

A PERSPECTIVE ON INNOVATION IN SOUTH AFRICA

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This document was compiled using research from the Human Sciences Research Council (HSRC), SA Department for Science and Technology (DST), the SA National Advisory Council on Innovation (NACI), as well as various other sources. Furthermore, information was obtained through an extensive public participation and engagement process, comprising almost 100 thought leaders in the research and development, science, technology and innovation fields in South Africa.

We would like to acknowledge the contributions of these organisations, as well as the Research Institute for Innovation and Sustainability (RIIS) in compiling and supporting the development of this work, as well as facilitating the Science and Innovation World Café that provided the thought leader insights. We would also like to thank James Durno for his effort in graphically recording the outcomes of the workshop.

1. INTRODUCTION / OVERVIEW



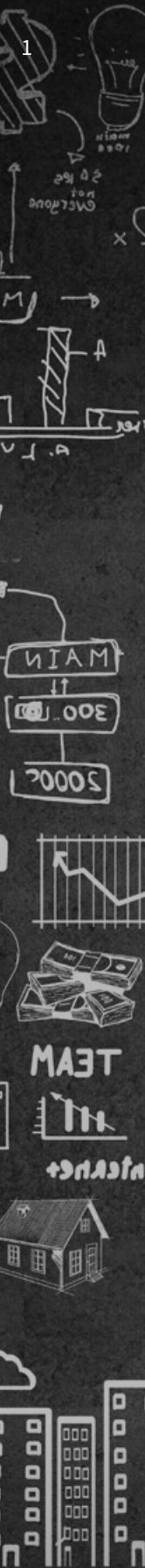
1.1 SOUTH AFRICA SOCIETY

South Africa – known colloquially as the Rainbow Nation – is a middle income country with nearly 56 million residents. Since the advent of democracy in 1994, South Africa has changed dramatically in many respects. Major government-led programmes have provided millions of South Africans with access to basic services such as electricity, running water, housing and education (though the quality and reliability of these services is varied).

The economy itself is amongst the three largest in Africa, at approximately \$350 billion US dollars (Nigeria and Egypt move ahead or behind South Africa depending on, amongst other things, oil prices). It is by far the most diverse economy in Africa, with advanced financial and banking systems, manufacturing, logistics, and mining industries. South Africa has one of the most dynamic stock exchanges in the world (the Johannesburg Stock Exchange), with the currency itself being one the most traded emerging market currencies.

The country is host to over 30 universities and higher education institutes, several of which are ranked in the top 500 globally. The country is home to one of the largest global science and research projects – the Square Kilometre Array; in time this will be largest radio-astronomy facility on earth, producing more data every hour than the entire global internet does every year.

The country does face some major challenges, with inequality one of the most severe crises the country needs to deal with. There are many causes for this, both structural and economic; at the same time the high inequality itself leads to numerous tensions across political, social and economic areas. Yet, the country has maintained strong juristic and constitutional systems, a vibrant (if somewhat fractious) democratic parliament, and a well-respected legal system.





1.2 INNOVATION IN SOUTH AFRICA

South Africa, like every other nation, faces the constant challenge of improving the lives of its people, of creating a future that is desirable to live in.

Of the many tools available to society to create this future, innovation is one that promises much, and has shown to both deliver and fail on that same promise. For every story of a life-changing innovation, there is another of missed expectations. Innovation has become a buzz-word for many organisations and people, and yet despite the scepticism that seems increasingly prevalent, no-one denies that fundamental changes in society are often due to marvellous innovations, and innovative thinking.

South Africa has, over time, created a number of world leading technologies; some areas of basic research (such as in lithium battery technology) have led to fundamental global changes over time. Yet these exceptional achievements are relatively scarce, with the impact that South Africa is not perceived as one of the leading innovation nations globally; indeed it falls behind its peers:

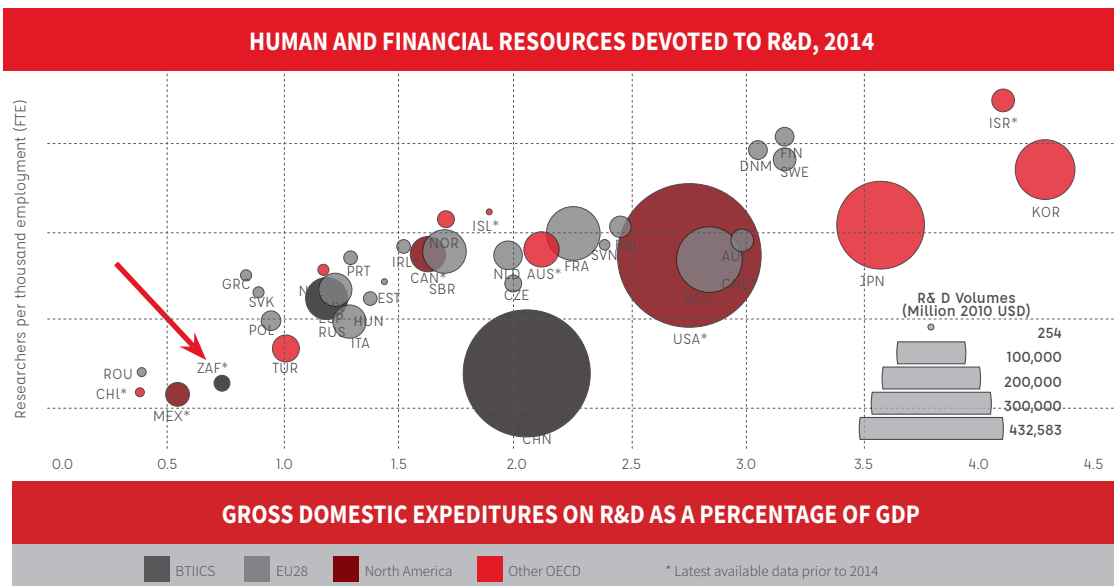


Figure 1: National Comparison of human and financial resources devoted to R&D, 2014; Source: OECD, 2016, <http://www.oecd.org/innovation/inno/researchanddevelopmentstatisticsrds.htm>

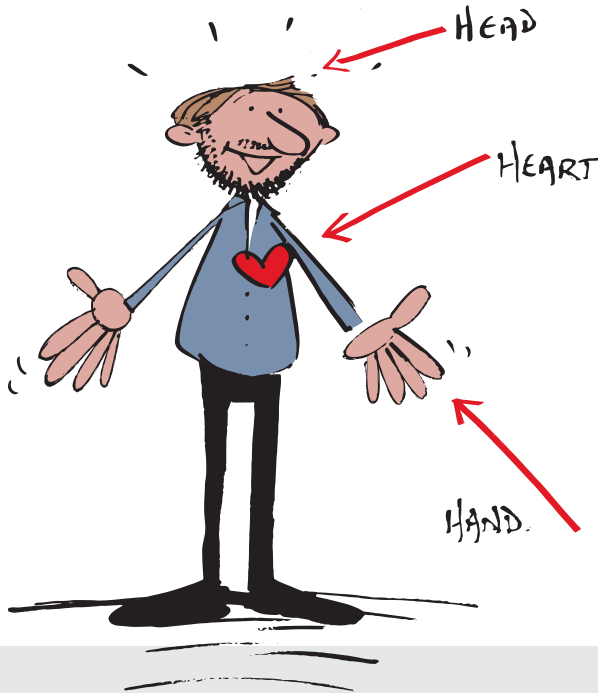
What does this imply for South Africa, in the long term? While there is no single, simple answer to this question, in the broadest sense it suggests that, over time, other nations will become more competitive in creating economic and social value, relative to South Africa.

Various groups within South Africa, from across the entire social spectrum, have recognised this as a major concern – most obviously quantified by the relatively low percentage of GDP spent on Research, Development and Innovation at around 0.75% of GDP. Compare this against some of our BRICS partners – Brazil spends approximately 1.24%, Russia 1.13%, India 0.85% and China 2.01%.

