2021 South African Science, Technology and Innovation Indicators Report

Dhesigen Naidoo 26 August 2021

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South African Innovation Scorecard





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Dysfunctional Innovation Ecosystem







Fractional Publications Benchmarking



Fourth Industrial Revolution Publications

 Country has high world share of publications on AI, IoT & Nanotechnology

Technologies	South Africa Publications 2019	World Publications 2019	World Share (%)
Internet of Things	81	12 303	0,65
3D Printing	31	7 551	0,41
Quantum Computing	9	1 777	0,50
Nanotechnology	1 424	220 207	0,64
Robotics	85	25 863	0,32
Artificial Intelligence	84	11 509	0,72
Autonomous Vehicles	54	9 269	0,58



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Researchers per Sector



Performance on 2019 TIMS

		Grade 5		Grade 9						
International Benchmark	Mathematics		Science	Mathematics				Science		
	2015	2019	2019	2011	2015	2019	2011	2015	2019	
Advanced (>625)	1%	1%	2%	1%	1%	1%	1%	1%	1%	
High (550-625)	4%	4%	4%	2%	3%	2%	3%	4%	4%	
Intermediate (475- 550)	12%	11%	8%	6%	10%	10%	7%	9%	10%	
Low (400-475)	22%	21%	14%	18%	210%	28%	14%	18%	21%	
Not Achieved (<400)	61%	63%	72%	73%	66%	59%	75%	68%	64%	
Average SA Scores	376	374	324	352	372	389	332	358	370	



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Publications vs Patents Performance



- Scientific publications per million population continue to grow
- Opposite trend for patent applications per million population



Publications

Patent Applications

Benchmarking of BRICS Countries

• South Africa remains outside the top 50 on all indices, despite the size of GDP and market sophistication



BERD and GERD Trend



Foreign Funded Business Expenditure on R&D



NRF Research Infrastructure Funding



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Main Patents Applicants at CIPC, 2018





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Medium and Higher Technology

Innovatio n Research	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019
	output in R' billion (constant 2010 prices)										
Manufacturing	339	359	370	377	381	382	381	384	383	387	384
Medium & Higher Technology (MHT)	101	106	108	107	108	108	111	113	112	108	113
MHT less motor vehicles	90	93	94	94	94	93	95	97	96	92	95
	% share of manufacturing output										
МНТ	29,95	29,59	29,09	28,45	28,29	28,35	29,16	29,51	29,22	27,99	29,36
MHT less motors %	26,52	26	25,51	24,82	24,55	24,41	25	25,33	24,95	23,89	24,75

Higher Technology Exports

	South Africa	Brazil	South Africa%	Brazil%		
	value (US	D' million)	% share of manufactured exports			
2010	2 505 592	8 819 040	6,2	12,3		
2011	2 763 367	9 155 405	6,2	10,9		
2012	2 939 308	9 475 998	6,9	11,5		
2013	2 717 238	9 070 091	6,8	10,7		
2014	2 808 162	8 808 891	6,7	11,7		
2015	2 934 141	9 447 829	7,7	13,6		
2016	2 398 334	10 421 109	6,7	14,8		
2017	2 198 489	10 756 517	5,7	13,9		
2018	2 268 032	11 096 280	5,7	13,4		
2019	2 043 756	9 427 925	5,5	13,3		



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Benchmarking of Higher Technology

	Percentage
Malaysia	51,8
China	30,8
World	23,6
Middle Income Countries	22,6
Mexico	20,4
Brazil	13,3
Russian Federation	13,0
Chile	7,5
Portugal	6,9
South Africa	5,5
Argentina	5,2



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Some Reflections





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Box of Chocolates is half empty

- Important fundamentals are still in place and functioning
- 4IR progress has had a good start.
- We are falling short of both our ambitions and aspirations.
- The overall development indicators and the STI indicators [GII, WCY] contribute actively to the Social Progress Index [SPI] and the Human Development Index [HDI].







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Socio-Economic Landscape





Difficult Box of Chocolates

- · Important fundamentals are still in place and functioning
- RSA progress in the 4IR domain has a good start.
- We are falling short of both our ambitions and aspirations.
- The overall development indicators and the STI indicators [GII, WCY] contribute actively to the Social Progress Index [SPI] and the Human Development Index [HDI].
- STI Investment decline is discouraging and its continuation will have grave repercussions
- Bridge across the Innovation Chasm is still single lane, mostly gravel and requires a 4X4.
- The HCD pipeline is in trouble.
- The NSI needs structural renovation.





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Publications: adequacy, directionality & linkages + o

 Scientific publications continue to increase in South Africa:

~Are 476 publications per million population per year sufficient for South Africa considering a catch-up by Egypt?

Who should produce more (university types?, science councils vs universities? postgraduate students? Established researchers? Early career researchers?)

~Increasing number of publications are in Social Sciences, a proportion that seems to be one of the largest globally?

Should this be a concern? What type of knowledge is generated? Should government drive prioritisation of scientific enquiry?

~Are there any linkages between local knowledge generation and technology development/ learning?





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Insufficient Technological Capabili

 These indicators demonstrates low technological capability: low level of patenting, low share of high technology exports and declining proportion of BERD:

~Are we clear about the gaps in our technological capability?

- We should not forget our pockets of excellence (e.g. Sasol)
- We need to focus on global challenges such as Health (e.g. Covid-19, HIV/AIDS and tuberculosis), Energy, Environment, steering of Fourth Industrial Revolution
- We should solve local challenges such as mineral beneficiation and deep-levels mining

~Is TIA achieving its mandate of bringing the Innovation Chasm?

~ Are our assumptions correct regarding the linear model of innovation?

Will we not always be behind the technological frontier?





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Constrained Funding of STI

- Evidence shows lack of funding for various NSI activities:
 - GERD as % of GDP declining from 0,83% in 2017/18 to 0,75% in 2018/19 (*there is a caution regarding the survey's low response rate due to Covid-19*)
 - 18,1% decline in the National Research Foundation (NRF) grants claimed from 2019 to 2020 (impact on areas such as research infrastructure)
 - Share of the BERD on GERD has been declining consistently since 2009/10 (from 53,2% to 39,3% in 2018/19)
 - ~ Where should funding come from for research, technology development and commercialisation?
 - What about the return on investment from both profit and public good perspectives?





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Dankie Enkosi Ha khensa Re a leboga Ro livhuwa Siyabonga Siyathokoza Thank you





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