Keynote Address

Research and Innovation Strategy Group (RISG) Dialogue, Durban, South Africa

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Research and Innovation for Societal and Economic Impact

The Chairperson of the Research and Innovation Strategy Group (RISG), Professor Thoko Mayekiso, Vice Chancellors and Deputy Vice Chancellors present, the Chief Executive Officer of Universities South Africa, Dr Phethiwe Matutu, Members of the Organizing Committee of the 2023 RISG Dialogue, Distinguished Invited Guests, Fellow Participants, Distinguished Ladies and Gentlemen. Kindly permit me to stand on the existing protocols to thank you for the invitation extended to me to give the keynote address at the 2023 RISG Dialogue. I bring you warm greeting from Kwame Nkrumah University of Science and Technology (KNUST) in Ghana, where I have been serving as the Dean of the Business School for the past six years.

I am excited to be asked to lead this morning's dialogue on the theme: "**Research and Innovation for Societal and Economic Impact**". This theme is not only relevant to the contemporary development challenges facing Africa and the rest of the world, but it also really touches on the growing need to marshall research, innovation as well as entrepreneurial resources for greater economic, social, and environmental sustainability.

1. Existing Dialogues on Research and Innovation and their Impacts on Society

Professor Chair, scholarly and policy dialogues on the societal and economic impacts of research and innovation activities have been extensive and spanned across various disciplines, including development economics, sociology, policy studies among others. An understanding is that research and innovation activities are intertwined, with scientific research activities serving as foundation for innovation outputs to create social and economic values. Ongoing narratives highlight the multidimensional nature of research and innovation activities, and they reflect the perspectives of scholars from various disciplines on how research and innovation activities can be harnessed to generate positive developmental impacts.

On that note, Professor Chair, several reports issued by governments, international development agencies such as the World Bank, IMF, the Organization for Economic Co-operation and Development (OECD), as well as academic publications have highlighted the primacy of research and innovation activities in fostering societal and economic development. This body of knowledge has particularly underscored the crucial role that research and innovation play in fostering improved living standards and quality of life of people. The United Nations Conference on Trade and Development (UNCTAD) has published several reports on the subject, including their "Science, Technology, and Innovation Policy Review" series, which provides an overview of the state of research and innovation in different countries. The World Bank has also conducted studies on the economic benefits of research and innovation, such as their report on "The Economic Benefits of Research and Innovation: A Global Perspective" (2015). Studies conducted by academia have also highlighted the impacts of research and innovation activities on economic growth and job creation. For example, studies show that research and development (R&D) activities had a positive impact on economic growth in the United States, and are major drivers of job creation in the European Union. In addition, the International Monetary Fund (IMF) published a report in 2017 that highlighted the importance of research and innovation for poverty reduction. Similarly, the OECD published a report in 2018 that discussed the role of research and innovation in promoting sustainable development. Thus, there has been an extensive body of knowledge that has established the societal and economic impacts of research and innovation activities.

2. How research and innovation activities have fostered societal and economic development around the world

It is well recognized that research and innovation activities are important in generating new knowledge, products, services, and technologies that improve the lives of people and create new opportunities for economic prosperity and wellbeing of the human society. Research and innovation activities have also been credited for strengthening competitiveness of businesses and national economies. The World Intellectual Property Organization (WIPO) estimates that innovative economies tend to grow faster than non-innovative ones and countries that invest more in research and development (R&D) exhibit higher gross domestic product (GDP) growth rates.

For example, the United States National Science Foundation has determined that research and innovation is critical for the competitiveness, prosperity, and security of United States (U.S.) and its businesses, and such as the U.S. increased its "R&D expenditure by **$51 Billion in 2020** to **$717 Billion**; and this amount was projected to be increased further to **$792 Billion by 2022**. This investment in research and innovation has led to advances in fields such as medicine, healthcare, technology, engineering, and among others. In particular, medical advances have led to improved health and longer life expectancy, while technological advances have enabled new products and services that have improved people's lives. In addition, research and innovation activities have led to springing up of new industries and revitalization of existing industries, thus providing new and emerging job opportunities. The development of the internet and the growth of the digital economy have led to the creation of millions of new jobs in the technology sector. This has had a positive impact on the American economy and society as a whole, as people have been able to find new and better-paying jobs and new businesses have been able to expand and create new opportunities for economic growth.