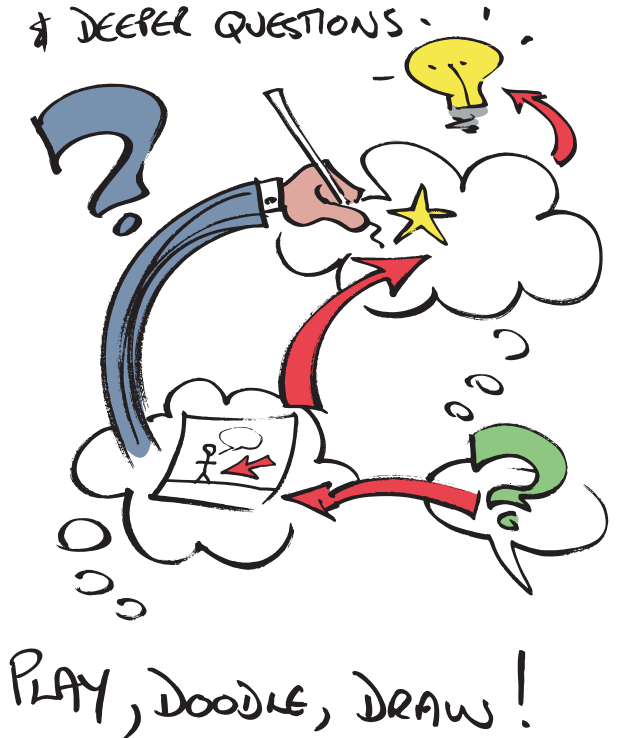
That South Africa is not performing to its potential in this area is therefore not a matter for debate; but this by no means suggests that there is not a passionate and earnest effort being made to turn this around and drive excellence in innovation throughout the country. This effort is being led by many people across the public, private, academic and civil sectors of society, and the growth in interest in the field of innovation is testimony to the energy that is being applied to enabling South African society to create a desirable future.

How World Cafés work

World Cafés work because they create a safe space for people to engage with each other, share opinions, gain collective ownership of ideas, and most importantly - have fun!



LISTEN TOGETHER FOR INSIGHTS & DEEPER QUESTIONS



1.3 THE WORLD CAFÉ APPROACH

In the spirit of this desire to create a meaningful change in the innovation state-of-play in South Africa, a number of partners came together to host a Science and Innovation focused participatory conversation, called a World Café. This Café explored critical issues around the National System of Innovation (NSI) of South Africa – basically, the various components that make up the innovation scene across the country.

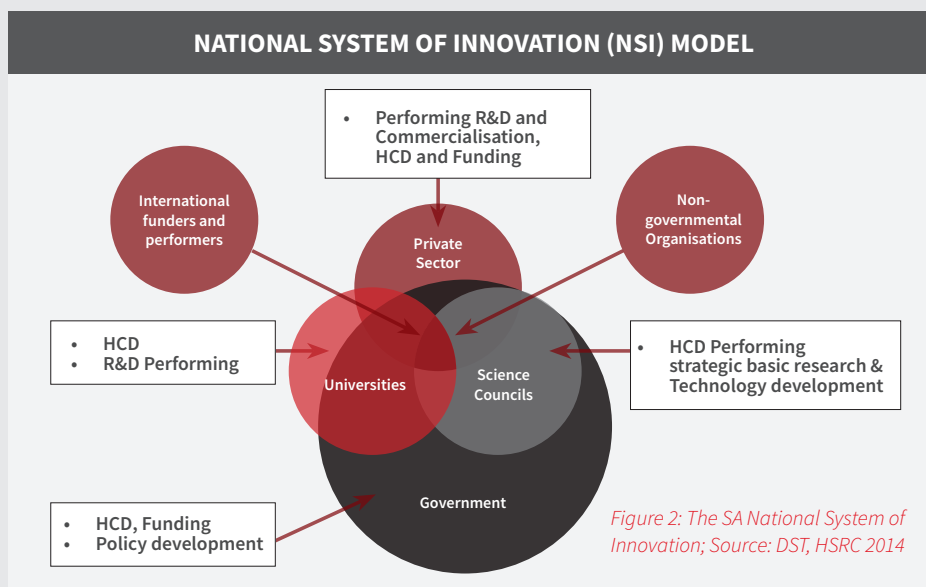
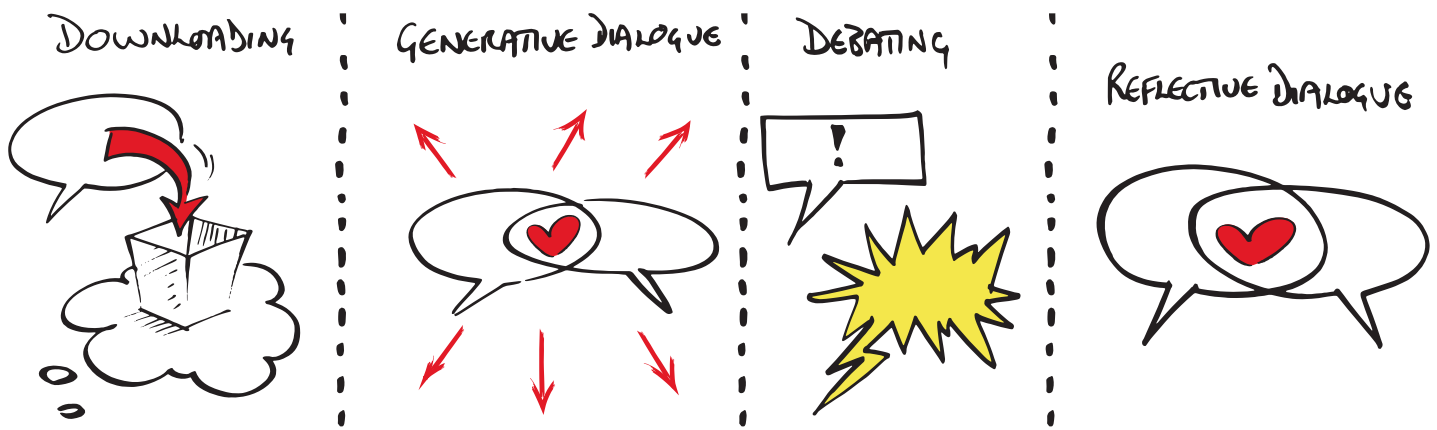


Figure 2: The SA National System of Innovation; Source: DST, HSRC 2014

The four stages a World Café moves through



A World Café progresses through four main stages: Downloading, where delegates can put out their ideas, thoughts and opinions; Generative Dialogue, where the conversation is aimed at expanding these ideas as much as possible; Debate, in which everything is critically evaluated and analysed; and finally a reflective dialogue, in which the group pulls together all the various insights into a common understanding

Participants in the Café were brought together from a wide variety of organisations and thought leaders across the country, with no single group dominating the participants came from small technology start-ups and from multinational companies; from local universities and international organisations; from banks to research councils, from consulting firms to industry associations.

The conversations ranged around five broad themes:¹

The National Agenda:

The National Agenda focused conversation on the longer term strategic priorities of different actors across the country, in order to understand how coherent that agenda is, who is responsible for driving that agenda, and what the implications of that agenda are.

Human Capital:

The Human Capital conversation focused on the intellectual, social and personal capabilities of individuals working within innovation-related roles and functions, across every type of organisation of relevance including public and private sector, universities, start-ups and international organisations.

Financial Capital:

The Financial Capital conversation focused on all types of financial and related resources available for innovation activities. It also refers to physical assets and infrastructure that is directly determined by financial resources, e.g. physical precincts, laboratories, hubs and so on.

The Regulatory Environment:

The regulatory environment conversation considered the various laws, policies, systems and incentives established to support innovation efforts within South Africa.

¹ Three were specific topics of discussion (human capital, financial capital, and system performance), while two (the national agenda, and the regulatory environment) were cross-cutting themes applicable to all three specific topics. These last two were therefore not discussed specifically, but rather helped inform the discussions of the three other topics

System Performance:

This final conversation topic combined all the above factors to understand the overall performance of the system, and understand what the output or outcomes are. It also explored what metrics should be developed to measure innovation effectively, and how to undertake this measurement.

