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FOURTH INDUSTRIAL REVOLUTION (4IR) WEBINAR REPORT

The Impact of 4IR Technologies: An Overview

March 2025

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LIST OF ACRONYMS AND ABBREVIATIONS

4IR:	Fourth Industrial Revolution
AI:	Artificial Intelligence
COVID-19:	Coronavirus Disease 2019
CSIR:	Council for Scientific and Industrial Research
DBE:	Department of Basic Education
DCDT:	Department of Communications and Digital Technologies
DDG:	Deputy Director-General
DED:	Department of Economic Development
DOL:	Department of Labour
DST:	Department of Science and Technology
DSTI:	Department of Science, Technology and Innovation
DTI:	Department of Trade and Industry
ICT:	Information and Communications Technology
IDC:	Industrial Development Corporation
ISTEAM:	Innovation, Science, Technology, Engineering, Arts and Mathematics
MPs:	Members of Parliament
PRU:	Parliamentary Research Unit
PSET:	Post-School Education Training
RPL:	Recognition of Prior Learning
STEM:	Science, Technology, Engineering and Mathematics

TIA: Technology Innovation Agency
WEF: World Economic Forum

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1. INTRODUCTION

The Fourth Industrial Revolution (4IR) is upon South Africa and Africa as a continent and young people have a huge role to play in Africa's development during the new digital era. With such a high population of young minds, the question should not be about South Africa's readiness for the 4IR, but rather the role young people will play in promoting it.

The 4IR could be described as the advent of "cyber-physical systems" involving entirely new capabilities for people and machines. It represents entirely new ways in which technology becomes embedded within societies and even our human bodies. Examples include, amongst others, genome editing, new forms of machine intelligence, breakthrough materials, and approaches to governance that rely on cryptographic methods such as blockchain. According to the World Economic Forum (WEF), the top three (3) skills required to thrive in 4IR include: complex problem solving, critical thinking, and creativity. These skills differ from the top skills listed by the WEF in 2015. As such, for the youth to be able to contribute to the 4IR, they need to upskill.

2. BACKGROUND[1]

In October 2017, a South African Parliament multi-party delegation led by the Deputy Speaker Honourable Lechesa Tsenoli embarked on a study tour to the Denmark Parliament (Folketing), the Danish Board of Technology and the then Department of Science and Technology (DST), now known as the Department of Science and Innovation (DSI) was undertaken. Denmark boasts of having one of the best Information and Communications Technology (ICT) infrastructures in the world. To give impetus and expression to the lessons learned from the Denmark Study Tour, Parliament hence proceeded to host a roundtable discussion on the 4IR on 31 May 2018.

This inaugural roundtable discussion was positioned as a launching pad to a series of high-level engagements of leading agencies and institutions, with the strategic intention of gearing South Africa towards optimising the benefits of the 4IR, while mitigating the inherent risks and challenges before us. The main purpose of the roundtable discussion was for Parliament to set the tone for further engagements focussing on the most crucial choices confronting South Africa on how the 4IR will influence the development trajectory.

Stemming from the first 4IR Roundtable discussion held on 31 May 2018, Parliament continued its commitment to engage in public dialogue to further explore opportunities and address any threats that may be associated with the 4IR. These engagements included various 4IR public awareness campaigns, Expos, roundtable discussions and webinars amongst others.

[1] Parliament of RSA (2018; 2019).

Subsequently, since the launch with the 4IR roundtable in 2019, there have been various commitments to “4IR” initiatives including Committees of Parliament with the mandate to conduct oversight over the Executive implementation of the “4IR”. This included numerous 4IR initiatives including roundtables, expos and awareness campaigns. In 2023 the Office of the Deputy Speaker in collaboration with the Portfolio Committee on Higher Education Science and Innovation embarked on a joint venture to celebrate young innovators through a series of initiatives to showcase youth innovation. This took the form of an EXPO where innovators could showcase their innovation. The ongoing partnership with the Council for Scientific and Industrial Research (CSIR), focusing on 4IR-related work in various forms remains critical to the success of such initiatives.

