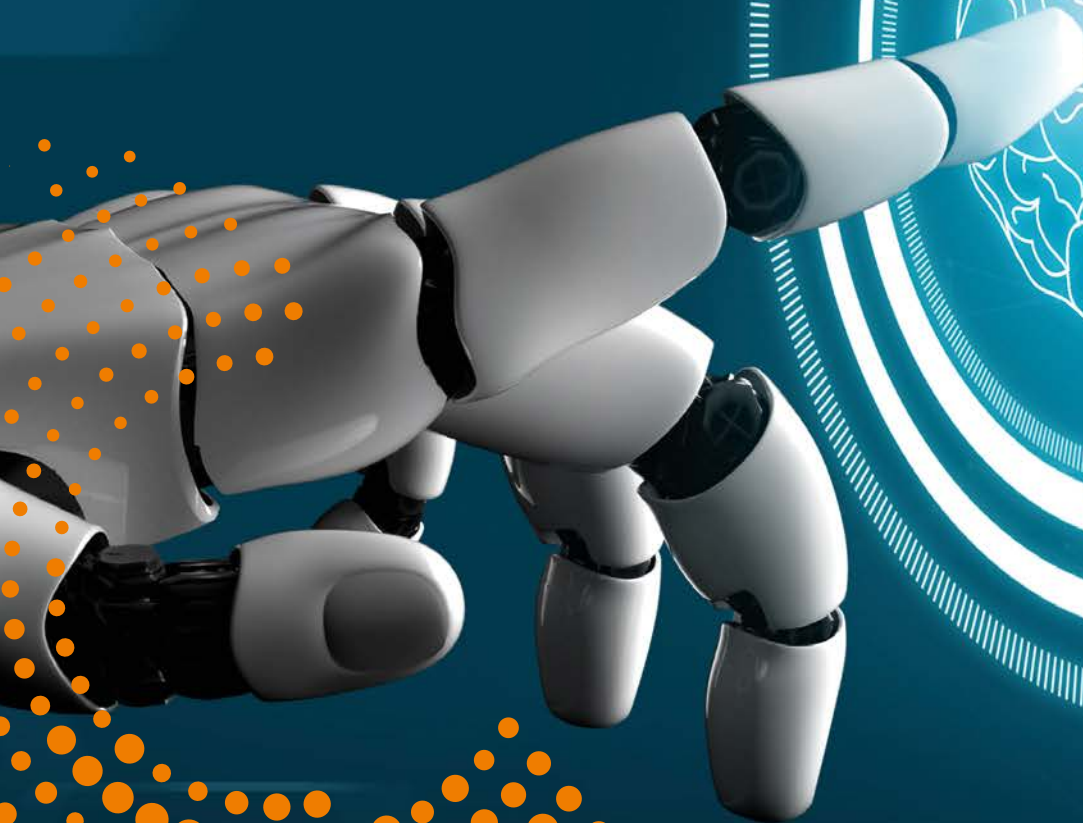




higher education  
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Department:  
Higher Education and Training  
REPUBLIC OF SOUTH AFRICA

# REPORT OF A MINISTERIAL TASK TEAM ON THE IMPLICATIONS OF THE 4TH INDUSTRIAL REVOLUTION FOR THE POST-SCHOOL EDUCATION AND TRAINING SYSTEM



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on the Implications of the  
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# ABBREVIATIONS AND **ACRONYMS**

<b>4IR</b>	Fourth Industrial Revolution
<b>AI</b>	Artificial Intelligence
<b>ABET</b>	Adult Basic Education and Training
<b>BPESA</b>	Business Process Enabling South Africa
<b>BRICS</b>	Brazil, Russia, India, China and South Africa
<b>BUSA</b>	Business Unity South Africa
<b>CET</b>	Community Education and Training
<b>CHE</b>	Council on Higher Education
<b>CPD</b>	Continuous Professional Development
<b>CPS</b>	Cyber-Physical System
<b>CSIR</b>	Council for Scientific and Industrial Research
<b>DCDT</b>	Department of Communications and Digital Technologies
<b>DHET</b>	Department of Higher Education and Training
<b>DSI</b>	Department of Science and Innovation
<b>DSIDE</b>	Data Science for Impact and Decision Enablement
<b>DST</b>	Department of Science and Technology
<b>DTI</b>	Department of Trade and Industry
<b>DTPS</b>	Department of Telecommunications and Postal Services
<b>EIU</b>	Economic Intelligence Unit
<b>GBS</b>	Global Business Services
<b>GER</b>	Gross Enrolment Ratio
<b>GETC</b>	General Education and Training Certificate
<b>HE</b>	Higher Education
<b>HEI</b>	Higher Education Institution
<b>HSRC</b>	Human Sciences Research Council
<b>ICT</b>	Information and Communication Technology
<b>IFPTI</b>	Intsimbi Future Production Technologies Initiative
<b>merSETA</b>	Manufacturing, Engineering and Related Services Sector Education and Training Authority
<b>MICT SETA</b>	Media, Information, and Communication Technology Sector Education and Training Authority
<b>MOOC</b>	Massive Open Online Course
<b>MTSF</b>	Medium-Term Strategic Framework
<b>MTT on 4IR</b>	Ministerial Task Team on the Fourth Industrial Revolution
<b>NCV</b>	National Certificate (Vocational)

<b>NDP</b>	National Development Plan
<b>NEETs</b>	Not in Employment, Education, or Training
<b>NOLS</b>	National Open Learning System
<b>NQF</b>	National Qualifications Framework
<b>NSF</b>	National Skills Fund
<b>NSFAS</b>	National Student Financial Aid Scheme
<b>NSI</b>	National System of Innovation
<b>NTC</b>	National Training Certificate
<b>NZQA</b>	New Zealand Qualification Authority
<b>NZQF</b>	New Zealand Qualification Framework
<b>OER</b>	Open Educational Resources
<b>P4P</b>	Pay for Performance
<b>PISA</b>	Programme for International Student Assessment
<b>PPGI</b>	Public Private Growth Initiative
<b>PSET</b>	Post-School Education and Training
<b>PTSA</b>	Production Technologies Association of South Africa
<b>PYEI</b>	Presidential Youth Employment Intervention
<b>QCs</b>	Quality Councils
<b>QCTO</b>	Quality Council for Trades and Occupations
<b>RPL</b>	Recognition of Prior Learning
<b>SANREN</b>	South African National Research and Education Network
<b>SAQA</b>	South African Qualifications Authority
<b>SARChI</b>	South African Research Chairs Initiative
<b>SETA</b>	Sector Education and Training Authority
<b>SIBs</b>	Social Impact Bonds
<b>STEM</b>	Science, Technology, Engineering, and Mathematics
<b>STI</b>	Science, Technology, and Innovation
<b>TIMSS</b>	Trends in International Mathematics and Science Study
<b>TIPC</b>	Transformative Innovation Policy Consortium
<b>TVET</b>	Technical and Vocational Education and Training
<b>UNESCO</b>	United Nations Educational, Scientific and Cultural Organisation
<b>WEF</b>	World Economic Forum
<b>WIL</b>	Work-Integrated Learning

# LISTS OF FIGURES AND ANNEXURES

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# GLOSSARY OF KEY TERMS

## Glossary of Key Terms

**Artificial Intelligence (AI):** The ability of a digital computer or computer-controlled robot to perform tasks commonly associated with intelligent beings. The term is frequently applied to the project of developing systems endowed with the intellectual processes characteristic of humans, such as the ability to reason, discover meaning, generalise, or learn from experience.<sup>1</sup>

**Blended learning:** Learning which involves a combination of traditional face-to-face instruction, e-learning, and online learning, including gaming, virtual reality, text messaging, and use of social networking sites. Online technology is not used to just supplement but to also transform and improve the learning process. It usually includes some element of student control over time, place, path, or pace.

**Digital jobs:** Generally refer to work in the digital sector. Also refers to jobs created by applying ICT to new or existing activities or processes. These jobs usually include performing information-based tasks that build the individual's capacity for future work.<sup>2</sup>

**Distance education:** A mode of education provision based primarily on a set of teaching and learning strategies (or educational methods) that are used to overcome spatial and transactional distance between educators and learners. It is neither necessary for learners to attend classes frequently nor for long periods. Instead, it may use a combination of face-to-face interactions, different media, learner support mechanisms, discussions, and practical sessions. The face-to-face contact that does take place typically involves various forms of student support, for example, academic debate, tutorials, peer group discussion, or practical work. Students are actively involved and more accountable for their own learning.

**e-Learning:** Learning or training via a computer or other digital device (like tablets and cellular phones), facilitating learning anytime and anywhere. It provides access or interaction with digital learning materials, enables interaction with peers and educators, and allows participation in discussions and the undertaking of assessments. E-Learning can take place online, offline, or in a combination thereof.

**Fourth Industrial Revolution (4IR):** The current and developing environment where the convergence of new digital, physical, and biological technologies, such as artificial intelligence, cloud computing, the Internet of Things, robotics, augmented reality, 3D printing, and biotechnology, are merging with humans' physical lives, changing the way we interact, live and work.

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1 Copeland, B. J. (2020). Artificial Intelligence. *Encyclopaedia Britannica*, 2020. Retrieved from: <https://www.britannica.com/technology/artificial-intelligence>.

2 Imaizumi, S. (2015). Partnerships and opportunities for digital jobs. Retrieved from: <https://blogs.worldbank.org/digital-development/partnerships-and-opportunities-digital-jobs>.

**Information and Communication Technology (ICT):** Technologies that provide access to information, focusing primarily on communication technologies, such as the Internet, wireless networks, and computing devices, whether mobile or otherwise. It includes all devices, networking components, applications, and systems that, combined, allow people and organisations to interact in the digital world.

**Online learning:** A variant of e-learning in which the learning that takes place is delivered entirely via the Internet. Learners have to be connected to the Internet to access and interact with learning materials, interact with peers and educators, participate in discussions, and do assessments.

**Open learning:** An educational approach which combines the principles of learner-centredness, lifelong learning, flexibility of learning provision, the removal of barriers to access learning, the recognition for credit of prior learning experience, the provision of learner support, the construction of learning programmes in the expectation that learners can succeed, and the maintenance of rigorous quality assurance over the design of learning materials and support systems.

**Open Educational Resources (OER):** Any educational resources (including curriculum maps, course materials, textbooks, streaming videos, multimedia applications, podcasts, and any other materials that have been designed for use in teaching and learning) that are published under an open licence and are available for use without an accompanying need to pay royalties or licence fees. Openly licensed content can be produced in any medium: text, video, audio, or computer-based multimedia.

**Post-schooling (in the South African context):** The provision of education and training opportunities to all people who have left school. It includes education and training for out-of-school youth, institutions offering second-chance learning, technical and vocational education and training (TVET) colleges, community education and training (CET) colleges, education and training offered by the Sector Education and Training Authorities (SETAs), universities of technology, universities, private providers, and other training colleges and institutes.

**Resource-based learning:** Resource-based learning is student-centred, fostering the development of individual students by accommodating their diverse interests, learning styles, experiences, needs, and ability levels. It involves a move away from the traditional notion of using the 'talking teacher' to communicate curriculum, to include the use of different media (such as text, videos, simulations, and animations) as appropriate. Students who use a wide range of resources in various mediums for learning have the opportunity to approach a theme, issue, or topic of study in ways which allow for a range of learning styles and access to the theme or topic via cognitive or affective appeals.

**Work-integrated learning (WIL):** An educational approach that aligns academic and workplace practices for the mutual benefit of students and workplaces. It is an intentional experiential learning process which combines academic studies with professional work experience to integrate theoretical, conceptual knowledge with practice in the workplace through directed or supported educational activities.

# ACKNOWLEDGEMENTS

The report of a Ministerial Task Team represents the collective effort of a team appointed by the Minister based on their recognised expertise and ability to successfully complete the task required of them. This task team was no different and consisted of a collective of individuals intentionally drawn from diverse backgrounds, who were able to robustly debate and yet also collegially engage on the implications of the Fourth Industrial Revolution (4IR) in the post-school education and training (PSET) system in South Africa, a country that has huge potential, and where, if the opportunities are effectively embraced, significant benefits can accrue. However, the unique character of the country has to be taken into account, and task team members were very cognisant of the need to take on the affordances of the 4IR in ways that assist to address rather than exacerbate the triple challenge of poverty, inequality, and unemployment facing the country.

I thus extend my deep appreciation to my fellow task team members for their intellectual, practical and always passionate contributions to the report, in alphabetical order: Prof. Brian Armstrong, Prof. Aslam Fataar, Ms Nicola Galombik, Dr Geci Karuri-Sebina, Ms Zamatungwa Khumalo, Ms Ilse Krag, Dr Adriana Marais, Mr Imraan Patel, and Dr Colin Thakur.

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The task team convened ten times, with the last four meetings taking place online during the national lockdown period. Ms Gill Scott very ably and accurately captured the minutes of the meetings and helped to ensure the multiple ideas that members put forward were recorded so that they could be pulled into the final report.

Pulling together a report of this nature in a manner that captures diverse views and voices is no easy task, and Mr Neil Butcher's ability to take account of academic, bureaucratic, and practical perspectives to construct a coherent, readable narrative is to be applauded.

The report aims at providing insights into how the policy-making mechanism can respond to the challenges posed by rapid shifts in the way we learn, live, and conduct our business. It is our hope that some of the key recommendations emanating from this report will help in the re-imagining of the PSET sector of the 21st century.

In closing, I wish to thank the Minister of Higher Education, Science and Technology, Dr Blade Nzimande, for the trust vested in me as chairperson of the task team, and in the members that the Minister appointed. We trust that we have fulfilled the task that the Minister set for us and that this report will contribute to the further development of a responsive PSET system in South Africa.

**Prof. Zebulon Vilakazi**

*Task Team Chairperson*

# EXECUTIVE SUMMARY

## The imperative for change

The world is on the threshold of the so-called Fourth Industrial Revolution (4IR), which is based on the confluence of multiple digital, physical, and biological technologies. Emerging thinking is that the 4IR is so powerful, so transformative, because it is based not only on the technology revolution sweeping the world, but also on the transformation of society, and on new ways of doing business and governing. The 4IR is rapidly changing the way humans create, exchange, and distribute value, resulting in systemic change across many sectors and aspects of human life, with cross-cutting social, political, cultural, and economic implications. The speed, breadth, and depth of this revolution are forcing us to rethink how countries develop, and how organisations create value.

The 4IR is not a social phenomenon with a predetermined trajectory. While many commentators seek to highlight the negative social consequences of the 4IR (particularly in terms of job losses), we believe that the social effects of the 4IR will depend predominantly on *how* we, as South Africans, choose to harness it. If the values and principles on which this vision is based underpin the 4IR, its technologies and tools can be harnessed in a myriad of ways to create a better, more inclusive, wealthier South Africa that benefits all its citizens.

Historically, the formal education system was adopted at scale as steam and electrically powered industry flourished and people with specific skills were required for a mass production era. While new content has been added, the classroom-based, learner-instructor system and methods of assessment remain largely unchanged. However, the 4IR is inspiring new ways of working, learning, and thinking. New skills will be required to create, maintain, and leverage these new technologies. This will require the formal post-school education and training (PSET) system, working in partnership with government departments and employers, to repurpose and reconfigure curricula considering lifelong learning and the need for a broader and more agile PSET system to respond to skills needs as they arise.

While the 4IR technologies have the potential to improve living standards, the impact is often unequally distributed. At the heart of the challenges we face is inequality in access to education and the outcomes of education. An agile education and training system can lead to breakthrough solutions that are needed to provide equitable solutions, but the rapid change precipitated by the 4IR will likely perpetuate and increase inequality and social divide, if it is combined with a lagging education system. This is particularly so because many associated retraining and upskilling requirements are often focused on those who are already skilled or at least relatively well educated. Thus, the social consequences of the 4IR will demand much larger-scale access to education and training opportunities for all South Africans, with the focus on those who have been excluded from PSET historically or whose prior education has failed them, as well as with ongoing access for people to move in and out of PSET throughout their lives.

The formal PSET sector in South Africa is, however, not well equipped to enable the country and its citizens to harness the full social and economic potential of the 4IR effectively. It is not able to offer PSET opportunities on the scale demanded by a knowledge economy. Current curricula, programmes, and courses are misaligned with labour

market demands, while mechanisms to review and update programmes and curricula are highly bureaucratic and operate in long, slow cycles. Further, spending in the sector remains strongly geared towards full- or multi-year programmes of study with a bias towards a fulltime face-to-face educational experience that aims predominantly to prepare limited numbers of young people upfront for a lifelong career.

Fortunately, a central characteristic of being human is our ability to imagine a world beyond the reality we are currently experiencing. Never before have ideas had the power to come to fruition at such a pace or scale. Connectivity and data enable this, while the current socio-economic context in South Africa demands it, given our structurally high levels of unemployment (now severely compounded by the effects of economic downgrades and the unfolding impact of the Covid-19 pandemic) and persistently high levels of social inequality in our country.

This ability applies to our PSET system as much as any other social system in South Africa and a new vision for PSET is urgently required, given the imperatives for change propelled by the 4IR.

## **A new vision for the PSET system**

At the centre of our new vision for the PSET system is a focus on ensuring that its programmes, courses, and other learning opportunities are aligned with the needs outlined above. We envision a PSET system that provides:

- 1) A strong core of education and training programmes that align with the changing needs of both South African society and the world of work in the context of the 4IR.
- 2) Access to high-quality educational opportunities that meet a burgeoning and immediate demand for 'digital skills' in the labour market created by the 4IR and a parallel need for a new wave of South African innovators and entrepreneurs who will help to drive and shape the 4IR, to the social and economic benefit of all of its citizens.
- 3) Massive increases in short-course skilling opportunities for unemployed and underemployed South Africans in parallel with wider government and private-sector efforts to rapidly grow new employment opportunities for those people.
- 4) Growing emphasis on integrating into PSET programmes and courses learning opportunities that prepare people to be able to cope with accelerating change, both socially and economically, and thus that emphasise key generic skills.

We envision a PSET system with the following key characteristics:

- 1) Educational opportunities that prepare students *who are capable of creative insights, collaborating in diverse social and economic sectors, and navigating through cultural differences*, and that will give them an advantage in the workplace.
- 2) Curricula and educational programmes that are *responsive to the accelerating pace of technological change*.
- 3) A system that *creates an 'open-loop' education platform in which students can combine building a strong initial education foundation with ongoing educational and skills-acquisition opportunities throughout their lives*.
- 4) Educational approaches that enable *much greater flexibility in terms of how and where students access learning opportunities*.
- 5) *Wider and more pervasive application of work-integrated learning (WIL) in PSET*, recognising that the workplace is an essential site of learning and also that it will be critical to be able to bring PSET to the workplace, given that many learners may need to continue working while they study.
- 6) Accreditation systems that allow students to *accumulate 'stackable micro-credentials' throughout a lifelong learning career*, that they can acquire while moving in and out of the education system and the workplace and through a diverse and growing range of educational modalities enabled by information and communication technology (ICT) and WIL.
- 7) Modes of educational delivery that embrace the principles of open learning, as outlined in current PSET policies.

- 8) Integrated delivery models that work at district and regional levels and that enable PSET institutions in common localities to work with each other, with public and private enterprises, with social structures, with the communities they serve, and with local, district and provincial government to create articulated, seamless, responsive education and development opportunities.

## Requirements for success

Achieving the vision above will require a focus on transforming key aspects of the PSET system. This will require a greater emphasis on developing curricula, programmes, and courses that are informed by the demands of the labour market. Being demand-led in this way requires customised initiatives that respond directly to the needs of groups of similarly focused employers and result in the employment or self-employment of the young person. However, ensuring the relevance of PSET programmes cannot be exclusively dictated by the demands of the labour market as it exists today. There will equally be a strong requirement to ensure that ongoing curriculum development prepares students to thrive even as the needs of the labour market change and to become active agents in shaping the future of both South African society and its economy.

The PSET system should be re-oriented to provide for a wide range of teaching and learning approaches and strategies, according to need. Such an approach requires flexibility in admission criteria, curriculum design, learning and teaching modes, and assessment, with appropriate support systems and services across the PSET sector but also within subsectors. This in turn requires more flexible quality assurance systems, both at institutional and national levels, which are capable of assuring quality across a wider range of educational modalities with fewer common key indicators of quality. In much the same way as the ability to provide an agile PSET system depends on the achievability of interventions, agile education and training require accreditation to happen quickly. Where there is a mismatch between what the industry defines as a necessary skill and what the credentialing authority does, where the time taken to achieve the credential is lengthy, and where the credential is all-encompassing and not compartmentalised, this agility is lost or compromised.

Further, if the promise of the 4IR is one of disruption to work and skills over time, then there is a need to ensure that the PSET system creates lifelong learning opportunities that help people to upgrade the skills needed for work continuously and provides pathways to inclusion in the world of work. This is a joint responsibility that requires the active engagement and support of the government, employers, workers, and educational institutions.

There has been an unprecedented explosion of innovation in ICT leading to a bewildering array of new technological options that can be harnessed to support PSET – in its managerial and administrative operations, in teaching and learning, and research. Many of these developments have emerged because of the growing availability of high-quality, stable broadband Internet connections. This growth is predominantly driven by assumptions that educators and students can be online, in a broadband environment, 24 hours a day. The problems associated with this, for people living in countries or areas (as much of South Africa outside of large cities) where such Internet access does not exist or is not affordable, are significant. Unless there is a concerted effort to ensure that steps are taken to integrate marginalised students into ICT-enriched PSET environments, a widening of the digital divide and a deepening of social inequities, both within and between countries, is assured.

The 4IR can potentially create insiders and outsiders. Insiders are positioned to seize the economic opportunities on offer in the 4IR by virtue of their work readiness and outsiders are locked out of the new economy. To avoid this scenario, learning needs to be opened so that all people can take advantage of the opportunities on offer. Doing so, however, requires recognition that not all people have the same baseline levels of functional competence and so investments in closing foundational learning gaps are required as a first step. Further, it requires acknowledgement that the living conditions of many people mitigate against independent learning, which is practically impossible for those living in cramped, overcrowded conditions. Thus, community spaces for learning will be an essential requirement of more inclusive, flexible learning opportunities for all people.

The PSET systems and credentialing authorities also need to provide quality assurance and governance systems that are responsive to this changing landscape, to make credentialing information from multiple sources more

accessible, to provide the methodologies for comparing credentials, and to understand how these combine meaningfully. While the functionality must ultimately exist across the PSET system, the imperatives and pace of the 4IR suggest that responses focused on specific economic sectors and disciplines can offer some of the agility that is needed in the short to medium term.

A more responsive, agile and open PSET system will require simpler and more flexible policy frameworks, especially those responsible for governing programme accreditation and quality assurance. These policy frameworks should also be well aligned with broader, linked government policies. The number of areas and elements of PSET that need to be centrally regulated is far fewer than those currently being regulated. Increased flexibility and simplicity of policy frameworks are not challenges posed by the 4IR. This inevitably creates ongoing pressures for change to the structures and operations of education systems. The more complex policies and procedures become, the less flexible they become and the harder they make it to allow for these shifts.

To ensure that the above approaches are not fragmented or operating in silos, there is a need to develop a systemic regional approach to initiate integrated 4IR-related development at the regional level. This should link to the National Development Plan's (NDP's) focus on integrated development and the government's district-based coordinated approach. It should centre on specific economic sectors, carefully chosen to develop a pivot for regional economic development. Coordination and network mechanisms could be established, two per province (one rural and one urban), that would aim to develop an ecology of integrated development activity centred on one broad productive sector per region. The mechanism for establishing this should include an intersection of government sectors in collaboration with PSET providers, business, and relevant civic players. Given that this requires engagement between government ministries, it might require initiation from the Presidency, connected to existing initiatives already in place.

Finally, disruptive innovations and change brought about by the 4IR require disruptive responses achieved through collaboration, risk-sharing, and incentives that shift behaviour and accelerate adoption and scaling. In the context of the rate of change the 4IR introduces to the world of work and by extension the PSET system, there is both a requirement and an opportunity for innovation in financing that can then leverage changes to how education and training occur. To meet the opportunities and challenges that the 4IR present, alternative pathways to PSET are required that are cheaper, quicker, more accessible, and require funding to scale. These should not necessarily seek to introduce new money into the system but rather direct existing budgeting allocations to cost-effective models that can quickly and efficiently upgrade the employability of youth and transition them into the income-generating opportunities that the 4IR presents, and which need human capital.

## **Rapid introduction of new educational opportunities to model the change**

### **Expanding the supply of digital skills**

We need to grow the pool of youth, and especially, young women, ready to take up digital opportunities. If this is to be done at a scale that meets demand, then universities cannot be the only pathway to employment in these types of jobs. Scalable, alternative skills development opportunities are required – accessible to excluded youth and capable of shifting the distribution of digital opportunities currently skewed to those who can afford expensive educational investments. These must be agile, relevant, and streamlined interventions that can provide entry into multiple pathways and provide alternatives (to degrees) but credible credentials for employers.