In order to explore the issues in these different topic areas, the World Café focused on three key questions:

// 01 What is important

What is important to think about in relation to the topic at hand? What is important about having a national agenda, if anything? What aspects of financial, or human, capital are important to analyse in the South African context? How can regulation play a positive role? What type of performance should be focused on to manage relevant innovation growth?

// 02 What needs to change

What is missing from what South Africa is currently doing? What does South Africa (and South Africans) need to change? What should South Africa be optimising and improving to enhance current activities and create even more positive change? What should be improved in terms of measuring the overall performance of the innovation system?

// 03 What next

What bold steps can be taken to create a fundamental change in the way that the various components of the system operate? What are the most important changes that should be made?

The outcomes of this conversation are captured in this document, and are intended to act as one of many starting points for future discussions, actions and changes to the South African innovation system. None of this can happen in isolation, and all the participants in the conversation are well aware of the efforts being put in to drive innovation across many different avenues.

So, while collaboration and cohesion in action remain somewhat elusive, the information captured reflects that there is in fact significant interest across the entire spectrum of actors in South Africa to drive innovation, along with enormous goodwill to work together in creating a better future for all.

STRUCTURE OF THE DOCUMENT

Each section contains two distinct, but connected sections. Firstly, some basic information about the topic at hand (human capital, financial capital, or system performance). This is not intended as an exhaustive analysis of the issues in that particular area, but rather some key metrics that set the scene for debate and discussion; this information is generally quantified and is a result of specific research by various groups. This information was shared with the entire delegation prior to the World Café itself.

Then, the outcomes of the conversations themselves – what were the key discussion points that arose during the World Café? What was the essence of the conversation between the participants? These views are the aggregated opinions and discussions of the group – they are perspectives on what is possible, and what can be done; they also do not represent the view of any single organisation or individual that participated in this process.

HUMAN CAPITAL.

The World Cafe showed a unanimous agreement that the education system in South Africa required fundamental re-imagining - that innovation stemmed from sufficiently curious, educated and empowered people, and that virtually every aspect of education in SA needs to be deeply considered and rejuvenated.

HUMAN CAPITAL
= MEANS OF
EMPLOYMENT



IS OUR EDUCATION
SYSTEM GOOD ENOUGH
TO 'BUILD' INNOVATION

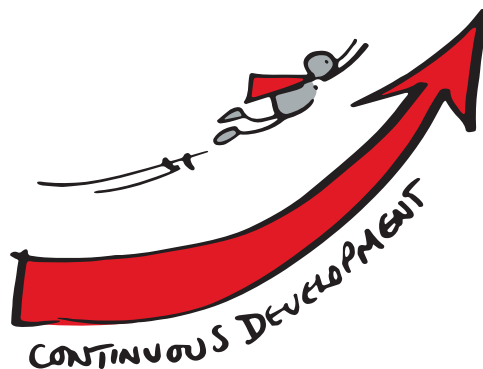
NEED TO IDENTIFY WHAT
THE COUNTRY NEEDS. NOT JUST
TECHNICAL BUT EDUCATIONAL.



WE NEED EDUCATION
FROM GRASS ROOTS UPWARD
TO FOSTER INNOVATION.

LACK OF
LEADERSHIP.

LACK OF
CURIOSITY



2. HUMAN CAPITAL

The intellectual, social and personal capabilities of individuals working within innovation-related roles and functions, across every type of organisation of relevance including public and private sector, universities, entrepreneurs and foreigners

WHAT WE ALREADY KNEW – EXISTING RESEARCH

Despite spending one of the highest proportional amounts on the development of our people in the world at over 6%, South Africa's education performance is recognised as being a mixed set of results, with both excellent and poor areas of performance.

Higher Education SET graduates 2005 - 2014

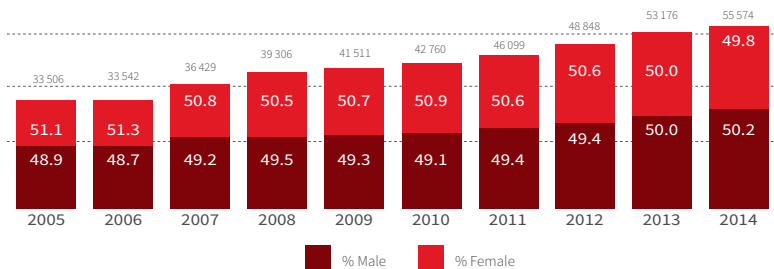


Figure 3: Higher Education SET graduates, 2005-2014; Source: SA STI Indicators, NACI, 2016

Importantly for many forms of innovation, South Africa has shown some excellent growth in Science, Engineering and Technology (SET) university graduates, both in absolute numbers as well as gender balance – in 2014, South Africa saw a greater proportion of female graduates in SET than male; this is the first time that such a gender balance has occurred in South Africa. Overall, the number of SET graduates in South Africa grew from around 33 500 in 2005 to 55 500 in 2014 – an increase of 65% over ten years. In the five year period from 2010 to 2014, South Africa also saw an increase in doctoral graduates, from 832 to 1 301. Our universities are therefore performing well in producing more, higher qualified, and diverse SET graduates than ever before.

% of matric learners achieving above 30% in mathematics

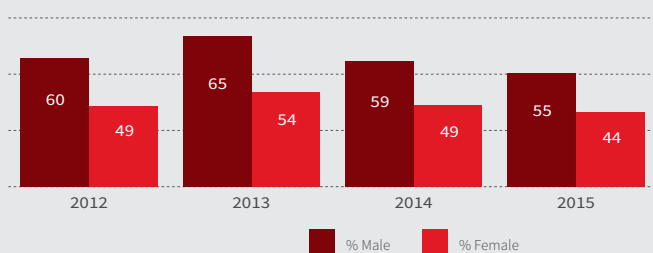


Figure 4: % of Matric learners achieving above 30% in mathematics; Source: TIMSS 2016 <http://www.timss-sa.org.za/download/Gender%20infographic%20final.pdf>

Yet at the secondary level, South Africa's performance is cause for concern. South African matriculants have shown a slow but steady decline in overall performance at high school – with between 5% and 10% fewer passing mathematics and science at high school level between 2012 and 2015.

% of learners achieving above 30% in Science

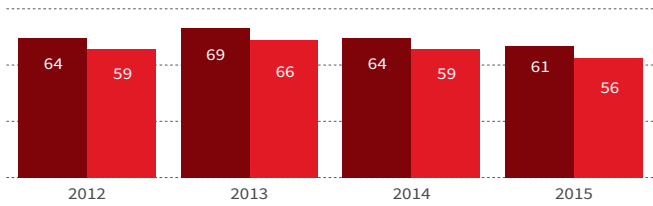


Figure 5: % of Matric learners achieving more than 30% in science; Source: TIMSS <http://www.timss-sa.org.za/download/Gender%20infographic%20final.pdf>

performance, gender balancing), and at secondary level (decreasing performance, and a lack of gender balance).

At the same time, there remains some persistent differences in gender performance in mathematics and science across this same period, with women consistently under-performing their male counterparts.

There is therefore a problematic dichotomy between what is happening in South Africa at tertiary level (improved

Higher Education SET graduates 2005 - 2014

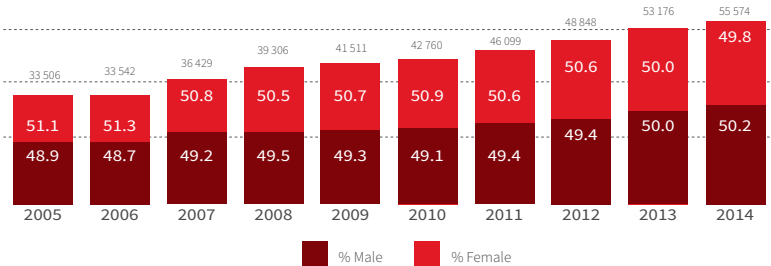


Figure 6: Higher education SET graduates, 2005-2014; Source: SA STI Indicators, NACI, 2016

absolute numbers as well as gender balance – in 2014, South Africa saw a greater proportion of female graduates in SET than male; this is the first time that such a gender balance has occurred in South Africa.

