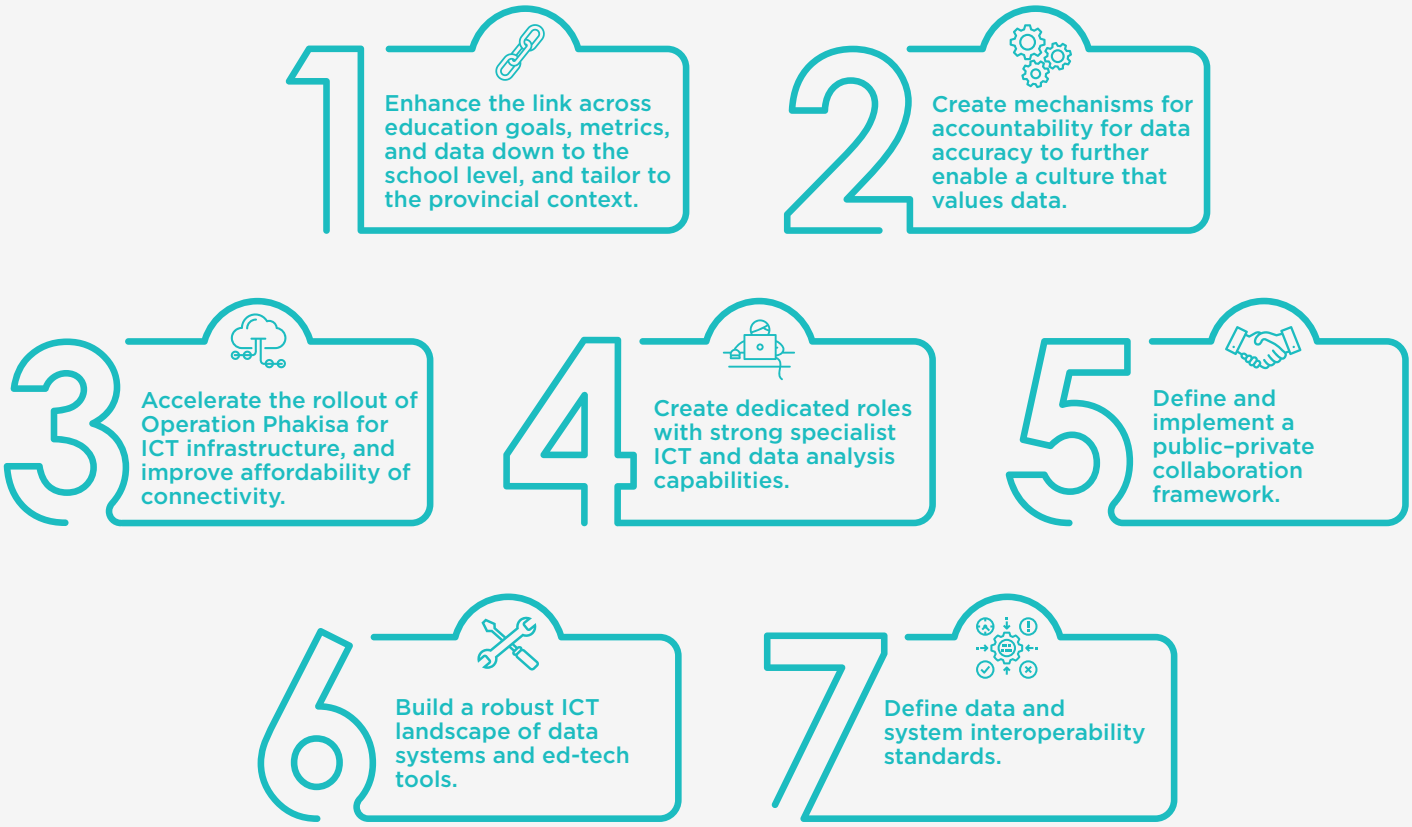
Importantly, the tool helps district and circuit staff use data to make decisions on allocation of scarce resource, but also assists school management to plan and educators to identify and address learners' specific needs.