3. DISCUSSION

The Education and Recreation Cluster in the Parliamentary Research Unit (PRU) in collaboration with the CSIR hosted a webinar on 17 February 2025. The theme was: The Impact of 4IR: An Overview. The PRU is a unit within the Knowledge and Information Services (KIS) Division, Parliament of the Republic of South Africa (“Parliament”). A total of 169 participants attended the session.

3.1 Welcome and introduction

Dr J Moroe introduced the discussion with a short background and located the discussions on the 4th IR within context of the work of Parliament. Dr Moroe officially welcomed participants and unpacked the key tenets of the impact of 4IR technologies on sectors. He highlighted the opportunities to harness the power of technology to shape a future that is innovative, inclusive and globally competitive.

3.2 Keynote Address

The Deputy Speaker of the National Assembly, Hon Dr Annelie Lotriet delivered the keynote address in which she gave an overview of the impact of 4IR technologies. She highlighted how the 4IR is transforming our daily lives with digitalisation. She noted that technologies like artificial intelligence, cloud computing, robotics, and 3D printing are becoming increasingly prevalent.

Key Points

AI models specifically, such as ChatGPT and, more recently, DeepSeek, have taken the world by storm. When OpenAI released ChatGPT on 30 November 2022, the chatbot went viral on social media. In just two months, its users reached 100 million, excitedly sharing how ChatGPT can hold discussions, write articles, jokes, school assignments, and even poetry in response to prompts. This phenomenon raises important questions about the responsible and safe use of 4IR technologies.

Potential: These technologies hold incredible potential for human and socio-economic development. Integrating smart technologies in various sectors enhances productivity, reduces resource waste, fosters economic development, and enables better decision-making. It can also lead to improved quality of life by boosting healthcare, designing smarter cities, and

providing enhanced services, while also contributing to sustainability through optimised resource usage and reduced environmental footprint.

Risks: 4IR technologies raises fears of job displacement due to automation and AI, the unequal distribution of technological benefits, and widening of existing economic disparities. It increases risks of cybersecurity threats that jeopardise privacy and security It also raises ethical concerns about AI and surveillance misuse. Regulatory challenges are also becoming widespread as laws have been unable to keep pace with rapid technological developments. Our lack of digital infrastructure and necessary skills further exacerbate these risks.

Parliament: Parliamentarians and parliamentary officials are entrusted with law-making and government oversight. It is essential for us to ensure the responsible use of these technologies while mitigating all other risks. In 2023 at the 147th Inter-Parliamentary Union Assembly, I vividly recall the chilling expert hearing on the social and humanitarian impact of autonomous weapon systems and artificial intelligence which have the capability to operate without direct human control or supervision. The advancements discussed showcased how decisions on life and death are shifting from humans to opaque algorithms, raising serious concerns about human rights. While the 4IR has positive aspects, these types of discussions highlight the critical need for technology regulation across policy areas.

2024 AI Index Report: The 2024 *AI Index Report* from Stanford University finds that there has been a noticeable surge in AI-related legislation worldwide. Over the period from 2016 to 2023, parliaments in 127 countries passed a combined total of 123 bills that reference AI. These regulations cover a range of issues, such as educational reforms, ensuring fairness and non-discrimination in AI algorithms, and setting up AI education initiatives. This demonstrates a growing acknowledgment of the need for structured regulatory guidelines to oversee the ethical advancement and use of AI technologies. In South Africa, although certain activities involving AI are governed by existing legislation, and efforts are underway towards future regulation, most AI operations remain unregulated.

2020 Report of the Presidential Commission: The 2020 *Report of the Presidential Commission on The Fourth Industrial Revolution* highlights key sectors in South Africa where 4IR technologies can be employed to improve services and other outcomes. These include Energy, Water and Sanitation, Agriculture and Bio-diversity Management, Health, and Mining, to name but a few.

