

Zambia

Summarising Report
of the Determinants of the
Zambian Innovation System



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Preface

Regional and national competitiveness is not only driven by individual companies but increasingly accelerated by the innovative activities of entire industries and branches and has therefore become a key topic of economic and technology policies worldwide. As innovative firms grow faster than average and are more likely to survive during a recession, a strong innovation support policy may be a promising approach to enable companies to cope with any economic crisis.

However, the assets of innovation are not only limited to the original innovator. The innovation process itself generates knowledge spillover from which other firms can benefit and thus increase their productivity and innovation capacity. In turn this can create the conditions for a circular flow of economic growth from which the entire society may benefit.

Nowadays, innovation has become high priority within emerging and especially developing countries. Several innovation policy measures and support schemes have been implemented or are being designed, all of them with a different impact. These measures and schemes reflect the diversity of framework conditions, cultural preferences and political priorities. A smart innovation policy may establish favourable framework conditions for innovation. Thus, policy makers may foster the innovation capabilities of their national innovation system (NIS) by setting up appropriate framework conditions and by investing in infrastructure, education and funding R&D innovation programmes. All these measures and related efforts aim at improving the performance of an NIS.

The indicator-based Analysis of National Innovation Systems (ANIS) includes a comprehensive examination and evaluation of the status of existing national innovation systems. It is mainly intended for emerging and developing countries for which standard innovation benchmarking and monitoring approaches might not be sufficient as often the statistical data is missing or outdated. Policy makers from these countries can benefit from clear advice as regards to overcoming weaknesses of a national innovation system and to identifying those determinants that should receive special attention.

We are convinced that the ANIS approach will serve as a fact-based platform initiating discussions on how to improve innovation capabilities and competitiveness in the analysed countries.

Berlin, July 2010

Gerd Meier zu Köcker

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1 ANIS – Analysis of Zambia’s National Innovation System

Innovation may be considered as one of the main drivers for economic competitiveness, growth and wealth creation. Therefore, innovation policy has become an important part of economic policy. The design of suitable framework conditions for innovation reflected by the maturity level of national innovation system (NIS) has been given high priority worldwide. Although there is no common definition of an NIS, the following comments may help to clarify what is meant by NIS:

Innovation may be defined as new solutions adding value to both customers and firms.¹ One distinguishes between incremental innovations (e.g. further development of existing products and technologies, often realised by SME without involving any R&D institutions) and radical innovations (completely new solutions, technologies or products not yet available on the market, usually involving R&D institutions).

A national innovation system may be defined as a network of institutions in public and private sectors whose activities and interactions initiate, import, modify and diffuse new technologies.² The main elements of an NIS in terms of education and research institutes, firms, industrial parks, incubators, governmental institution, etc. exists, but differs in terms of how they are coordinated or meshed.

Innovation policy may be defined as the creation of framework conditions aiming at supporting innovation capabilities of companies and public entities.

The concept of an NIS relies on the premise that a good understanding of innovation actors’ relationships is crucial to foster technology performance. Innovation and technical progress are indeed outcomes of a complex set of relationships among actors producing, distributing and implementing various kinds of knowledge. The innovative performance of a country broadly depends on the one hand on these actors’ cooperation within a global knowledge creation system and on the other hand on the extent to which they utilise technologies. The actors are mainly private enterprises, universities and public research institutes. Their cooperation ranges from joint research to personnel exchanges, cross patenting, purchase of equipment and a variety of other channels.³

The number of theoretical models, reports and analyses of NIS has been increasing since the beginning of the 21st century. Because of the various factors impacting national innovation capacities, the assessment of a country’s innovation system remains

¹ Nordic Innovation Monitor 2009, FORA.

² Freeman, C. “The National System of Innovation in Historical Perspective”, Cambridge Journal of Economics, No. 19, 1995.