Figure 20: DDD Case study

7. Define data and system interoperability standards.

Data interoperability standards are an important enabler to public–private collaboration and efficient use of government systems and tools. These standards ensure data is in the correct format and can be easily and cost-effectively used by a variety of stakeholders. These standards must be adopted before critical mass of systems and tools is reached, as it is extremely costly to retrofit. The new office of the CIO should be well positioned to drive implementation of interoperability standards required by the National Education Information Policy.

In summary, the education sector should activate seven key recommendations:



The two most important recommendations are “Enhancing the link between goals, metrics and data” and “Accelerating the improvement of ICT infrastructure and data affordability.” These should be kickstarted immediately as they would ensure clear direction for the education sector from a data perspective and provide the necessary infrastructure to enable all the remaining recommendations.

In addition to the seven recommendations listed above, the government should consider a few other recommendations in policy areas that were not originally included in the scope, but did nevertheless emerge from the research and documentation. These include:

- **Introduce incentives for the private sector to invest in ed-tech:** this includes providing financial (e.g. funding, grants) and non-financial incentives (e.g. awards, data transparency) for ed-tech companies, while improving and streamlining the procurement process for ed-tech

- **Refresh the curriculum to include the use of ed-tech:** the curriculum needs be continuously reviewed to capture the latest developments in ed-tech. The deployment of ed-tech can be facilitated through a structured integration of ed-tech tools into the educational process and the provision of the necessary support to relevant stakeholders (e.g., teachers) to implement the tools effectively

- **Re-introduce regular national assessments and improve the reliability of school-based assessments leveraging technology:** it is important to collect frequent and reliable data points on the performance of the education system at multiple stages during the student journey. This can be achieved by introducing multiple and regular national assessments and increasing the quality of school-based assessments leveraging standardisation and technology in priority subjects (e.g. literacy and numeracy)

These additional key policy enablers are essential to drive and contribute to the success of the previously mentioned seven recommendations. A draft implementation roadmap (figure 22) prioritises the recommendation to clearly link data collection to education goals and metrics. Key success factors include focusing on a few strategic metrics and defining data requirements related to each metric, such as data type, format source and frequency of reporting.

Defining the education data system landscape will make clear the role of existing systems (e.g. DDD and SA-SAMs) and give schools the flexibility to in-source already successful players or other innovative education tools that meet their unique needs, encouraging a vibrant, innovative and compatible system landscape.

Interoperability education data standard definition can start once the data strategy and system landscape take shape. Standards will drive efficiencies through decreased dual data capture, simplify a full data view of each learner and ensure schools are able to unlock their data, regardless of which tools and systems they use. Standards must be in place before adoption of ed-tech tools becomes too widespread.

The other recommendations, particularly those with longer implementation horizons, can be phased in as specialist ICT resources and capabilities are put in place.

1. Enhance the link across education goals, metrics, and data down to the school level, and tailor to the provincial context.
2. Create mechanisms for accountability for data accuracy to further enable a culture that values data.
3. Accelerate the rollout of Operation Phakisa for ICT infrastructure, and improve affordability of connectivity.
4. Create dedicated roles with strong specialist ICT and data analysis capabilities.
5. Define and implement a public–private collaboration framework.
6. Build a robust ICT landscape of data systems and ed-tech tools.
7. Define data and system interoperability standards.