Access to these educational opportunities needs to change so that, where feasible, eligibility does not always rely on mathematics, science, or a degree, especially for entry-level jobs. Continuing to rely on these proxies will only serve to reinforce the existing exclusion of youth from digital opportunities and will be insufficient to meet the demand for digital skills at lower levels. This means that employers (and PSET institutions) need to change their hiring-selection practices and find new ways to screen and match young people for opportunities. A specific proposal that could be implemented in partnership with the Presidential Youth Employment Intervention (PYEI) is to implement a prototype programme of accelerated digital skilling for 100 000 young people 'not in employment, education, or training' (NEETs) into entry-level digital roles. In parallel, this short-term skills development strategy could be accompanied by prototyping of a more agile credentialing mechanism in two sectors (digital jobs and

global business services [GBS]) that functions as a proof-of-concept (i.e. that agile credentialing can help address the skills mismatch between supply [work seekers] and demand [employers]) and can then be adapted for other sectors. These two initiatives should respectively aim to match work seekers with at least 100 000 digital jobs, and 80 000 GBS jobs, in five years.

### Targeted open learning programmes to support employment growth

South Africa urgently needs to find solutions to its massive and growing employment crisis. Consultative processes with the community education and training (CET) and technical and vocational education and training (TVET) sectors have determined that there is significant potential to harness open learning in those sectors both to increase access to PSET learning opportunities, align those opportunities more closely with the needs of the labour market and help to drive growth in employment among those currently most adversely affected by the 4IR, and improve the quality of educational courses and programmes. Consequently, we propose a selective approach to the implementation of open learning approaches in the CET and TVET college sectors. This would incorporate the following key aspects:

- 1) Open learning could be harnessed to provide an integrated mechanism for expanding access to high-quality CET and TVET programmes and short courses in key areas of national need.
- 2) Specific programmes and short courses for development using open-learning principles could be identified according to:
  - (i) their alignment with key economic sectors identified in the NDP and other key government strategies to accelerate economic growth and development in South Africa;
  - (ii) the potential for employment growth in that sector so that graduates of identified programmes have a meaningful prospect of becoming economically productive on completion of programmes; and
  - (iii) their potential to scale significantly.
- 3) When designing and implementing national programmes and short courses using open-learning principles, the Department of Higher Education and Training (DHET) should work closely with colleges to ensure implementation is both sustainable and financially viable.
- 4) Policy and financing mechanisms should be established to facilitate cooperation and collaboration between colleges in programme design and delivery.

### Recommendations

South Africa faces unprecedented challenges as it grapples with the challenges and opportunities presented by the 4IR. Responding to these challenges cannot be achieved through slow, incremental change. The economic headwinds we face and the relentless pace of technological change precipitated by the 4IR mean that we have to respond in kind, with purpose and speed. To do so will require a willingness to reconsider many of the core principles and operational models on which the PSET system is currently based. Considering this, the Ministerial Task Team on the 4IR (MTT on 4IR) recommends the following:

- 1) **The DHET should, as a matter of urgency, integrate the recommendations contained in this report into its current draft National Plan for PSET to develop an overarching PSET Reform Plan** that recognises the serious operational problems outlined in this report and proposes concrete strategies for an overhaul of the current PSET system. As the draft plan is already under consideration by the Minister, this is a perfect opportunity to integrate affordances for the 4IR into the final plan.
- 2) **Establish small, cross-sectoral teams as soon as practically possible to commence planning and implementation of new educational opportunities**, such as those outlined above to model the PSET change proposed in this report, with one team focusing on skills development strategies, digital jobs and global business services and another on open-learning programmes and short courses in the TVET sector.

- 3) In implementing the above two recommendations, urgently **convene a suitable mission board to integrate research and innovation into the PSET reform plan**. The mission board should include science councils like the Council for Scientific and Industrial Research (CSIR) and Human Sciences Research Council (HSRC), relevant research chairs, key stakeholder groups, including students and PSET management, technology companies, international experts, and partner departments.
- 4) **Convene a meeting of the three quality councils (QCs), the two Departments of Education, and key non-profit and private sector actors to begin planning a review and reform of credentialing and quality assurance processes in PSET** to align them more effectively with the long-term needs of the PSET system and its students.
- 5) **Commission a review of all PSET policies and legislation** to enable clear identification of all the policy and legislative provisions that present impediments to the kind of systemic transformation envisaged in this report. The highest priority should be given to streamlining and simplifying the PSET policy environment in response to this review.
- 6) In parallel with the above processes, **develop and implement flexible programmes of professional development support**, making these widely available to institutions, educational staff, support staff, and quality council staff to enable ongoing reskilling in preparation for the changes that will need to be made in the PSET system as the PSET Reform Plan rolls out.
- 7) **Develop an integrated ICT plan for the PSET system** that includes the provision of affordable ICT devices and connectivity to all PSET students to ensure equitable access to learning opportunities made possible through the affordances of the 4IR. This should be an integrated section of the finalised national plan for PSET mentioned in Recommendation 1 above.
- 8) **Establish a mission board** as a matter of urgency to finalise proposals for one or more research and innovation missions for inclusion in the first decadal plan for science, technology, and innovation (STI).



# 1

## Introduction

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In a 2018 budget speech, the then Minister of Higher Education and Training, Dr Naledi Pandor noted that ‘we are in the age of the pervasive influence of emerging technologies and artificial intelligence and need responsive skills and development research focus and investment to benefit fully’. These trends and their unfolding social and economic effects have come to be known as the Fourth Industrial Revolution (4IR) and are already having massive implications for how we live, how we interact with each other, how we learn, and how we work. Similarly, they have significant consequences for education systems globally and in South Africa.

While some institutions and individuals in this country have begun to engage with the effects of the 4IR on post-school education and training (PSET), there has not yet been any systematic response. To this end, a Ministerial Task Team on the Fourth Industrial Revolution (MTT on 4IR) was established to advise the Minister of Higher Education and Training (the Minister) the implications of the 4IR for the South African PSET system.

### Terms of reference

The purpose of the MTT on 4IR is to advise the Minister on how the PSET system should take up opportunities presented by the 4IR. Its objectives are to:

- Understand the possible impact of the 4IR on society as a whole and its implications for the PSET system.
- Explore implications of the 4IR for the labour market and skills planning (for example, identifying new and emerging occupations, as well as ‘dying’ occupations) and the implications of these insights for the kinds of qualifications and programmes that the PSET system should offer.
- Identify current 4IR initiatives in institutions in the PSET system (significant programmes directed at taking advantage of the 4IR) as well as external initiatives impacting the PSET system.
- Analyse the impact of the 4IR on the PSET system, particularly:
  - The potential of the 4IR to improve pedagogy in PSET institutions and an accompanying need to ensure that pedagogies are ‘modernised’;
  - Updating of PSET curricula to be responsive to changing dynamics in the context of the 4IR;
  - Enabling of lifelong learning and continuous upskilling and reskilling of academics and educators in the PSET system;
  - Implications for changes to existing information and communication technology (ICT) infrastructure and connectivity; and
  - Implications for digitisation, open educational resources, and open learning.
- Identify priority areas and interventions that should be undertaken by the Minister of Higher Education and Training to advance digital skills and their absorption in society.

The MTT on 4IR was gazetted on 7 June 2019. Details of members of the task team are contained in Appendix One.

While the MTT was undertaking its work, a macro re-organisation of the State resulted in the appointment of a minister for the combined functions of Higher Education and Training, and Science and Innovation, Dr Blade Nzimande. In a meeting in early January 2020, the Minister met the MTT to review the task team's mandate and progress in its work. Considering his responsibilities over two departments, that is, the Department of Higher Education and Training (DHET) and the Department of Science and Innovation (DSI), he noted the importance of ensuring that the task team should include reflections on how best:

- 1) The National System of Innovation (NSI) can be mobilised to support the transformation of the PSET system in the face of rapid technological development;
- 2) Academics/educators and students can be equipped to prepare for a world of work that is rapidly changing and where such change is both fundamental and uncertain (building capacity for functioning in a 4IR-world); and
- 3) To embrace the affordances of the 4IR in the PSET system, how it is managed, administered and equipped, how teaching and learning take place, and how assessment is done.

## Policy context

The MTT on 4IR recognises that this report and its recommendations exist within a broader national policy context that is both aspirational and practically relevant. This section maps out the relevant policy and legislation. This policy context should be understood in the context of pre-existing and growing inequalities across all levels of South African society, which are often magnified in education.

The current policy context is framed by the *National Development Plan 2030* (NDP), which defines long-term government priorities and objectives for the development of South Africa. The NDP aims to eliminate poverty and reduce inequality by 2030. According to the plan, South Africa can realise these goals by drawing on the energies of its people, growing an inclusive economy, building capabilities, enhancing the capacity of the state, and promoting leadership and partnerships throughout society. All of these are approaches that likewise underpin the approach that this MTT has considered in assessing what will be required to transform the PSET system in the wake of rapid change across a range of technological domains.

Since the advent of democracy in South Africa, extensive policy development has taken place in the PSET sector to ensure that there are clear frameworks for the governance and implementation of education and training in the sector. This began with *White Paper 3: A programme for the transformation of Higher Education* (1997), a framework for the extensive transformation of South Africa's post-apartheid higher education and training sector into a system that is planned, governed and funded as a single national coordinated system.<sup>3</sup> The white paper forms the basis for many of the policy imperatives for PSET transformation in South Africa. It was followed by the *National Plan for Higher Education* (2001), which outlines the framework and procedures for implementing and realising the policy goals set out in the white paper.<sup>4</sup>

More than a decade later, the *White Paper for Post-school Education and Training* (2013) created a vision for the type of PSET system that the government aims to achieve by 2030. It outlines strategies to improve the PSET system's capacity to meet South Africa's growing and diverse needs. The document highlights policy directives to guide the DHET and institutions that fall under its purview in building 'a developmental state with a vibrant democracy and a flourishing economy'.<sup>5</sup> The main policy objectives are as follows:

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- 3 Ministry of Education, South Africa. (1997). Education White Paper 3: a programme for higher education transformation. Retrieved from: <https://www.justice.gov.za/commissions/FeesHET/docs/1997-WhitePaper-HE-Transformation.pdf>.
  - 4 Ministry of Education, South Africa. (2001). National Plan for Higher Education. Retrieved from: [https://www.ru.ac.za/media/rhodesuniversity/content/institutionalplanning/documents/National\\_Plan\\_for\\_Higher\\_Education\\_in\\_South\\_Africa\\_2001.pdf](https://www.ru.ac.za/media/rhodesuniversity/content/institutionalplanning/documents/National_Plan_for_Higher_Education_in_South_Africa_2001.pdf).
  - 5 Department of Higher Education and Training. (2013). White paper for post-school education and training: building an expanded, effective and integrated post-school system. Retrieved from: <http://www.dhet.gov.za/SiteAssets/Latest%20News/White%20paper%20for%20post-school%20education%20and%20training.pdf>.

- A post-school system that can assist in building a fair, equitable, non-racial, non-sexist and democratic South Africa;
- A single, coordinated PSET system;
- Expanded access, improved quality and increased diversity of provision;
- A stronger and more cooperative relationship between education and training institutions and the workplace; and
- A PSET system that is responsive to the needs of individual citizens and employers in both public and private sectors, as well as broader societal and developmental objectives.<sup>6</sup>

Following the 2013 White Paper, the 2014 *Policy Framework on Differentiation in the South African Post-school System* provides clear government steering in terms of planning, quality assurance, and funding of the PSET sector. It considers several contextual factors, including ‘market forces, geographical location; and institutional strategies linked to an applicable mission statement; social or community expectations and pressures; internal dynamics, legacies and the capacities of the institutions.’<sup>7</sup> The document argues that differentiation in the PSET sector is necessary for both students and institutions. For the former, because it ensures access for a diverse group of students and, for the latter, because it gives institutions a chance to focus on areas of strength.<sup>8</sup>

The *Policy Framework for the Realisation of Social Inclusion in the Post-School Education and Training System* (2016) aims to assist PSET institutions to implement social inclusion measures as the country continues to battle longstanding historical and present-day inequalities in education access, experience and performance.<sup>9</sup> Social inclusion takes account of ‘socio-economic background, age, disability, language, ethnic or racial origin, religion and any other form of belief’.<sup>10</sup>

The draft *Open Learning Policy Framework for Post-School Education and Training* (2017) follows the directives of the White Paper for Post-School Education and Training. It outlines DHET’s strategic intent to steer the national PSET system towards increasing widespread access and improving the quality of education, while ensuring that this access is cost-effective, through open learning. The policy covers intentions for the entire PSET system, including universities, technical and vocational education and training (TVET) colleges, community education and training (CET) colleges, as well as skills providers.<sup>11</sup> The framework was released for comment in 2017.

Within this context, the PSET policy environment has also sought to tackle pervasive social issues through policy interventions, such as the *Policy Framework to Address Gender-Based Violence in the Post-School Education and Training System* (2019)<sup>12</sup> and the *Strategic Policy Framework on Disability for the Post-School Education and Training System* (2018).<sup>13</sup> Other policies that the government has introduced include the *Policy for the Post-School*

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6 Taken verbatim from Department of Higher Education and Training. (2013). White paper for post-school education and training: building an expanded, effective and integrated post-school system. Retrieved from: <http://www.dhet.gov.za/SiteAssets/Latest%20News/White%20paper%20for%20post-school%20education%20and%20training.pdf>.

7 Department of Higher Education and Training. (2014). Policy framework on differentiation in the South African post-school system. Retrieved from: <http://www.dhet.gov.za/Gazette/Policy%20Framework%20on%20Differentiation%20in%20the%20South%20African%20Post%20School%20System.pdf>.

8 Department of Higher Education and Training. (2014). Policy framework on differentiation in the South African post-school system. Retrieved from: <http://www.dhet.gov.za/Gazette/Policy%20Framework%20on%20Differentiation%20in%20the%20South%20African%20Post%20School%20System.pdf>.

9 Department of Higher Education and Training. (2016). Policy framework for the realisation of social inclusion in the post-school education and training system. Retrieved from: <http://www.dhet.gov.za/SiteAssets/Latest%20News/2017/January/Gazetted-Policy-Framework-for-the-Realisation-of-Social-Inclusion-in-PSET-No40496-Notice-no-1560.pdf>.

10 Ibid., p. 38.

11 Department of Higher Education and Training. (2017). Open learning policy framework for post-school education and training. Retrieved from: [https://www.gov.za/sites/default/files/gcis\\_document/201704/40772gon335.pdf](https://www.gov.za/sites/default/files/gcis_document/201704/40772gon335.pdf).

12 Taken verbatim from Department of Higher Education and Training. (2019). Policy framework to address gender-based violence in the post-school education and training system. Retrieved from: <http://www.dhet.gov.za/SiteAssets/2019-04-15%20GBV%20Policy%20and%20Strategy%20Framework%20for%20the%20PSET%20Sector%20Ver%204%20For%20public%20comments.pdf>.

13 Department of Higher Education and Training. (2018). Strategic policy framework on disability for the post-school education and training system. Retrieved from: <http://www.dhet.gov.za/SiteAssets/Gazettes/Approved%20Strategic%20Disability%20Policy%20Framework%20Layout220518.pdf>.

*Education and Training Central Application Service* (2017)<sup>14</sup> and the *Draft Post-School Education and Training Information Policy* (2018).<sup>15</sup>

The 2019 *White Paper on Science, Technology and Innovation* (STI) charts a new path for the NSI, with a strong emphasis on inclusion, transformation, and partnerships. The white paper proposes a package of policy measures to strengthen the contribution of innovation in South African society and government, improve policy coherence and budget coordination, and expand the research system.<sup>16</sup>

The 2019 White Paper on STI aligns with new and evolving thinking on innovation policy and practice. This thinking emphasises the need for innovation to engage proactively in the transformation of various systems of provision, such as transport, energy, healthcare, food, education, and finance, to meet human needs effectively and sustainably.<sup>17</sup> Innovation interventions are therefore best targeted at the level of socio-technical systems grounded in a transdisciplinary approach. A significant new approach currently being deployed is the use of focused and targeted research and innovation missions.

For missions to create an impact with societal relevance, flexibility is needed. In some areas, a mission should trigger action to speed up progress in the development of technologies to increase their societal impact. In other areas, the mission should drive a systemic change. Most likely, ambitious missions that have the potential to have a wide societal impact will need a combination of both.<sup>18</sup>

Complementing the approach of missions are theoretically grounded practices on how best innovation can be mobilised to support a fundamental transformation of socio-technical regimes. Socio-technical systems are characterised by strong and vested interests, as well as legacy processes, institutions and technologies, and where societal norms and values reinforce the existing system. There is growing evidence, accelerated by the current Covid-19 crisis, that the education socio-technical system (both basic and post-school) is at the early stages of a fundamental transformation enabled by innovation. The core challenge is what arrangements and processes can provide directionality to the transformation in ways that maximise overall social returns, including new opportunities for economic activity and where existing inequalities are not reinforced.<sup>19</sup>

The MTT on 4IR recognises this robust policy environment and has sought to locate its recommendations within the current policy environment wherever possible, while also noting that some aspects of existing policy require modifications to enable some of the systemic and operational restructuring proposed in this report.

The work of the task team is also located within an unfolding tapestry of initiatives linked to the 4IR. Government has launched several initiatives aimed at capacity-building as well as research and development in 4IR and related fields. The draft *National Digital and Future Skills Strategy* (2020)<sup>20</sup> presents a vision of a South Africa in which all its people are able to benefit from enhanced digital skills, thereby contributing to a significantly better quality of life, improved education, and higher economic growth. Digital skills blended with originality, agility, critical thinking and problem-solving are key skills sets required for the creation of new kinds of 21st-century jobs. This strategy sets out a structured series of initiatives intended to contribute to the capacities of South Africans to meet the challenges arising from the increasing deployment and adoption of digital technologies in the economy and society by using 4IR technologies.

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14 Department of Higher Education and Training. (2017). Policy for the post-school education and training central application service. Retrieved from: [https://www.gov.za/sites/default/files/gcis\\_document/201711/41226gon1224.pdf](https://www.gov.za/sites/default/files/gcis_document/201711/41226gon1224.pdf).

15 Department of Higher Education and Training. (2018). Draft post-school education and training information policy. Retrieved from: [http://www.dhet.gov.za/Information%20Systems%20Coordination/Draft\\_Review\\_Information\\_Policy\\_21\\_Feb\\_2018%20\(1\)%20\(3\).pdf](http://www.dhet.gov.za/Information%20Systems%20Coordination/Draft_Review_Information_Policy_21_Feb_2018%20(1)%20(3).pdf).

16 Andoh, H. (2019). South Africa's new science policy holds promise, but there are gaps. *The Conversation*, 10 April 2019. Retrieved from: <https://theconversation.com/south-africas-new-science-policy-holds-promise-but-there-are-gaps-115078>.

17 Schot, J., Daniels, C., Torrens, J. and Bloomfield, G. (2017). Developing a shared understanding of transformative innovation policy. Retrieved from: <http://www.tipconsortium.net/wp-content/uploads/2018/04/TIPC-Research-Brief.-Developing-a-Shared-Understanding-of-Transformative-Innovation-Policy-FINAL.pdf>.

18 Mazzucato, M. (2018). Mission-oriented research and innovation in the European Union: a problem-solving approach to fuel innovation led growth. Brussels: European Commission. Retrieved from: [https://ec.europa.eu/info/sites/info/files/mazzucato\\_report\\_2018.pdf](https://ec.europa.eu/info/sites/info/files/mazzucato_report_2018.pdf).

19 Department of Science and Technology. (2019). White paper on science, technology and innovation. Retrieved from: [https://www.dst.gov.za/images/2019/WHITE\\_PAPER\\_ON\\_SCIENCE\\_AND\\_TECHNOLOGY\\_web.pdf](https://www.dst.gov.za/images/2019/WHITE_PAPER_ON_SCIENCE_AND_TECHNOLOGY_web.pdf).

20 Department of Telecommunications and Postal Services. (2020). Draft national digital and future skills strategy: originality, agility, critical thinking and problem solving for digital inclusion. Pretoria: DTPS.

With respect to innovation, the government continues to support efforts to build capability and capacity in the full range of technology domains that characterise the 4IR. The MTT is aware of complementary efforts to assess capabilities within the NSI and how such capabilities can be better coordinated, have greater focus and directionality, and where critical mass can be achieved. This includes the foresight study for STI published by the National Advisory Council on Innovation<sup>21</sup> in November 2019 that identifies nine priority STI domains, one of which is *Education for the Future*.

There are also efforts to facilitate South Africa’s (government, industry, and society) effective participation in shaping critical technology governance challenges. This includes the establishment of an Affiliate Centre to the World Economic Forum’s (WEF) Centre for the Fourth Industrial Revolution as a multi-stakeholder forum.

Government is planning on introducing new subjects at schools to ensure that students are ready for careers which will incorporate 4IR-related technologies, including data science and analytics, AI, blockchain, additive manufacturing, robotics, and quantum computing.<sup>22</sup> Details of additional government initiatives are presented in Appendix 3.

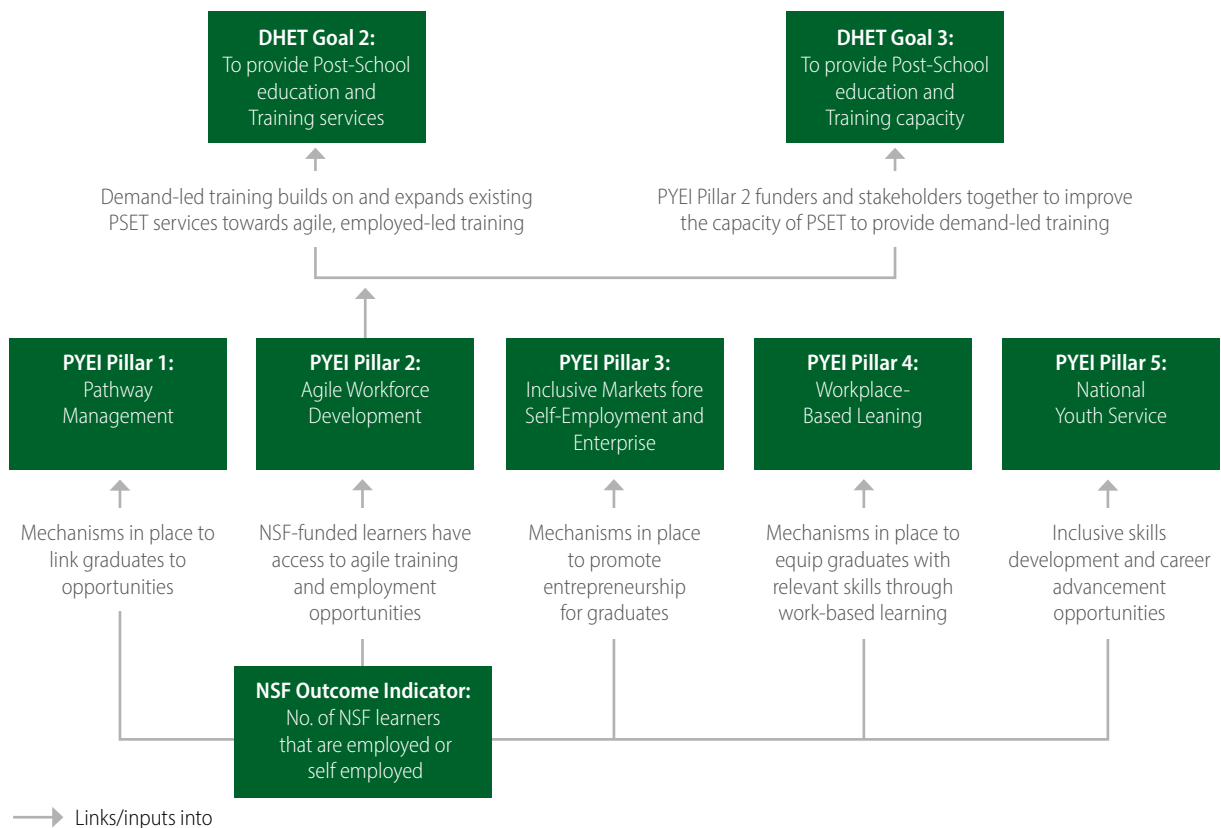
The work of the task team is also contextualised by the signing of the Presidential Jobs Summit Framework Agreement in October 2018 and the Presidential Youth Employment Intervention (PYEI); a programme of action supported by business, government, labour, and community partners to deliver inclusive growth and job creation. In addition to institutionalising a national pathway management model to provide young people with access to jobs and self-employment, other priorities include solutions to absorb youth into growth sectors, enabling township economies, accelerating paid work experiences and work-integrated learning programmes, and opportunities for youth service.

The DHET and National Skills Fund (NSF) plan to deliver skills training for South Africans that align with the goals of the PYEI. The DHET and NSF have identified initiatives and activities in their respective strategic plans to drive skills

21 Department of Science and Innovation and National Advisory Council on Innovation (2019) *South Africa foresight exercise for science, technology and innovation*. Retrieved from: <http://www.naci.org.za/wp-content/uploads/2020/07/South-African-Foresight-Exercise-For-Science-Technology-and-Innovation-2019.pdf>

22 South African Institute for Professional Accountants. (2020). South Africa builds its “Capable 4IR Army”. Retrieved from: <https://www.saipa.co.za/south-africa-builds-its-capable-4ir-army/>.