³ National Innovation Systems, OCED Report, 2005.



a challenging exercise. For years, economists have tried to identify the reasons leading to the nations' competitiveness and growth, and as a consequence many NIS reports and analyses have been generated. Despite the high quality of these reports which describe the essential features of an NIS and summarise its main strengths and weaknesses, the benefits in terms of usable results were unfortunately limited. This is explained by the fact that the implemented methodologies did not sufficiently consider the way policy makers think and operate. Recommendations are neither prioritised nor ranked according to their complexity when turning into practice.

Policy makers, especially in emerging and developing countries, usually are looking for well structured descriptions of an NIS and clear recommendations how to improve the functionality of an NIS and the kind of specific measures recommended. They do not ask for receiving scientific models of the functionality of an NIS or how the single actors are linked. As far as embryonic or not well established NIS were analysed, they were mainly compared with those that are matured. The consequences are plenty of weaknesses found and recommendations made. Often, policy makers are confused, rather than getting a clear guideline on how to start corrective actions. Such reports have often failed to provide clear information or recommendations how to start and how to gain a high leverage effect (especially when public investments were limited). When it comes to concerns of the Federal German Ministry for Education and Research and the Ministry for Science, Technology Vocational Training of Zambia it is of interest to:

- **identify areas for improvement**
- **identify areas for regional cooperation and mutual learning across the southern African countries**
- **identify areas for bilateral cooperation between Zambia and Germany**

The ANIS approach fits into the new tradition of indicator-based studies relying on quantitative data generated by the evaluation of expert interviews. Such an approach differs from traditional benchmarking studies on innovation performance. The Global Competitiveness Report (GCR)⁴ and the European Scoreboard or the Nordic Innovation Monitor are excellent approaches for measuring or benchmarking innovation-related performance indicators. However, since the statistical base is often insufficient, the latter is rather intended for well-matured economies than for developing or emerging countries' issues. The GCR uses a mix of statistical data and expert interviews but since it focuses on the competitiveness of nations, the issue of innovation is not sufficiently targeted.

The ANIS approach is based on the assumption that an NIS is mainly influenced, at national level, by 30 determinants.⁵ ANIS takes up this challenge by providing an indicator-based assessment of these determinants, each of which reflects an aspect of

⁴ Schwab, Klaus (ed.) (2009). The Global Competitiveness Report 2009-2010. Geneva: World Economic Forum.

⁵ We are fully aware that an NIS is also influenced by determinants outside of a country. However, as these determinants need a different approach of adjustment, they are not regarded within our analysis.



the complex reality of the innovation system. The determinants may be grouped according to a three level hierarchy:

- **Macro Level: Innovation Policy Level**
- **Meso Level: Institutional Innovation Support Level and Programmatic Innovation Support Level**
- **Micro Level: Innovation Capacity Level**

The 30 determinants' level classification is shown in Figure 1. A comparison between the determinants of these different levels allows the identification of key policy areas requiring a potential intervention to strengthen the NIS. Please note that a further description of the methodology is given at the end of the document.