South Korea's economic transformation, often referred to as "**Miracle on the Han River**," was driven by significant investments in research and innovation. The country's focus on technology and R&D has led to the rise of global giants like **Samsung, Hyundai, LG Electronics, etc**, contributing to sustained economic growth. Further, the World Health Organization (WHO) estimates that innovative healthcare solutions, such as vaccines and medical technologies, have significantly reduced global mortality rates. For example, the **Green Revolution**, which introduced high-yield crop varieties and advanced agricultural practices, has played a pivotal role in addressing food scarcity and hunger in parts of Africa, Asia and Latin America. Besides, the United Nations Development Programme (UNDP) highlights that innovation is critical for achieving key Sustainable Development Goals (SDGs), as it enables the development of solutions for clean water, affordable healthcare, and poverty reduction. For instance, the **innovative use of mobile money platforms in many parts of Sub-Saharan Africa** has expanded financial inclusion and improved access to financial services among underserved and socially excluded populations.

In sum, research and innovation activities are instrumental in driving societal and economic development, and evidence shows how **these activities can transform societies through economic growth, job creation, technological advancements, and solutions for pressing developmental challenges.** I argue in this keynote that African countries can position themselves for long-term prosperity and improved quality of life for their citizens by fostering an environment that allows research and innovation activities to flourish, particularly within institutions of higher learning.

3. The Current Landscape of Research and Innovation in Africa

Professor Chair, kindly permit me to share some thoughts on the current landscape of research and innovation in sub-Saharan Africa.

The African continent represents approximately 20% of the earth's surface and is home to **1.3 billion people**, likely **reaching 2.5 billion people by 2050**. The continent boasts **60% of the world's arable lands**, large swathes of forest reserves, **30% of the world's reserve of minerals**, and the **youngest population of any continent**. Despite these riches, Africa produces only **3% of global GDP**, accounts for less than **3% of international trade** (mainly primary commodities and natural resources), and **shoulders 25% of the global disease and poverty burdens**. This bleak picture about Africa is even worse when it comes to research and innovation activities: Africa has barely **1% of the world's global research and innovation outputs**, averagely contributes less than **1% of its GDP to research and innovation activities**, accounts for only **1.3% of total global research spending** and produces **0.1% of all patents**. While South Africa, through its

National Research Foundation, continues to be the largest spender on research and innovation as a share of GDP in Africa, even that is very small: in 2022, the gross domestic expenditure on research & development as a percentage of South Africa's GDP amounted to only **0.85%** and there is no evidence that this expenditure level will increase in the foreseeable future as annual increment has been averaging around **0.1%**.

Besides, estimates show that the proportion of researchers in the African population is **25 and 28 times** lower than the proportion in the United Kingdom and the United States, respectively. The percentage of Africans pursuing graduate research study is **three times lower than the global average**. There are similar gaps with respect to facilities and equipment needed to conduct cutting-edge research on the continent: African countries lack the infrastructure to support investment in research and innovation activities, and investment is lacking in building up research infrastructure. It is also the case that resources for research and innovation on the continent are fragmented, with individuals, organizations, and governments that fund and engage in research and innovation activities not having any mechanism for systematic collaboration.

As I indicated earlier, Professor Chair, countries that spend more on research and innovation, tend to be the more competitive and prosperous globally. But, when we look at the **world's top 20 innovative countries** in terms of their research and development expenditures, the number of domestic patent applications and the number of domestic public high-tech companies, Africa is completely absent. This raises serious concerns about Africa's readiness for global competitiveness (**see Figure 1 and Figure 2**).

Show Figure 1 here: Top 20 Innovative Countries in the World

Show Figure 2 here: The World Most Innovative Countries

According to the **Global Innovation Index, 2021 (GII),** as published by the **World Intellectual Property Organization (WIPO),** only Mauritius (52), South Africa (61), Kenya (85), Cape Verde (89) and Tanzania (90) are captured in the top 100 innovative countries in the world. WIPO's estimate is that the remaining 49 sovereign African countries (along with South America and the Middle East regions) will continue to languish in the hierarchy of R&D spenders. Besides, **the 2021 Global R&D Funding Forecast by Country** shows that Africa is not expected to do well as the continent does not feature in the top ten R&D expending countries (**see Figure 3**). Africa's overall R&D expenditure is expected to be just about **$20 billion** (see **Figure 4**), which is a mere **0.9% of its total GDP** (see **Figure 5)**.