The Report also makes recommendations, of which the review, amendment or creation of policy and legislation is one. It states that “the regulatory environment must be adapted to enable the desired progress. This exercise requires **the legislature to be trained to become science literate** in order to implement changes that are holistic, integrating the specific logics of technologies, the industries they impact, the people who will both consume and produce them and the agility requirements to compete on a global stage.”

The Deputy Speaker appealed to Members of Parliament, committee researchers and content advisors to keep 4IR developments and policy implications on your committees’ radars. Be proactive in following local and international 4IR policy narratives related to your subject areas. Continue collaborating with colleagues and experts from organisations like the CSIR and others to gather diverse and informed perspectives. Bring tough questions to the Committees’ attention to ensure the ethical and transparent use of these new technologies. She urged

Parliament to do its part in narrowing the gap between technological developments and their responsible application.

3.3 Introductory Remarks

The introductory remarks were delivered by Dr Mmboneni Muofhe - Deputy Director-General (DDG) for Socio-Economic Innovation Partnerships [Department of Science, Technology and Innovation (DSTI)]. Dr Muofhe noted that South Africa has reached a point where we no longer talk about 4IR as this coming force that is going to impact us and our economy. Instead, the 4IR is upon us. As such, there are several opportunities to embrace as well as challenges that we need to look at. Dr Muofhe emphatically noted that we cannot control the pace at which these technologies are emerging.

Key Points

The 4IR is upon us: The 4IR is here and we have no choice but to embrace it and not find ourselves left behind. It is the rise in the usage of data, connectivity, analytics, the human machine interaction, space robotics amongst others. There is also predictive analysis, additive manufacturing which is crucial in industry. When referring to data, the aspect of cloud computing and smart sensors come into play. As such, it is pivotal that Government be one to drive and enable 4IR. Government has not reaped much from the 4IR in terms of efficiencies in Government as it relates to planning and policy development.

Challenges: One of the challenges that needs to be addressed is connectivity and infrastructure. For example, data collection and storage. It is the kind of data collected and the quality thereof and where it's stored, how accessible it is and most of all how secure and safe it is. This leads to the issue of data security. Cyber security is crucial since the level of cyber crime is a major concern.

Government: Government thus see the power of these technologies in terms of policymaking and implementation of policies, data handling, data usage, etc. It is also critical to understand that education is key to the 4IR as skills are required and education itself enables 4IR. Digital skills thus becomes pivotal within all communities. These technologies can also serve as interventions to address many challenges within sectors. This leads to cycles of interdependencies where one thing breaks down it then impacts everything. It is thus essential to ensure that the ecosystem is fixed and functional. Foundational digital capabilities is the key enabler.

Regulation: There are so many sources of information, some of which are not regulated. Some of which we do not know what is true or not. As much as we are adopting these technologies, there is always going to be a need for human intervention.

Parliament: Dr Muofhe acknowledged Parliament as a key player in ensuring that we explore the pitfalls and opportunities and continue to build on them. The reality being that our existence and success as a country is dependent on how well we adapt and adopt these technologies and at the same time minimizing the negative impact on society.

3.4 Panel Discussion

The CSIR played a video which demonstrated the opportunities 4IR technologies can bring. The video centred on an application or technology developed by the CSIR. This application aims to promote early literacy among students. It highlighted the need to ensure technology reaches all. However, connectivity is essential for any technology to be rolled out.

Mr A Mmoto is the Acting Deputy Director-General for ICT Policy at the Department of Communications and Digital Technologies (DCDT) in South Africa. Mr Mmoto posed the question whether South Africa is ready. He noted that we may have pockets of technologies within various sectors and industries including Government in which we may be doing well. However, Mr Mmoto also indicated that in some areas we may not be doing very well like privacy, especially how companies use artificial intelligence. In some instances, companies in South Africa may be at the centre of 4IR globally whilst others may be moving at a slow pace. The big question is how and where we as Africa and South Africa anchor these technologies since these technologies are anchored on data. Mr Mmoto highlighted that if we are not generators and contributors to data then ultimately, we will find ourselves complaining about issues of ethics and AI bias. How much of African data is there where these models are going to learn and draw from?