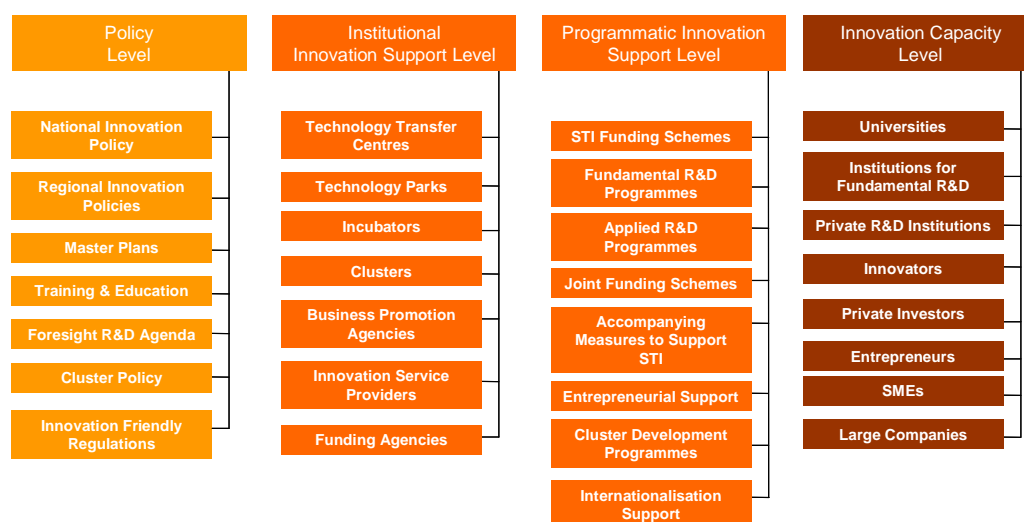


Figure 1 Main determinants of a national innovation system

The comparative portfolio, which is an integrated element of the ANIS approach, against which the determinants of the Zambian innovation system are benchmarked, consists of the corresponding data of countries having similar comparative economies.

We used the classification based on the Global Competitiveness Report (GCR) of the World Economic Forum.⁶ The GCR defines three different stages of economies. These are: factor-driven economy (stage 1), efficiency-driven economy (stage 2), and innovation-driven economy (stage 3). Countries that are situated in between these stages are called transition countries, either in transition from stage one to stage two or from stage two to stage three.

⁶ Schwab, 2009.



According to the GCR, factor-driven economies mainly rely on their facilities and basic competencies which mostly are “unskilled labour and natural resources”.⁷ Primarily, simple products and commodities are traded. Workers have very low incomes. The differentiation of the individual companies mainly happens through pricing. Furthermore, economic advancement is achieved through “well-functioning public and private institutions [...], well-developed infrastructure [...], a stable macro-economic framework [...], and a healthy workforce that has received at least basic education [...]”.⁸ Accordingly, the Zambian economy is defined as factor-driven economy.

In the comparative portfolio of this ANIS study not only countries with a factor-driven economy are regarded but also countries with economies that are in transition from factor-driven to efficiency-driven. This approach provided a broader statistical base for the comparative portfolio which consists of Botswana, Egypt, Guatemala Honduras, and Syria. The data of these countries have also been collected by the iit with the ANIS tool.⁹

Besides assessing and benchmarking the determinants, policy makers prove to be much more interested in receiving guidance for action. Therefore, the ANIS report provides comprehensive recommendations for improvement, taking into account the realistic efforts, Zambian policy makers or third party donors are able and willing to provide. At the end of the report, some areas for policy interventions are pointed out. These areas may range from those providing a high impact on the national innovation system to those that do not require much public investments or political intervention for a successful implementation.

⁷ Schwab, 2009.

⁸ Ibid.

⁹ The individual country reports are available at www.iit-berlin.de/exchange.



2 Zambia's Economic Situation in Brief

As one of the most urbanised countries of Sub-Saharan Africa, Zambia is located landlocked in Southern Africa, east of Angola. Further border countries are the Democratic Republic of Congo, Malawi, Mozambique, Namibia, Tanzania, and Zimbabwe. Zambia is often confronted with periodic drought and tropical storms depending on the seasons. The natural resources of Zambia are copper, cobalt, zinc, lead coal, emeralds, gold, silver, uranium and hydropower. Only 7% of the total land area is arable. The land use with permanent crops is about 0.04%.¹⁰

As regards competitiveness, the Republic of Zambia has not yet been able to attain an international leading position. The Global Competitiveness Report (GCR) reveals that Zambia experiences little market access, lack of financing resources, corruption, insufficient infrastructure, inefficient government bureaucracy and tax regulations.¹¹ Most of the competitiveness indicators are described as disadvantageous for competition.

Zambia (independent from the United Kingdom since 1964) is led by the president Rupiah Banda who has acted as chief of state and head of the national government since 19 August 2008. The death of the former president, Levy Mwanawasa, in August 2008 brought with it uncertainties about the economic and political situation.