Show Figure 3 here: Top Ten R&D Spending Countries

Show Figure 4 here: R&D Spending Summaries by Regions

Show Figure 5 here: R&D Spending as a Share of GDP by Regions

4. Funding Research and Innovation Activities in sub-Saharan Africa

Professor Chair, kindly permit me to highlight some additional challenges associated with research and innovation spending in Africa. It is the case that Africa's continued low investment in research and innovation is seriously undermining the continent's economic transformation goal. While research institutions (particularly universities) in more innovative economies rely on funding from a variety of public and private sector funding sources (e.g., **crowd funding, industrial grants, licensing of IPs, philanthropic grants, internal resources, government grants, and others**), research and innovation in Africa is largely funded by the public sector, with significant proportions of financing in many African countries coming from international development agencies and aid providers. However, this funding remains dreadfully insufficient **(see Figure 6).** For example, Universities in Ghana receive less than **$1,000 per annum** per academic faculty from government to fund what is called faculty **Book and Research allowance**. Researchers in many African HEIs must, therefore, depend largely on very competitive international research grant calls to remain relevant in research. Unstable political environments, poor governance, and corruption has often been cited as major deterrents to private sector funding for research and innovation on the continent. As a result, there are not enough resources and infrastructure available for research and innovation in Africa, and with the limited resources available, we do not get the most out of them because they are so fragmented.

Show Figure 6 here: Africa's Top R&D Spenders

The several years of low research and innovation investment, Professor Chair, has had far-reaching consequences. Kindly permit to highlight three of these consequences.

a) One is **poor economic and scientific infrastructure** that has compelled the continent to rely on outdated colonial development model of resource extraction, which we all know is unsustainable and largely responsible for the continent's worsening poverty condition and continued dependency on aid from other countries to fund the continent's budgets: the continent received a total of **$204 billion in aid in 2022**, representing **47.2% of all global aid**.

b) The other is **high brain-drain of talents to more innovative OECD countries**. As Mo Ibrahim Foundation recently highlighted, a growing brain-drain of talents is a bane to Africa's development potential. The African Union estimates that about **70,000 skilled professionals** (particularly healthcare professionals) leave the continent every year, with the total number of African migrants in OECD countries estimated to rise to **34 million by 2050**. Interestingly, countries that rank high on global innovation index (e.g., France, UK, and U.S) are host to about **50.0% of the total sub-Saharan African diaspora**.

c) **Poor quality and low volume of research from the continent.** According to the World Bank, African researchers produce only **1% of the world's research,** and that is disappointing.

5. Some Proposed Strategies to Push Frontiers of Research and Innovation in Africa's HEIs

Professor Chair, it is well recognized that globalization and internationalization, among other forces, continue to modify the role Africa's HEIs play in advancing development of Africa's economy. HEIs are now expected to prioritize research, innovative and entrepreneurship; with an enhanced capacity to commercialize their research outcomes and spin-out new knowledge-based enterprises, while at the same collaborating closely with the private sector, offering advisory and consulting services, among a host of other key engagements to generate new revenue streams and to impact the society more positively. Along this line, one can imagine a huge potential from the growing recognition by policymakers and development partners of the role that research and innovation can play in fostering Africa's economic and societal transformation. Kindly permit me to offer some ideas around this issue.

a) African countries must create an enabling environment by using ***pro-research, pro-innovation, pro-science, pro-technology and pro-entrepreneurship*** policies to overcome barriers to over-regulation, corruption, and low investment, while enabling private-and-public sector innovation, adaptation, and adoption. At the same time, African governments must also invest in creating an ecosystem that facilitates investment in research and innovation in a way that does not only accelerate discovery but also allow innovations to enter the marketplace more quickly.

b) It is also crucially important to **bridge Africa's skills deficiency gap in science, technology, innovation, and entrepreneurship** to unlock the continent's potential to accelerate its own economic growth and prosperity. We need to take note of the fact that the best-trained and most talented researchers are attracted to environments where their efforts are complemented and leveraged by modern equipment, reliable utilities, sufficient funding for supplies and a pool of other talented people. To this end, serious efforts should be made to reverse the tide of Africa's brain drain. This can be done by creating a **world-class education and research infrastructure** in the higher education ecosystem to attract and retain global talents on the continent. I think South Africa is providing leadership on this front, and its model may be a standard for other African countries.