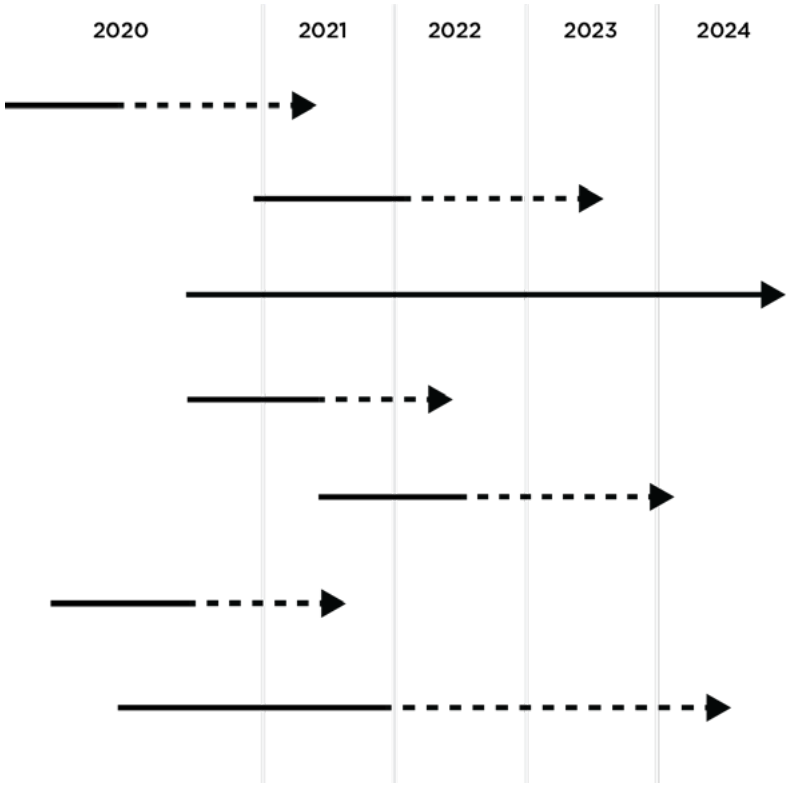
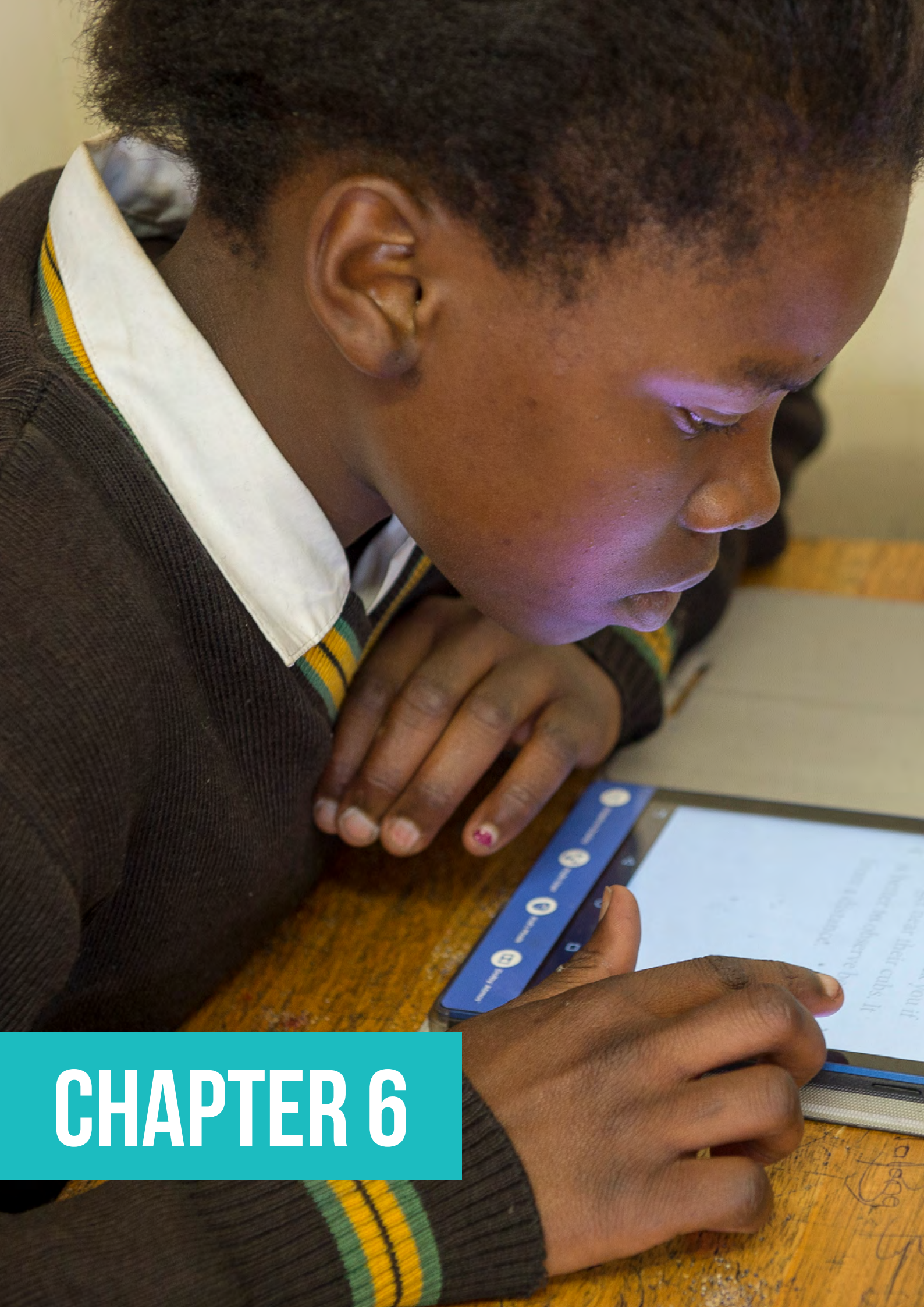