THE WORLD CAFÉ VIEW ON HUMAN CAPITAL CHALLENGES IN SOUTH AFRICA

Yet, while our performance at the secondary level is concerning, South Africa has shown some excellent growth in Science, Engineering and Technology (SET) university graduates, both in

WHAT EMERGED THROUGH THE CONVERSATION

With this background, the conversations identified a few key aspects to human capital that were of most interest to the participants:

NON-ACADEMIC / NON-SET EDUCATION

The role of different forms of learning and training were seen as key towards driving a truly pervasive culture of innovation across South Africa.

While science-led innovation is a key component of the overall innovation system, there are many additional forms in which innovative thinking can and should be taking place; and these should begin with varied forms of education. Vocational training was one key element for this – the development of basic technical competencies will accelerate industrialisation, manufacturing competitiveness and overall operational efficiencies in organisations throughout South Africa.

Secondly, there are many areas in which innovations can be achieved outside of traditional scientific disciplines. These include socially oriented innovations and design led innovation thinking. While science-led innovation can be a strong complement to these ‘newer’ disciplines, they are separate approaches towards problem solving, and can be taught to non-scientific students. This opens up an entire world for innovation amongst people that have unique perspectives on problems, and unique abilities to solve them.

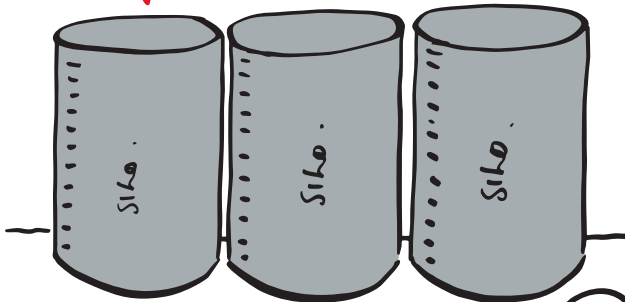
Financial Challenges for SA

Education will become an even more important tool by which to address the demographic challenges facing South Africa - but this will require that the type of education provided is fit for purpose in a future world of work

ADDRESS THE ANGER
DISAPPOINTMENT &
FRUSTRATION OF
DISILLUSIONED YOUTH.

ANALYSIS
OF SKILLS
NEEDED IN
SA.

SILOS



REMODEL ENTIRE
EDUCATION SYSTEM

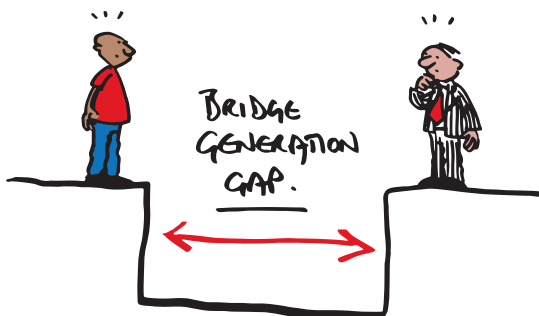
STARTING WITH
GRADE R & INCLUDING
SETAS

SETAS - MISPLACED
IN MINISTRIES
OF EDUCATION

INNOVATION CULTURE
NEEDS TO GROW FROM
SCRATCH.

MORE RESPECT
FOR TEACHERS

ADDRESS
IMBALANCE



THE AVAILABILITY OF ROLE MODELS

A common theme that arose repeatedly in the context of young people making choices about what path they wanted to pursue, was that there is a lack of innovative role models for young South Africans. People such as Elon Musk or Mark Shuttleworth, irrespective of their achievements, made poor role models in the sense that they have left South Africa; who are the South African innovators that stay within South Africa?

Identifying and promoting innovators and entrepreneurs (being closely related) was noted as a key activity to show the youth of South Africa that a future as an innovator is not just possible, but also desirable.

SOCIAL PRESSURE

Closely linked to the availability of role models is the social pressure that many South African's face – to pursue financial freedom² through stable, well-paying corporate jobs. This requires the pursuit of degree qualifications (such as accounting, medicine and engineering) which, although critical for a well-functioning society, do not always lead to innovative pursuits. This is particularly the case when the reason for studying in these directions is to obtain high paying corporate positions, as opposed to pursuing them for curiosity or creativity sake.

In fact, the lack of curiosity and creativity in the South African education system was noted as a key driver as to why people pursued traditional job paths – if our youth are not taught to be curious about the world around them, but rather to apply their knowledge systematically to solve the same problems in the same way, then they are likely to never search for a better solution, i.e. to innovate.

And because our professionals are paid extremely well, this creates a feedback loop in which it is rewarding to pursue a non-innovation focused career path.

INCLUSIVITY AND DIVERSITY

One of the greatest assets that South Africa possesses is its diversity – with a variety of peoples, languages, cultures and perspectives, South Africa is a truly varied nation.

This diversity can also provide us with a significant advantage in that it allows us to see problems from multiple perspectives; to analyse issues from a range of different viewpoints and including many different factors.

This diversity of insight can be a powerful tool for innovative thinking, as it enables us to see new solutions to problems, and often even to see new problems in how the world works.

A common theme that emerged from this discussion was thus focused on how to harness this diversity to accelerate innovation efforts – how to use the deep wealth of human insights we have access to, in order to develop, design and conceptualise innovative solutions.

² This is necessarily different from the financial needs that many South Africans face, i.e. getting any kind of work because of financial necessity; this is an important distinction made during the conversation.

CHANGING EDUCATION OUTCOMES

The final common theme that emerged through the discussions on human capital focused on changing the educational trajectory of the country.

Acknowledging the challenges faced by existing education facilities, the group instead discussed the opportunities to create different education outcomes through innovative teaching and learning methodologies, not just for academic training, but also for skills based training (such as artisanal and vocational training).

A number of ideas were raised, including:

- promoting the use of internships within private sector companies;
- increasing the use of online or digital training systems;
- promoting the teaching of creativity within school and other systems;
- developing entrepreneurial training programmes at primary and secondary schools to promote innovation and entrepreneurship; and
- Improving educators understanding of the role of innovation and entrepreneurship within society.