Foundational digital capabilities are thus essential to build our own technologies. The education system is thus pivotal in addressing the digital skills shortage. Mr Mmoto noted that globally policy is lagging behind the technology development. However, there is policy and strategy development in this regard. He urged that the country move at speed in terms of building our data sets that will make us relevant players in the 4IR space.

Jay Moodley, one of the CSIR researchers, shared his thoughts on how government manages AI fairness, data, protection and infrastructure security and still remain agile enough to adopt rapid technological changes and promote a capable and innovative state. He highlighted the notion that whenever we speak about all aspects of 4IR then infrastructure is the first layer, then processes, the people and then security. He noted that South Africa experiences a lot of disparity in the technology researched and implemented. It easily takes a year or 2 to roll out policy for AI which is outdated as a consequence. Specifically, when products are being developed within 3 – 6 months. Thus, the pace of technology is pivotal in policy development to ensure relevancy. Policy should thus be addressed together with ongoing conversations of cyber security, infrastructure, compliance and monitoring.

There is a need for all role players to combine efforts in terms of a Digital Ethics and Security Council to conduct impact assessments on businesses that use AI or have plans of using AI. This would entail monitoring by means of centralised dashboards and registers. This is so that government and the science community have an overview of what tools are being used in industry, why, and what the impact is thereof. This may include whether it is automation of processes or whether it's cost savings and efficiencies which can be used as forms of declaration. This implies that companies, depending on size, implementing AI for whichever purposes, need to be compliant with standards set not only by South Africa but also BRICS. In addition, infrastructure is critical for implementation and monitoring. Compliance remains key to the implementation of any AI in the country. Besides looking at businesses that use AI, there is a need to also look at the Shadow AI concept that is a large gap in current initiatives and strategic initiatives. Shadow AI is workers using ChatGPT and the ChatGPT. There is a

need to look at what workers are doing and how it's been used. In addition to the coding curriculum, there is a need to look at digital bridging qualifications and micro certifications. Expanding innovation hubs beyond urban, smart city corporate centres to reach community centres where we can drive education and generative AI with the youth industry, and with small businesses.

Suveer Matadin responded to the anxiety from society as it relates to job losses. He noted that there are various factors that would influence it. However, this should not be the case for South Africa. He stated that technology should not be a one-size-fits-all. The mix and shape of technologies selected should depend on the functionality that's needed and the social and economic conditions of the company, country or industry. South Africa has a population of 60 per cent under the age of 25. It wouldn't make sense to do mass drop replacements using mechanisation from a financial perspective. A hybrid model would be appropriate for South Africa. For example, automation, manual or human workforce. Human-centred automation through exoskeletons which will help increase strength, stamin, safety of the workforce. The CSIR is also working the exoskeleton space. South Africa should embrace a self-balancing hybrid model that would take all these elements into consideration.

4. THE WAY FORWARD

Ms Linda Stofile, Senior Researcher, Parliament of RSA summed up the way forward and thanked the participants.

Emanating from the 4IR webinar initiatives in the 5th and 6th Parliament, it should be reiterated that no one must be left out, and we are thus looking forward to having a consolidated collaborative effort with various stakeholders such as the CSIR.

The rich discussions during the webinar ignited several topics that will be addressed in future 4IR webinars. The following recommendations emanated from the webinar.

4.1 Key recommendations emanating from the webinar

- Ethics is critical within the 4IR space.
- There is a need for government to draft substantive legislation on Artificial Intelligence (AI).
- Government should engage existing regulators on AI matters.
- There is a need for a legislative framework that will encompass aspects relating to compliance, monitoring, and innovation.
- There should be synergy between the various regulatory frameworks developed to deal with the implementation of AI in the country.
- Public participation and involvement is critical in creating awareness within the AI space.
- An appeal to policymakers to be cognizant when developing a legislative/regulatory framework to not hinder innovation.
- South Africa should secure information systems from ongoing threats from other countries and secure our workforce through training programs and regulation of international businesses and how they use AI systems within the country.