c) It is my contention that as **postgraduate research talent is developed across the continent, supported by investment in research, innovation and entrepreneurship**, we can expect dramatic productivity improvement across various sectors, including manufacturing, new business start-ups, which are required for Africa to realize its development potential and boost prosperity and wellbeing of its people. In fact, a McKinsey report estimates that manufacturing spending in Africa is projected to reach **$1 trillion by 2050**, and if sustained, it can reignite growth through improved productivity. I agree with the McKinsey report that efforts to accelerate digitization, develop the continent's talent of young researchers and scientists, collaborate more regionally, increase investment in research and innovation infrastructure, and grow more business champions are some of the pathways to increase productivity to support strong and sustainable growth in Africa.

d) Creating an **ecosystem where scientific culture can be central to economic transformation and policymaking decisions** is a long-term investment that must not be left in the hands of only political actors. Success will require effective tripartite (public-private-academia) collaborations and partnerships that should be sustained over time. Should this be done in an era of the African Continental Free Trade Area, one can expect the benefits of research and innovation to be marshaled for greater economic, social, and environmental sustainability on the continent.

6. Notable Initiatives to Strengthen Research and Innovation Capacity on the Continent

Professor Chair, with your kind permission, I would like to end my address by showcasing some remarkable initiatives that have been pioneered across the continent to push the frontiers of research and innovation in higher education institutions (HEIs).

a) South Africa's National Research Foundation is providing a remarkable leadership with its robust research system that comprises of excellent universities and science facilities that allow South Africa to be a full-fledged contributor to the global scientific community and an integral participant in international collaborations. Besides the South African Research Chairs Initiative (SARChI), the recently launched OR Tambo Africa Research Chairs Initiative, of which I am one of the ten recipients, is certainly the way to go: this initiative is a collaborative effort led by South Africa's National Research Foundation with funding support from Oliver & Adelaide Tambo Foundation, Department of Science and Innovation of South Africa, International Development Research Center of Canada, and Science Granting Councils in the recipient African countries. With the O.R. Tambo Africa Research Chairs Initiative (ORTARChI) funding, we have been successful in increasing scientific research excellence by recruiting, training and retaining excellent postgraduate and post-doctoral researchers (100+), support career development of young and emerging scientists, and through our inclusive and gender responsive entrepreneurship training program, we have provided essential entrepreneurship and business venture management skills to vulnerable groups (e.g., women, students and young people) in selected African countries (135 women business owners are targeted to be trained in 2023/2024). These initiatives and efforts have made it possible for us to directly impact on the youth employability and new job creation.

b) The World Bank funded Africa Centers of Excellence Impact projects, one of which I jointly lead at Kwame Nkrumah University of Science and Technology, has supported 53 centers of excellence across the continent to: 1) strengthen capacity for technology transfer; 2) develop capacity for institutional innovation and entrepreneurship; and 3) foster innovation-oriented cooperation of research infrastructures. With this intervention mechanism, we have created platforms to engage key stakeholders from industry, government, and the public through organization of several innovation weeks and research fairs across the West Africa subregion. We are also using this mechanism to promote tripartite (public-private-academia) co-creation activities to stimulate entrepreneurship culture on university campuses by commercializing student and faculty research and innovation outputs in partnership with industry and governmental stakeholders.

c) The Center for Applied Research and Innovation in Supply Chain-Africa (CARISCA), established three years ago, with funding support from USAID, offers another excellent lens for understanding how research and innovation can be co-created in Africa to drive positive societal impact. CARISCA is a global center of excellence for training, generating, and translating applied research and innovations into positive development outcomes across Africa. The center operationalizes this goal through four mechanisms: research & innovation, stakeholder engagement, curricula & training, and access & inclusion. These mechanisms provide a major pathway for research and innovation co-creation process that uses the center's student innovation lab to provide a pro-innovation and pro-entrepreneurship environment (with modern equipment) to support students and faculty to commercialize their innovative ideas in partnership with industry.

d) The Coalition for African Research and Innovation (CARI) has also been established to accelerate scientific breakthroughs in Africa so that more Africans can be supported to lead better lives sooner. It is an initiative under the auspices of the **Alliance for Accelerating Excellence in Science in Africa (AESA)**, with funding support from NEPAD, national institutes of health, Bill & Melinda Gates foundation, and other funding agencies, and aims to create a platform within Africa from which a coalition of stakeholders can build a highly coordinated, well-funded, innovative African R&D community together.

e) **African Union Research Grants (AURG)** has also been established by the Africa Union Commission to support pan African research and development through grants and direct funding. The Commission through the support of the European Union secured a sum of **17.5 million euro** under the **EU Pan-African Programme** to launch 2 calls for research proposals in Africa in 2016 and 2018.