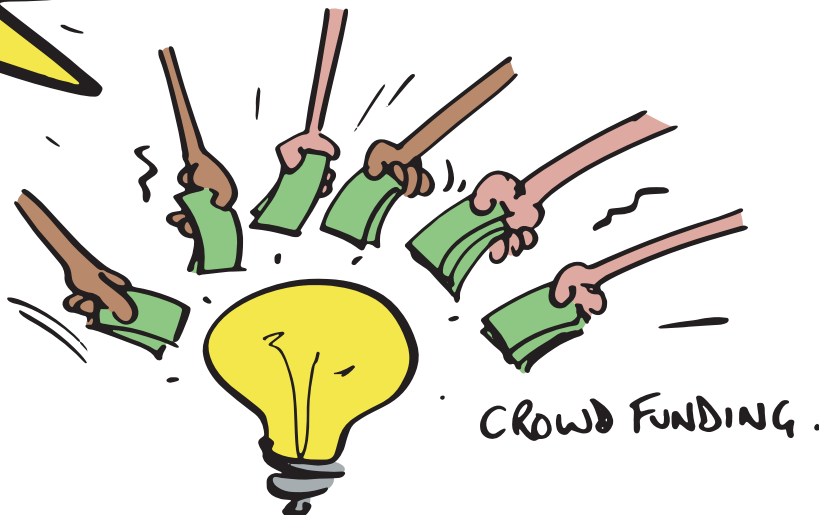
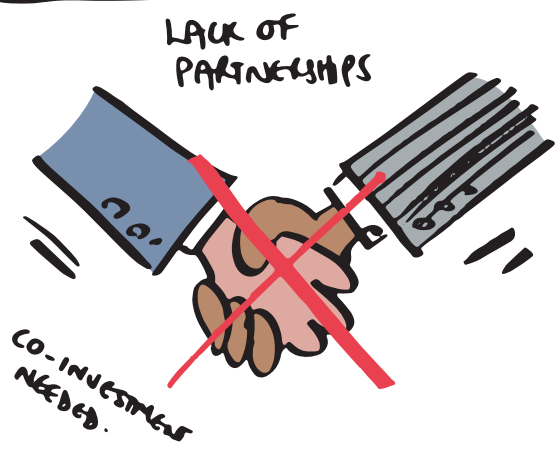
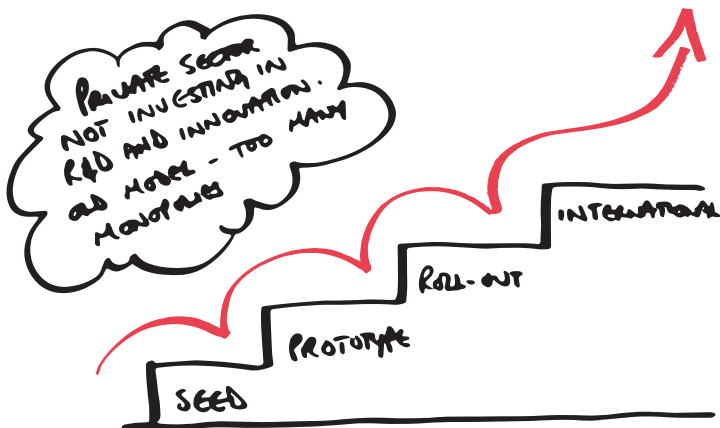
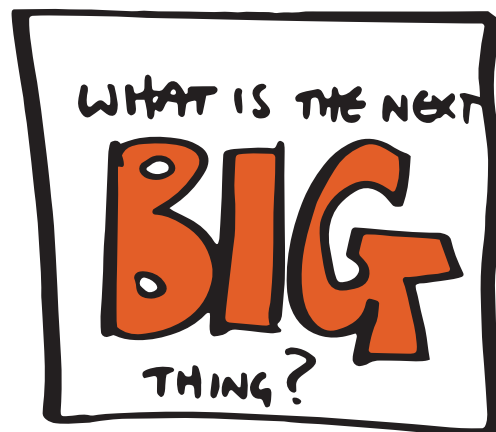
Lastly, the group recognised – again – that the presence of positive role models for innovation would have a significant positive effect on the desirability for innovation-related learning, particularly at schools

3. FINANCIAL CAPITAL

Financial Capital refers to all types of financial and related resources at our disposal for innovation activities. It also refers to physical assets and infrastructure that is directly determined by financial resources, e.g. physical precincts, laboratories, hubs and so on

FINANCIAL CAPITAL.

One of the strongest themes that emerged in the discussion around financial capital was the lack of cohesion between different actors - that there is actually a great deal of activity, but it is poorly coordinated. This creates conflict, tension and an unnecessary administrative burden for all parties concerned.



WHAT WE ALREADY KNEW – EXISTING RESEARCH

South Africa puts significant effort into research, development and innovation efforts, particularly in the context of its broad socio-economic development challenges. Overall expenditure on R&D activities in 2013/14 (the last year of account) exceeded R25 billion, and reflecting sustained nominal growth of 7.5% per year.

Yet, this growth should be examined in more detail as it firstly comes off a low base – South African R&D expenditure counts for only around 0.73% of national GDP. A generally accepted expenditure ratio for an active science and innovation ecosystem is around 1.5% of GDP, which suggests that unless fundamental changes are made to the efforts and input to the R&D sector, the country will take decades to reach this level.

This is important because our peer nations and major trading partners are putting significantly more effort into R&D and innovation; the result being the long term increase in their relative competitiveness against South Africa. This will have major impacts on the country’s ability to maintain advantageous trade relations, and may also impact on the ability to move up the value chain. For a country that intends to move away from reliance on resource extraction, this is therefore a critical national strategy.

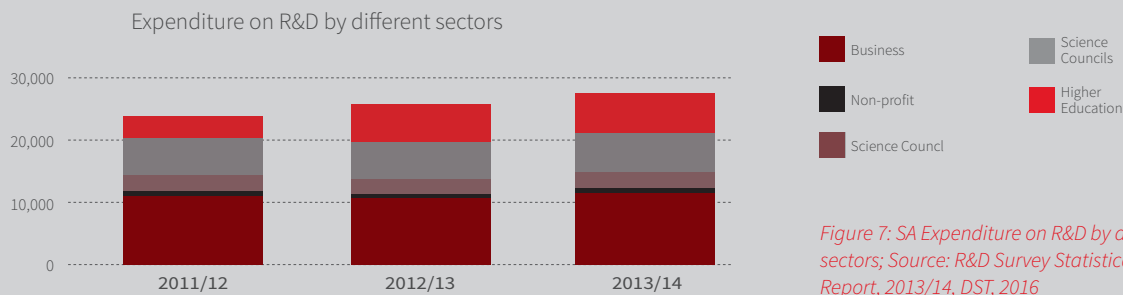


Figure 7: SA Expenditure on R&D by different sectors; Source: R&D Survey Statistical Report, 2013/14, DST, 2016

Further affecting this is the effect that fluctuating exchange rates have on this R&D expenditure. Even though South Africa has seen growth in this space, in dollar terms the absolute value associated with South Africa’s expenditure has decreased over time, from around \$3 000m in 2011/12 to around \$2 570m in 2013/14. This comparison in an international currency is important because so much knowledge development is global – and particularly if one considers factors such international licensing costs, which are generally priced in US dollars.

What we therefore see is that, despite an increase in rand-value expenditure on research and development, our expenditure in global terms fell significantly by international measures.

One would be inclined to assume, from the above, that South Africa has significant constraints in terms of available funding for research, development and innovation activities. Yet the numbers do not bear this out:

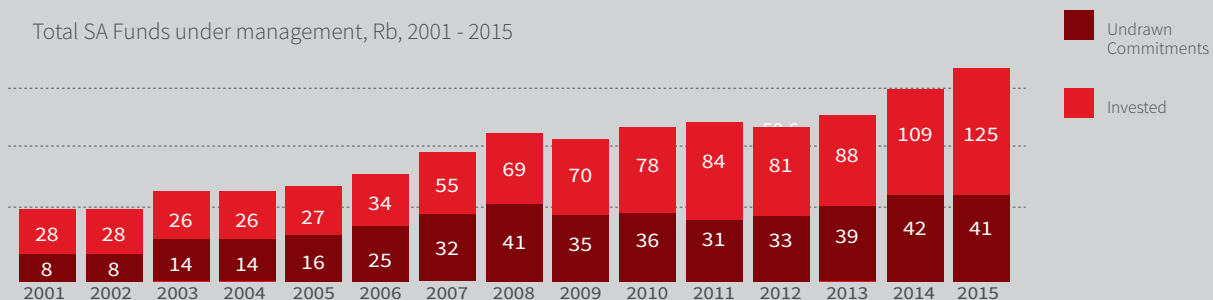


Figure 8: Total SA funds under management, Rb, 2001-2015; Source: KPMG/SAVCA, KPMG and SAVCA Private Equity Industry Survey 2015, 2016

From figure 8 we see that South Africa has some R40b in undrawn commitments from various private equity institutions, both public and private. A significant fraction of this resides within public sector organisations such as the Industrial Development Corporation, while the remainder lies within a spectrum of private sector firms.

Importantly, this includes a range of venture capital firms, though as can be seen from Figure 9, this represents only a small fraction of the total available funding

SA Investments by stage, % of total

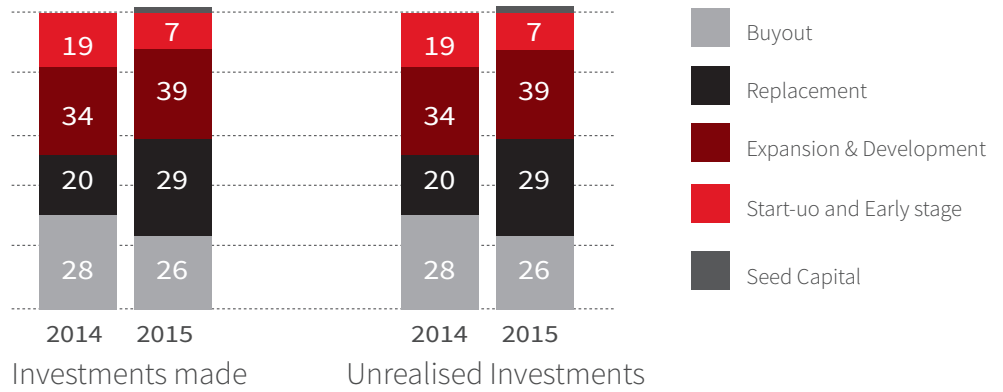


Figure 9: SA investments by business stage, % of total; Source: KPMG/SAVCA, KPMG and SAVCA Private Equity Industry Survey 2015, 2016

Even so, there is strong evidence to suggest that the challenge is not that there is no money available in South Africa, but rather that money, which is in theory available for RD&I activities, is not being allocated towards these activities.