**FIGURE 1: Alignment of DHET’s goals to the Presidential Youth Employment Intervention**



development for employment creation. Both the DHET and the NSF are working towards Outcome 5 of the 14 government outcomes defined in the Medium-Term Strategic Framework (MTSF), namely, A skilled and capable workforce to support an inclusive growth path.

To achieve these MTSF outcomes, the DHET and NSF have both identified strategic outcome-oriented goals. As depicted in Figure 1 above, the PYEI youth training initiatives across all pillars are closely aligned to the DHET and NSF strategic objectives. This is consistent with PYEI's ambition to be complementary to, and aligned with, existing programmes. In particular, DHET's Goal Statement 2 and 4 both position the DHET towards improving the quality and capacity of the PSET system (an ambition that can be advanced with successfully partnering on innovative training programmes, such as Agile Workforce Development), and to increasing access to skilling opportunities for the many youths who are not currently accessing TVET or higher education.

## **Scope of the report**

Using the above policy context as its point of departure, this report commences by defining the 4IR and explaining its relevance for South African society, as well as what broad opportunities and challenges it poses. It also explores general implications that these social developments will have for education globally, before analysing the specific role for PSET in leveraging the opportunities and mitigating the challenges.

From there, the report explores how well prepared the South African PSET system is to fulfil these roles as a precursor to setting out a proposed vision for a future PSET system. It argues the need for a three-track strategy for PSET systems reform: (i) growing and skilling the digital economy and enabling South African society to leverage the developmental benefits that can flow from that growth; (ii) supporting strategies to drive large-scale employment growth for all South Africans; and (iii) ensuring the PSET system supports efforts to build an engaged and empowered citizenry who are better able to adapt to ongoing and uncertain technology-fuelled change. Large-scale employment growth will require a focus on those who are currently either under- or unemployed and whose current education provides limited to no opportunities for meaningful social reintegration. With this vision defined, the report concludes by presenting practical steps that can be taken, both in the short and long term, to attain the vision.

As this report has been finalised while South African society has been in the initial phases of a lockdown to mitigate the effects and spread of the Covid-19 virus, the MTT on 4IR is cognisant that the unfolding social and economic consequences of the virus will have deep and lasting effects on South African society. It will exacerbate the severe social stresses that many South Africans already encounter in their daily lives while drawing more South Africans than ever before into social and economic distress.

As such, the MTT on 4IR believes that there will be an urgent demand for a new social contract in South Africa, in which all citizens – and particularly those with the means, skills, and education to contribute – will be called upon to play unprecedented roles in rebuilding our society. We see this as a critical opportunity to reset our political vision, economic priorities, and social values, as well as to lay the platform for a more equitable and inclusive country that provides opportunities for all. We see the restructuring of the PSET system to leverage the opportunities of the 4IR towards this end as a critical pillar of this programme of social reconstruction and thus have incorporated proposals to attain this, both in our vision of a restructured PSET system and in our recommendations for action.

# 2

## Unpacking the Fourth Industrial Revolution

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The world is on the threshold of the so-called Fourth Industrial Revolution, with origins in the concept of Industry 4.0. Industry 4.0 was first used in 2011 at the Hannover Fair in Germany by Prof. Wolfgang Wahlster, Director and CEO of the German Research Centre for Artificial Intelligence. It has subsequently morphed into the concept of the 4IR, championed by Klaus Schwab and popularised by the WEF.

The 4IR is based on the confluence of multiple digital, physical, and biological technologies that are disrupting how we live, work, and interact. Emerging thinking is that the 4IR is powerful and transformative because it is based not only on the *technology revolution* sweeping the world, but also on the *transformation of society*, and on *new ways of doing business and governing*, as illustrated in Figure 2.

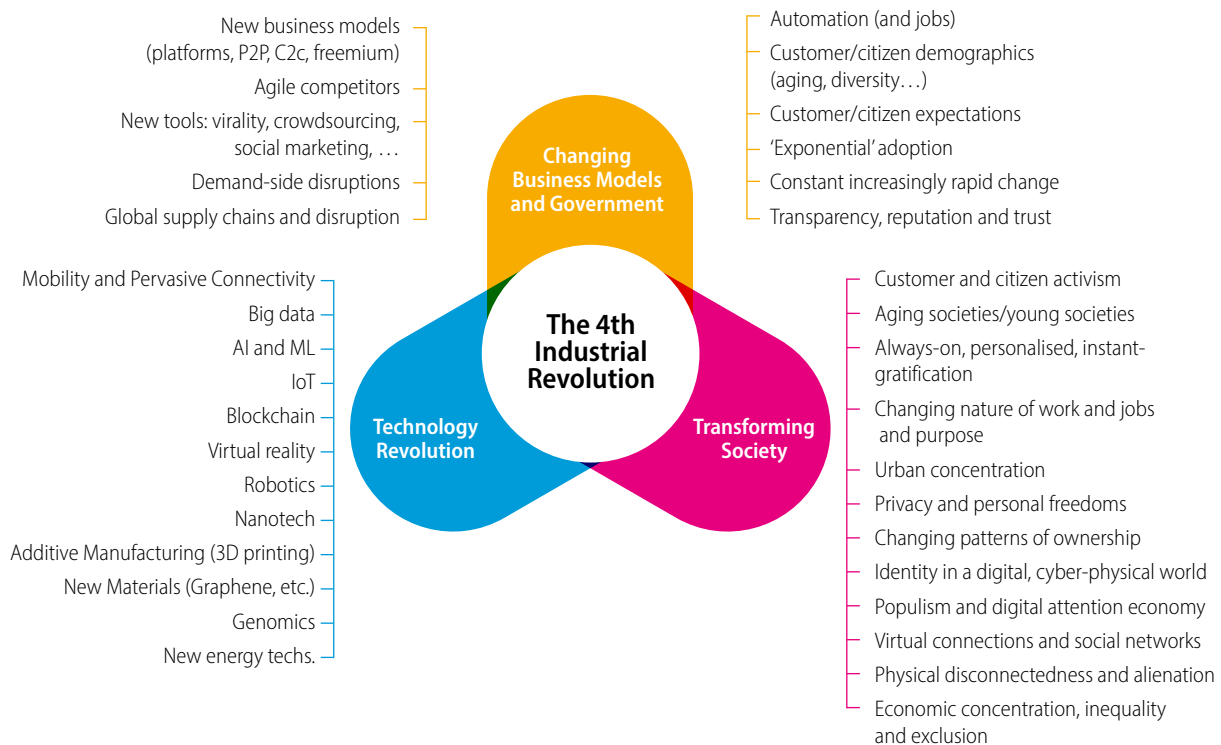
It is this intersection between the technology revolution, a transforming society, and radically new ways of doing business and governing that make the 4IR so disruptive and transformative. As a country, South Africa needs to identify and excel in targeted areas of technical and scientific disciplines that best align with the South African development agenda. Within broad disciplines, there is a need to target competitive and comparative advantage within broad areas such as artificial intelligence (AI), software sciences, data sciences, robotics, communications, virtual reality, genetics, bioinformatics, and key areas of social science, including language studies, economics, social policy, and the changing nature of livelihoods.

But we also need to understand and excel in the sciences and arts at the intersection of these enabling disciplines with our transforming society and new ways of doing business. It is mostly through these intersections that real value is created and economic transformation manifests itself. We therefore also need to find the right models to explore and improve our capabilities in integrative, trans-disciplinary theory and practices. Sciences like systems thinking and complexity and design thinking have historically been underemphasised. Convergent applications, for example, in financial technology, digital government, e-commerce, new media, e-health, e-education, 'manufacturing 4.0', digital mining, and digital arts, need to be nurtured and scaled. Before understanding the role of PSET in supporting this, it is worth unpacking the concept of the 4IR in more detail.

### **What is the Fourth Industrial Revolution?**

Since the origins of the human species in Africa, our ability to wield tools has enabled us to survive global climate shifts, adapt to a range of environmental conditions, and expand our population across the habitable surface of our planet. Our ancestors made stone tools, controlled fire, domesticated animals, developed agriculture, and learned to manipulate metals. Knowledge was shared locally in relatively small isolated groups. All this took place over a couple of million years.

**FIGURE 2: Elements of the 4IR**



Source: Armstrong<sup>23</sup>

By comparison, in the past few hundred years, we have evolved our capabilities from controlling fire to harnessing energy, which has enabled us to build engines and power machines. Most recently, we have represented our systems of language and logic in machines with information storage and computing capabilities and then connected these systems in a communications network that is global, even including devices that send information back from other locations in and beyond our solar system.

These developments have been grouped into so-called ‘revolutions’;<sup>24</sup> the first being driven by steam-power, the second electricity, the third computing, and the fourth connectivity. In economic terms, these revolutions have been associated with mechanisation, mass-production, digitisation, and data as currency, respectively.

The 4IR is the current and developing environment characterised by a range of new technologies that are blending the physical, digital, and biological worlds.<sup>25</sup> This has led to the emergence of cyber-physical systems (CPS) which refers to a fusion of technologies, including, AI, cloud computing, robotics, genome editing, 3D printing, augmented and virtual reality, the Internet of Things, and advanced wireless technologies.<sup>26</sup> It represents a fundamental change in the way we live, work, and relate to one another, and is impacting all disciplines, economies, and industries.<sup>27</sup> While there is general agreement that fundamental changes are underway, commentaries and predictions about what these changes mean and their implications for society reveal wide-ranging perspectives and disagreements.<sup>28</sup>

23 Armstrong, B. (2020). Towards a skills framework for the 4th IR. Working Paper, Wits Business School.  
 24 The word ‘revolution’ evokes an abrupt change that occurs over a short time. However, this description could be inaccurate because these revolutions could be a total sum of a culmination of evolutions over a longer time horizon. Looking back, they appear as single incidents, whereas they are a series of events in real time. Thus, we acknowledge that these revolutions represent our historical perspective of evolutions that we have compressed into a single event.  
 25 World Economic Forum. (no date). The Fourth Industrial Revolution by Klaus Schwab. Retrieved from: <https://www.weforum.org/about/the-fourth-industrial-revolution-by-klaus-schwab>.  
 26 Ndung’u, N. and Signé, L. (2020). The Fourth Industrial Revolution and digitization will transform Africa into a global powerhouse. Retrieved from: <https://www.brookings.edu/research/the-fourth-industrial-revolution-and-digitization-will-transform-africa-into-a-global-powerhouse/>.  
 27 World Economic Forum. (no date). The Fourth Industrial Revolution by Klaus Schwab. Retrieved from: <https://www.weforum.org/about/the-fourth-industrial-revolution-by-klaus-schwab>.  
 28 For a helpful discussion of these debates, see: Bessant, J. (2018). The great transformation, history for a techno-human Future. Abingdon: Routledge.

What we do know is that the 4IR is rapidly changing the way humans create, exchange, and distribute value,<sup>29</sup> resulting in systemic change across many sectors and aspects of human life, with cross-cutting social, political, cultural, and economic implications. Importantly, the speed, breadth, and depth of this revolution are forcing us to rethink how countries develop, and how organisations create value.

### Example 1 Estonia

Estonia, albeit a small country, is the exemplar. Here, taxes are completed online within 5 minutes, 99% of Estonia's public services are web-available 24 hours a day, and nearly 50% of citizens vote online. A key feature of Estonia's digital society worth emulating is the e-Residency, a unique initiative which allows individuals to start businesses in the country without living there. Estonia is now a launch pad to the European Union (EU), with over 66 000 e-Residency businesses.

Source: <https://e-estonia.com>.

We are thus living in an unprecedented era. Our population and our technological capabilities are growing rapidly and the industry supporting this growth is having a significant impact on our planet's climate. The uncertainty associated with a complex and rapidly evolving global system means that we simultaneously face possibly the greatest challenges and opportunities that our species has ever confronted. The effect is societal transformation at all levels of societies:

By affecting the incentives, rules, and norms of economic life, it transforms how we communicate, learn, entertain ourselves, and relate to one another and how we understand ourselves as human beings. Furthermore, the sense that new technologies are being developed and implemented at an increasingly rapid pace has an impact on human identities, communities, and political structures. As a result, our responsibilities to one another, our opportunities for self-realisation, and our ability to positively impact the world are intricately tied to and shaped by how we engage with the technologies of the Fourth Industrial Revolution. This revolution is not just happening to us – we are not its victims – but rather we have the opportunity and even responsibility to give it structure and purpose.<sup>30</sup>

The structure and purpose have been approached in different ways around the world. For example, Japan is already working towards 'Society 5.0' which is defined as a 'human-centred society that balances economic advancement with the resolution of social problems by a system that highly integrates cyberspace and physical space.'<sup>31</sup> Central to Japan's approach is human wellbeing and the resolution of social problems. As is discussed below, the 4IR has the potential either to increase or decrease existing social inequalities, depending on how countries respond, and can intentionally harness the technological developments to achieve their social goals. Peters (2017) reminds us that:

The digital revolution in and of itself will not transform education and if it does, it will not be entirely for the good. What is required in addition to new digital technologies and the emergence of massive digital systems that operate to centralise power is both political will and social vision to respond to the question: What is the role of [post-school education and training] in the digital age when technological unemployment becomes the rule rather than the exception?<sup>32</sup>

## What are its implications for societies?

Each industrial revolution changed how societies supported livelihoods, including the changes in paid and unpaid work, with rapid and fundamental change predicted for the current era. The 4IR differs from its predecessors because of its velocity, exponential rate, breadth, depth of convergence, and systems impact on industries, firms, governments, and societies.<sup>33</sup> This is manifesting in a shift from labour-intensive production to knowledge and skills-intensive production for which countries will need a ready pool of digital, technical, commercial, and management expertise

29 Schwab, K. (2018). The Fourth Industrial Revolution. Encyclopaedia Britannica, 2018. Retrieved from: <https://www.britannica.com/topic/The-Fourth-Industrial-Revolution-2119734>.

30 Ibid.

31 See: [https://www8.cao.go.jp/cstp/english/society5\\_0/index.html](https://www8.cao.go.jp/cstp/english/society5_0/index.html).

32 Peters, M.A. (2017). Technological unemployment: educating for the Fourth Industrial Revolution, *Educational Philosophy and Theory*, 49(1): 5. Retrieved from: <https://doi.org/10.1080/00131857.2016.1177412>.

33 Schwab, K. 2017. The Fourth Industrial Revolution. New York: Crown Publishing.

to harness and benefit from adoption and use of the associated emergent technologies.<sup>34</sup> There is expected to be a large-scale decline in some areas of paid work as tasks within these roles become automated or redundant, accompanied by growth in new products and services, and associated new tasks and paid work, generated by the adoption of new technologies.<sup>35</sup>

Peters (2017) notes that 'technological unemployment is undoubtedly an impending problem that will create greater inequalities and an increasing gap between the returns to labour and the returns to capital.'<sup>36</sup> In South Africa, for example, restructuring of the financial services labour market through retrenchment has begun, with several companies having made job loss announcements. These retrenchments were 'AI-driven', as job functionality changed (job shift) and jobs slowly disappeared (job extinction) due to task automation or displacement.

## Example 2 Job shift/skill shift

Job shift or skill shift is the notion of an occupation evolving in nature, design, and function over time. The evolution happens due to technological advances, activity obsolescence, or new processes. The more frequent the shift, the more likely the job will cease to exist in its current form. Measuring the shift in occupations is an important indicator of the change in job description. For example, the Insurance SETA and the Durban University of Technology have combined to monitor insurance sector job categories to develop a generalised tool to monitor this trend to identify 'at-risk' occupations. Retrenchment could then be mediated through cross- and retraining.

*Source: McKinsey Global Institute. (2018). Skill shift automation and the future of the workforce. Retrieved from: <https://www.mckinsey.com/featured-insights/future-of-work/skill-shift-automation-and-the-future-of-the-workforce>.*

However, there are growing demands for specific types of paid work, including data analysts and scientists, software developers, and e-commerce and social media specialists, roles that are significantly based on and enhanced by the use of technology. Other paid work opportunities that are expected to grow include those that leverage uniquely human skills, such as customer service workers, training and development specialists, and innovation managers. These will be further supplemented by an entirely new set of specialist roles related to understanding and leveraging the latest emerging technologies, such as AI and machine learning specialists, process automation experts, information security analysts, and blockchain specialists.<sup>37</sup> It is not only functional skills that are required; 'soft' skills (such as, creativity, originality, initiative, critical thinking, persuasion and negotiation) will retain or increase their value, as will attention to detail, resilience, flexibility, and complex problem-solving.<sup>38</sup>

In South Africa, skills already in demand include analytical thinking and innovation, creativity, originality and initiative, active learning and learning strategies, technology design and programming, complex problem-solving, leadership and social influence, reasoning, problem-solving and ideation, critical thinking and analysis, resilience, stress tolerance and flexibility, and emotional intelligence.<sup>39</sup> The World Bank categorises these skills into three sets: advanced cognitive skills, such as complex problem-solving; socio-behavioural skills, such as teamwork; and skill combinations that are predictive of adaptability, such as reasoning and self-efficacy.<sup>40</sup>

Not all new demand, though, is for digital jobs and skills. For example, the shift to online retail reduces demand for employment in the traditional retail sector (having been exacerbated and accelerated by unexpected social lockdowns triggered by the Covid-19 pandemic) but has grown demand for courier services, including many new

34 Trade and Industrial Policy Strategies. (2018). World Economic Forum and the Fourth Industrial Revolution. TIPS research report prepared for the Department of Trade and Industry, p. 11. Retrieved from: [https://www.tips.org.za/research-archive/trade-and-industry/item/download/1722\\_cf04f6a06c4e94caba97246ca4381357](https://www.tips.org.za/research-archive/trade-and-industry/item/download/1722_cf04f6a06c4e94caba97246ca4381357).

35 World Economic Forum. (2018). The future of jobs report, p. viii. Retrieved from: [http://www3.weforum.org/docs/WEF\\_Future\\_of\\_Jobs\\_2018.pdf](http://www3.weforum.org/docs/WEF_Future_of_Jobs_2018.pdf).

36 Peters, M.A. (2017). Technological unemployment: educating for the fourth industrial revolution, Educational Philosophy and Theory, 49(1): 2. Retrieved from: <https://doi.org/10.1080/00131857.2016.1177412>.

37 World Economic Forum. (2018). The future of jobs report, p. 9. Retrieved from: [http://www3.weforum.org/docs/WEF\\_Future\\_of\\_Jobs\\_2018.pdf](http://www3.weforum.org/docs/WEF_Future_of_Jobs_2018.pdf).

38 World Economic Forum. (2018). The future of jobs report, p. ix. Retrieved from: [http://www3.weforum.org/docs/WEF\\_Future\\_of\\_Jobs\\_2018.pdf](http://www3.weforum.org/docs/WEF_Future_of_Jobs_2018.pdf).

39 World Economic Forum. (2018). The future of jobs report, p. 96. Retrieved from: [http://www3.weforum.org/docs/WEF\\_Future\\_of\\_Jobs\\_2018.pdf](http://www3.weforum.org/docs/WEF_Future_of_Jobs_2018.pdf).

40 World Bank. (2019). World Development Report 2019: the changing nature of work. Washington, DC: World Bank, p.3. Retrieved from: <http://documents.worldbank.org/curated/en/816281518818814423/pdf/2019-WDR-Report.pdf>.

frontline workers required to deliver packages to customers. While some low-level digital skills are required for these frontline jobs, predominantly they are leveraging old skills to meet new demands, driven by possibilities introduced by the 4IR. With creative planning and appropriate incentives, there is no reason why the 4IR cannot contribute to creating many new jobs in similar ways for those people whose education levels currently exclude them from the mainstream economy – this will be essential to tackle the high levels of unemployment in the country.

Thus, the impact on paid work is not binary in terms of jobs added versus jobs lost. In many cases, the composition of skills required to perform a job will change.<sup>41</sup> The WEF estimates that, on average, in the next three years, nearly half of the skills required to perform a job will change.<sup>42</sup> Technological change makes it hard, though, to anticipate which job-specific skills will grow and which will become obsolete in the future,<sup>43</sup> thus requiring education and training systems to become far more agile and all people to expect to engage much more actively in lifelong learning as societies and economies transform.

It is not just jobs and required skills that are changing, but the way in which work is done. Instead of standard long-term contracts, digital technologies are giving rise to more short-term work, often via online work platforms that make certain types of work available on a more flexible basis. Access to digital tools such as laptops, tablets, and smartphones provides an enabling environment in which on-demand services can thrive.<sup>44</sup> Thus, the context of how we work and the tools used to get work done is changing. The WEF notes that:

Businesses are set to expand their use of contractors doing task-specialized work, with many respondents highlighting their intention to engage workers in a more flexible manner, utilising remote staffing beyond physical offices and decentralisation of operations.<sup>45</sup>

This marks a shift in the quality, location, format, and permanency of paid work. The 'gig economy'<sup>46</sup> is commonly associated with this restructuring of the employment relationship. However, while labour markets are becoming more fluid in advanced economies, informality continues to persist in emerging economies.<sup>47</sup> Derviş, at the Brookings Institute, argues that, given the breadth of informal work in developing countries, the shift from informal work to gig work is less about a shift in the *type* of work and more a shift in the *way* work is obtained. The gig economy, Derviş argues, is essentially the digitisation of informality.<sup>48</sup> While this brings some benefits, flexibilities, and efficiencies, it introduces significant socio-economic uncertainties for many people, particularly at the lower end of the economic spectrum. Thus, there is a need to construct a way forward for this growing flexibility in work arrangements that provides all people with a much greater sense of economic stability than is currently present in South African society.

Digitisation and technology are widely regarded as having a high potential to spur economic growth in South Africa and there is a growing demand for paid digital work, as well as niche 4IR skills. As a country, though, we will also need to be purposeful and proactive to ensure that these possibilities bring about greater social equity and socio-economic stability for all South Africans. Before the credit rating double downgrade and concurrent economic shutdown due to the Covid-19 pandemic, South Africa was already predicted to lose millions of jobs in the next decade because of increasing automation. In addition to unreliable power caused by mismanagement of the State-owned enterprise Eskom, bandwidth – the fuel of the 4IR – is many times more expensive in South Africa than other emerging economies. Furthermore, South Africa is in an area predicted to become more water-scarce due to

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41 Armstrong, B. (2020). Towards a skills framework for the 4th IR. Working Paper, Wits Business School.

42 World Economic Forum. (2018). The future of jobs report. Retrieved from: [http://www3.weforum.org/docs/WEF\\_Future\\_of\\_Jobs\\_2018.pdf](http://www3.weforum.org/docs/WEF_Future_of_Jobs_2018.pdf).

43 World Bank. (2019). World Development Report 2019: the changing nature of work. Washington, DC: World Bank. Retrieved from: <http://documents.worldbank.org/curated/en/816281518818814423/pdf/2019-WDR-Report.pdf>.

44 Ibid.

45 World Economic Forum. (2018). The future of jobs report, p. viii. Retrieved from: [http://www3.weforum.org/docs/WEF\\_Future\\_of\\_Jobs\\_2018.pdf](http://www3.weforum.org/docs/WEF_Future_of_Jobs_2018.pdf).

46 A gig economy is a free market system in which organisations contract with independent workers for a short-term engagement. The term 'gig' is a slang word meaning 'a job for a specified period of time' and was used typically by musicians.

47 World Bank. (2019). World Development Report 2019: the changing nature of work. Washington, DC: World Bank. Retrieved from: <http://documents.worldbank.org/curated/en/816281518818814423/pdf/2019-WDR-Report.pdf>.

48 Derviş, K. (2016). The future of work in the developing world. Brookings Institute Up Front Blog, 28 July 2016. Retrieved from: <https://www.brookings.edu/blog/up-front/2016/07/28/the-future-of-work-in-the-developing-world/>.

climate change, impacting cities already facing shortages, rural communities without infrastructure, and agriculture. Without a clear strategic shift in emphasis by all key social players in South Africa – government, the private sector, and civil society – these negative social trends will not be reversed.

South Africa has a population of almost 60 million people. Excluding those below six years of age and those in school, that leaves 40 million adults and an additional 1 million school-leavers annually who require ongoing PSET. Overall, the South African population is young, which magnifies the importance of investment in education and skills development to achieve social and economic development. Yet, the combined capacity of formal PSET institutions (excluding sector education and training authorities [SETAs]) is below 2 million students. Further, current demand for 4IR-related skills opportunities outstrips supply, with more job vacancies than graduates each year.

Young people are disproportionately affected by unemployment, at a rate of over 40%. Even in an optimistic growth scenario of 5% per annum over the next five years (which seems massively idealistic without purposeful action, given the combined effects of the Covid-19 pandemic and ongoing rating downgrades), it is estimated that there would still be 5.5 million unemployed youth in 2025.<sup>49</sup> Statistics SA's employment outlook has found that temporary employment rose from 2.6 million in 2017 to 3.9 million in 2018, a 50% rise, having grown by almost 500 000 over the last five years.<sup>50</sup> Thus, temporary and informal employment have risen significantly in recent years, and, given the high unemployment rate, are likely to remain the only opportunities for many young people in the future. However, the Covid-19 pandemic has severely affected even informal work and is likely to place new limits on opportunities for young people in this space. This type of economic uncertainty regarding the future is a major potential source of social destabilisation and requires focused efforts by all South Africans to be reversed. Critically, we must chart a future trajectory for the 4IR that sees solving these major social problems as its main long-term goal.