5. CONCLUDING REMARKS

The 4IR has impacted all sectors of society, especially with the onset of the Coronavirus Disease 2019 (COVID-19) pandemic. COVID-19 brought drastic changes from face-to-face teaching and learning in four-walled lecture halls, and inequality among countries, institutions, and students which was unveiled and exposed. For example, the COVID-19 pandemic has compelled educational institutions across the world to change from traditional pedagogies of curriculum delivery to digital platforms and has thus been a catalyst for the 4IR.

The anticipated impact the 4IR will have on society has laid the platform for South Africa and the rest of the African continent to embrace the opportunities presented and develop a shared 4IR vision for Africa. It is eminent that the posed challenges are becoming unique opportunities. Especially whereby current and future technologies are leveraged and the potential threats mitigated. Achieved by ensuring a cohesive and comprehensive national response involving the citizenry and prioritising the key areas of focus in developing policies, laws and programmes of action.

The inequalities during the pandemic were evident as historically disadvantaged institutions and sectors continued to experience technological infrastructural and staff capacity limitations. The lack of suitable infrastructure and access to technology can cause some constraints for the successful integration of remote conditions. Challenges include access to digital devices such as laptops and data, digital literacy training, and connectivity, amongst others.

It is evident that inequalities remain a huge challenge across all sectors of society. However, while challenges do remain in the system, South Africa has made many strides in the 4IR landscape. The 4IR conversation is becoming rigorous and it is acknowledged that there is a need to redefine this phenomenon to suit our context.

Parliament thus maintains its vision of an activist and responsible People's Parliament devoted to improving the quality of life for all citizens. As the highest public political institution in the country, our contribution to truly representing the people will be to contribute to taking action to close the inequality gap. Parliament, therefore, has an obligation through its oversight functions to facilitate proactive oversight over the implementation of the Executive's priorities. It is thus imperative that Parliament create a regulatory and enabling environment by developing a 4IR legislative framework to ensure that effective oversight is conducted.

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6. REFERENCES

- World Economic Forum (2017).
- Parliament Roundtable Report (2018).
- Parliament Roundtable Report (2019).
- Parliament Webinar Report (2022).

APPENDICES

Appendix A: Findings and recommendations from previous 4IR initiatives

Below is an overview of key findings and recommendations that emanated from 4IR initiatives such as the roundtable discussions and webinars.

FINDINGS	RECOMMENDATIONS
Roundtable 1: 18 May 2018	

• There are departments that have initiatives on the 4th IR.
  ○ Department of Science and Technology (DST)
  ○ Department of Trade and Industry (DTI)
  ○ Department of Higher Education and Training (DHET)
  ○ Department of Economic Development (DED)
  ○ Department of Labour (DOL)
  ○ Department of Basic Education (DBE)
  ○ Industrial Development Corporation (IDC)
  ○ Technology Innovation Agency (TIA)
• An Inter-ministerial task team has been initiated.
• Lack of co-ordination and integration across spheres and sectors.
	• Adopt an integrated approach and develop a National Strategy on the 4th IR.
	• Consolidate the Inter-ministerial task team.
	• Presidential Advisory Council as a focused approach towards the development, production, uptake and usage of cutting-edge technologies throughout the economy, taking into account the possible negative consequences on employment and job creation.
	• The proposed Advisory Council shall commission high-level research, international and regional benchmarking, and engage stakeholders within and outside government in meetings and other fora to obtain and consider the views of a cross-section of societal role players in the development of the Fourth Industrial Revolution National Action Plan.
	• A National Blueprint is recommended to regulate the 4IR.
	• Public-private partnership model is required to create an innovative and competitive manufacturing ecosystem.
	• Consultative process, being initiated by Parliament.