This presents an interesting challenge as it speaks more about the decision making criteria and processes associated with investment into innovation, rather than with the availability of resources to undertake that innovation.

In the light of this paradox – that there are resources available, but that they are not necessarily being spent as quickly as would be required to boost innovation, the delegates identified the following:

THE WORLD CAFÉ VIEW ON FINANCIAL CAPITAL CHALLENGES IN SOUTH AFRICA

Increased risk-sharing between public and private sector

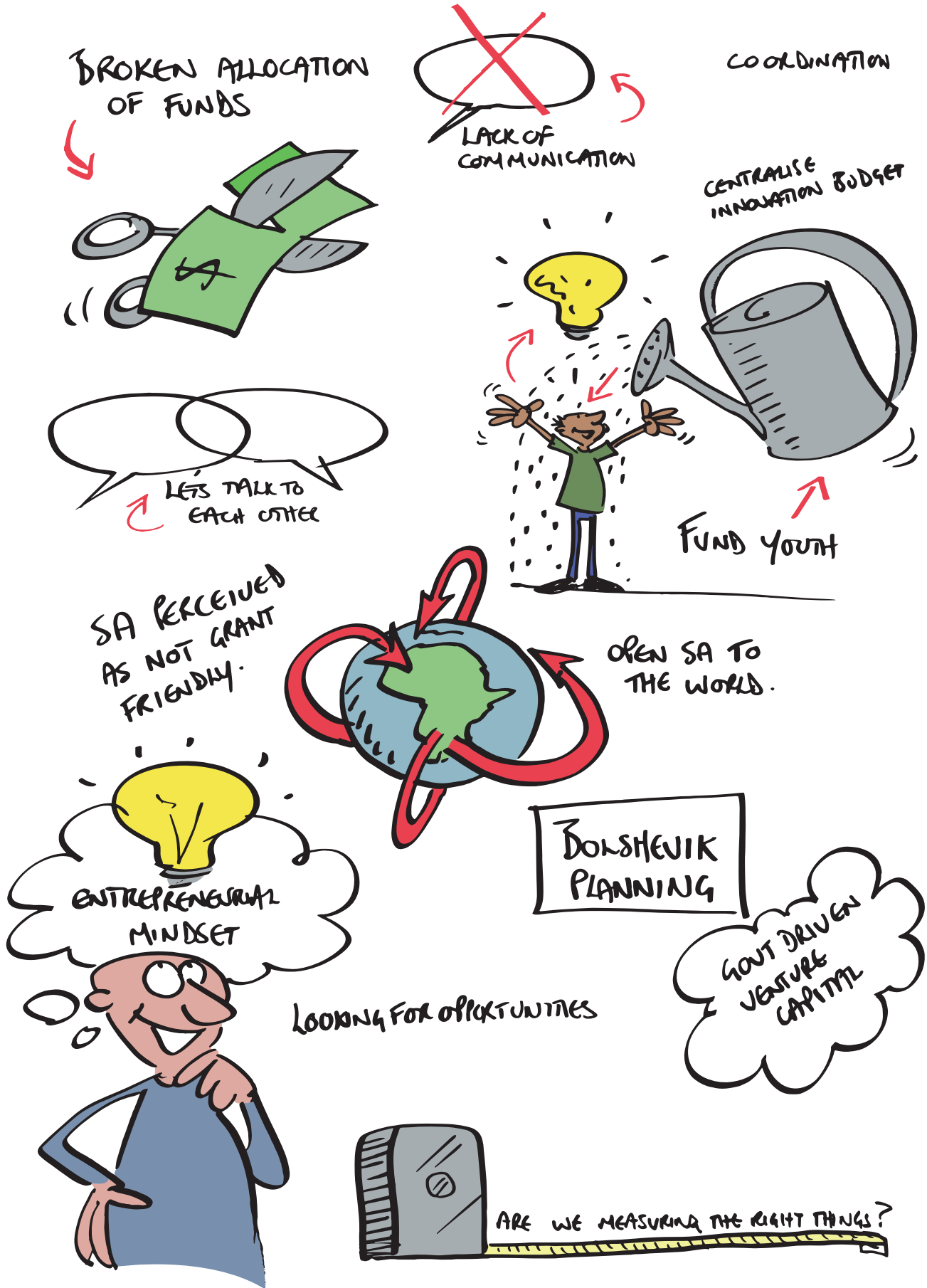
Innovation is naturally seen as risky, and the propensity for the public sector – through specially designed instruments – to reduce these risks, was seen as a critical factor missing in South Africa.

Although a number of instruments, policies and structures exist, their performance and implementation can be enhanced significantly. Mention was made of mechanisms such as SPII and THRIP – both conceptually excellent programmes that have suffered from poor execution.

A key success factor to drive innovation was therefore the ability of the public sector to reduce or remove innovation related risks from private sector ventures in a systematic, efficient and fair manner.

Financial challenges for SA

Creating more conversations amongst different actors will lead to greater transparency, greater trust, and a better understanding of how to unlock the significant amounts of financial capital available in SA for innovation, R&D and entrepreneurship.



An increase in the pipeline of investable projects

Much of the conversation revolved around the availability of investable projects in South Africa, seen from a few different perspectives. Many investors had a perception that the rate of return on innovation projects was simply too small – or too slow – to justify significant investment. This is particularly the case when other, more attractive investments were available.

Partly this was due to the relatively small market in South Africa – innovative firms that target only the SA market will simply not provide the investment return that venture capitalists in particular are looking for.

A second challenge is the length of time in which these innovation projects actually start turning a profit – how close innovations are to the market. This was noted as a particular challenge for university-based innovations, as this IP is often quite distant from being commercialised.

Lastly, it was noted that, in general, only science- and technology-led innovations were successful in raising funding. Social innovation efforts were usually relegated to enterprise development or Corporate Social Investment (CSI) efforts, and while the return on investment for these social innovations were relatively smaller than for massively scalable technology innovations, they could represent a significant boost in the overall pipeline of innovation projects.

In summary, being able to increase the availability of projects ready for investment by different stages of the private equity / venture capital world was seen as a key enabler for innovation.

Changing the risk culture of investors and entrepreneurs

Throughout the discussions, risk appetite was a common topic – how much risk are South Africans (in both public and private sectors) willing to take? For the most part, that answer was – very little.

Failure in South Africa (as in many other places) is seen as a major barrier towards innovation, not in the positive sense as a learning process, but rather that fear of failure and loss prevents people from innovating, and investors from taking risks into innovative organisations.

This was seen through various channels – in the private sector, investors were generally seen to require unreasonably high equity stakes in new ventures. One of the main reasons for this is to manage and control the risk that the ventures do not perform well – as well as trying to ensure a sufficiently high return on investment. In the public sector, financial governance and transparency – as well as the need to account effectively for public expenditure – was seen as a constraint on the risk taking necessary for innovation expenditure.