The 4IR is not a social phenomenon with a predetermined trajectory. While many commentators seek to highlight the negative social consequences of the 4IR (particularly in terms of job losses), we believe that the social effects of the 4IR will depend predominantly on *how* we, as South Africans, choose to harness it. The NDP 2030 already contains a strong vision for a future South Africa. If the values and principles on which this vision is based underpin the 4IR, its technologies and tools can be harnessed in a myriad of ways to create a better, more inclusive, wealthier South Africa that benefits all its citizens. Indeed, given the pressing challenges the country now faces, we believe we have no choice as its citizens but to embrace a new social contract to leverage the opportunities of the 4IR to achieve the vision of the NDP. If we do not do this, the compounding risks we face threaten to undermine all the progress we have made as a country since the advent of democracy.

Technology is a tool. The opportunities for using emerging technologies to solve challenges with unprecedented efficiency and scale far outweigh the risks of those technologies, provided we develop a skilled population who are thinking creatively: smart grids and solar energy for power provision; 3D printing of homes to mediate the housing crisis; new membrane technology and connected devices for water management; smart farming for urban food and biofuel production; and big data and drones for remote healthcare are just a few examples of the possibilities. And, if technology is the tool, then data is the fuel. The 4IR is an explosion of data. We can equip people to participate meaningfully in this data-driven world only if we provide them with access to education and training to navigate this surge of information and to build sustainable livelihoods for themselves regardless of their socio-economic or educational background.

## **What are the implications for PSET?**

A formal education system was adopted at scale as steam and electrically powered industry flourished and people with specific skills were required for a mass production era. While new content has been added, the classroom-based, learner-instructor system and methods of assessment remain largely unchanged. The 4IR is inspiring new ways of working, learning, and thinking. What are the implications for PSET?

New skills will be required to create, maintain, and leverage these new technologies. This will require the formal PSET system, working in partnership with government departments and employers, to repurpose and reconfigure curricula considering lifelong learning and the need for a broader and more agile PSET system to

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49 Harambee. (no date). Analysis of United Nations World Population Prospects and Statistics South Africa.

50 Harambee. (no date). Analysis of Statistics South Africa Quarterly Labour Force Survey Quarter 4, 2018 and Quarter 2, 2014.

respond to skills needs as they arise. These curriculum changes will also have to be coordinated with the primary and secondary school system, where much of the current curriculum has become increasingly irrelevant to the needs of its students.

### Example 3 Northeastern University, Boston, Massachusetts

Joseph Aoun, the President of Northeastern University, explains: 'that to stay relevant in the new economic reality, higher education needs dramatic realignment'. (p. xii). The university's curriculum is explicitly organised to address the educational challenges associated with employment and skills in the 4IR. Its formal institutional curriculum is an example of an explicit generic skills orientation and pedagogical approach. The university has designed what it claims is a unique human education (p. xvii). Labelled Humanics, the curriculum is based on experiential and lifelong learning, the use of digital technologies and workplace learning. Aoun describes the university's explicit focus on the acquisition of three types of literacy and four types of skill. Technological, data and human literacies are touted as the crucial new literacies that students have to acquire during their learning. The skills that will become increasingly valuable in the workplace are creative problem solving, conflict resolution, communication, and the ability to work on a team.

*Source: Aoun, J.E. (2017). Robot-proof: higher education in the age of artificial intelligence. Cambridge, Massachusetts: MIT Press.*

However, while technology has the potential to improve living standards, the impact is often unequally distributed. At the heart of the challenges we face is inequality in access to education and in the outcomes of education. While an agile skilling system can lead to breakthrough solutions that are needed to provide equitable solutions, the rapid change precipitated by the 4IR will likely perpetuate and increase inequality and social divide, if it is combined with a lagging education system. This is particularly so because many associated retraining and upskilling requirements are often focused on those who are already skilled or at least relatively well educated. Thus, the social consequences of the 4IR will demand much larger-scale access to education and training opportunities for all South Africans, with the focus on those who have been excluded from PSET historically or whose prior education has failed them, as well as with ongoing access for people to move in and out of PSET throughout their lives.

While large-scale and more flexible access to PSET is a priority, it is equally important to ensure that the education and training opportunities to which people have access are meaningful and relevant in the context of a rapidly changing world of work. The PSET system will need to shift from its current predominant orientation (content-focused programmes that prepare people at the beginning of their working lives for permanent employment) towards becoming more holistic, focused on developing a broader range of capabilities that are required for success at work, and enabling people to access ongoing, and increasingly flexible, learning opportunities throughout their lives. This will also prepare people for a lifelong learning orientation at the outset of their PSET careers. These programmes will need to focus not only on the socio-behavioural attributes that the 4IR is foregrounding as important (such as teamwork, curiosity), but the skills and attributes required for self-employment and lifelong learning, such as self-efficacy, resilience, and self-management.

The digitisation of the informal sector has produced a range of job-sharing platforms and marketplaces to source temporary work online. With the Covid-19 pandemic significantly impacting the informal sector, the fast-tracking of digitisation for this sector should be a priority. For employers, it is cost-effective to employ professionals to work on specific projects. For employees, gigging should offer lifelong learning, formal recognition of skills and experience, and the opportunity to develop interpersonal skills and technical expertise. However, this requires appropriate and responsive legislative interventions and regulatory frameworks, none of which are currently in place. Consequently, for many people, particularly at the lower end of the skills spectrum, gigging simply creates uncertainty, a lack of economic stability, and reduced responsibilities on the part of employers to attend to the wellbeing of their workers.

Shifts in the world of work need to be matched by ongoing development and modification of curricula and programmes/courses, as well as improved mechanisms to ensure their continued relevance. Armstrong breaks curriculum needs into three areas: (i) ICT and digital-specific skills; (ii) the continued importance of 'foundational' or basic skills which include traditional<sup>51</sup> industries and sectors; and (iii) 'soft' or complementary skills transferable across types of work.<sup>52</sup> Growing importance will be placed on collaboration and the ability to work across disciplines, as technologies themselves operate at the interface of various combinations of disciplines. Applying 4IR technologies

51 Traditional industries and sectors include, for example: agriculture, mining, manufacturing, construction, transport, utilities, wholesale, retail trade, business services, government services, administration, and so on.

52 Armstrong, B. (2020). Towards a skills framework for the 4th IR. Working Paper, Wits Business School.

in local contexts and contributing to future trends and technologies will require entrepreneurship, creativity, critical thinking, problem-solving, and lifelong learning. Equally important will be PSET opportunities that develop learners' ethical reasoning, empathy, social intelligence, curiosity, resilience, and adaptability.

This growing need for generic skills acquisition should not be confused with a move towards generic programmes and courses. Specialised skills, content, knowledge, and abilities will grow in importance and PSET institutions will need to play a critical role in providing access to them. Disciplinary bodies of knowledge remain at the core of effective PSET as, increasingly, does the need for inter-disciplinary engagement. Equally importantly, development of the generic skills outlined above happens most effectively within a situated educational context, rather than being taught in isolation. Thus, skills acquisition depends on a proper relationship with specialised content and knowledge. This disciplinary and multi-disciplinary content is linked to categories of work, while categories of work are tied to bodies of knowledge, which in turn are linked to changing professions and categories of knowledge. Without this situated learning context, skills acquisition becomes emptied of its knowledge, rendering the PSET platform an empty shell.

An example of change in the knowledge mixes of universities is the emergence of data sciences at selected universities in South Africa. Data science centres are offering courses in data science that bring together engineering, statistics, and applied science disciplines. Another example is the multidisciplinary programmes that have emerged in arts and humanities faculties. These programmes might, for example, combine political science, ethics, data science, and information technology to offer their students intellectual platforms in which humanities-centred perspectives are applied to 4IR political, socio-economic, and work contexts. Similar programmes are emerging in other social science disciplines and professions, such as law, theology, teacher education, and medical education.

Connectivity and data, the hallmarks of the 4IR, are also expanding the range of ways in which education takes place. In addition to online learning, the use of AI and virtual and augmented reality can expand the possibilities of where and how we learn. Simultaneously, though, we still require hands-on project-based learning, work-integrated learning opportunities, and real-world connections, for active and interactive learning. Key to the viability of more flexible forms of access to and delivery of PSET are new forms of assessment and accreditation of courses across different educational formats that take account of the institutional differences across the PSET sector.

# 3

## South Africa's current PSET system

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The numerous challenges faced by the PSET system have been well documented and were considered in the planning for the system, as shown in the 2013 White Paper.<sup>53</sup> While some gains have been made in the seven subsequent years, on the whole, the system continues to struggle, so it is unlikely that the ambitious targets of the white paper will be met. Despite a budget of R200 billion a year between the private and the public sector on PSET and employment programmes, skills expenditure is not translating well enough into income-generation opportunities for excluded youth. Approximately R77.5 billion is directed towards PSET (TVET colleges, university subsidies, the National Student Financial Aid Scheme [NSFAS], the National Skills Fund, and SETAs), R17.5 billion to employment programmes (Extended Public Works Programme, Youth Employment Tax Incentive, and Public Employment Services, among others), while approximately R100 billion is spent on training directed towards broad-based black economic empowerment compliance by the private sector.<sup>54</sup> Yet the youth unemployment rate remains at about 50% and skills expenditure is not translating into a high conversion of income-generating pathway opportunities for excluded youth, which results in limited impact and low return on investment. A WEF report looking at the readiness for the future of production ranked South Africa 67th of 100 countries surveyed in terms of human capital and 94th in the sub-component 'digital skills among population'.<sup>55</sup> In the Economic Intelligence Unit (EIU) Automation Readiness Index, South Africa is ranked 22nd of 25 countries.<sup>56</sup> From a human capital perspective, the country is not producing what is needed to maximise 4IR opportunities.

A significant challenge confronting PSET is a basic education system that remains beset by 'binding constraints';<sup>57</sup> as a result of growing poverty and social inequality,<sup>58</sup> as well as policy implementation failures, which limit throughput,

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53 Department of Higher Education and Training, South Africa. (2013). White paper for post-school education and training: building an expanded, effective and integrated post-school system. Retrieved from: <http://www.dhet.gov.za/SiteAssets/Latest%20News/White%20paper%20for%20post-school%20education%20and%20training.pdf>.

54 Donaldson, A. (2017). Presentation at Harambee Youth Employment Accelerator – Solutions Exchange, Stellenbosch, October 2017. Presentation slides from the Accelerating Solutions for Youth Employment Exchange.

55 World Economic Forum. (2018). Readiness for the future of production report 2018. Geneva: WEF. Retrieved from: <https://www.weforum.org/reports/readiness-for-the-future-of-production-report-2018>.

56 The Economist Intelligence Unit. (2018). The automation readiness index: who is ready for the coming wave of automation? London: The Economist. Retrieved from: <https://www.automationreadiness.eiu.com/>.

57 Van der Berg, S., Spaull, N., Wills, G., Gustafsson, M. and Kotze, J. (2016). Binding constraints in education: synthesis report for the programme to support pro-poor policy development (PSPPD). Stellenbosch: Research on Socio-Economic Policy (RESP). Retrieved from: [http://resep.sun.ac.za/wp-content/uploads/2017/10/PSPPD\\_BICiE-email-01062016.pdf](http://resep.sun.ac.za/wp-content/uploads/2017/10/PSPPD_BICiE-email-01062016.pdf).

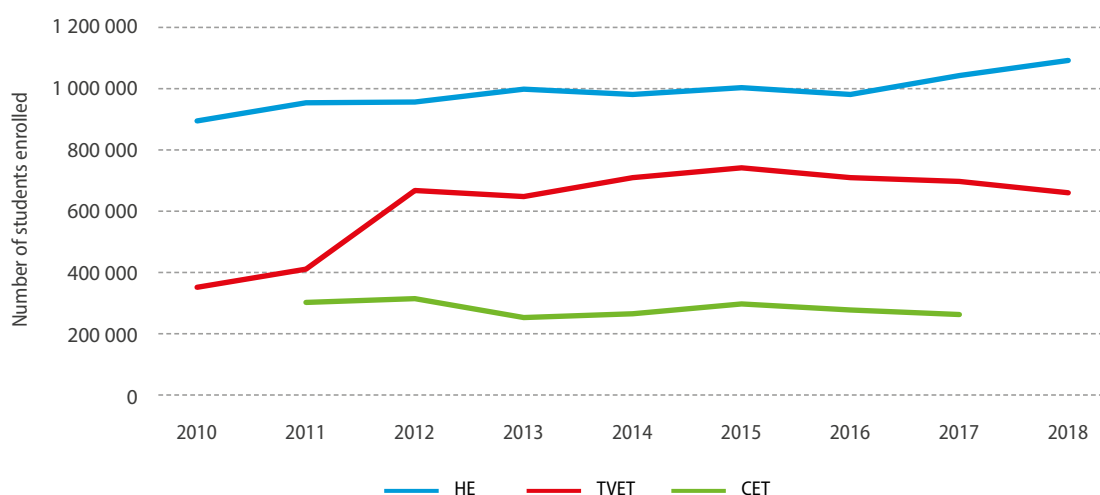
58 Allais, S., Cooper, A. and Shalem, Y. (2019). Rupturing or reinforcing inequality? The role of education in South Africa today. *Transformation*, 101: 105–126.

learning, and the quality of preparation for entry into PSET.<sup>59</sup> The pipeline is insufficient across subject areas, but particularly so for science, technology, engineering, and mathematics (STEM) subjects. Success in mathematics is often a requirement for entry to digital education and work. However, South Africa does not produce school leavers with the quality of mathematics abilities required in the quantities needed. Only 26% of students in South Africa meet the international benchmark for basic proficiency in secondary school when looking at country-level average test scores benchmarked using the Programme for International Student Assessment (PISA). This compares, for example, to 98% of students in Singapore.<sup>60</sup> Only 5% of all quintile 1–3 schools, which serve just 3% of the total learner population, perform on average at a level that could lead to obtaining a Bachelor's pass in matric.<sup>61</sup> But these educational outcomes are not uniformly distributed for learners in South Africa. The de facto existence of two schooling systems – a smaller, better performing system attended by the most privileged South African learners and a larger less efficient system serving the majority of learners – results in inequality in access to and outcomes of education.<sup>62</sup> For example, scores for assessments from the Trends in International Mathematics and Science Study (TIMSS) for public schools in South Africa are comparative to those of Saudi Arabia and effectively two grades lower than independent South African schools, where scores are similar to those of Malaysia.<sup>63</sup>

Even with the constraints faced in basic education, there has been significant growth in enrolment in the PSET system (excluding CET) since 2010 but it remains unlikely that the ambitious targets set out in the white paper will be achieved based on the current trajectory. Further, South Africa's gross enrolment ratio (GER) in the PSET sector is substantially below the average for upper-middle-income and BRICS<sup>64</sup> countries.<sup>65</sup> In higher education (HE), the number of enrolled students grew by about 83 000 from 2010 to 2016 and TVET college enrolment almost doubled from 358 393 to 705 397 students. In contrast, enrolment in CET dropped from 297 491 being enrolled in adult basic education in 2010 to 258 199 enrolled in CET colleges in 2017. This is despite the potential demand for CET provision being very high, with the United Nations Educational, Scientific and Cultural Organisation (UNESCO) estimating that there were 2.2 million illiterate youth and adults in South Africa.<sup>66</sup> Although CET enrolment has decreased in the public sector, as Figure 3 shows, there has been significant growth in private higher education and college education.

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- 59 Ibid. and see: Spaull, N. (2019). Priorities for education reform in South Africa. Input document for Treasury's Economic Colloquium, 19 January 2019. Retrieved from: <https://nicspaull.files.wordpress.com/2019/01/v2-spaull-priorities-for-educ-reform-treasury-19-jan-2019.pdf>.
- 60 World Bank. (2019). World Development Report 2019: the changing nature of work. Washington, DC: World Bank. Retrieved from: <http://documents.worldbank.org/curated/en/816281518818814423/pdf/2019-WDR-Report.pdf>.
- 61 Eldridge, M., van der Berg, S. and Rich, K. (2017). A society divided: how unequal education quality limits social mobility in South Africa. Retrieved from: [http://resep.sun.ac.za/wp-content/uploads/2017/03/2372-Resep\\_PSPPD\\_A-society-divided\\_WEB.pdf](http://resep.sun.ac.za/wp-content/uploads/2017/03/2372-Resep_PSPPD_A-society-divided_WEB.pdf).
- 62 Ibid., p. 20.
- 63 Ibid., p. 16.
- 64 Brazil, Russia, India, China and South Africa.
- 65 Department of Higher Education and Training. (2019). Post-school education and training monitor: macro-indicator trends. Retrieved from: [http://www.dhet.gov.za/SiteAssets/Post-School%20Education%20and%20Training%20Monitor%20Report\\_March%202019.pdf](http://www.dhet.gov.za/SiteAssets/Post-School%20Education%20and%20Training%20Monitor%20Report_March%202019.pdf).
- 66 Ibid.

**FIGURE 3: Enrolment trends – public PSET institutions**



Source: DHET

In 2010 there were 90 767 students enrolled in private higher education institutions (HEIs) and this had grown to 197 898 by 2018. There has been an even steeper growth rate in enrolment at private colleges, from 46 882 in 2010 to 219 837 in 2018.

Financial inefficiencies in the sector itself, together with the need for targeted resourcing and investment in key areas, and large numbers of youth living in poverty, partly explain the relatively low enrolment levels, but it is also likely that since much education provision in the sector remains face-to-face and fulltime, the dominant mode of delivery in PSET limits who is able to learn and the numbers that can be accommodated by a given institution. Without a shift in modes of delivery and greater and more effective use of online learning approaches and distance learning methods (high-tech, low-tech and no-tech, depending on the learners’ contexts and resource availability), it is unlikely that the demand for PSET will be met. However, social inequalities in South Africa also mean that new and more flexible modes of educational delivery are out of reach for large numbers of people, many of whom lack access to the technologies required, are unable to afford data costs, live in circumstances that make studying at home difficult, and have an educational background that has not equipped them with the skills and competencies to be able to study independently effectively.

The need to introduce and expand diverse modes of delivery was explicitly discussed in the 2013 PSET White Paper and expanded on in the Open Learning Policy Framework for PSET,<sup>67</sup> but progress in this regard has been slow, particularly outside of the higher education sector. Among other policy commitments, the Open Learning Policy Framework outlined the intention to establish a National Open Learning System (NOLS) serving the PSET sector. DHET has selected the Occupational Certificate: Electrician programme as the first programme to be developed and delivered through the NOLS. Curriculum and content development are underway, and the open content developed is being piloted with TVET students.<sup>68</sup> To be successful, modes of education need to take account of the access that learners have to devices and connectivity. We know that access to technology in South Africa schools is low by international standards, and this means that preparation to learn using technology will be uneven.<sup>69</sup> Further, appropriate learner support, including academic support, counselling, administrative support and ICT/technology support, is critical for open learning to be effective.<sup>70</sup> Little student support is provided outside of the HE sector at present. Cohort studies in HE have clearly shown that success rates for students studying via distance learning (67.6%) are

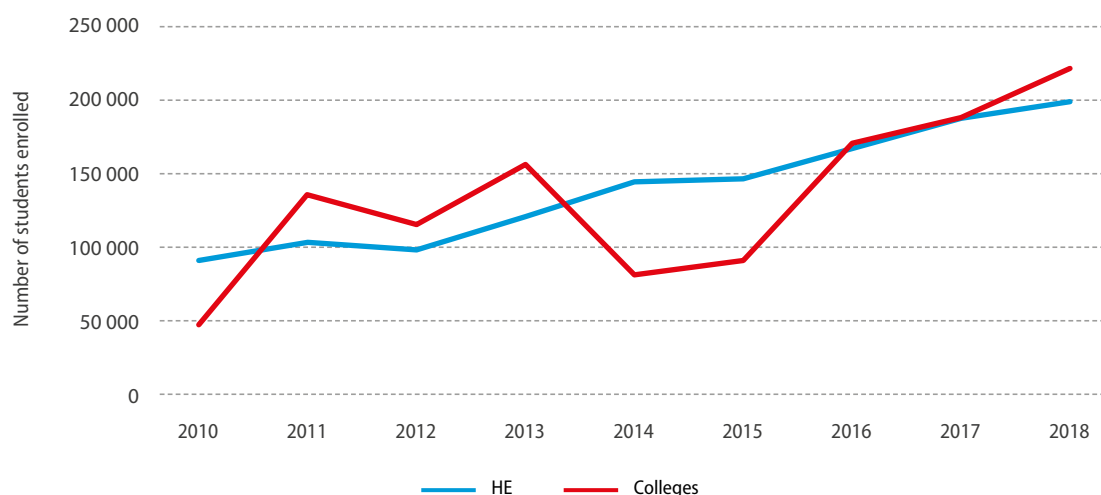
67 Department of Higher Education and Training. (2017). Open learning policy framework for post-school education and training. Retrieved from: [https://www.gov.za/sites/default/files/gcis\\_document/201704/40772gon335.pdf](https://www.gov.za/sites/default/files/gcis_document/201704/40772gon335.pdf).

68 ee: [http://www.dhet.gov.za/open\\_learning](http://www.dhet.gov.za/open_learning).

69 Spaull, N. (2019). Priorities for education reform in South Africa. Input document for Treasury’s Economic Colloquium, 19 January 2019. Retrieved from: <https://nicspaull.files.wordpress.com/2019/01/v2-spaull-priorities-for-educ-reform-treasury-19-jan-2019.pdf>.

70 Department of Higher Education and Training. (2017). Open learning policy framework for post-school education and training. Retrieved from: [https://www.gov.za/sites/default/files/gcis\\_document/201704/40772gon335.pdf](https://www.gov.za/sites/default/files/gcis_document/201704/40772gon335.pdf).

**FIGURE 4: Enrolment trends – private PSET institutions**



Source: DHET

much lower than for students in contact programmes (83.0%).<sup>71</sup> For online learning, distance education, and blended learning to be viable options for the TVET and CET subsectors, significant improvement in student support provision will be needed.

Throughput, completion, and graduation rates, although improving, continue to highlight systemic inefficiencies. The HE subsector performs best, with graduation rates growing at an average annual rate of 4.6% for undergraduate degrees and 6.0% for postgraduate degrees. Success rates have also been increasing. Dropout rates from universities are still high but are decreasing. The first-year dropout rate for the 2000 cohort was 19.7% and by 2015 had declined to 11.8%. By the fourth year of study, 17.9% of the 2013 entering cohort had dropped out.<sup>72</sup> DHET reported that certification rates in 2017 for TVETs range between 30% for the National Certificate (Vocational) (NCV) and 55% for N6. The overall throughput rate is 33.47%<sup>73</sup> and unemployment rates on average across all National Training Certificate (NTC) levels stands at 46%.<sup>74</sup> For the CET colleges, completion rates for General Education and Training Certificate: Adult Basic Education and Training (GETC: ABET) were 41.8% in 2012 but had dropped to only 35.9% by 2016.<sup>75</sup> Given the low, and decreasing enrolment in CET colleges, these dropping completion rates are even more concerning. The CET sector is envisioned to target the most vulnerable and to provide opportunities for those currently excluded from TVET and HE systems. The white paper argued that 'a new type of institution has to be built and supported, one that can offer a diverse range of possibilities to people for whom vocational and technical colleges and universities are not desirable or possible'.<sup>76</sup> To date, the largely dysfunctional and severely underfunded CET sector is not living up to this ideal.

Further, SETA-supported skills development and training (including learnerships, internships, and skills programmes) have not delivered as planned. Although there has been an increase in the numbers enrolled in these programmes, a cohort analysis of learnerships between 2011 and 2014 found that only 33.8% of those who enrolled completed the programme after three years.<sup>77</sup> The PSET Monitor report described these findings as 'signs of very low efficiency in this subsector'. The bulk of training is allocated to accredited training and traditional skilling pathways that are not responsive to business needs and economic priorities. These programmes are often not linked to the desired outcomes of translating into meaningful or sustainable employment opportunities for excluded youth. The subsector is characterised by cumbersome processes to unlock funding, long runways to obtaining accreditation, and expensive programmes (for example, the average cost for a toolmaker artisan for four years of study is R834 800).<sup>78</sup> Thus, the bulk of accredited training in South Africa is not agile or responsive to business needs and economic priorities, while obtaining accreditation is slow, expensive, and not conducive to scale.

In 2017, new entrants into the labour market constituted 40% of all unemployed individuals, and the 15–24 year age cohort who are 'not in employment, education, or training' (NEETs) has remained consistent at approximately 30% from 2012 to 2017.<sup>79</sup> Further, as van Broekhuizen (2016) and others have shown, youth unemployment varies substantially by race and can, at least in part, be attributed to the quality and type of PSET institution the individual attended. Unemployment is highest for TVET students who graduate with a

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71 Department of Higher Education and Training. (2019). Post-school education and training monitor: macro-indicator trends. Retrieved from: [http://www.dhet.gov.za/SiteAssets/Post-School%20Education%20and%20Training%20Monitor%20Report\\_March%202019.pdf](http://www.dhet.gov.za/SiteAssets/Post-School%20Education%20and%20Training%20Monitor%20Report_March%202019.pdf).