FINDINGS	RECOMMENDATIONS
Roundtable 2: 19 February 2019	

• Rapid organisational change that 4IR is creating in not only organisations but also society and legislatures
• The future of regulation in relation to Adaptive regulation, Regulatory sandboxes and greenhouses, Outcome-based regulations, One-size fits all scenario and Collaboration.
• Regulation to date has been largely based on a one-size fits all model and with the advent of digital technology, one-size-fits-all does not fit all.
• 4IR strategies are mainly focusing on technology and the digital landscape
• Awareness and understanding of 4IR are one of our main themes of the digital industrial policy.
• Members of Parliament (MPs) need to understand the implications of the 4IR and what responsibility it confers in relation to oversight and the key role of MPs in communicating important issues to the public.
• An aging workforce
• Industrialisation vs Automation
• Commercialise innovation and protect intellectual property rights
• The current education system (both pedagogy and the content in its current state) does not support 4IR
• Teacher-centred and learner-centred methodologies are not adequate
• It takes at least 2 years to change a curriculum
• There is a need to establish strategic partners
• Data bias: There are limited African databases. The systems are trained with data that is available and most of the existing data does not come from Africa
• Limited public access to data
  ○ There is a lack of data ownership
• Cyber security is critical since initially the internet was developed with a focus on connectivity and not security. A similar trend is emerging with the 4IR.
• The focus on Science, Technology, Engineering and Mathematics (STEM) must change to Innovation, Science, Technology, Engineering, Arts and Mathematics (ISTEAM).
	Paradigm shift required across sectors
	Organisations to understand how 4IR technology such as the internet of things (IoT), and AI, can improve the work at grassroots level
	• **Adaptive regulation:** Agile government requires adaptive regulation. Due to the high level of complexity, appropriate agile governance, regulation and decision-making require a systems approach
	• **Regulatory sandboxes and greenhouses:** There is a role for legislatures and policymakers to encourage regulation to create these sandboxes and greenhouse environments
	• **Outcome-based regulations:** Include regulations not determining the technical inputs by technologies that are being applied here but driven by the outcomes
	• **One-size fits all scenario:** Regulation needs to reduce red tape and an application of a regulatory framework is required that is risk-weighted and allows small start-ups to be able to scale their solutions in a safe environment.
	• **Collaboration:** National and international collaboration is necessary and explore the integration of Africa into the 4IR space.
	• Create research capacity to develop a strategy for the digital and industrial economy.
	• Introduce a social compact and include the human aspect into strategies.
	• Political commitment required including the review of mandates
	  ○ Review of policy coherence and alignment when exploring the development of systems for connectivity.
	• Design and implement information and awareness programmes to discuss and have policy dialogues on 4IR.
	• There is a need to explore the self-regulatory dimensions of all of this as it relates to ethical decision-making to enhance a good/responsible citizenry.

FINDINGS	RECOMMENDATIONS

	• Africa has a younger population and there is a huge opportunity for the world to invest in the young people of Africa and do skills development
	• There is a need to look at jobs in relation to industrialisation and automation
	• Not only focus on research-based innovation that is being commercialised, but also explore solutions introduced by industry and commercialising that together with protecting the intellectual property rights
	• There is a need for curriculum reform/change in the existing curriculum development
	• There is a need for learner-led methodologies i.e. 5Cs
	  ○ Critical thinking, collaborating, creativity, communication skills, computational skills;
	  ○ Simulations; and
	  ○ Coding programmes.
	• Create an enabling environment for innovation.
	• Partnerships with a shared 4IR vision are required to include social and human scientists.
	  ○ Country-wide, cross-sectoral plan of action is required including academia, industry, civil society.
	  ○ Africa must participate in global data creation spaces.
	• Social media can be used to collect data
	  ○ Policies required to deal with data ownership include encrypting data.
	• From the onset, there should be a focus on security aspects relating to 4IR.
	• It is pivotal to include the creative industry in technology development to ensure a holistic enabling environment that embraces the needs of industry and society.