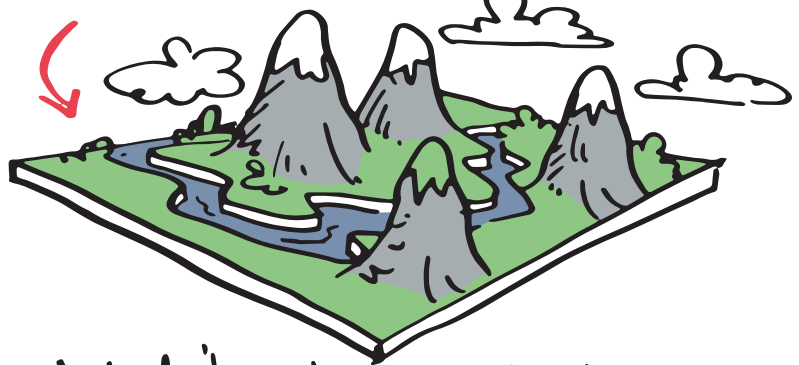
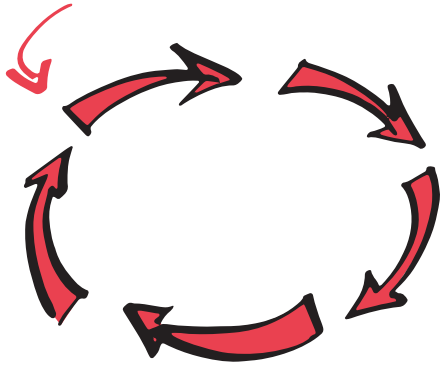
While there are very strong, valid reasons for these behaviours, the outcome remains that the culture of risk taking in South Africa is not conducive towards innovative projects.

A key question then emerged – how to create a positive culture of failure in the country? One in which investments are made into ventures in such a way that enables intelligent risk taking, and rewards the positive outcomes of failure – such as validated learning – rather than preventing investment for fear of loss.

SYSTEMS PERFORMANCE.

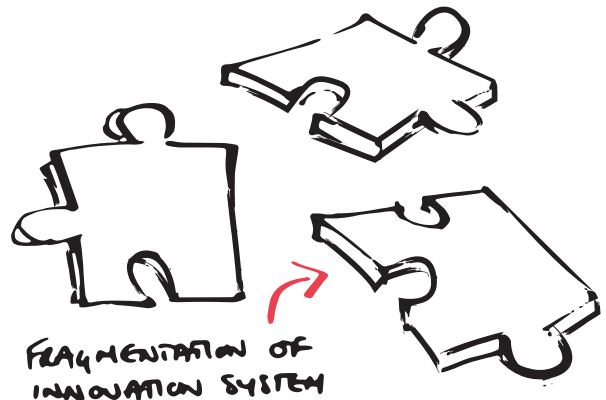
DEPENDENT UPON
HUMAN CAPITAL.

Not a System → it's an environment



"we don't want a strict definition, therein lies the inhibitors!"

WE NEED KPI
THAT BENEFITS THE
ENTIRE VALUE CHAIN



FRAGMENTATION OF
INNOVATION SYSTEM

4. SYSTEM PERFORMANCE

All of these various factors ultimately result in the overall performance of the system, and understanding what the outcomes are is important from a management perspective. It is also critical to understand what performance should be measured, and how to manage it.

WHAT WE ALREADY KNEW – EXISTING RESEARCH

Despite all the challenges facing South Africa, and the South African innovation ecosystem, the country nonetheless continues to perform, and even improve its performance.

Data from the WEF's Global Competitiveness Index shows a slow but steady improvement in the Innovation Pillar, with the 2015/16 ranking placing South Africa as the 38th most innovative nation in the world – an improvement.

Yet there are some worrying long term trends to enable the continuation of this excellent performance. In particular, the availability of engineers and scientists in the country is ranked exceptionally low – at 106 out of 140 countries; and even more worryingly, this particular metric has been decreasing over time. In addition, the adoption of modern technologies by government – traditionally a major procurer of advanced systems, is ranked even worse at 119 out of 140 countries. This puts South Africa roughly on par with Myanmar, Nigerian and Cambodia when it comes to the sophistication of public service technologies.

In another worrying metric, the overall technology balance of payments for South Africa is extremely unbalanced, with technology imports almost completely dominating the technology trade.

Although the growth in receipts has outstripped that of payments in percentage terms (some 433% growth in receipts, vs. 276% growth in payments over the ten year period 2005-2014), the gap between these two sides of the trade is so large that, even with these different growth rates, it would take decades before the two would equalise.

Given the inevitable weakening of the rand against major trading currencies, this is likely to place additional pressure on the South African economy, as well as impact on our ability to absorb world-leading technologies.

This is seen also by the number of global patents produced by South Africa, such as measured by the number of PCT patent applications (generally viewed as patents holding global potential). South Africa has shown to produce only between 6 and 7 such applications for every million of population; compare this with leading nations such as Japan (335 per million), Switzerland (321 per million) and Sweden (313 per million). By comparison, nations that produce approximately the same as South Africa include Saudi Arabia, Bulgaria, and Chile.

This is important to consider as it gives an indication of what the future technology income can be for the country – without significant international patents, it is unlikely that significant changes will take place in the overall technology balance of payments.

SA Technology payments and receipts, Rb. 2005 - 2014

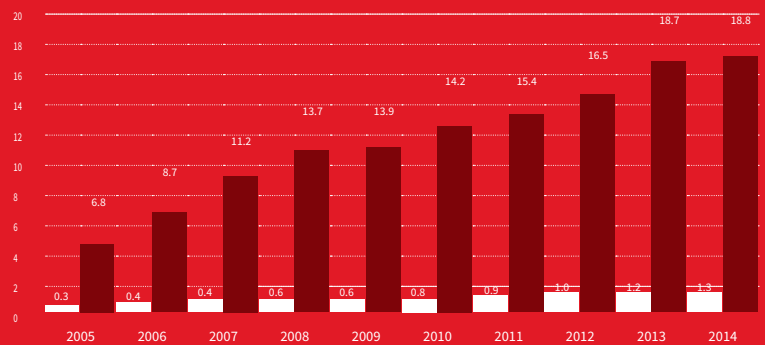


Figure 10: SA Technology Payments and Receipts, Rb, 2005-2014;
Source: SA STI Indicators, NACI, 2016



THE WORLD CAFÉ VIEW ON OVERALL NSI PERFORMANCE IN SOUTH AFRICA

INNOVATION AND ENTREPRENEUR SUPPORT FRAMEWORKS

One of the opportunities identified through the conversation was to provide scientists, innovators and entrepreneurs with more support to reduce their risk and pursue new ventures.

This could extend to everything from improving the efficiency of existing government mechanisms (such as through the Technology Innovation Agency, IDC or other funding mechanisms), to providing structured venture acceleration and incubation programmes – staffed by people who have deep experience in actually creating successful ventures.

This last point was seen as critical, particularly given the perceived growth in ‘incubators’ across the country. Many of these appear to be managed by individuals with limited experience and track record in systematically creating successful organisations (irrespective of the passion they have for the entrepreneurial world). The challenge therefore is to identify not only the right institutional arrangements to support innovation, but also appropriately competent people to manage those systems.

COLLABORATION

Fragmentation of the innovation ecosystem was viewed as a key constraint on overall performance – individual sectors do not play well with each other. The private sector raised frustrations that they are unable to operate at the pace of government; the academic sector noted that the private sector is unwilling to participate in basic research; the public sector raised issues of transparency and anti-competitive behaviour; and so on.