72 Ibid.

73 Department of Higher Education and Training. (2018). Briefing on the 2017/8 annual report to the Portfolio Committee for Higher Education and Training, October 2018.

74 Harambee. (no date). Analysis of Statistics South Africa Quarterly Labour Force Survey Quarter 1, 2019.

75 Department of Higher Education and Training. (2019). Post-school education and training monitor: macro-indicator trends. Retrieved from: [http://www.dhet.gov.za/SiteAssets/Post-School%20Education%20and%20Training%20Monitor%20Report\\_March%202019.pdf](http://www.dhet.gov.za/SiteAssets/Post-School%20Education%20and%20Training%20Monitor%20Report_March%202019.pdf).

76 Department of Higher Education and Training. (2013). White paper for post-school education and training: building an expanded, effective and integrated post-school system. Retrieved from: <http://www.dhet.gov.za/SiteAssets/Latest%20News/White%20paper%20for%20post-school%20education%20and%20training.pdf>.

77 Department of Higher Education and Training. (2019). Post-school education and training monitor: macro-indicator trends. Retrieved from: [http://www.dhet.gov.za/SiteAssets/Post-School%20Education%20and%20Training%20Monitor%20Report\\_March%202019.pdf](http://www.dhet.gov.za/SiteAssets/Post-School%20Education%20and%20Training%20Monitor%20Report_March%202019.pdf).

78 National Tooling Initiative. (2017). Presentation to the Department of Higher Education and Training. Unpublished.

79 Department of Higher Education and Training. (2019). Post-school education and training monitor: macro-indicator trends. Retrieved from: [http://www.dhet.gov.za/SiteAssets/Post-School%20Education%20and%20Training%20Monitor%20Report\\_March%202019.pdf](http://www.dhet.gov.za/SiteAssets/Post-School%20Education%20and%20Training%20Monitor%20Report_March%202019.pdf).

certificate or diploma compared to university graduates, where employment rates are better.<sup>80</sup> These generally poor employment outcomes have continued to grow, which shows that there is a mismatch between education supply and labour market demand.<sup>81</sup> This is especially apparent in the PSET sector, amplified for CET and TVET, and likely to become an increasingly pressing issue in the context of the 4IR where the labour market itself needs to adapt continuously in new and innovative ways. Although HE graduates fare better in finding jobs, the 2019 QS Employability Rankings did not place any South African universities in the top 100.<sup>82</sup> This ranking seeks to rank universities in terms of the effectiveness and competence of their graduates for the workplace.

A quick look at the websites of South African universities shows that there is a growing focus on defining graduate attributes – the cross-cutting skills, competencies, and qualities that all graduates ought to develop during their studies. Although the specific lists differ, they typically include soft skills such as critical thinking, problem-solving, having an enquiring mind, being engaged in the world, teamwork, innovation, lifelong learning, and so on. Despite university claims to focus on graduate attributes, employer dissatisfaction with graduates has also been widely reported, suggesting the inadequate implementation of graduate attribute policies at the programme level.<sup>83</sup>

To understand the (broken) link between education and employment, we need to look more critically at curriculum responsiveness, and concerns that current curricula across subsectors are often outdated. There is a need to better understand the relationship between education and the world of work, as well as to move away from too strong a focus on qualifications rather than knowledge.<sup>84</sup> Along these lines, Business Unity South Africa (BUSA) recently noted that:

The future of work is changing and job insecurity is increasing. There is a growing need for flexibility, critical thinking and life-long learning. A sustainable PSET system will have to grapple with these needs. The current one seems ill suited to respond to changes in the world of work.<sup>85</sup>

The BUSA document continues to reflect on ‘curricula that ignore business needs’ and ‘a generally weak relationship with the private sector’ as key challenges of PSET and TVET, more specifically. What constitutes curriculum responsiveness is complex, as shown by case studies conducted by Wedekind and Mutereko (2016) that look at agribusiness (sugar and forestry), and automotive production and maintenance. It also needs to take account of the real-life paths that people take into education and employment, particularly those who are commonly excluded.<sup>86</sup> The study showed that, for responsive curricula, there needs to be a strengthening of relationships between all components of the system, including employers, students/workers/job seekers and the policy and regulatory components, including quality assurance and credentialing.

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80 Van Broekhuizen, H. (2016), Graduate unemployment and higher education institutions in South Africa. Stellenbosch Economic Working Papers, 08/16. Retrieved from: <http://resep.sun.ac.za/wp-content/uploads/2018/07/wp-08-2016.pdf>.

81 Burger, R. and van Fintel, D. (2010). Rising unemployment amongst South Africa’s newest generation. Stellenbosch Policy Brief, 04/20. Retrieved from: <http://resep.sun.ac.za/wp-content/uploads/2017/10/20100607-saunemployment-v0.3.pdf>.

82 See: <https://www.topuniversities.com/university-rankings/employability-rankings/2019>.

83 BizTrends. (2017). SA’s graduate labour market: trends and issues. Retrieved from: <https://www.bizcommunity.com/Article/196/722/157320.html>.

Lourens, E. and Fourie-Malherbe, M. (2017). From graduate to employee: examining the factors that determine the professional success of graduates from disadvantaged backgrounds. Cape Town: Cape Higher Education Consortium (CHEC). Retrieved from: <http://www.chec.ac.za/files/2017-06-30%20Final%20CHEC%20research%20report%20with%20cover%2030%20June%202017.pdf>. See also: Fongwa, S. (2018). Towards an expanded discourse on graduate outcomes in South Africa. Retrieved from: [http://www.scielo.org.za/scielo.php?script=sci\\_arttext&pid=S1947-94172018000300002&lng=en&nrm=iso&tlng=en](http://www.scielo.org.za/scielo.php?script=sci_arttext&pid=S1947-94172018000300002&lng=en&nrm=iso&tlng=en).

84 Allais, S. (2014). Skills? What skills? Jobs? What jobs? The South African skills shortage? *Post-School Education Journal*, 1(1): 14–16. Retrieved from: <https://www.uj.ac.za/faculties/facultyofeducation/cert/Documents/Post-School%20Education%20Review%201.pdf>.

85 BUSA. (2017). Strategic focus: education and skills development for current and future work. Retrieved from: <https://www.busa.org.za/wp-content/uploads/2018/05/Education-and-Skills-Development-for-Current-and-Future-Work.pdf>.

86 Wedekind, V. and Mutereko, S. (2016). Employability and curriculum responsiveness in post-school education and training. LMIP Report 22. Retrieved from: <http://www.psetresearchrepository.dhet.gov.za/sites/default/files/documentfiles/LMIP%20Report%2022%20WEB.pdf>.

#### Example 4 The New Zealand Qualification Authority

The New Zealand Qualification Authority (NZQA) has taken deliberate steps to ensure that learners are able to respond to the rapid changes accompanying the 4IR through its Future State portfolio of work. Future State complements the whole-of-system work to enhance student learning and wider international research on the most critical 21st century skills. It is focused on ensuring that NZQA's services are fit for purpose to meet the current and future needs of learners, education providers, employers and society in a world that is global, digital and connected.

The portfolio includes:

- Recognition arrangements – these ensure New Zealand qualifications and ‘badges’ are trusted, recognised, transferable, and portable both nationally and internationally. NZQA has recognition arrangements with at least 50 other countries.
- Moving to digital assessment – utilising new technologies to deliver assessments that reflect digitally supported teaching and learning, are available online and available anytime.
- Single qualifications register – The New Zealand Qualifications Framework (NZQF) register has been designed to be the single, authoritative register of data for qualifications, awards, programmes, and components of programmes. It eliminates the need to store qualification and programme information in separate systems across various education agencies.
- Single digital record of achievement – The NZQA has been working to deliver a modernised and comprehensive record of achievement that displays a learner's most relevant and up-to-date qualifications and components of learning. It allows the user to preview and save an electronic copy of this record and send it to third parties, who can verify it through the NZQA. The record will continue to display standards, endorsements and awards, and progressively all qualifications achieved across the 10 levels of the NZQF.
- Micro-credentialing – The NZQA undertook a micro-credential pilot project in 2017/8 to better understand the role micro-credentials could play in New Zealand's education, training, and qualification system of the future. Subsequently the NZQA has formally introduced a micro-credential system as part of New Zealand's education and training system. The system provides rules for registering a micro-credential which is then published on a micro-credential register once approved (approval will take up to 20 working days) and it is then displayed on the Record of Authority. At a minimum, micro-credentials are subject to the same requirements as training schemes or assessment standards but are also required to: be 5–40 credits in size; have strong evidence of need from employers, industry and/or community; not duplicate current quality assured learning approved by NZQA; and must be reviewed annually to confirm they continue to meet their intended purpose.

Source: <https://www.nzqa.govt.nz/about-us/future-state/>.

Further complicating curriculum responsiveness is the rigid, slow, and arduous processes of quality assurance and programme accreditation at institutional and national levels. The policy environment is at best unreceptive, and at worst, hostile, to a more agile credentialing system. Credentialing bodies, such as the Council on Higher Education (CHE) and the South African Qualifications Authority (SAQA), are underfunded and lack the human capital to process the applications they receive. Furthermore, rigidity within the current qualifications architecture, including the National Qualification Framework (NQF) and the policy framework for which it is the proxy, make it difficult to put more agile credentialing processes in place. SAQA, the overseer of the NQF, agreed that the system was now overly rigid, with a present ‘square pegs in a round hole’ scenario.<sup>87</sup> In a similar vein, the Quality Council for Trades and Occupations (QCTO) currently uses a separate register (currently called the ‘holding area’) for promising skills programmes that do not fit the current policy framework.<sup>88</sup> CHE, SAQA, and QCTO will need to be capacitated so that they can respond rapidly to the demand for more flexible, agile, responsive qualifications and credentialing systems.

The entrenched regulatory regime was also cited as a barrier to exploring new and more agile credentialing opportunities, in a context in which massive open online courses (MOOCs) and digital badges are becoming more mainstream around the world. The CHE strongly argued for a ‘transformative venture’ in South Africa to move towards a more agile system, central to which would be an overhaul of the entire regulatory regime.<sup>89</sup> In relation to

87 Interview with Julie Reddy, Acting CEO, SAQA. Summary verified by the interviewee.

88 Interview with Vijayen Naidoo, Chief Executive Officer, QCTO. Summary verified by the interviewee.

89 Interview with Narend Bajjnath, Chief Executive Officer, CHE. Summary verified by the interviewee.

the current credentialing system, a Manufacturing, Engineering and Related Services SETA (merSETA) representative also noted that there is a need to strengthen and adapt the system to provide a framework for more agile credentials and that the NQF, 'may be limiting the long-term career development of an individual'. The need for more flexible credentialing was noted, requiring possibilities to recognise competencies that have become complementary to the whole qualification. For example, it ought to be possible for a qualified motor mechanic to accumulate additional credentials to serve the skills requirements associated with the maintenance and repair of electric vehicles instead of having to register for a whole new qualification dedicated to electrical vehicles only.<sup>90</sup>

In summary, the formal PSET sector in South Africa is not well equipped to enable the country and its citizens to harness the full social and economic potential of the 4IR effectively. It is not able to offer PSET opportunities on the scale demanded by a knowledge economy. Current curricula, programmes, and courses are misaligned with labour market demands, while mechanisms to review and update programmes and curricula are highly bureaucratic and operate in long, slow cycles. Further, spending in the sector remains strongly geared towards full- or multi-year programmes of study with a bias towards a fulltime face-to-face educational experience that aims predominantly to prepare limited numbers of young people upfront for a lifelong career.

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90 Interview with Helen Brown, Senior Manager: Applied Research & Innovation Projects, merSETA, followed by a written submission. Summary verified by the interviewee.

# 4

## Transforming the South African PSET system

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A central characteristic of being human is our ability to imagine a world beyond the reality we are currently experiencing. Never before have ideas had the power to come to fruition at such a pace or scale. Connectivity and data enable this. The current socio-economic context in South Africa demands it, given our structurally high levels of unemployment (now severely compounded by the effects of economic downgrades and the unfolding impact of the Covid-19 pandemic) and persistently high levels of social inequality in our country.

However, preparing people for the world of work cannot be the sole goal of a strategy for reforming the PSET system, given the scale of social transformation being ushered in by the 4IR. A trend in the series of industrial revolutions is *all* people gradually being freed from tasks related to their survival, with activity based more around what separates us from our machines: our curiosity, imagination, empathy, and passion. Sometimes we see technology as evolving externally to us and feel that we are subjects in this emerging world, without agency. There is a risk of this becoming true if we do not envision and then operationalise a different trajectory for the 4IR. As part of this, a successful PSET system will be one that moves beyond meeting labour market demands and producing workers for the goals of more powerful economic actors, to one that provides all citizens with the skills to shape tomorrow's trends and technologies.

Of course, the PSET system does not exist in isolation from its broader social context. Access to reliable power, adequate shelter, clean water, nutritious food, and healthcare is necessary for any human expected to learn. These fundamental prerequisites for a functional education system remain absent from the lives of many South Africans, while institutionalised corruption prevents efficient delivery of basic services and fuels already dire inequality. While these issues are beyond the scope of this report, effective transformation of the PSET system depends critically on their resolution.

Consequently, a new vision for the PSET system can only be successful if it is implemented in parallel with strategies to ensure, among others, that we (i) target economic growth in areas that will make the most direct contribution to expanding employment opportunities for all South Africans (recognising that many South Africans remain either unskilled or semi-skilled and that strategies to solve this problem at scale will take time to implement but cannot afford to ignore problems of unemployment in the interim); (ii) ensure stable and affordable access to key infrastructure, most notably reliable, affordable energy and ubiquitous, cheap broadband Internet access for all South Africans; (iii) root out corruption from government administrations so that funds allocated to social development are used optimally to achieve the goals of the NDP; (iv) achieve the above with due regard to the need to reverse our negative impact on the climate and environment; and (v) focus squarely on eradicating social inequality.

In developing a new vision for the PSET system that responds to these imperatives for change, the following questions bear consideration:

- What responses for securing greater social equality and productive citizenship are needed for those people entering the world of work compared to those already working? What are the needs of the latter for reskilling and upskilling and what do they need to keep learning through their lifetime?
- For those entering the world of work from the PSET system, what responses are needed in the short term to (i) meet current priority labour market demands; and (ii) enable new entrants to the world of work to be able to respond to (and create) opportunities in the economy and ensure that the economy has the talent that it needs in the next five years?
- In the medium term, how can we make the education system more agile both for youth exiting the education system in the next ten years and for those engaged in lifelong learning?
- In the longer term, how can we prepare and equip young people for the future world of work before they enter the PSET system for the first time, noting that the 4IR will bring a need not only for new functional skills but also for a diverse array of socio-behavioural skills that are acquired in early years and then shaped throughout one's life?
- How can the reshaping of the PSET system help to put young people at the front of the queue as the 4IR creates new opportunities, given that young people are disproportionately affected by unemployment?
- How can the PSET system be better aligned to current social demands and the changing needs of employers, while also developing a generation of new leaders who will help to build and shape new economies, industries, and developmental models of social governance?

## **A new vision for the PSET system**

At the centre of our new vision for the PSET system is a focus on ensuring that its programmes, courses, and other learning opportunities are aligned with the needs outlined above. We envision a PSET system that provides:

- 1) A strong core of education and training programmes that align with the changing needs of both South African society and the world of work in the context of the 4IR. Rather than drifting into generic and superficial curricula, we envision PSET programmes providing access to specialised skills and content, grounded in disciplinary bodies of knowledge and providing space for growing inter-disciplinary engagement. This disciplinary and multi-disciplinary content will be linked to clear categories of work and livelihood opportunities, while those categories of work will be tied to bodies of knowledge, which in turn are linked to changing professions and broader categories of knowledge. Critically, the mechanisms for reviewing and updating PSET programmes and curricula will be revised and streamlined to enable curriculum development to keep pace with the production of new knowledge enabled by the 4IR.
- 2) Access to high-quality educational opportunities that meet a burgeoning and immediate demand for 'digital skills' in the labour market created by the 4IR and a parallel need for a new wave of South African innovators and entrepreneurs who, whether from within government, in the private sector, or broader civil society, will help to drive and shape the 4IR to the social and economic benefit of all of its citizens.
- 3) Massive increases in short-course skilling opportunities for unemployed and underemployed South Africans in parallel with wider government and private-sector efforts to rapidly grow new employment opportunities for those people. In scaling up access to these skilling opportunities, the PSET system (and particularly the CET and TVET college sectors) will need to take cognisance of the reality that most people with this need are likely to have received primary and secondary schooling that has not adequately prepared them to meet the demands of further studies. Likewise, people requiring access to this kind of educational opportunity most often have an urgent need to earn a living and limited, if any, disposable income and time to invest in long-term, fulltime educational programmes and courses.
- 4) Growing emphasis on integrating into PSET programmes and courses learning opportunities that prepare people to be able to cope with accelerating change, both socially and economically, and thus that emphasise key generic skills such as problem-solving, critical thinking, advanced literacy and numeracy skills, oral and written communication skills, the capacity for ethical reasoning, and the ability to work effectively in teams, among others.

## Example 5 Taylor's University, Malaysia

Taylor's University in Malaysia has developed what it calls a 'Teach Less, Learn More' pedagogical approach. This refers to an attempt to accord quality time in the classroom for interaction, opportunities for expression and developing critical skills. Such an approach eschews a preponderance of face-to-face teaching, rote learning, repetitive tests, and following prescribed answers and set formulae. The aim of this approach is to reduce the emphasis on 'vast specific knowledge and repetitive tests' and replace this with students engaging in active and interactive learning.

Source: Nair, P. 2020. *Preparing 21st Century Teachers for Teach Less, Learn More (TLLM) Pedagogies*. In Kumar, P., Keppell, M., and Lim, C. (eds), *Preparing 21st Century Teachers for Teach Less, Learn More (TLLM) Pedagogies*. Hersey: IGI Global.

To support South Africa's effective integration in a 4IR world and leveraging of its possibilities to create a country of opportunity for all its citizens, we envision a PSET system with the following key characteristics:

- 1) Educational opportunities that prepare students *who are capable of creative insights, collaborating in diverse social and economic sectors, and navigating through cultural differences*, which will provide them with an advantage in the workplace. This will be achieved by embracing curricula that stress multi-, transdisciplinary and cultural perspectives. PSET education geared towards the 4IR will emphasise the acquisition of creative skills, interactive pedagogies, and multidisciplinary perspectives, rather than a narrow focus on the acquisition and transfer of disciplinary content only.
- 2) Curricula and educational programmes that are *responsive to the accelerating pace of technological change*. This requires at least some specialised programmes that enable students to comprehend the role and function of technologies, adapt to them, and be able to thoughtfully analyse and predict the evolution of networked systems of technology, the environment, and educational platforms and systems. More broadly, PSET curricula also need to help students develop the capacity for ethical reasoning needed to comprehend the impact of 4IR technologies on people and the environment.
- 3) A system that *creates an 'open-loop' education platform in which students can combine building a strong initial education foundation with ongoing educational and skills acquisition opportunities throughout their lives*. This would allow them to re-enter PSET at points where their skills become outdated and of low relevance or where they wish to advance their lives or careers in response to changing circumstances. The goal of this will be to create a PSET system that is agile in being able to respond to changing educational needs across the life of a person and as the 4IR evolves and transforms society.
- 4) Educational approaches that enable *much greater flexibility in terms of how and where students access learning opportunities*. Specifically, this will lead to greater integration of technology into the provision of educational opportunities as appropriate and taking account of technology access inequalities. Use of technology to support teaching and learning might take different forms according to need and curriculum context, but could include online learning and blended learning courses, use of MOOCs, integration of AI into learning delivery to create individualised learning opportunities, use of simulation and virtual practical demonstrations, flipped classrooms, and online tutoring, among others.
- 5) *Wider and more pervasive application of work-integrated learning (WIL) in PSET*, recognising that the workplace is an essential site of learning and also that it will be critical to be able to bring PSET to the workplace, given that many learners may need to continue working while they study. On-the-job learning approaches offer people the opportunity to learn while they earn, and better integrate theory and practice for better learning outcomes than traditional learning approaches.
- 6) Accreditation systems that allow students to *accumulate 'stackable micro-credentials' throughout a lifelong learning career*, which they can acquire while moving in and out of the education system and the workplace and through a diverse, and growing, range of educational modalities enabled by ICT and WIL. This form of accreditation will be facilitated by a flexible qualifications framework able to accredit the accumulation of micro-credits across different modalities in an open system of learning and working.
- 7) Modes of educational delivery that embrace the principles of open learning, as outlined in current PSET policies. Open learning is an approach to education that seeks to remove all unnecessary barriers to learning while aiming to provide students with a reasonable chance of success in an education and training system centred on their specific needs and located in multiple areas of learning. It incorporates several key principles:
  - a) Learning opportunities should be lifelong and should encompass both education and training.
  - b) The learning process should centre on the learners, build on their experience, and encourage independent and critical thinking.
  - c) Learning provision should be flexible so that learners can increasingly choose, where, when, what and how they learn, as well as the pace at which they will learn.

- d) Prior learning, prior experience and demonstrated competencies should be recognised so that learners are not unnecessarily barred from educational opportunities by lack of appropriate qualifications.
  - e) Learners should be able to accumulate credits from different learning contexts.
  - f) Providers should create the conditions for a fair chance of learner success.<sup>91</sup>
- 8) Integrated delivery models that work at district and regional levels and that enable PSET institutions in common localities to work with each other, with public and private enterprises, with social structures, with the communities they serve, and with local, district and provincial government to create articulated, seamless, responsive education and development opportunities.

## Requirements for success

Achieving the vision above will require a focus on transforming key aspects of the PSET system, the most important of which are described below.

### Create relevant education opportunities

The WEF notes that the economic and societal challenges of the 4IR mean that employers will increasingly need to partner with other stakeholders to manage the large-scale education and training challenges ahead and build talent pipelines. It goes on to state that:

The future of jobs is not singular. It will diverge by industry and sector, influenced by initial starting conditions around the distribution of tasks, different investments in technology adoption, and the skills availability and adaptability of the workforce.<sup>92</sup>

#### Example 6 Global Business Services' demand-led response

The Global Business Services (GBS) sector is a good example of a demand-led response. The GBS sector is a growth sector with its export segment growing at over 22% and expected to double in size over the next five years. Much of this growth has been driven by the increasing attractiveness of South Africa as a destination for offshored GBS, the availability of a large-scale English-speaking talent pool, costs that are 60% lower than source markets, and a robust enabling environment. In identifying how to respond to this opportunity by growing the available pool of talent (particularly at the entry level) and the skilling solutions that are required, stakeholders in the sector convened a series of action labs to produce an action-oriented agenda to catalyse growth. This has culminated in the formalisation of a partnership between Business Process Enabling South Africa (BPESA) that serves as the GBS industry body, an operator providing skilling solutions for the sector (Harambee Youth Employment Accelerator), the Department of Trade, Industry and Competition (DTIC), who have committed to the creation of new jobs in the sector over the next five years (20% of which have been earmarked for excluded youth). This has been formally ratified through a memorandum of understanding into a set of policy guidelines for the sector, with the partnership and commitment being presented and accepted at both the Presidential Jobs Summit and the Public Private Growth Initiative in 2018.

*Source: Business Process Enabling SA (BPESA) (Industry Association).*

In part, this will require a greater emphasis on developing curricula, programmes, and courses that are informed by the demands of the labour market. Being demand-led in this way requires customised initiatives that respond directly to the needs (both in terms of skills and attributes of work-readiness) of groups of similarly focused employers and results in the employment or self-employment of the young person.<sup>93</sup> Thus, being demand-led is about finding the zones of opportunity where (i) there is an absence of entry-level skills; (ii) those skills are needed in a given industry; and (iii) there is a sizeable demand. Understanding this requires partnership and collaboration between employers, industry bodies, public and private PSET providers, the government, and civil society. It is necessary to identify where and what the opportunities for young people are, the status quo of existing pathways to those opportunities, the barriers that constrain young people from taking up these opportunities, and what is needed to unblock these pathways. This provides a basis for co-

91 See Appendix Two for more detail on open learning.

92 World Economic Forum. (2018). The future of jobs report, p. 15. Retrieved from: [http://www3.weforum.org/docs/WEF\\_Future\\_of\\_Jobs\\_2018.pdf](http://www3.weforum.org/docs/WEF_Future_of_Jobs_2018.pdf).

93 Making Cents International. (2017). Scaling demand-driven training programs: a framework, p. 13. Retrieved from: <https://youtheconomicopportunities.org/sites/default/files/uploads/resource/2017%20DDT%20report.pdf>.

creation and joint adoption of curricula, programmes, and short courses that are aligned to the needs of both society and the changing labour market.<sup>94</sup>

A useful mechanism for determining whether a demand-led response is feasible or whether further work with the various partners is required, is to consider whether the conditions in response to the following questions are true:

- Is there a well-defined value proposition or business case for a sector or 'family' of jobs, the broader economy, the public good and the ability to create jobs for youth?
- Is there an organised and well-run industry body or other organisation to convene, coordinate, and drive planning?
- Can jobs targets be set and accountability for delivery assigned?
- Can education interventions be scaled and made more flexible to ready the supply side?
- Can actionable/measurable interventions to activate demand, including the necessary enabling environment, be defined?