FINDINGS	RECOMMENDATIONS
4IR Webinar: April 2022	
• Inadequate provision of robotics kits; the introduction of this new subject into an already full curriculum presents timetabling problems; • Inadequate training of teachers; and the challenges brought through the use of robotic systems as these are costly, require internet connectivity and are sometimes too unwieldy for the larger classroom setting. • The downsides of 4IR may include deepening existing inequalities and widening the gender gap. • Find local solutions for local problems. • Prepare learners in the Post-School Education and Training (PSET) system for an uncertain future; and the need to foster creativity and 'mental elasticity' to ensure the creation of something valuable for society. • All institutions must produce competent students who can then enter the job market upon exiting their studies. • Interrelated subsystems include technology-enabled learning environments; accreditation and certification; teacher/learner reskilling; curriculum relevance and competency skills; ecosystem agility and redesign; entrepreneurship; industry linkages and relationships; and decent work. • The importance of the humanities and social sciences in developing the emotional intelligence, creativity, writing and communication skills required to thrive in a "4IR workplace". • Key departments are driving the 4IR from the executive perspective. As such budgeting is influenced by what projects and plans these key departments will implement. • Within the rural setting where infrastructure, development and load shedding present challenges to accessing coding, robots and internet connectivity a specific rural strategy framework should be developed to guide the advancement of computer skills, internet usage, wireless internet and the cost factor. • Technology exists for learners to learn in an online environment in a place where there is no internet connectivity.	• Government and Parliament to ensure adequate budget is appropriated to successfully implement the 4IR; • The PSET sector to continuously review and implement a curriculum needed to create an enabling environment that contributes to the 4IR; • The high costs associated with accessing information need to be addressed by Government through relevant partnerships with the private sector; • Government should place a special focus on the marginalised and rural areas; • Government and relevant stakeholders should support the work of local creatives, innovators and creators who, through their localised solutions, contribute to the reduction of costs associated with the implementation of the 4IR; • Due to the speed at which the internet of things is developing, Government should ensure that no learner or teacher is left behind through continuous improvement of competency and foundational skills; • Parliament to develop systems to ensure that there is a deeper engagement with the public on the research and innovation underway in the PSET sector, as well as the implications of the 4IR on labour and employment; • Government needs to fast-track the rollout of digital infrastructure that facilitates access to information, enhancing transparency and building interconnected communities; • Government and Parliament to continue their efforts to review, amend or create policy and legislation that supports the successful implementation of the 4IR; • Government and stakeholders should use the COVID-19 disruption as a lesson to evaluate its current initiatives within the education sector and reinforce the need for creating an adaptable workforce that approaches learning as a continuous process.

FINDINGS	RECOMMENDATIONS
• Basic and Higher Education and Training curriculum must be revised. • Need for teachers to be adequate training in the pedagogy and methodology for teaching Coding and Robotics. • A need for teachers to transform their teaching to teaching in a play-based environment and employ a problem-based methodology. • The is a need for skills development in the education sector. • The COVID-19 disruption highlighted how unprepared the education system was for the 4IR. It further underscored the level of inequality in the sector, accessing infrastructure, and equipment.	• Government and Parliament to ensure adequate budget is appropriated to successfully implement the 4IR; • The PSET sector to continuously review and implement a curriculum needed to create an enabling environment that contributes to the 4IR; • The high costs associated with accessing information need to be addressed by Government through relevant partnerships with the private sector; • Government should place a special focus on the marginalised and rural areas; • Extensive training of officials, and research and development of more affordable robotics kits accompanied by teacher guides. • Collaboration across key directorates within the department. • A dedicated educational network to facilitate interconnectedness which encompasses finding a long-term solution to introduce zero-rating on all access to local content; a strategy for expanding online learning for PSET; various infrastructure initiatives; open, i.e. free educational resources; curriculum and programme review; and skills development and capacity building. • The strategic placement of the National Advisory Council on Innovation (NACI) within Government, particularly the Presidency, to ensure that all Government Departments have a directed focus on the implementation of 4IR. • Different solutions are required within the South African context, particularly when the inequalities of economics and geographical spaces are taken into consideration. • Universities to include robotics in the programme of students of education to ensure they enter the job market already armed with these skills. • HEIs to explore offering recognised short courses, which carry credits, in coding to teachers so these courses can be regarded

FINDINGS	RECOMMENDATIONS
	within the system of Recognition of Prior Learning (RPL). • Adequate, deep training of teachers through ongoing short courses throughout their careers is essential to keeping teachers current in the implementation of 4IR in the curriculum. • These are thus issues that need to be addressed through discussion and appropriate budgeting for all relevant sectors, particularly education and science, to ensure equality.