7. Conclusion

In conclusion, Professor Chair, I would like to thank the organizers of this year's Research and Innovation Strategy Group (RISG) Dialogue once again for the invitation extended to me to speak to the importance of using research and innovation as well as entrepreneurship as development tools to foster positive societal and economic impacts in Africa. It is important that all major stakeholders within the research and innovation ecosystem are engaged in partnership of equals, marked by mutual respect and understanding of the needs and interests of partners involved in funding and sustaining research and innovation capacity to support the continent's economic transformation.

It is really an honor to join this important gathering, and I wish you all fruitful deliberations. Please enjoy the dialogue.

Thank you!

Nathaniel Boso (PhD)

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Figures

Figure 1: Top 20 Innovative Countries in the World

1. Switzerland (Number 1 in 2020)
2. Sweden (2)
3. United States of America (3)
4. United Kingdom (4)
5. Republic of Korea (10)
6. Netherlands (5)
7. Finland (7)
8. Singapore (8)
9. Denmark (6)
10. Germany (9)
11. France (12)
12. China (14)
13. Japan (16)
14. Hong Kong (China) (11)
15. Israel (13)
16. Canada (17)
17. Iceland (21)
18. Austria (19)
19. Ireland (15)
20. Norway (20)

Figure 2: The World Most Innovative Countries

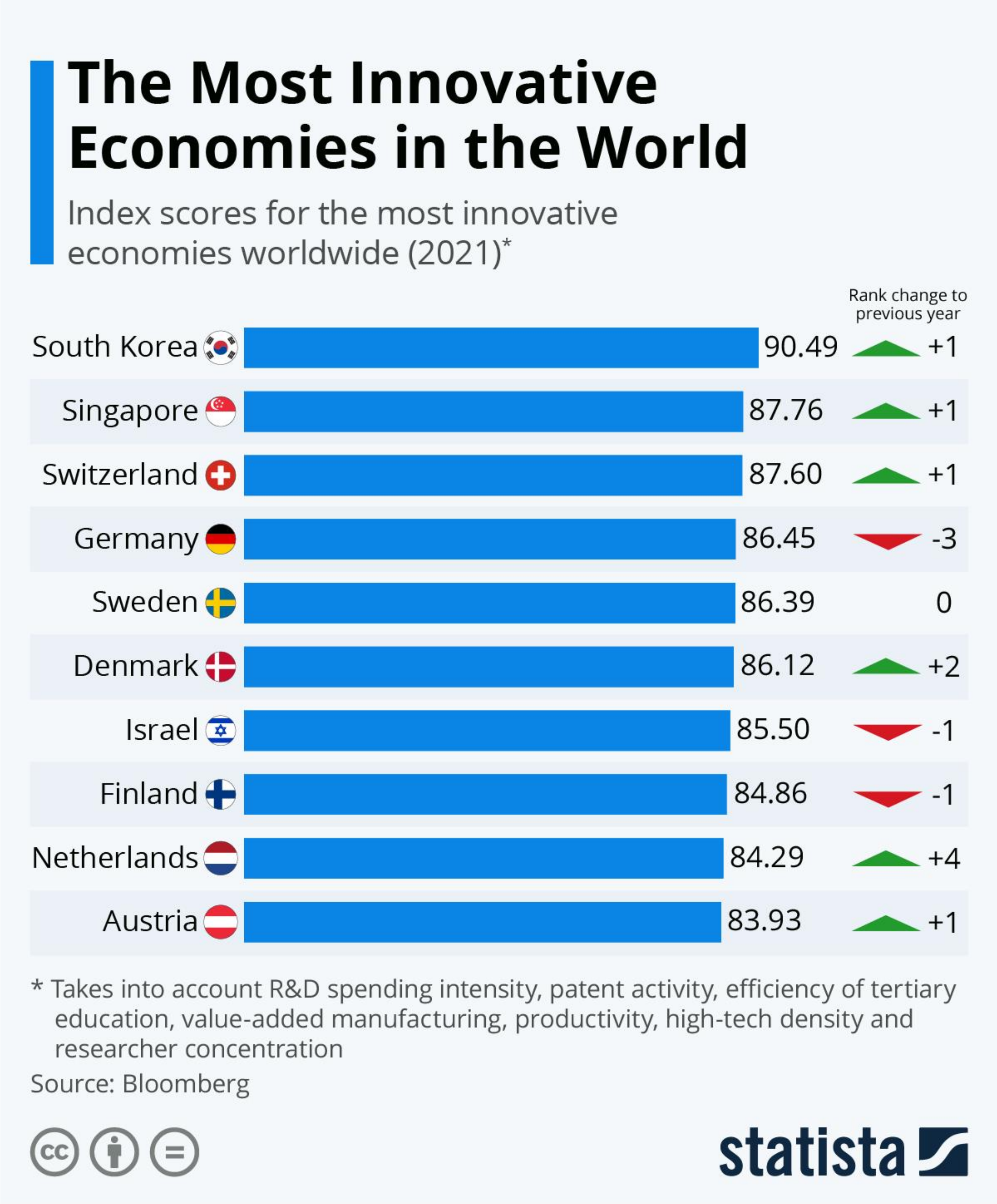

Figure 3: Top Ten R&D Spending Countries

TOP 10 R&D SPENDING COUNTRIES FOR 2021							
		2020 Estimated			2021 Forecast		
Top 10	Country	GDP PPP Bil, US$	R&D as % GDP	GERD PPP Bil, US$	GDP PPP Bil, US$	R&D as % GDP	GERD PPP Bil, US$
1	China	29,010.7	1.98%	574.40	31,389.6	1.98%	621.50
2	United States	20,145.1	2.88%	580.20	20,789.7	2.88%	598.70
3	Japan	5,174.2	3.50%	181.10	5,210.4	3.50%	182.36