In some areas, the velocity of the 4IR requires that learning outcomes, especially for short courses and many lifelong learning opportunities, must be achievable in the sense that it should not take a long time to reach proficiency. Getting very specific about exactly what skills are required for work is a feature of successful demand-led skilling interventions. Work readiness interventions, such as Harambee's bridging programmes which provide on-demand and just-in-time skills, are a good example of this. They are designed to provide young work-seekers with the specific skills required to perform and succeed in entry-level jobs in as little as four to six weeks.

However, ensuring the relevance of PSET programmes cannot be exclusively dictated by the demands of the labour market as it exists today. There will equally be a strong requirement to ensure that ongoing curriculum development prepares students to thrive even as the needs of the labour market change and to become active agents in shaping the future of both South African society and its economy. Thus, curriculum reform in South African PSET should not drift towards a co-dependent relationship with large employers but rather seek to ensure that the graduates of programmes and courses are empowered to play this active role both to their own economic benefit and towards the broader social benefit of the country as a whole.

### **Enable new approaches to teaching and learning**

The PSET system should be re-oriented to provide for a wide range of teaching and learning approaches and strategies, according to need. Such an approach requires flexibility in admissions criteria, curriculum design, learning and teaching modes, and assessment, with appropriate support systems and services – across the PSET sector and also within the specific subsectors. This in turn requires more flexible quality assurance systems, both at institutional and national levels, which are capable of assuring quality across a wider range of educational modalities with fewer common key indicators of quality. In much the same way as the ability to provide an agile PSET system depends on the achievability of interventions, agile education and training require accreditation to happen quickly. Where there is a mismatch between what the industry defines as a necessary skill and what the credentialing authority does, where the time taken to achieve the credential is lengthy, and where the credential is all-encompassing and not compartmentalised, this agility is lost or compromised.

Expanded access to learning will also have limited impact if it is not part of an integrated ecosystem that connects learning with opportunities, pathways, and a spectrum of workforce and support resources that are accessible and inclusive for those who are at risk of being systematically locked out of the labour market by the 4IR, as well as for those who are already excluded. Further, if the promise of the 4IR is one of disruption to work and skills over time, then there is a need to ensure that the PSET system creates lifelong learning opportunities that help people to continuously upgrade the skills needed for work, and provides pathways to inclusion in the world of work. This is a joint responsibility that requires the active engagement and support of the government, employers, workers, and educational institutions.

Diversification and improvement of teaching and learning strategies and methods as envisaged above will require ongoing mobilisation of funds and human capacity to invest in curriculum design, programme and course development and review processes, development of teaching and learning materials of different kinds,

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94 Ibid., p. 10.

and the judicious use of ICT and e-learning. It also requires recognition of the reality that, in many respects, educators and academics in the current system are not equipped with the kinds of skills and competencies needed to teach effectively in this more diversified learning environment and will thus need access to ongoing continuous professional development (CPD) to enable them to adjust to changing requirements.

### **Tackle the digital divide in PSET at all levels**

There has been an unprecedented explosion of innovation in ICT leading to a bewildering array of new technological options that can be harnessed to support PSET – in its managerial and administrative operations, in teaching and learning, and research. Many of these developments have emerged because of the growing availability of high-quality, stable broadband Internet connections. This growth is predominantly driven by assumptions that educators and students can be online, in a broadband environment, 24 hours a day. The problems associated with this for people living in countries or areas (like much of South Africa outside of large cities) where such Internet access does not exist or is not affordable are significant.

Of course, harnessing ICT for educational purposes to create blended learning, including gaming, virtual reality, text messaging, and social networking sites, requires continued investment in supporting educators to create and manage these new learning ‘venues’. This will have significant financial implications for institutions. In addition, technological churn is bringing new kinds of support challenges. This introduces the importance of ensuring that technologies adhere to common open standards to facilitate integration and interoperability. However, each new technology introduced brings its own requirements for support, while the support needs of established technologies remain. Introducing new technologies can also create a backlash from those expected to change how they work.

Critically, the emergence of these, and other related technological innovations has tremendous potential to accentuate the already significant and growing digital divide within education, conferring a benefit on those with access to ICT and further marginalising those without such access. However, while the provision of hardware has been an essential focus of debate on the digital divide, it is now seen as only one of a range of factors that must be tackled to increase participation in the information economy, including the provision of basic services, such as stable electricity connections. Increasingly the issue has become about access to broadband (high-speed) Internet connections, not just access to hardware. Particularly, speed and access to the Internet matter to productivity. While the digital divide continues to widen, there is no binary digital divide and no single overriding factor for determining such a divide. Consequently, the concept of digital inclusion has become increasingly important, as it seeks to examine the combination of factors that may limit participation in the information economy. Factors that require consideration include access to hardware (including devices for students) and affordable/reliable Internet connections, information literacy, the extent of integration of ICT into the social fabric of everyday life, provision of technical and training support, and access to compelling applications and content. Most importantly, though, unless there is a concerted effort to ensure that steps are taken to integrate marginalised students into ICT-enriched PSET environments, a widening of the digital divide and deepening of social inequities, both within and between countries, is assured.

### **Ensure effective student support**

The 4IR can potentially create insiders and outsiders – insiders are positioned to seize the economic opportunities on offer in the 4IR by virtue of their work readiness and outsiders are locked out of the new economy. To avoid this scenario, learning needs to be opened so that all people can take advantage of the opportunities on offer. Doing so, however, requires recognition that not all people have the same baseline levels of functional competence, and so investments in closing foundational learning gaps are required as a first step. Further, it requires acknowledgement that the living conditions of many people mitigate against independent learning, which is practically impossible for those living in cramped, overcrowded conditions. Thus, community spaces for learning will be an essential requirement of more inclusive, flexible learning opportunities for all people.

Effective student support will be critical in providing students with a meaningful opportunity of success in their studies, especially because many students come from schooling backgrounds that have not adequately prepared them for the rigours of study at a PSET level. This support requirement spans a broad range of skills and competencies, including literacy and numeracy, writing skills, information literacy, ICT proficiency, study and research skills, time management, and life skills of various kinds. Given this, it is essential that academic support and advising is well planned, effectively coordinated, and made available to all students as an integral part of the overall educational experience. Although this is especially important in the early years of study, as students manage the transition from schooling to PSET, it will most likely remain important throughout their educational careers.

## Build micro-credentialing systems

Micro-credentialing – the ability to learn and be accredited for the acquisition of a particular skill – has merit. Keevy et al. (2019) noted that:

From the perspective of the learner and the employer, micro-credentials offer the possibility of both granularity and flexibility. Rather than relying on traditional university degrees as a proxy for employability, micro-credentials allow employers to determine, in more precise detail, whether candidates have demonstrated specific knowledge, skills, and competencies of interest. As employers' needs evolve, micro-credentialing opportunities can as well, in a relatively rapid manner. Unlike the traditional academic pedigree, the low cost with which many micro-credentials can be acquired also potentially opens new doors for individuals from lower income households.<sup>95</sup>

Additionally, micro-credentialing offers 'ubiquity and interoperability', transversal applicability across industries and jobs, shorter learning pathways, the possibility to overcome time and resource constraints, the potential to enable the recognition of prior learning (RPL), and more transparent recognition of skills and qualifications required by employers.<sup>96</sup>

But for micro-credentialing to be effective, several issues need to be addressed:

- Access to connectivity, equipment, and digital skills.<sup>97</sup> Heavy reliance on technology for micro-credentialing creates a risk of perpetuating digital insiders and outsiders, while further excluding those already excluded from the labour market.
- Pathway visibility, or the ability to 'connect the atoms'<sup>98</sup> so that work-seekers can understand and are able to develop marketable portfolios of credentials that combine effectively into more meaningful qualifications over time.
- Quality assurance so that skills are portable and there is trust in the signal provided by the micro-credential. Systems are needed to help learners and employers identify which learning opportunities and micro-credentials are valid and of quality.<sup>99</sup>
- The risk that 'the whole is not the sum of the parts', that learning becomes too fragmented, and fails to result in a meaningful whole that is recognisable to employers.<sup>100</sup>

Thus, the PSET systems and credentialing authorities need to provide quality assurance and governance systems that are responsive to this changing landscape, to make credentialing information from multiple sources more accessible, to provide the methodologies for comparing credentials, and to understand how these combine meaningfully. While the functionality must ultimately exist across the PSET system, the imperatives and pace of the 4IR suggest that responses focused on specific economic sectors and disciplines can offer some of the agility that is needed in the short to medium term.

## Develop simpler policy frameworks

A more responsive, agile, and open PSET system will require *simpler and more flexible policy frameworks*, especially those responsible for governing programme accreditation and quality assurance. These policy frameworks should also be well aligned with broader and linked government policies. The number of areas and elements of PSET that need to be centrally regulated are far fewer than those currently being regulated. Attempts to regulate too many aspects of education implementation make it impossible to regulate anything effectively, as resource constraints and the complexity of detailed regulatory frameworks will derail such efforts. Regulation is important, but there needs to be a focus on a few, simple and clear indicators of quality that ensure accountability, and processes for ensuring that these are met. It is also important to differentiate between regulation and support. Regulations set rules that people must follow or face legal action of some kind, while support creates no such obligations. Much work currently being done on regulating aspects of PSET can shift from regulating education provision to supporting its effective implementation. Increased flexibility and simplicity of policy frameworks are not important for their own sakes but because they are necessary prerequisites for meeting the policy challenges posed by the 4IR, which inevitably creates ongoing pressures for change to the structures and operations of education systems. The more

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95 Keevy, J., Rein, V., Chakroun, B. and Foster, L. (2019). Credentialing in the 21st century – beyond event horizon, in F. Oswald, T. Behrend and L. Foster. *Workforce readiness and the future of work*. New York: Routledge, p. 246.

96 *Ibid.*, p. 243.

97 *Ibid.*, p. 246.

98 *Ibid.*, p. 239.

99 *Ibid.*, p. 246.

100 *Ibid.*, p. 243.

complex policies and procedures become, the less flexible they become and the harder they make it to allow for these shifts.

### **Adopt a regional approach to 4IR-related development**

To ensure that the above approaches are not fragmented or operating in silos, there is a need to develop a systemic regional approach to initiate integrated 4IR-related development at the regional level. This should link to the NDP's focus on integrated development and the government's district-based coordinated approach. It should centre on specific economic sectors, carefully chosen to develop a pivot for regional economic development. Coordination and network mechanisms could be established, two per province (one rural and one urban), that would aim to develop an ecology of integrated development activity centred on one broad productive sector per region. The mechanism for establishing this should include an intersection of government sectors in collaboration with PSET providers, business, and relevant civic players. Given that this requires engagement between government ministries, it might require initiation from the Presidency, connected to existing initiatives already in place.

Stimulating employment generation related to newer digital technologies would be a key driver. The energies of all social, education and state infrastructural systems in the area surrounding the economic sector would form part of this ecology. The PSET system should focus on maximising responsiveness in the areas of skills acquisition, curriculum responsiveness, streamlined qualifications structure and management, and mobilisation of state and business finances, among other requirements. All sectors of the PSET system should participate, including universities, CET and TVET colleges, and the NEET sector. Digitisation would be prioritised and digital skills encouraged. Key to success will also be to incorporate research and innovation, driven by universities in the region. Schools could also participate to render their curricula responsive to AI, robotics, coding, blockchain technology, and other relevant developments. The intersection of 4IR-related economic development in the sector, the emergence of 4IR-linked jobs, the rollout of digital platforms, and the supply for digital and other employability skills would be the focus of targeted development in such a regionalised, sector-specific approach, which could later be taken to scale in other economic sectors in the region and beyond.

### **Develop agile funding models to incubate critical skills**

Disruptive innovations and change brought about by the 4IR require disruptive responses achieved through collaboration, risk-sharing, and incentives that shift behaviour and accelerate adoption and scaling. In the context of the rate of change the 4IR introduces to the world of work and by extension the PSET system, there is both a requirement and an opportunity for innovations in financing that can then leverage changes to how education and training occur. To meet the opportunities and challenges that the 4IR presents, alternative pathways to PSET are required that are cheaper, quicker, more accessible, and require funding to scale. These should not necessarily seek to introduce new money into the system but rather direct some existing budgeting allocations to cost-effective models that can quickly and efficiently upgrade the employability of youth and transition them into the income-generating opportunities that the 4IR presents, and which need human capital.

Pay for performance (P4P) models could be valuable instruments in this context, by focusing on skilling initiatives to produce clear and tangible outcomes that matter. Social impact bonds (SIBs) are one such model. SIBs are typically a contract with the public sector in which a commitment is made to pay for improved social outcomes only when these outcomes have been achieved. SIBs typically involve investors who provide upfront working capital for the achievement of a social outcome, which is then directed via an intermediary to operators or service providers to deliver the outcome. When these outcomes have been achieved and verified, then the outcomes payer (typically the public sector) pays investors back.

P4P models like SIBs applied to PSET are attractive for various reasons. They are outcomes-focused, drive performance, and incentivise and build a culture of collaboration.<sup>101</sup> They encourage innovation in the PSET sector. They de-risk the funding investments for government by sharing the risk between both the public and private sector in a way that inculcates joint responsibility for both sectors to address skilling for inclusive employment. They increase the returns (outcomes) achieved by making operators more focused on outcomes. For example, instead of trying to transform the role of TVET colleges, performance-based contracting could be concluded for the placement of their graduates into jobs, thereby tying their access to funding operations dependent on curricula and learning outcomes that meet the needs of the market. P4P approaches can offer

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101 Gustafsson-Wright, E. (2018). *Impact bonds and outcome funds for development*. Washington, DC: Brookings Institute.

a better return on fiscal spending on skills and provide a credible platform through which spending can be coordinated and channelled at scale to more efficient and impactful solutions, working ineffective/inefficient programmes out of the system over time.

### Example 7 Bonds4Jobs

An example of a pay for performance (P4P) model that is currently being piloted in South Africa is Bonds4Jobs. Bonds4Jobs is a P4P outcomes funding platform established to efficiently direct and deploy financial resources, share risk, and increase return on fiscal spend in learning programmes by incentivising and rewarding transitions into the economy and not just training. It aims to accelerate innovative, alternative models to skilling – in growth sectors where there is a scarcity of skills – that are more effective, cheaper, and quicker than traditional models. The risk of non-performance by operators (skilling and placement providers) is shared between the outcomes funders (government) and private sector investors, who provide the upfront funding required for delivery by operators, for which they will expect a financial return that varies depending on their respective mandates. Launched in April 2018, in its first two years, Bonds4Jobs acting in partnership with Harambee Youth Employment Accelerator, provided upfront capital to service providers, to identify employment opportunities and deliver training to 1 674 excluded young people nationally. Over the next two years Bonds4Jobs aims to onboard other operators equipped to provide skilling interventions that can transition excluded youth into high-value jobs in the selected job families.

*Source: Bonds4Jobs (NPC) and Harambee Youth Employment Accelerator (NPC).*

### Build effective partnerships

Partnership models are required – to build communities for coordination and change. Creating new pathways for skilling is meaningless if the requirements of employers are not understood. New proxies for matching and selection cannot be developed without being tested through partnerships between learning institutions, employers, industry bodies, and government departments. Programmes and capacity to scale cannot be built without understanding how existing funding models can be innovatively directed or unblocked to do so. And so, a community of employers, learning institutions, government, funders, and those institutions working across the ecosystem needs to be established. While a version of this needs to happen at the macro-level, sector or job-family partnerships offer agility and excellent opportunities for creating new ideas, solution development, and implementation. A practical example of how this is being done is the #Shift Digital Partnership.

### Example 8 #Shift Digital Partnership

The #Shift Digital Partnership is a partnership involving Tshimologong, CiTi, Explore Data Academy, We Think Code, the Johannesburg Centre for Software Engineering, and Harambee Youth Employment Accelerator. It is a group of organisations successfully moving young people into digital jobs in an accelerated, agile, and responsive way. It is a partnership of like-minded digital skills academies producing talent for the digital economy through inclusive, efficient, scalable, and demand-driven pathways. The partnership recognises that traditional pathways into digital roles are long and expensive and are not producing enough digital talent fast enough. It seeks to grow the supply of skilled youth through alternate pathways that are more cost effective, inclusive, and scalable.

*Source: Harambee Youth Employment Accelerator (NPC).*

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## Operationalising the vision

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The vision of the MTT on 4IR is a country in which we have a differentiated and all-encompassing post-school education and training system that allows South Africans to access relevant, quality PSET opportunities, to fulfil the economic and social goals of participation in an inclusive economy and society. To achieve this, we propose the following broad actions to operationalise the vision sketched out above.

### **Rapid introduction of new educational opportunities to model the change**

Many aspects of systemic transformation of the PSET sector will take time to implement, though hopefully this will be accelerated given the growing urgency for social and economic reform, and particularly to find innovative strategies to grow employment to mitigate the rising joblessness precipitated by the Covid-19 pandemic. Current approaches to innovation policy and practice including the establishment of research and innovation missions and innovation-led socio-technical change offer significant opportunities for accelerating the pace for a systematic and systemic transformation of the PSET system. While this requires policy reforms, shifts in spending priorities, curriculum development, and large-scale capacity-building to support new approaches to teaching and learning, there is also an immediate imperative to find quick wins that can be implemented almost immediately. Consequently, we propose two areas of immediate action, the first focused on expanding the supply of digital skills to meet the demands of the 4IR and the second aimed at scaling up open learning programmes in economic sectors where there are the greatest prospects for strong employment growth (understanding that the latter will need to be accompanied by broader government strategies to target those economic sectors for growth using a wide range of support mechanisms and incentives).

### **Expanding the supply of digital skills**

A lack of industry coordination and the concomitant lack of a single, coherent view of the size, scale, and the level of demand for digital jobs makes it difficult to identify what jobs have the potential to absorb youth – and in particular excluded youth – in large numbers. However, we believe, based on a synthesis of existing industry demand reports and as a result of a six-month diagnostic of the sector, that the following entry-level roles should be considered based on the potential to find shorter, innovative ways to identify and prepare youth to take up these opportunities:

- 1) *Data analysis and data mining*: in a comprehensive 2016 LinkedIn study,<sup>102</sup> data analysis and data mining (the process of sorting through large data sets to identify relationships and solve problems) was ranked

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102 Barbarasa, E., Barrett, J. and Goldin, N. (2016). Skills gap or signalling gap? Insights from LinkedIn in emerging markets of Brazil, India, Indonesia, and South Africa. Washington D.C.: Solutions for Youth Employment; Mountain View, CA: LinkedIn. Retrieved from: [https://economicgraph.linkedin.com/content/dam/me/economicgraph/en-us/download/Skills\\_Gap\\_or\\_Signalling\\_Gap.pdf](https://economicgraph.linkedin.com/content/dam/me/economicgraph/en-us/download/Skills_Gap_or_Signalling_Gap.pdf).

as one of the top skills wanted by employers in South Africa. This skill is required across multiple disciplines, for example, marketing, finance, strategy, business intelligence, legal, and customer service.

- 2) *Software development*: software development (especially in Python, Java, and C#) is the most sought-after skill set on job portal Career Junction, with the Career Junction Index showing a 6% jump in demand for software developers from July to August 2017. Java programming also came in at number two on LinkedIn's South African top-skills study.
- 3) *Cybersecurity*: with businesses moving their capabilities and data onto digital platforms, the need to protect this information is becoming more urgent than ever before. This skill featured highly in LinkedIn's global list of in-demand skills.
- 4) *Multichannel contact centres*: Harambee's work in placing over 3 000 excluded youth into contact-centre opportunities in the GBS sector over the last ten years demonstrates that these jobs are viable pathways for young people. There may also be scope to grow the number of new jobs in this sector by expanding its digital component (reshoring domestic activities, such as testing and developing the digital/ICT outsourcing proposition), and by capitalising on the evolution of contact centres to offer multiple delivery channels of engagement.
- 5) *Digital entrepreneurship*: the decreasing cost of digital fabrication machines and microcomputers – such as 3D printers, laser cutters, Arduino, and Raspberry Pi – creates opportunities to find a job, start a business and earn an income for anyone able to do programming, design, manufacturing, and sales. Learning these skills is becoming easier through accessing tech hubs in Africa, *fab labs* around the world and leveraging free training courses online. Initial funding for businesses can also be crowdsourced through online platforms including Kickstarter, Indiegogo and Goteo.<sup>103</sup>
- 6) *Jobs emerging via online platforms*: Many online platforms serve as a marketplace for anyone to be a shop owner through e-commerce (for example, eBay, Alibaba), or an instructor/teacher through educational platforms (for example, Udemy, Skillshare). Some online platforms empower users to earn incomes through sharing and lending their resources, time, and skills. Examples of these are car sharing, peer-to-peer accommodation, and task assignments. For example, virtually anyone can be a driver through Uber and Lyft, a hostel service provider through Airbnb, or a deliverer or handyman through TaskRabbit.<sup>104</sup>

We need to grow the pool of youth, and especially, young women, ready to take up digital opportunities such as these. If this is to be done at a scale that meets the demand, then universities cannot be the only pathway to employment in these types of jobs, when collectively the university sector can only offer between 6 000 and 10 000 seats for computer science and related ICT qualifications against, for example, an estimated 158 000 new digital jobs that will have been created in the financial services, IT, and business services sectors in 2021.<sup>105</sup> The supply can also not come from new training institutions that are scaled – existing assets and infrastructure need to be leveraged. Universities can deliver shorter, demand-led non-degreed programmes that offer and build micro-credentials, and their ability to offer a wide array of courses through flexible delivery models can serve as a platform for innovation.<sup>106</sup> TVET colleges – depending on their location – can provide a space for blended learning to occur. Employers – supported by the government – can offer internships and job shadowing that offer young people an opportunity to learn while they earn. Existing training vendors – together with government – can explore performance-based funding solutions that would allow them to access financing for scaling their programmes, in return for agreed outcomes such as placement post-training into jobs.

Scalable, alternative skills development opportunities are required that are accessible to excluded youth and capable of shifting the distribution of digital opportunities currently skewed to those who can afford expensive educational investments. These must be agile, relevant, and streamlined interventions that can provide entry into multiple pathways and provide alternative (to degrees) but credible credentials for employers.

Access to these educational opportunities needs to change so that, where feasible, eligibility does not always rely on mathematics, science, or a degree, especially for entry-level jobs. Continuing to rely on these proxies will only serve to reinforce the existing exclusion of youth from digital opportunities and will be insufficient to meet the demand for digital skills at lower levels. This means that employers (and PSET

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103 Imaizumi, S. (2015). Partnerships and opportunities for digital jobs. Retrieved from: <https://blogs.worldbank.org/digital-development/partnerships-and-opportunities-digital-jobs>.

104 Ibid.

105 Harambee commissioned research from Dalberg Advisors, 'Assessing the demand for digital jobs', 2016.

106 World Bank. (2019). World Development Report 2019: The Changing Nature of Work. Washington, DC: World Bank. Retrieved from: <http://documents.worldbank.org/curated/en/816281518818814423/pdf/2019-WDR-Report.pdf>.

institutions) need to change their hiring selection practices and find new ways to screen and match young people for opportunities. Harambee has done this successfully for entry-level jobs by looking at the results of a psychometric Concept Formation Test, which measures a person's learning potential and correlates the scores with those of a numeracy assessment. The results show that, if young people were to be screened for hiring on the basis of their numeracy scores, nearly 80% would be screened out of opportunities when they have a learning potential that would make them eligible for most entry-level jobs. Likewise, WeThinkCode<sup>107</sup> uses gamified assessments to identify matches for its programmes and can be taken by anyone regardless of their educational level.<sup>108</sup>

A specific proposal that could be implemented in partnership with the PYEI is to implement a prototype programme of accelerated digital skilling for 100 000 NEETs into entry-level digital roles. We propose that this should embody a new way of working that embraces agile credentialing, demand-led planning, and new forms of delivery and financing. We propose that this prototype be implemented by the DSI, the DHET, Department of Communications and Digital Technologies (DCDT), the Department of Trade, Industry and Competition, National Treasury, and the digital and technology sector in South Africa, supported by the programme management office (PMO) for the PYEI in the Presidency.

In parallel, this short-term skills development strategy could be accompanied by prototyping of a more agile credentialing mechanism in two sectors (digital jobs and GBS) that functions as a proof-of-concept (i.e. that agile credentialing can help address the skills mismatch between supply [work seekers] and demand [employers]) and can then be adapted for other sectors. These two initiatives should respectively aim to match work seekers with at least 100 000 digital jobs, and 80 000 GBS jobs, in five years.<sup>109</sup>

### Targeted open-learning programmes to support employment growth

As noted, South Africa urgently needs to find solutions to its massive, and growing employment crisis. Consultative processes with the CET and TVET sectors have determined that there is significant potential to harness open learning in those sectors to increase access to PSET learning opportunities, align those opportunities more closely with the needs of the labour market and help to drive growth in employment among those currently most adversely affected by the 4IR, and improve the quality of educational courses and programmes. Consequently, we propose a selective approach to the implementation of open-learning approaches in the CET and TVET college sectors. This would incorporate the following key aspects:

- 1) Open learning could be harnessed to provide an integrated mechanism for expanding access to high-quality CET and TVET programmes and short courses in key areas of national need. In doing

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107 WeThinkCode is a not-for-profit organisation working to close the digital skills gap in Africa by developing software engineering skills.