However, during the last years Zambia has benefited from a solid growth of its economy. The real GDP growth of the years 2005 – 2008 was about 6% per year. One of the main sources of this strong growth is copper mining. During the 1990s, copper mining was privatised and therefore caused an increase in the overall economic growth. Since 2004 the copper prices have been increasing and foreign investors have shown interest in copper mining until today, which contributed to the GDP growth. In 2009, Zambia benefited from prospering trade with copper and a tremendous maize crop. However, when the demand for commodities declined together with the prices of world commodities, Zambia's GDP decreased in 2009 as well. According to the World Economic Forum, Zambia's growth declined from 6.21% to 5.5% in the year 2008. It is expected that, due to the global recession, the growth will decline further to 2.8% in 2009. The inflation rate in 2008 was 16.6% which was mainly caused by an increase in food and oil prices.⁷

Summarising the above mentioned facts, it can be said that Zambia is strongly dependent on the weather (maize crop) and on the volatility of the copper prices. All in all, Zambia still suffers from poverty. The GDP per capita in Zambia amounts to approximately 1.500 USD (in 2009). This puts Zambia on number 199 in the world ranking.⁷

¹⁰ CIA World Fact Book available at: <https://www.cia.gov/library/publications/the-world-factbook/geos/za.html>.

¹¹ Schwab, Klaus (ed.) (2009). The Global Competitiveness Report 2009-2010. Geneva: World Economic Forum.



Zambia has 11.8 million inhabitants. The population growth rate, including birth rates, death rates and life expectancy, is clearly marked by the high number of people infected with HIV/AIDS. Many social indicators have been declining from good to bad conditions. The life expectancy at birth is currently 38.6 years. Infant mortality is at 101.2 deaths on 1000 births. This is place 8 in the world ranking. The rate of adults aged 15-49 years infected with HIV/AIDS amounts to 15.2% (in 2007), which is a number 7 in the world ranking. The risk of contagion with infectious diseases is very high. Among them are diarrhoea, hepatitis A, typhoid fever, malaria and others.

Regarding the progress of competitiveness, the GCR puts Zambia on stage one. This stage means that the respective country mainly competes with its given factors, e.g. trading products that mainly derive from natural resources, employing unskilled labour force and the GDP per capita is below 2000 USD. The unemployment rate in Zambia is 50%. 85% of the working population work in the agricultural sector, 6% in the industrial sector and 9% in services (Figure 3). In contrast to that, the composition of the sectors with regards to the contribution to the GDP consists of 19% in agriculture, 31% in industry and almost 50% in services (Figure 2).

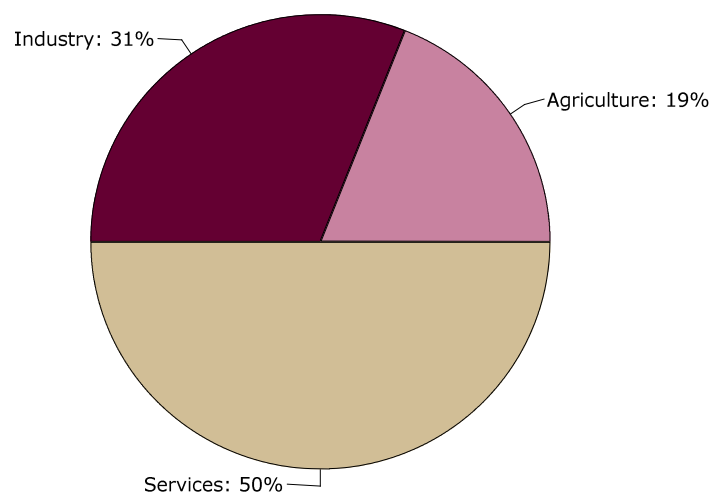


Figure 2 GDP allocation Zambia (Source: The Africa Competitiveness Report 2009)