Figure 21: Implementation roadmap



CHAPTER 6

CONCLUSION

South Africa's education data and tool landscape has improved since the *Success by Numbers* report. However, significant challenges remain. The fundamental levers for improving education quality, especially those relating to educators, must not be lost in the discussion on digital transformation. Education data and technology shall be seen as an important tool to support decision-making processes and augment education delivery.

For data and ed-tech to support learning outcomes, all education stakeholders—from the DBE to the Department of Communications, from NGOs to private education companies —must collaborate to address the challenges outlined in this report and establish an environment that enables the development and deployment of innovative and effective data and ed-tech solutions.

Education can shape the future of individuals, society and the economy. The contribution of education to improving a person's socio-economic conditions and influencing strategic outcomes at a national level has been demonstrated in countless contexts. However, education is undergoing a holistic transformation, mainly driven by a deeper understanding of human development and the proliferation of education data systems and learning tools.

The speed of change demands swift and decisive action. Inaction is not an option – it needs to be thought-through, properly structured and well-coordinated. It is our hope that the findings and recommendations presented here will provide valuable ideas for leaders from the public and private sector seeking to impact the education outcomes of the country. All who read this report are encouraged to begin the journey of steering the future in the right direction towards a high-quality, efficient education sector with deep collaborations across all stakeholders.

This report shows how South Africa has achieved solid progress against the findings in *Success By Numbers*. However, the country's education sector is at a pivotal point of development and must move urgently to capture the opportunity and attain success *Beyond the Numbers*. Decisions need to be powered by data with technology woven into every aspect of education.

ABBREVIATIONS

CIO	Chief Information Officer
DBE	Department of Basic Education
DDD	Data Driven Districts
Ed-tech	Education technology
EMIS	Education Management Information Systems
LURITS	Learner Unit Record Information and Tracking System
NECT	National Education Collaboration Trust
NDP	National Development Plan
NGOs	Non-Governmental Organisations
PIRLS	Progress in International Reading Literacy Study
PMO	Project Management Office
SACMEQ	Southern and Eastern Africa Consortium for Monitoring Education Quality
SA-SAMs	South African School Admiistration and Management System
TIMSS	Trends in International Mathematics and Science Study