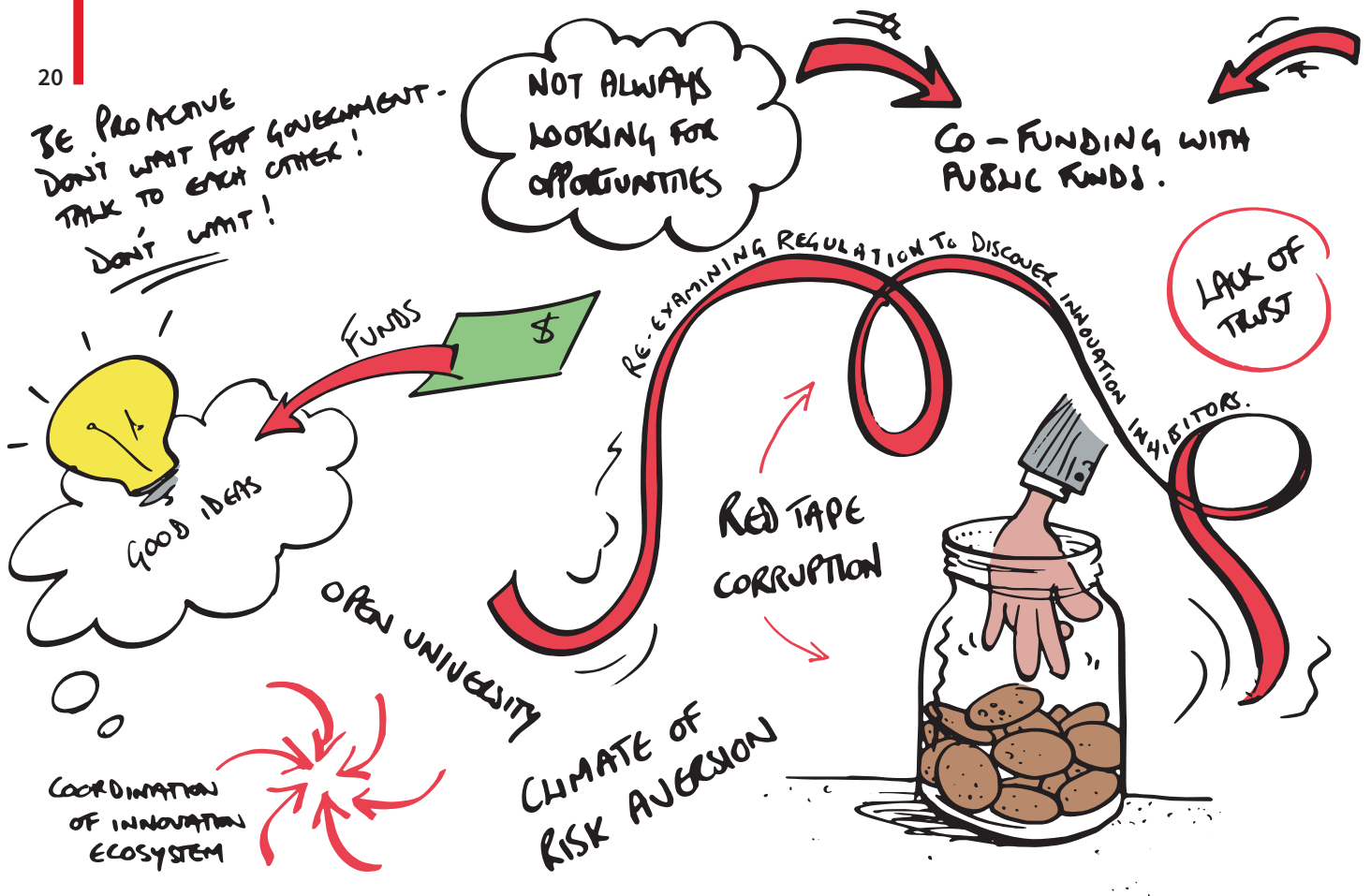
Although these are valid concerns that should be dealt with, the participants felt that sometimes they were used as excuses by various parties to justify different actors not pursuing difficult conversations to find a solution. Similar issues exist elsewhere in the world, and yet a way to overcome these constraints in a robust and transparent manner had been found – why not in South Africa?

Overall, the desire for the different players within the ecosystem to find common ground should overcome the barriers presented by these various concerns, and achieving a greater deal of harmony would unlock enormous potential for innovation and economic activity.

5. WHAT BOLD STEPS WE CAN TAKE

The conversations and interactions amongst delegates ran down many different pathways, with many ideas to explore and opportunities to pursue.

Nonetheless, a few common bold ideas emerged as central concepts that could fundamentally re-write South Africa’s future as an innovation leader.



BE PRO-ACTIVE, BUT DON'T LEAD WITH THE EGO

Someone needs to take the lead, and in different spaces it makes sense for different groups to do this. But assuming that 'someone else should be doing this' inevitably leads to no-one doing anything effectively.

Certainly, in all of the above discussions around driving improvements in the innovation system, there are natural leaders – groups or organisations that would be the most suited to leading a particular change. For whatever reason, though, these groups may or may not be most capable of leading that change in the present moment.

This should not be a constraint or barrier – where others have the opportunity to lead, to create change through innovation, we should simply begin to make those changes. And wherever possible, support should be provided to enable such changes to happen, even if they are seen to be encroaching on someone's 'territory'.

It is more important that the changes we need in society are initiated, and supported, than any one group takes ownership and recognition for it; particularly if it means that such a group creates obstacles to the successful implementation thereof.

LEVERAGE OFF DIVERSITY THROUGH INCLUSIVITY

South Africa has such a wealth of diversity and perspectives, that the more we are able to access this plurality of insights, the greater will be our ability to innovate and bring value to society.

This diversity is not just in our different peoples and cultures, but also resides in some hugely important and powerful assets that exist across generations – from the deeply experienced older generations who are still willing to provide mentorship, guidance and leadership, to the growing youth labour force that will provide South Africa with a wide pool of resources from which to draw in future.

We also have an enviable gender balance in science, engineering and technology skills that can stand the country proud as we address major issues of gender inequality across the country, continent and beyond. Unlocking these two groups (youth and women) can be an enormous force for development.

And finally, South Africa remains an internationally diverse place, with strong connections to Africa and the rest of the world. This internationality is a further asset that should be leveraged in terms of creating new locally relevant solutions to African problems, using internationally leading technology and science.

CHANGE OUR CULTURE TOWARDS RISK

The World Café discussed the idea that South Africans are afraid of failure – that the consequences of failure appear to be so dire that it is avoided at all costs. And this needs to change, in order for a truly innovative society to emerge.

Failure should be celebrated, it should be seen as an opportunity to learn and improve. It should be explored, examined and incorporated into day-to-day business, education and learning; not as examples of poor performance, but rather as the means to continuously improve the decisions we make.

At the same time, it is completely reasonable to acknowledge the realities that failure can bring in South Africa which does not have the larger social safety nets that may exist in other regions around the world. The consequences of failure in South Africa, in terms of lost income for families and extended families, can be more severe than in many other leading innovation nations. Therefore, efforts should be made to find ways in which to reduce the negative consequences of failure for innovators and entrepreneurs, without dulling their hunger for change.

MAKE INNOVATION A NATIONAL PRIORITY

Despite all the challenges facing the nation, the group believed that the development of a national ‘attitude’ towards innovation – that can act as an effective tool to address our varied social needs and obligations – would go a long way towards achieving our goals as an ambitious development state.

This can be achieved through various means, including the education of public figures about the importance of innovation, and the role that innovation can play in helping to deliver public services. It can be achieved by creating appropriate role models for the youth about how an innovative, entrepreneurial mind-set can empower them to create meaningful change in their lives, and the lives of those around them. It is achieved through showing the private sector the competitive advantages that can be achieved through collaborative projects with each other, and across the entire value chain in which they operate.

Ultimately, by making South Africans proud to be innovative – by having innovation be synonymous with the South African story – we will be able to transform our country and our future.

6. CONCLUSION

In summary, South Africa is a country that is actively putting effort into driving its performance in science, technology and innovation. It faces a variety of challenges, the most dangerous of which is the ability of the secondary education system to create a pipeline of future scientists, engineers, innovators and entrepreneurs. The tertiary education system – despite robust civil debates – maintains a high quality of scientific rigour and research, and continues to improve its overall performance.

A second major constraint facing South Africa is the actual spending of money on innovation and R&D efforts – unlike many other regions, South Africa has the money, but is not spending it as efficiently as possible. Mechanisms to unlock this can lead to significant changes in the performance of the system.

There is an overall dynamic, and optimistic ecosystem, driven by passionate people, with access to world class technologies and research facilities. Given the leading role that South Africa plays in educating and developing science not just for South Africa, but even for the rest of the continent, the country is well placed to continue developing in the area of R&D, science and innovation, despite the constraints it currently faces.



Switzerland.



INNOVATION LEADING SUCCESS

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