4	Germany	4,283.5	2.84%	121.65	4,480.5	2.84%	127.25
5	India	9,991.1	0.86%	85.92	10,870.3	0.86%	93.48
6	South Korea	2,002.6	4.35%	87.11	2,102.7	4.35%	91.47
7	France	2,864.7	2.25%	64.46	2,979.3	2.25%	67.03
8	Russia	3,927.7	1.50%	58.92	4,037.7	1.50%	60.57
9	United Kingdom	2,876.7	1.73%	49.77	2,983.1	1.73%	51.61
10	Brazil	3,199.3	1.16%	37.11	3,288.9	1.16%	38.15

Figure 4: R&D Spending Summaries by Regions

R&D SPENDING SUMMARY						
	2019		2020		2021	
	GDP Bil, US$	R&D Bil, US$	GDP Bil, US$	R&D Bil, US$	GDP Bil, US$	R&D Bil, US$
All Countries	137,773.6	2,370.8	133,628.8	2,325.2	140,484.0	2,440.5
Top Ten	84,730.4	1,857.5	83,475.6	1,840.6	88,132.2	1,932.1
North America	26,259.1	644.5	25,011.7	624.9	25,853.0	645.4
U.S.	21,006.4	596.6	20,145.1	580.2	20,789.7	598.7
South America	6,831.7	51.8	6,247.7	48.1	6,449.3	49.6
Europe	26,442.0	487.5	24,797.4	457.3	25,963.0	479.3
Africa	4,865.2	20.6	4,617.7	19.5	4,765.9	20.2
Middle East	7,599.2	56.3	7,214.6	53.5	7,418.2	55.7
Russia / CIS	5,171.3	64.5	4,982.2	61.9	5,128.8	63.6
Asia	60,291.7	1,041.1	60,643.2	1,055.8	64,600.0	1,122.4
China	26,909.1	532.8	29,010.7	574.4	31,389.6	621.5

Figure 5: R&D Spending as a Share of GDP by Regions

R&D SHARES						
	2019		2020		2021	
	GDP	R&D	GDP	R&D	GDP	R&D
All Countries	137,773.6	2,370.8	133,628.8	2,325.2	140,484.0	2,440.5
Top Ten	61.5%	78.3%	62.5%	79.2%	62.7%	79.2%
North America	19.1%	27.2%	18.7%	26.9%	18.2%	26.4%
U.S.	15.2%	25.2%	15.1%	25.0%	14.8%	24.5%
South America	5.0%	2.2%	4.7%	2.1%	4.6%	2.0%
Europe	19.2%	20.6%	18.6%	19.7%	18.5%	19.6%
Africa	3.5%	0.9%	3.5%	0.8%	3.4%	0.8%
Middle East	5.5%	2.4%	5.4%	2.3%	5.3%	2.3%
Russia / CIS	3.8%	2.7%	3.7%	2.7%	3.7%	2.6%
Asia	43.8%	43.9%	45.4%	45.4%	46.0%	46.0%
China	19.5%	22.5%	21.7%	24.7%	22.3%	25.5%

Source: NSF, 2018

Figure 6: Africa's Top R&D Spenders