108 Recently, seven young people from Harambee's network graduated from the WeThinkCode Academy and are all employed. One of these was a young woman who took the online gaming in Poortjie, a township on the western outskirts of Johannesburg. After Harambee's advocacy work with youth in the area to try the online learning service offering in the library, Poortjie had the highest number of young people passing the WeThinkCode tests compared to other sites where Harambee has advocated the offering.

109 If successful, these initiatives will contribute to a future where:

- Regulatory bodies, more closely connected to the world of work, can innovate and respond to the diverse needs of stakeholders including employers, work seekers and education and training providers.
- Employers have access to a trusted source of work-ready, skilled/competent labour, able to fill critical vacancies.
- Other benefits include reduced risk when hiring new staff, reduced cost of training new staff, and a more diverse workforce.
- Work seekers have access to relevant and recognised training, which is trusted by employers, develops skills/competencies which are in demand, and leads to employment.

Success of the initiatives will be measured by:

- Buy-in/involvement of regulatory bodies;
- Buy-in/adoption from employers;
- Use of prototype credential schema for recruitment;
- Number of work seekers employed via the prototype credential schema;
- Willingness to employ new staff;
- Buy-in/adoption from work seekers;
- Number of job matches (work seekers and jobs);
- Success/duration of job matches (% still employed after one year, as compared to other types of employees); and
- Influence on policy (later).

this, selected programmes will harness methods of distance education, resource-based learning, and e-learning to enable better, more efficient use of learning spaces and learning times and change the way that learning is conceptualised. More detail on this type of approach is presented in Appendix 2.

- 2) Specific programmes and short courses for development using open learning principles could be identified according to (i) their alignment with key economic sectors identified in the NDP and other key government strategies to accelerate economic growth and development in South Africa; (ii) the potential for employment growth in that sector so that graduates of identified programmes have a meaningful prospect of becoming economically productive on completion of programmes; and (iii) their potential to scale significantly (that is, to enrol large numbers of learners across colleges).
- 3) When designing and implementing national programmes and short courses using open learning principles, the DHET should work closely with colleges to ensure implementation is both sustainable and financially viable. To this end, the following principles should accompany the growth of open learning in the CET and TVET college sectors:
  - a) Introduction of open learning programmes and short courses should be phased in to enable absorption and necessary change management.
  - b) Introduction of open learning programmes and short courses should be used to de-commission/replace outdated curricula in key areas of national need. As the 2013 White Paper on PSET notes, the current Programme and Qualification Mix 'is complex to administer, difficult to understand, and often poorly quality assured'. There is no point in rolling out open learning programmes and short courses based on outdated or irrelevant curricula, so implementation of open learning needs to be accompanied by curriculum reform, as envisaged in the PSET White Paper.
  - c) Open learning programmes and short courses should replace traditional programmes when they are developed to avoid the creation of parallel systems, with capacity for individual colleges to function as learning centres for identified programmes (linked with centres of specialisation as hubs for programmes where appropriate).
  - d) Every open learning programme and short course should have its own specific mix of modes of delivery to cater to unique needs in different trades and occupations. Thus open learning should not be implemented using a one-size-fits-all approach to the design or implementation of programmes.
  - e) Flexible entry and exit points into programmes and short courses should be created through further development of RPL systems for those programmes/courses, combined with increased opportunities for self-study to reduce the financial and time burden of study.
- 4) Policy and financing mechanisms should be established to facilitate cooperation and collaboration between colleges in programme design and delivery, with the online National Open Learning System (NOLS) under development by DHET functioning as an online facility for sharing resources and supporting joint programme delivery.

Successful implementation of open learning at this level will require coordination across colleges to achieve necessary economies of scale and leverage national investments, but the current policy environment tends to encourage competition between colleges. To be cost-effective, open learning needs to be implemented nationally, so policy and financial mechanisms to facilitate cooperation are required.

Specific attention will need to be given to establishing student support centres across the college system for open learning programmes and courses. These will provide educational, administrative, and logistical support, as well as access to digital and online materials, including access to the NOLS and online library services. They could also be used for contact sessions, particularly in the evenings, over weekends and during school holidays, as well as for supervised assessment in compliance with regulations governing summative assessments in TVET and CET. Such centres could be based at universities, CET and TVET colleges, and facilities such as community libraries, where feasible. In parallel, getting these ICT-enabled support centres operational could provide employment and skills-development opportunities for youth.

Inter-institutional cooperation in the facilitation of student support, coupled with sharing high-quality resources, is particularly important when implementing distributed learning. Such cooperation will need to be explicitly fostered. The DHET will, together with institutions, develop a sound business model for student support centres. Strategic partnerships will be established to extend the provision of centres in strategic localities remote from, or under-served by, PSET institutions.

## Standardisation of quality assurance across PSET sectors

As mentioned above, there is an urgent need to overhaul systems of quality assurance so that they can be streamlined, agile, and responsive to changing needs. In addition, the DHET, SAQA and the three quality councils (QCs) – the CHE, Umalusi, and the QCTO – need to accommodate new ways of teaching and learning, such as massive online open courses (MOOCs) and e-learning in their quality assurance practices.

Thus, building on the pilot activities outlined in Section 5.1, the DHET should work urgently with the three QCs to assist institutions to introduce more flexible learning opportunities and much greater agility and responsiveness in curriculum development processes, including the adaptation of quality assurance mechanisms for open learning approaches. These measures should complement (or, where necessary, replace) the normal monitoring and assessment roles and activities of the QCs in the PSET sector, including institutional audits and programme accreditation.

There is a need to review the current credential landscape through a collaborative and coherent approach between SAQA, CHE, QCTO, Umalusi, DHET, DBE, and key non-profit and private-sector actors. This exercise should aim to review the current NQF-related legislation and its implementation based on the Department of Planning, Monitoring and Evaluation implementation evaluation findings, lessons learned to date, and the imperatives documented in this report. This collaboration should be closely involved in the prototype of more agile credentialing schema in the digital jobs and GSB sectors, but not to the extent that the process reports to, or is overseen by, the state agencies. Flexibility, while ensuring systemic takeup, is critical to ensure a rapid pace of change. It will not be easy, and some resistance may be expected. In this regard, the PSET CLOUD<sup>110</sup> scenario building process may be used in whole or in part. Innovations currently underway should form the basis of the review process, while the prototyping should feed into it on a more real-time basis. The review process should be led by the DHET and overseen by the entities which form part of the NQF *System of Collaboration*, namely, the CEO Committee and the NQF Forum.

A parallel critical requirement to overhauling systems of quality assurance will be to undertake ongoing capacity-building of staff in the QCs to align their skills with the requirements generated by the kinds of reform outlined above. Overhauling the credential and quality assurance landscape will require very different skills within the QCs than those that are needed currently to maintain existing systems.

## Creating an enabling policy environment in PSET

The current legislative and policy environment across the PSET system supporting greater flexibility and agility, alternative approaches to funding PSET opportunities, support for ongoing curriculum reform and development, and support for different modes of delivery is uneven and gaps, inconsistencies, and duplication exist. Several policies governing PSET contain unnecessary constraints. This applies to all sectors, but particularly in the TVET and CET sectors, where, for example, minimum hours of face-to-face contact are required for students to qualify for funding from NSFAS; there is a lack of formal recognition of online assignments, combined with monitoring processes that require physical copies of documents; staffing structures and job descriptions do not make provision for the human resource requirements of online learning or distance education; policies encourage competition between colleges rather than collaboration; and there is lack of flexibility for students to be able to study across colleges.

Consequently, a thorough review and revision of all PSET policies are required to support the kinds of systemic transformation needed to respond to the 4IR and achieve the vision outlined above. Consequently, we recommend that the DHET should:

- 1) Complete an environmental scan of legislation, policies, and regulations in the PSET system and identify gaps, inconsistencies and duplication that are inconsistent with the vision we have presented above.
- 2) Commence a consultative process of implementing revisions to existing policies, legislation, and regulations based on the provisions of this policy and the results of the above scan.
- 3) Embed provision for a flexible and agile PSET system in the national quality assurance system for PSET.
- 4) Comprehensively overhaul current systems of RPL to enable more effective RPL and facilitate articulation where gaps exist, taking account of expanding access to non-formal learning, self-study, and WIL opportunities.

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110 The PSET CLOUD Project is a co-creation project between merSETA and the Joint Education Trust Education Services.

## **Develop the capacity of staff to support systemic changes**

The vision for PSET outlined above will introduce significant challenges for academics, educators, and staff in institutional support units whose current knowledge and skills have, in many cases, not kept pace with the rate of change precipitated by the 4IR. For most, this will include requirements to adjust to more flexible, responsive, and agile approaches to teaching and learning (for example, greater use of online learning strategies, design and development of more short courses, and more frequent revisions and updates to curricula), but for a critical mass, it will also pose a significant challenge as the very areas of expertise in which they currently teach may become redundant. Consequently, ongoing CPD for staff across all departments and units of PSET institutions will be needed to enable them to adapt to these ongoing changes.

An effective flexible, agile, and open learning environment that responds to the imperatives of the 4IR will require the use of teaching and learning strategies that incorporate quality self-directed and learner-centred learning as part of the pedagogical design, as well as some radically different approaches to course design, assessment, credentialing, and RPL. PSET institutions and staff will therefore have to grapple with issues such as regular curriculum review and growing inter-disciplinary engagement, active engagement of students, appropriate learning resources to support more independent learning, the development of staff to enable effective teaching and learning through online provisioning, support for students, appropriate technologies and media, and assessment strategies with a strong emphasis on timeous, formative feedback.

Human resource structures, job descriptions, and institutional capacity in universities, CET and TVET colleges typically do not support this type of approach. This includes both creating dedicated positions to implement open learning and enabling greater flexibility among all educators to facilitate their participation in open learning initiatives. Several capacity-building needs exist, including, among others, ongoing updating of disciplinary and inter-disciplinary knowledge, basic ICT skills, instructional design, materials development, online and blended learning design and implementation, and online tutoring and facilitation.

There is thus a need to create flexible programmes of professional development options to support staff in developing required skills and competencies, integrated into a broader change management strategy. Having created support policies and procedures and secured sufficient time to shift behaviour, it is then possible to develop a menu of professional development options or staff to select from in planning their own professional development. This might include access to learning materials, short courses and workshops, online courses (including access to MOOCs), and one-to-one mentoring support during course development, among others. The focus of this professional development should be on:

- 1) Improving curriculum and course design skills, with a particular focus on designing meaningful learning outcomes, formative and summative assessment tasks, and structured, blended teaching and learning pathways, and effective implementation of RPL.
- 2) Gaining mastery over the tools of production for ICT and online learning to enable academics and educators to work directly within digital and online learning environments while developing courses.
- 3) Understanding the pedagogical strengths and weaknesses of a wide spectrum of teaching and learning options in blended learning environments.
- 4) Developing skills in providing effective online support services to students while ensuring that such provision does not become unduly onerous.

Such a programme would need to place a heavy emphasis on reskilling academics, educators, and support/administrative staff whose competence currently lies primarily in operations that will become increasingly redundant as the PSET system adapts to the imperatives of the 4IR.

## **Improve access to ICT as an enabler for institutions, staff, and students**

To remain relevant and to accommodate the increasing demands of modernisation, institutions have to maximise the use of appropriate digital technology; collaborate and share infrastructure; participate actively in global knowledge networks (both staff and students) that help to drive and shape 4IR-related innovations; embrace open access and open educational resources (OER) and the sharing of materials and resources; and build staff capacity in the use of ICT for both research, and teaching and learning. The DHET and PSET institutions need to ensure a strong and reliable digital infrastructure for the PSET system, including access to devices and affordable broadband connectivity for all students and staff. As has been noted, the growing digital divide means that there is a particular imperative to ensure that investments in ICT infrastructure for the PSET system are made on an

inclusive basis that provides equitable opportunities to those currently excluded both from PSET and from the broader economy.

Consequently, it is essential that DHET, in partnership with institutions and other government departments, should:

- 1) Review and align the ICT legislative and policy environment in support of the PSET system.
- 2) Develop an integrated ICT plan for the PSET system that is aligned to the national e-Skills Plan and the *National Integrated ICT Policy White Paper*.<sup>111</sup> 3) Work with the Department of Science and Technology (DST) and the Department of Telecommunications and Postal Services (DTPS) to extend the South African National Research and Education Network (SANREN) into all public TVET and CET colleges and HEIs to provide broadband access to all PSET institutions and campuses, as well as to other student support centres that might be developed off-campus to extend access to PSET opportunities for more students.
- 4) Work collaboratively with the PSET community so that all staff and students in PSET have access to affordable mobile devices and affordable connectivity for educational purposes (including extending possible zero-rating of key online learning platforms that has been implemented during the current country lockdown).
- 5) Develop a strategy to support PSET institutions (and especially TVET and CET colleges) with the expertise to develop, manage, and maintain campus and institutional ICT infrastructure.
- 6) Enable the development of institutional, inter-institutional and learner support centre ICT policies and plans (aligned to national policies) with appropriate financing strategies. These policies also include user security and protection of personal information, according to the Protection of Personal Information Act (Act No 4 of 2013) policies.

## **Accelerate the deployment of new innovation policy tools and practice to support Education for the Future**

A blend of emerging innovation policy tools and practice is well-placed to add impetus to the above five proposals for operationalising the vision. Building on the foresight report that identified Education for the Future as a priority STI domain, it is proposed that a mission board is established as a matter of urgency to finalise proposals for one or more research and innovation missions for inclusion in the first decadal plan for STI. The mission board should adopt and adapt the following criteria currently informing the development of missions in the context of the European Commission:<sup>112</sup>

- Bold, inspirational with wide social relevance;
- A clear direction – targeted, measurable, and timebound;
- Ambitious but realistic research and innovation actions;
- Cross-disciplinary, cross-sectoral, and cross-actor innovation; and
- Multiple, bottom-up solutions.

Compared to existing ways of identifying research and innovation priorities, missions require a different process of development. The European Commission thinking has identified the following criteria, which should guide the work of the mission board: engagement of diverse stakeholders; measurement and impact by goals and milestones; a portfolio of instruments to foster bottom-up solutions; and flexibility, proactive management, and building in-house capacities.

The design of missions will also include structured opportunities for the testing and deployment of theoretical frameworks and tools being developed through the Transformative Innovation Policy Consortium (TIPC), of which South Africa is a founding member.<sup>113</sup> The TIPC is a global consortium of STI policymakers, funders and researchers. Through a co-creation process, the consortium is evolving the theoretical frameworks and tools that can mobilise the power of innovation to address priority societal and environmental challenges of our time.

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111 Department of Telecommunications and Postal Services. (2016). National Integrated ICT Policy White Paper. Retrieved from: [https://www.dtps.gov.za/images/phocagallery/Popular\\_Topic\\_Pictures/National\\_Integrated\\_ICT\\_Policy\\_White.pdf](https://www.dtps.gov.za/images/phocagallery/Popular_Topic_Pictures/National_Integrated_ICT_Policy_White.pdf).

112 Mazzucato, M. (2018). Mission-oriented research and innovation in the European Union: a problem-solving approach to fuel innovation led growth. Brussels: European Commission. Retrieved from: [https://ec.europa.eu/info/sites/info/files/mazzucato\\_report\\_2018.pdf](https://ec.europa.eu/info/sites/info/files/mazzucato_report_2018.pdf).

113 See: <http://www.tipconsortium.net/>.

# 6

## Conclusion and recommendations

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South Africa faces unprecedented challenges as it grapples with the challenges and opportunities presented by the 4IR. These challenges have now been thrown into sharp relief by the Covid-19 pandemic and associated socio-economic disruptions, such as the recent credit downgrades. Within these challenges, though, lies an enormous opportunity, provided we act with purpose and intent, to redevelop our society and economy on a new basis, in ways that are just, equitable, inclusive, and sustainable. The 4IR offers us many tools to support this redevelopment, as does the provision of high-quality, relevant PSET opportunities for all South Africans. To seize this opportunity, though, it will be necessary to reinvent our PSET system so it can fulfil its true potential as a vehicle for social development and wealth creation for all South Africans.

This cannot be achieved through slow, incremental change. The economic headwinds we face and the relentless pace of technological change precipitated by the 4IR mean that we have to respond in kind, with purpose and speed. To do so will require a willingness to reconsider many of the core principles and operational models on which the PSET system is currently based. This can be done but will require a binding social contract from many key players across South African society. Considering this, the MTT on 4IR recommends the following:

- 1) **The DHET should, as a matter of urgency, integrate the recommendations contained in this report into its current draft National Plan for PSET to develop an overarching PSET Reform Plan** that recognises the serious operational problems outlined in this report and proposes concrete strategies for an overhaul of the current PSET system. As the draft plan is already under consideration by the Minister, this is a perfect opportunity to integrate affordances for the 4IR into the final plan. Ideally, once completed, it should serve to fast-track attainment of the vision for PSET outlined in this document and inject a high degree of urgency and more radical recommendations of the kind laid out in this report into that plan. We envisage the resulting document as a kind of ‘Marshall Plan’ for PSET in South Africa, which recognises the need for urgent action and backs up its recommendations with clear mechanisms to finance the needed reform. The plan should also make provision for the regional, sector-based coordination mechanism outlined in Section 4.2 above. Once finalised, the plan should be presented to and refined through ongoing consultation with all key stakeholders, but with an understanding that action is imperative, and thus that implementation should commence in the last quarter of 2020/21 at the latest.
- 2) **Establish small, cross-sectoral teams as soon as practically possible to commence planning and implementation of the proposed new educational opportunities** to model the PSET change proposed in this report, with one team focusing on skills development strategies, digital jobs and global business services and another on open learning programmes and short courses in the TVET sector.

- 3) In implementing the above two recommendations, urgently **convene a suitable mission board to integrate research and innovation into the PSET reform plan**. The mission board should include science councils like the Council for Scientific and Industrial Research (CSIR) and Human Sciences Research Council (HSRC), relevant research chairs, key stakeholder groups, including students and PSET management, technology companies, international experts, and partner departments.
- 4) **Convene a meeting of the three QCs, the two Departments of Education, and key non-profit and private sector actors to begin planning a review and reform of credentialing and quality assurance processes in PSET** to align them more effectively with the long-term needs of the PSET system and its students.
- 5) **Commission a review of all PSET policies and legislation** to enable clear identification of all the policy and legislative provisions that present impediments to the kind of systemic transformation envisaged in this report. The highest priority should be given to streamlining and simplifying the PSET policy environment in response to this review.
- 6) In parallel with the above processes, **develop and implement flexible programmes of professional development support**, making these widely available to institutions, educational staff, support staff, and quality council staff to enable ongoing reskilling in preparation for the changes that will need to be made in the PSET system as the PSET Reform Plan rolls out.
- 7) **Develop an integrated ICT plan for the PSET system** that includes the provision of affordable ICT devices and connectivity to all PSET students to ensure equitable access to learning opportunities made possible through the affordances of the 4IR. This should be an integrated section of the finalised National Plan for PSET mentioned in Recommendation 1 above.

# REFERENCES

- llais, S. (2014). Skills? What skills? Jobs? What jobs? The South African skills shortage? *Post-School Education Journal*, 1(1): 14–16. Retrieved from: <https://www.uj.ac.za/faculties/facultyofeducation/cert/Documents/Post-School%20Education%20Review%201.pdf>.
- Allais, S., Cooper, A. and Shalem, Y. (2019). Rupturing or reinforcing inequality? The role of education in South Africa today. *Transformation*, 101: 105–126.
- Andoh, H. (2019). South Africa's new science policy holds promise, but there are gaps. *The Conversation*, 10 April 2019. Retrieved from: <https://theconversation.com/south-africas-new-science-policy-holds-promise-but-there-are-gaps-115078>.
- Aoun, J.E. (2017). *Robot-proof: higher education in the age of artificial intelligence*. Cambridge, Massachusetts: MIT Press.
- Armstrong, B. (2020). Towards a skills framework for the 4th IR. Working Paper, Wits Business School.
- Barbarasa, E., Barrett, J. and Goldin, N. (2016). Skills gap or signalling gap? Insights from LinkedIn in emerging markets of Brazil, India, Indonesia, and South Africa. Washington DC: Solutions for Youth Employment; Mountain View, CA: LinkedIn. Retrieved from: [https://economicgraph.linkedin.com/content/dam/me/economicgraph/en-us/download/Skills\\_Gap\\_or\\_Signalling\\_Gap.pdf](https://economicgraph.linkedin.com/content/dam/me/economicgraph/en-us/download/Skills_Gap_or_Signalling_Gap.pdf).
- Bessant, J. (2018). *The great transformation, history for a techno-human future*. Abingdon: Routledge.
- Bisseker, C. (2019). Strategic shift for Western Cape. *Financial Mail*, 17 October 2019. Retrieved from: <https://www.businesslive.co.za/fm/features/2019-10-17-strategic-shift-for-western-cape/>.
- BizTrends. (2017). SA's graduate labour market: trends and issues. Retrieved from: <https://www.bizcommunity.com/Article/196/722/157320.html>.
- Burger, R. and van Fintel, D. (2010). Rising unemployment amongst South Africa's newest generation. Stellenbosch Policy Brief, 04/20. Retrieved from: <http://resep.sun.ac.za/wp-content/uploads/2017/10/20100607-saunemployment-v0.3.pdf>.
- BUSA. (2017). Strategic focus: education and skills development for current and future work. Retrieved from: <https://www.busa.org.za/wp-content/uploads/2018/05/Education-and-Skills-Development-for-Current-and-Future-Work.pdf>.
- Business Report Correspondent. (2019). Government partners with MICT SETA in move to create 1 million new jobs by 2030. *IOL Business Report*, 18 October 2019. Retrieved from: <https://www.iol.co.za/business-report/economy/government-partners-with-mict-seta-in-move-to-create-1-million-new-jobs-by-2030-35194671>.
- Butcher, N., Hoosen, S. and Mawoyo, M. (2015). Open practices in higher education: trends and possibilities for Africa. Johannesburg: Saide. Retrieved from: <https://www.oerafrica.org/system/files/9954/2015-02-13-openness-african-he-edited.docx?file=1&type=node&id=9954>.

- Copeland, B. J. (2020). Artificial intelligence. *Encyclopaedia Britannica*, 2020. Retrieved from: <https://www.britannica.com/technology/artificial-intelligence>.
- Craffert, L. and Visser, K. (2019). Western Cape digital skills shared agenda for action. Retrieved from: [https://www.westerncape.gov.za/sites/www.westerncape.gov.za/files/skills\\_boost\\_western\\_cape\\_-\\_as\\_is\\_-\\_final\\_report.pdf](https://www.westerncape.gov.za/sites/www.westerncape.gov.za/files/skills_boost_western_cape_-_as_is_-_final_report.pdf).
- Department of Higher Education and Training. (2019). Policy framework to address gender-based violence in the post-school education and training system. Retrieved from: <http://www.dhet.gov.za/SiteAssets/2019-04-15%20GBV%20Policy%20and%20Strategy%20Framework%20for%20the%20PSET%20Sector%20Ver%204%20For%20public%20comments.pdf>.
- Department of Higher Education and Training. (2019). Post-school education and training monitor: macro-indicator trends. Retrieved from: [http://www.dhet.gov.za/SiteAssets/Post-School%20Education%20and%20Training%20Monitor%20Report\\_March%202019.pdf](http://www.dhet.gov.za/SiteAssets/Post-School%20Education%20and%20Training%20Monitor%20Report_March%202019.pdf).
- Department of Higher Education and Training. (2018). Briefing on the 2017/8 annual report to the Portfolio Committee for Higher Education and Training, October 2018.
- Department of Higher Education and Training. (2018). Draft post-school education and training information policy. Retrieved from: [http://www.dhet.gov.za/Information%20Systems%20Coordination/Draft\\_Review\\_Information\\_Policy\\_21\\_Feb\\_2018%20\(1\)%20\(3\).pdf](http://www.dhet.gov.za/Information%20Systems%20Coordination/Draft_Review_Information_Policy_21_Feb_2018%20(1)%20(3).pdf).
- Department of Higher Education and Training. (2018). Strategic policy framework on disability for the post-school education and training system. Retrieved from: <http://www.dhet.gov.za/SiteAssets/Gazettes/Approved%20Strategic%20Disability%20Policy%20Framework%20Layout220518.pdf>.
- Department of Higher Education and Training. (2017). Open learning policy framework for post-school education and training. Retrieved from: [https://www.gov.za/sites/default/files/gcis\\_document/201704/40772gon335.pdf](https://www.gov.za/sites/default/files/gcis_document/201704/40772gon335.pdf).
- Department of Higher Education and Training. (2017). Policy for the post-school education and training central application service. Retrieved from: [https://www.gov.za/sites/default/files/gcis\\_document/201711/41226gon1224.pdf](https://www.gov.za/sites/default/files/gcis_document/201711/41226gon1224.pdf).
- Department of Higher Education and Training. (2016). Policy framework for the realisation of social inclusion in the post-school education and training system. Retrieved from: <http://www.dhet.gov.za/SiteAssets/Latest%20News/2017/January/Gazetted-Policy-Framework-for-the-Realisation-of-Social-Inclusion-in-PSET-No40496-Notice-no-1560.pdf>.
- Department of Higher Education and Training. (2014). Policy framework on differentiation in the South African post-school system. Retrieved from: <http://www.dhet.gov.za/Gazette/Policy%20Framework%20on%20Differentiation%20in%20the%20South%20African%20Post%20School%20System.pdf>.
- Department of Higher Education and Training. (2013). White paper for post-school education and training: building an expanded, effective and integrated post-school system. Retrieved from: <http://www.dhet.gov.za/SiteAssets/Latest%20News/White%20paper%20for%20post-school%20education%20and%20training.pdf>.
- Department of Science and Technology. (2019). White paper on science, technology and innovation. Retrieved from: [https://www.dst.gov.za/images/2019/WHITE\\_PAPER\\_ON\\_SCIENCE\\_AND\\_TECHNOLOGY\\_web.pdf](https://www.dst.gov.za/images/2019/WHITE_PAPER_ON_SCIENCE_AND_TECHNOLOGY_web.pdf).
- Department of Telecommunications and Postal Services. (2020). Draft national digital and future skills strategy: originality, agility, critical thinking and problem solving for digital inclusion. Pretoria: DTPS, 2020.
- Department of Telecommunications and Postal Services. (2016). National Integrated ICT Policy White Paper. Retrieved from: [https://www.dtps.gov.za/images/phocagallery/Popular\\_Topic\\_Pictures/National\\_Integrated\\_ICT\\_Policy\\_White.pdf](https://www.dtps.gov.za/images/phocagallery/Popular_Topic_Pictures/National_Integrated_ICT_Policy_White.pdf).
- Derviş, K. (2016). The future of work in the developing world. *Brookings Institute Up Front Blog*, 28 July 2016. Retrieved from: <https://www.brookings.edu/blog/up-front/2016/07/28/the-future-of-work-in-the-developing-world/>.