Appendix B: Previous findings and recommendations pertaining to the role of Parliament

FINDINGS	RECOMMENDATIONS
Roundtable 1: 18 May 2018	
• Parliament has a key strategic role to play in the 4IR. • Parliament through its law-making functions must ensure that an appropriate legal framework is established for the 4IR. • Parliament should ensure evidence-based oversight over 4IR initiatives of the Executive. • Parliament is ideally placed through its public participation function to increase awareness, education and discussion on the 4IRamongst all sectors of society. • Parliament itself should harness the benefits of the 4IR.	• All Members and the parliamentary administration must be fully au fait of the impact of the 4IR on the core constitutional functions of Parliament i.e. law-making, oversight, public participation intergovernmental relations, and international relations. • Parliament must prioritise the development of a legislative framework to address the gains and challenges of the 4IR • Parliament should drive a countrywide process to ensure the appropriate integration across the provinces and local government. • The appropriate parliamentary structures should be identified to ensure coordination and synergy, particularly across and within the four critical sectors (society, industry, business and skills) • Parliament should ensure that broader civil society, such as organised labour, Non-Governmental Organisations (NGOs), the media, etc. is well-informed to engage knowledgeably and meaningfully • The parliamentary administration should adapt its strategy, systems and processes to incorporate 4IR in its support functions.
Roundtable 2: February 2019	
• Parliament through its public participation functions must ensure the implementation of a sector-wide information and awareness campaign • Parliament should ensure evidence-based oversight over 4IR initiatives of the Executive • Parliament through its law-making functions must ensure that an appropriate legal framework is established for the 4IR. • There is a need to develop policy, legislation and regulations that create an enabling environment for innovation to allow the economy to grow. • Parliament should rigorously drive its 4IR information and awareness campaign to optimise the opportunities emerging within this space	• Parliament should formalise strategic partnerships as part of its 4IR information and awareness campaign • The appropriate parliamentary structures should be identified to ensure coordination and synergy, particularly across and within the four critical sectors (society, industry, business and skills) • Parliament should prioritise the development of a legislative framework for the 4IR landscape • Parliament should drive a countrywide legislative process to ensure the appropriate integration across the provinces and local government. • The 4IR requires all stakeholders to be in constant dialogue due to the nature of the

FINDINGS	RECOMMENDATIONS
	technologies that characterize it and most importantly, this requires Parliament to take the lead. • Parliament should review its internal procedures that govern its constitutionally mandated functions • The parliamentary administration should develop an institutional 4IR strategy that will inform its systems and processes.
4IR Webinar: April 2022	
• Challenge of accessibility, i.e. access to Wi-Fi and social media, in the context of public involvement and how this is mitigated through solutions that include the use of WhatsApp, the provision of data particularly for citizens living in rural areas, and the use of social media. • The increased use of robotics and digitisation in response to the COVID-19 pandemic has prompted some to argue that this constitutes the onset of the 5IR. • Inadequate provision of robotics kits; the introduction of this new subject into an already full curriculum presents timetabling problems; • Inadequate training of teachers; and the challenges brought through the use of robotic systems as these are costly, require internet connectivity and are sometimes too unwieldy for the larger classroom setting.	• There is a need for Parliament (Members and administration) to be swiftly adaptable in this ever-changing landscape. • Extensive training of officials, and research and development of more affordable robotics kits accompanied by teacher guides. • Collaboration across key directorates within the department. • Need for Parliament to raise the significance of appropriate budget allocation because of the ripple effects of the implementation of the 4IR. • The budget should not merely be thought of in monetary terms, but the potential impact of investing appropriate resources should also be taken into consideration. • The appropriate allocation will ensure better preparedness for the future.