- Donaldson, A. (2017). Presentation at Harambee Youth Employment Accelerator – Solutions Exchange, Stellenbosch, October 2017.
- Eldridge, M., van der Berg, S. and Rich, K. (2017). A society divided: how unequal education quality limits social mobility in South Africa. Retrieved from: [http://resep.sun.ac.za/wp-content/uploads/2017/03/2372-Resep\\_PSPPD\\_A-society-divided\\_WEB.pdf](http://resep.sun.ac.za/wp-content/uploads/2017/03/2372-Resep_PSPPD_A-society-divided_WEB.pdf).
- Fongwa, S. (2018). Towards an expanded discourse on graduate outcomes in South Africa. Retrieved from: [http://www.scielo.org.za/scielo.php?script=sci\\_arttext&pid=S1947-94172018000300002&lng=en&nrm=iso&tlng=en](http://www.scielo.org.za/scielo.php?script=sci_arttext&pid=S1947-94172018000300002&lng=en&nrm=iso&tlng=en).
- Government of South Africa. (2019). Terms of reference for the presidential commission on the Fourth Industrial Revolution. Retrieved from: [https://www.gov.za/sites/default/files/gcis\\_document/201904/42388gen209.pdf](https://www.gov.za/sites/default/files/gcis_document/201904/42388gen209.pdf).
- Gustafsson-Wright, E. (2018). *Impact bonds and outcome funds for development*. Washington, DC: Brookings Institute.
- Harambee. (2016). Commissioned research from Dalberg Advisors, 'Assessing the demand for digital jobs', 2016.
- Harambee. (no date). Analysis of Statistics South Africa Quarterly Labour Force Survey Quarter 4, 2018 and Quarter 2, 2014.
- Harambee. (no date). Analysis of Statistics South Africa Quarterly Labour Force Survey Quarter 1, 2019.
- Harambee. (no date). Analysis of United Nations World Population Prospects and Statistics South Africa.
- Imaizumi, S. (2015). Partnerships and opportunities for digital jobs. Retrieved from: <https://blogs.worldbank.org/digital-development/partnerships-and-opportunities-digital-jobs>.
- Intsimbi Future Production Technologies Initiative. (no date). About Intsimbi. Retrieved from: <http://www.intsimbi.co.za/about.html>.
- Keevy, J., Rein, V., Chakroun, B. and Foster, L. (2019). Credentialing in the 21st century – beyond event horizon, in F. Oswald, T. Behrend and L. Foster. *Workforce readiness and the future of work*. New York: Routledge, 2019.
- Lourens, E. and Fourie-Malherbe, M. (2017). From graduate to employee: examining the factors that determine the professional success of graduates from disadvantaged backgrounds. Cape Town: Cape Higher Education Consortium (CHEC). Retrieved from: <http://www.chec.ac.za/files/2017-06-30%20Final%20CHEC%20research%20report%20with%20cover%2030%20June%202017.pdf>.
- Making Cents International. (2017). Scaling demand-driven training programs: a framework. Retrieved from: <https://youtheconomicopportunities.org/sites/default/files/uploads/resource/2017%20DDT%20report.pdf>.
- Matshediso, M. (2017). Tshepo One Million gives hope to unemployed youth. *Vuk'uzenzele*, June 2017. Retrieved from: <https://www.vukuzenzele.gov.za/tshepo-one-million-gives-hope-unemployed-youth>.
- Mazzucato, M. (2018). Mission-oriented research and innovation in the European Union: a problem-solving approach to fuel innovation led growth. Brussels: European Commission. Retrieved from: [https://ec.europa.eu/info/sites/info/files/mazzucato\\_report\\_2018.pdf](https://ec.europa.eu/info/sites/info/files/mazzucato_report_2018.pdf).
- McKinsey Global Institute. (2018). Skill shift automation and the future of the workforce. Retrieved from: <https://www.mckinsey.com/featured-insights/future-of-work/skill-shift-automation-and-the-future-of-the-workforce>.
- Ministry of Education, South Africa. (2001). National Plan for Higher Education. Retrieved from: [https://www.ru.ac.za/media/rhodesuniversity/content/institutionalplanning/documents/National\\_Plan\\_for\\_Higher\\_Education\\_in\\_South\\_Africa\\_2001.pdf](https://www.ru.ac.za/media/rhodesuniversity/content/institutionalplanning/documents/National_Plan_for_Higher_Education_in_South_Africa_2001.pdf).
- Ministry of Education, South Africa. (1997). Education White Paper 3: a programme for higher education transformation. Retrieved from: <https://www.justice.gov.za/commissions/FeesHET/docs/1997-WhitePaper-HE-Transformation.pdf>.

- Ndung'u, N. and Signé, L. (2020). The Fourth Industrial Revolution and digitization will transform Africa into a global powerhouse. Retrieved from: <https://www.brookings.edu/research/the-fourth-industrial-revolution-and-digitization-will-transform-africa-into-a-global-powerhouse/>.
- Peters, M. A. (2017). Technological unemployment: educating for the Fourth Industrial Revolution. *Educational Philosophy and Theory*, 49(1): 1–6. Retrieved from: <https://doi.org/10.1080/00131857.2016.1177412>.
- National Tooling Initiative. (2017). Presentation to the Department of Higher Education and Training. Unpublished.
- Schot, J., Daniels, C., Torrens, J. and Bloomfield, G. (2017). Developing a shared understanding of transformative innovation policy. Retrieved from: <http://www.tipconsortium.net/wp-content/uploads/2018/04/TIPC-Research-Brief.-Developing-a-Shared-Understanding-of-Transformative-Innovation-Policy-FINAL.pdf>.
- Schwab, K. (2017). *The Fourth Industrial Revolution*. New York: Crown Publishing.
- Schwab, K. (2018). The Fourth Industrial Revolution. *Encyclopaedia Britannica*, 2018. Retrieved from: <https://www.britannica.com/topic/The-Fourth-Industrial-Revolution-2119734>.
- South African Institute for Professional Accountants. (2020). South Africa builds its “Capable 4IR Army”. Retrieved from: <https://www.saipa.co.za/south-africa-builds-its-capable-4ir-army/>.
- Spaull, N. (2019). Priorities for education reform in South Africa. Input document for Treasury’s Economic Colloquium, 19 January 2019. Retrieved from: <https://nicspaull.files.wordpress.com/2019/01/v2-spaull-priorities-for-educ-reform-treasury-19-jan-2019.pdf>.
- The Economist Intelligence Unit. (2018). The automation readiness index: who is ready for the coming wave of automation? London: The Economist. Retrieved from: <https://www.automationreadiness.eiu.com/>.
- Trade and Industrial Policy Strategies. (2018). World Economic Forum and the Fourth Industrial Revolution. TIPS research report prepared for the Department of Trade and Industry. Retrieved from: [https://www.tips.org.za/research-archive/trade-and-industry/item/download/1722\\_cf04f6a06c4e94caba97246ca4381357](https://www.tips.org.za/research-archive/trade-and-industry/item/download/1722_cf04f6a06c4e94caba97246ca4381357).
- Van Broekhuizen, H. (2016). Graduate unemployment and higher education institutions in South Africa. Stellenbosch Economic Working Papers, 08/16. Retrieved from: <http://resep.sun.ac.za/wp-content/uploads/2018/07/wp-08-2016.pdf>.
- Van der Berg, S., Spaull, N., Wills, G., Gustafsson, M. and Kotze, J. (2016). Binding constraints in education: synthesis report for the Programme to Support Pro-Poor Policy Development (PSPPD). Stellenbosch: Research on Socio-Economic Policy (RESP). Retrieved from: [http://resep.sun.ac.za/wp-content/uploads/2017/10/PSPPD\\_BICiE-email-01062016.pdf](http://resep.sun.ac.za/wp-content/uploads/2017/10/PSPPD_BICiE-email-01062016.pdf).
- Wedekind, V. and Mutereko, S. (2016). Employability and curriculum responsiveness in post-school education and training. LMIP Report 22. Retrieved from: <http://www.psetresearchrepository.dhet.gov.za/sites/default/files/documentfiles//LMIP%20Report%2022%20WEB.pdf>.
- World Bank. (2019). World Development Report 2019: the changing nature of work. Washington, DC: World Bank. Retrieved from: <http://documents.worldbank.org/curated/en/816281518818814423/pdf/2019-WDR-Report.pdf>.
- World Economic Forum. (2018). Readiness for the future of production report 2018. Retrieved from: <https://www.weforum.org/reports/readiness-for-the-future-of-production-report-2018>.
- World Economic Forum. (2018). The future of jobs report. Retrieved from: [http://www3.weforum.org/docs/WEF\\_Future\\_of\\_Jobs\\_2018.pdf](http://www3.weforum.org/docs/WEF_Future_of_Jobs_2018.pdf).
- World Economic Forum. (no date). The Fourth Industrial Revolution by Klaus Schwab. Retrieved from: <https://www.weforum.org/about/the-fourth-industrial-revolution-by-klaus-schwab>.

# APPENDIX ONE: TASK TEAM MEMBERS

- Prof. Zebon Vilakazi (Chairperson), Deputy Vice-Chancellor, Research, University of Witwatersrand
- Dr Adriana Marais, Founder of Proudly Human, Director at the Foundation for Space Development Africa, Faculty at the Singularity University and Duke Corporate Education
- Prof. Aslam Fataar, Professor, Faculty of Education and Chair in University Transformation, Stellenbosch University
- Prof. BC Armstrong, Professor in the Chair of Digital Business, Wits Business School
- Dr Colin Thakur, Research Chair on Digitisation, Co Labs, Durban University of Technology
- Dr Geci Karuri-Sebina, South African Coordinator, African Development Bank Study on the Fourth Industrial Revolution and the Future of Work in Africa, African Centre for Economic Transformation
- Ms Ilse Karg, Chief Director, Future Production Technologies Fourth Industrial Revolution, Department of Trade and Industry
- Mr Imraan Patel, Deputy Director-General: Socio-Economic Innovation Partnerships, Department of Science and Innovation
- Ms Nicola Galombik, Founder and Chairman of the Board, Harambee Youth Employment Accelerator
- Ms Zamantungwa Khumalo, Head of Content, Supplements and Commercial Project, Mail and Guardian, World Economic Forum Global Shaper



# APPENDIX TWO: DEFINING OPEN LEARN

The *White Paper for Post-School Education and Training* (2013) defines open learning as:

An **approach** which combines the principles of learner-centeredness, lifelong learning, flexibility of learning provision, the removal of barriers to access learning, the recognition for credit of prior learning experience, the provision of learner support, the construction of learning programmes in the expectation that learners can succeed, and the maintenance of rigorous quality assurance over the design of learning materials and support systems.<sup>114</sup>

Thus, open learning is an approach to education that seeks to remove all unnecessary barriers to learning, while aiming to provide students with a reasonable chance of success in an education and training system centred on their specific needs and located in multiple areas of learning. It incorporates several key principles:

- *Learning opportunities should be lifelong and should encompass both education and training.*
- *The learning process should centre on the learners, build on their experience, and encourage independent and critical thinking.*
- *Learning provision should be flexible so that learners can increasingly choose, where, when, what and how they learn, as well as the pace at which they will learn.*
- *Prior learning, prior experience and demonstrated competencies should be recognised so that learners are not unnecessarily barred from educational opportunities by a lack of appropriate qualifications.*
- *Learners should be able to accumulate credits from different learning contexts.*
- *Providers should create the conditions for a fair chance of learner success.*<sup>115</sup>

Internationally and in South Africa, there is a tendency to conflate or equate open learning with distance education, e-learning, online learning, or blended learning and other terminology. As used by the DHET, open learning is not a synonym for *distance education*. The term *distance education* describes a collection of modes of delivery for the

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114 Department of Higher Education and Training. (2013). White paper for post-school education and training: building an expanded, effective and integrated post-school system. Retrieved from: <http://www.dhet.gov.za/SiteAssets/Latest%20News/White%20paper%20for%20post-school%20education%20and%20training.pdf>.

115 Butcher, N., Hoosen, S. and Mawoyo, M. (2015). Open practices in higher education: Trends and possibilities for Africa. Johannesburg: Saide. Retrieved from: <https://www.oerafrica.org/system/files/9954/2015-02-13-openness-african-he-edited.docx?file=1&type=node&id=9954>.

provision of structured learning in which the learner and the educator<sup>116</sup> do not have to be in the same place at the same time for learning to take place. It provides techniques of educational design and provision that, when used appropriately, can be open insofar as they can provide better chances of success to vastly more people who would otherwise not be able to access learning programmes, at a reduced cost once initial expenditure has been covered.

To deal with the growing combination of distance and face-to-face educational methods in many programmes, the notion of a continuum of educational provision has emerged in some circles. This continuum has at one end, provision only at a distance, while at the other end of the continuum, provision is solely face-to-face. The reality is that all educational provision exists somewhere on this continuum but cannot be placed strictly at either end. Re-conceptualising methods of educational provision as existing somewhere on this imaginary continuum has the result that certain methods of provision are no longer chosen to the exclusion of others, depending on whether they are 'distance' or 'face-to-face' educational opportunities. Rather, educational providers, when constructing educational courses, can choose, from a wide variety, those methods that are most appropriate for the context in which they will be providing learning opportunities. The principles of open learning provide an excellent framework for facilitating this decision-making process.

A logical consequence of the collapse of simplistic distinctions between contact and distance education, together with the increasingly exciting variety of digital media available and a decline in production and reception costs of these media, has been the emergence of resource-based learning. The concept is not new; it is based on the principle that educators should select, from the full range of educational provision options, those resources and methods most appropriate to the context in which they are providing education. This principle is, however, augmented by the understanding that managing the process of learning by using a 'talking lecturer' to transmit content is in many cases neither educationally nor financially effective. This is especially important in contexts in which quality solutions to educational problems are required on a large scale, as is the case in South Africa's PSET system.

The notion of resource-based learning means that a significant but varying proportion of communication between students and educators is not face-to-face, but takes place through the use of different media as necessary. The introduction of resource-based learning emerged strongly in the second half of the 20<sup>th</sup> century as more 'contact' institutions (particularly universities and colleges) became 'dual-mode' institutions, offering both distance and face-to-face educational programmes. Contact institutions have most often been making this move both to cope with increasing pressure on places and to find more cost-effective ways of providing education in a context of dwindling funds. As the distinctions between the two 'modes' of education have continued to collapse, however, it is becoming increasingly difficult to identify which programmes are being offered in which mode, particularly as resources developed for 'distance education' programmes are now being used in many 'contact' programmes. The emergence of ICT, and e-learning, which allow for much easier and cheaper production and online dissemination of knowledge through various digital media, has made this even more complex to define.

Thus:

- *Distance education* describes a set of teaching and learning strategies (or educational methods) that can be used to overcome spatial and temporal separation between educators and students. These strategies or methods can be integrated into any educational programme and potentially used in combination with other teaching and learning strategies in the provision of education (including with strategies that demand that students and educators be together at the same time and place).
- *Resource-based learning* involves the communication of curriculum between students and educators through the *use of resources* (instructionally designed and otherwise) that harness different media as necessary. Resource-based learning strategies can also be integrated into any educational programme,

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116 'Educator' is used in a general context and include teachers, lecturers, and instructors. When the document refers specifically to PSET, the word 'lecturer' also includes the instructors in practical components and skills development programmes.

using any mix of contact and distance education strategies. Resource-based learning need not imply any temporal and spatial separation between educators and students, although many resource-based learning strategies can be used to overcome such a separation.

There has been a growing tendency to use 'distance education' and 'e-learning' or 'online learning' interchangeably. However, the use of distance education and online learning as interchangeable or composite phrases introduces a confusing conflation of the terms, which has sometimes led to poor quality strategic planning. It is true that the introduction of ICT presents a new range of educational strategies, but it remains a relatively simple matter to establish whether specific uses of ICT incorporate temporal and spatial separation. Thus, for example, students working independently through online course materials are clearly engaged in a distance education practice, while the use of satellite-conferencing, although it allows a degree of spatial separation, has more in common with face-to-face education because it requires students to be in a specific place at a specific time. Thus, although online learning can potentially accommodate different ways and styles of learning (making for greater accessibility) and enable the construction of a potentially richer learning environment, it is not always the same as distance education.

Finally, the term *blended learning* has been introduced to refer to learning which involves a combination of traditional face-to-face instruction, e-learning, and online learning. This term recognises the reality that learning design increasingly involves a combination of a range of educational methods in ways that make it difficult to specify which mode of provision (face-to-face or distance) is being used.

While all the learning modalities mentioned above (distance education, resource-based learning, e-learning, online learning, and blended learning) are important *vehicles* for open learning, none of them should be *equated* with open learning. Open learning provides a framework to think about how to widen access and improve success in any educational context, with flexibility of provision contributing to expanded access, and quality of provision contributing to improved student success.

Part of this flexibility includes strengthening mechanisms that enable RPL, as well as credit accumulation and transfer, to allow learners more opportunities to learn and to have that learning formally recognised. This might include recognising both non-formal learning (learning offered by institutions that do not have a formal credential or certification as an outcome) and informal learning (learning that is not managed by an institution but by the individual learner, a form of learning facilitated by the explosion of educational content and resources online).

# APPENDIX THREE:

## GOVERNMENT INITIATIVES LINKED TO THE 4IR

- *Tshepo One Million Programme*: This is an initiative by the Gauteng government. Its goal is to target one million young people with skills training, job placement and entrepreneurship development in data science and related skills by 2030.<sup>117</sup>
- *Programme to Create One Million Jobs by 2030*: A partnership between the Ministry of Communications and the Media, Information, and Communication Technology Sector Education and Training Authority (MICT SETA) to create one million new jobs by 2030. The pilot phase of the project seeks to train and equip 1 000 unemployed youth with 4IR skills necessary to secure employment or start their own businesses. The skills development programme is segmented into seven streams: data science, digital content production, cybersecurity, cloud computing, drone piloting, 3D printing, and software development.<sup>118</sup>
- *Data Science for Impact and Decision Enablement (DSIDE) Programme*: An initiative of the DSI and hosted by the CSIR, DSIDE aims to build 4IR capacity by inviting university students to develop practical applications to real-world problems using data science.<sup>119</sup>
- *The South African Research Chairs Initiative (SARChI)*: Established in 2006 by the DSI, this initiative seeks to build research and innovation capacity at public universities. It does this by encouraging strong local research and innovation leadership in South Africa through research chairs with an investment trajectory of up to 15 years.<sup>120</sup>
- *Intsimbi Future Production Technologies Initiative (IFPTI)*: A national multi-stakeholder initiative established by the Department of Trade and Industry (DTI) and the Production Technologies Association of South Africa (PTSA). The initiative has been tasked with implementing a turnaround strategy for identifying trades required by the manufacturing sector for advanced production processes making use of digital technologies associated with 4IR.<sup>121</sup>

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117 Matshediso, M. (2017). Tshepo One Million gives hope to unemployed youth. *Vuk'uzenzele*, June 2017. Retrieved from: <https://www.vukuzenzele.gov.za/tshepo-one-million-gives-hope-unemployed-youth>.

118 Business Report Correspondent. (2019). Government partners with MICT SETA in move to create 1 million new jobs by 2030. *IOL Business Report*, 18 October 2019. Retrieved from: <https://www.iol.co.za/business-report/economy/government-partners-with-mict-seta-in-move-to-create-1-million-new-jobs-by-2030-35194671>.

119 South African Institute for Professional Accountants. (2020). South Africa builds its “Capable 4IR Army”. Retrieved from: <https://www.saipa.co.za/south-africa-builds-its-capable-4ir-army/>.

120 South African Institute for Professional Accountants. (2020). South Africa builds its “Capable 4IR Army”. Retrieved from: <https://www.saipa.co.za/south-africa-builds-its-capable-4ir-army/>.

121 Intsimbi Future Production Technologies Initiative. (no date). About Intsimbi. Retrieved from: <http://www.intsimbi.co.za/about.html>.

- *The Presidential plan to accelerate youth pathways into the economy over the next five years*: One element of the plan focuses on ensuring that economically excluded youth are absorbed into new jobs created in growth sectors. It is envisaged that 20 000 net new jobs will be created in the digital and ICT sector through this initiative over the next five years.
- *The Presidential Commission on the Fourth Industrial Revolution (4IR)*: Established in 2019, the commission coordinates the development of South Africa's national response action plan to deal with the 4IR in the form of policies, strategies, and plans that are needed to position South Africa as a leading country in the evolution and development of the 4IR. Its objectives (among others) include enhancing economic transformation and job creation and improving education outcomes and skills.<sup>122</sup>
- *The Western Cape Economic War-room*: An initiative set up by the Western Cape government to lift growth and job creation through direct engagement between government and the job sector. The war-room has five priority sectors, one of which is information technology and business process outsourcing.<sup>123</sup> Feeding into this is the Western Cape Digital Skills Shared Agenda for Action project which has been conceptualised with the main objective of positioning the province as a leading digital hub in the global economy by 2030, helping stimulate employment, and embedding digital skills across all sectors of the Western Cape economy.<sup>124</sup>
- *The Public Private Growth Initiative (PPGI)*: A sector-based collaboration between government and business which has earmarked 19 projects across various sectors of the South African economy for priority implementation. Work from the ICT sector group encompasses:
  - ICT curriculum – working with the government to introduce new legislation and policies for ICT to become formally part of the education curriculum to support the digital economy.
  - Skills development – enabling the ICT industry to direct SETA spend and skills levies to drive critical skills development.
  - A joint investment programme to create a sector fund for ICT start-ups that would provide preferential access to technologies and intellectual properties.
  - Establishment of an advisory council to work with ICT-related ministries in order to improve the collaboration, execution, and monitoring of how the sector and government partner to achieve economic and social impact.
  - Initiatives to introduce relevant incentives to attract local and foreign investment, promote innovation, and drive skills development objectives and programmes.

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122 Government of South Africa. (2019). Terms of reference for the presidential commission on the Fourth Industrial Revolution. Retrieved from: [https://www.gov.za/sites/default/files/gcis\\_document/201904/42388gen209.pdf](https://www.gov.za/sites/default/files/gcis_document/201904/42388gen209.pdf).

123 Bisseker, C. (2019). Strategic shift for Western Cape. *Financial Mail*, 17 October 2019. Retrieved from: <https://www.businesslive.co.za/fm/features/2019-10-17-strategic-shift-for-western-cape/>.

124 Craffert, L. and Visser, K. (2019). Western Cape digital skills shared agenda for action. Retrieved from: [https://www.westerncape.gov.za/sites/www.westerncape.gov.za/files/skills\\_boost\\_western\\_cape\\_-\\_as\\_is\\_-\\_final\\_report.pdf](https://www.westerncape.gov.za/sites/www.westerncape.gov.za/files/skills_boost_western_cape_-_as_is_-_final_report.pdf).



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