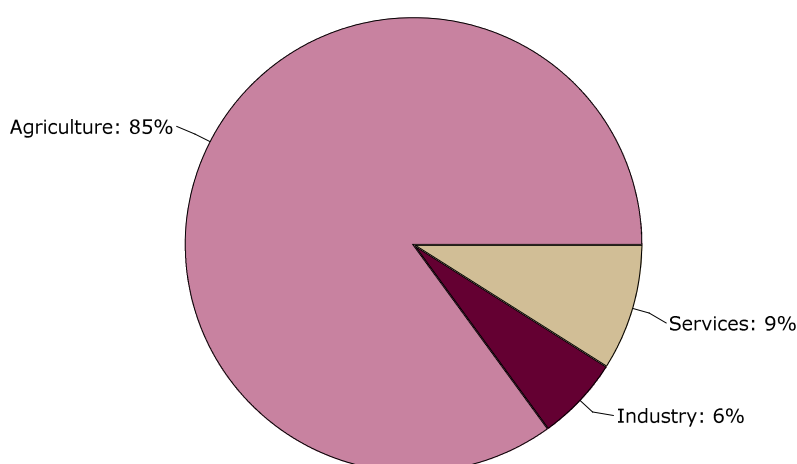


Figure 3 Distribution of working population according to sectors (Source: CIA World Factbook)

The main product that derives from the agricultural sector is maize. Furthermore, sorghum, rice, peanuts as well as sunflower seeds, vegetables, flowers, tobacco, sugar canes, cassava, coffee, cattle, goats, pigs, poultry, milk, eggs and hides are among the agricultural products. In industry, copper mining and processing take up the major part. Furthermore, construction, foodstuffs, beverages, chemicals, textiles, fertiliser and horticulture are to be found in Zambian industry.

Major export commodities are thus copper and cobalt (64%), electricity, tobacco, flowers, and cotton. The main export partners are China, South Africa, Democratic Republic of Congo, Saudi Arabia, South Korea, Egypt, Italy and Belgium. Major import commodities are machinery, transportation equipment, petroleum products, electricity, fertiliser, foodstuffs, and clothing. The most important import partners of Zambia are South Africa (51%), UAE (8%), China (6.8%), and India (4.5%).¹² Zambia is WTO member and signatory to several trade instruments, such as Trade Related Aspects of Intellectual Property Rights (TRIPs) or General Agreement on Trade in Services (GATS).

As regards communication technologies, the Zambian telephone system is said to be among the best developed in Sub-Saharan Africa but it is not at the latest state of the art anymore according to the CIA world fact book. Land lines and mobile phones are used. In terms of the frequency of using telephone communication, Zambia is in the middle field in comparison to other countries in the world. Similar observations account for the Internet use.

¹² The numbers refer to the year 2008.



Concerning environmental issues, Zambia has to deal with air pollution as well as acid rain as a result of copper mining, chemical pollution of water, soil erosion and deforestation. Especially the lack of technologies for water treatment poses a threat to human health. Furthermore, the wildlife is threatened by poaching (e.g. rhinoceros or elephants).

As stated by the World Economic Forum, Sub-Saharan Africa in general is less developed in its competitiveness, compared to the rest of the world.¹³

All in all, Zambia can be seen as a low-income country without much diversity in its economy. Therefore Zambia's economic growth is dependent on the volatility of the copper market and on the weather. Regarding the key indicators that are used by the GCR to measure competitiveness, Zambia is ranked at place 163 of 179 countries.

However, due to the reforms in the 1990s Zambia can - although being one of the poorest countries in the world - denote a positive development. This is due to the fact that Zambia has a floating exchange rate and opened up to the capital market which can diversify Zambia's economy in the future. The export sector receives special attention as well as the tourist industry. In order to increase the competitiveness of Zambia, the Zambian Government has identified an economic diversification programme. This approach aims at decreasing the reliance on copper and maize. Among the new economic drivers are tourism and hydro-power. Together with the African Development Bank Group the Zambian Government carries out support programmes and projects in the energy and transport sectors, in the tourism sector and in the agricultural sector as well as in water treatment, sanitation and health.¹⁴ Transport, storage and communication are the sectors that grew the strongest in Zambia in 2008 according to the World Economic Forum.

¹³ Schwab, Klaus (ed.) (2009). The Global Competitiveness Report 2009-2010. Geneva: World Economic Forum.

¹⁴ African Development Bank Group (2010). Available at: <http://www.afdb.org/en/>.

3 Zambian Innovation System Organisations

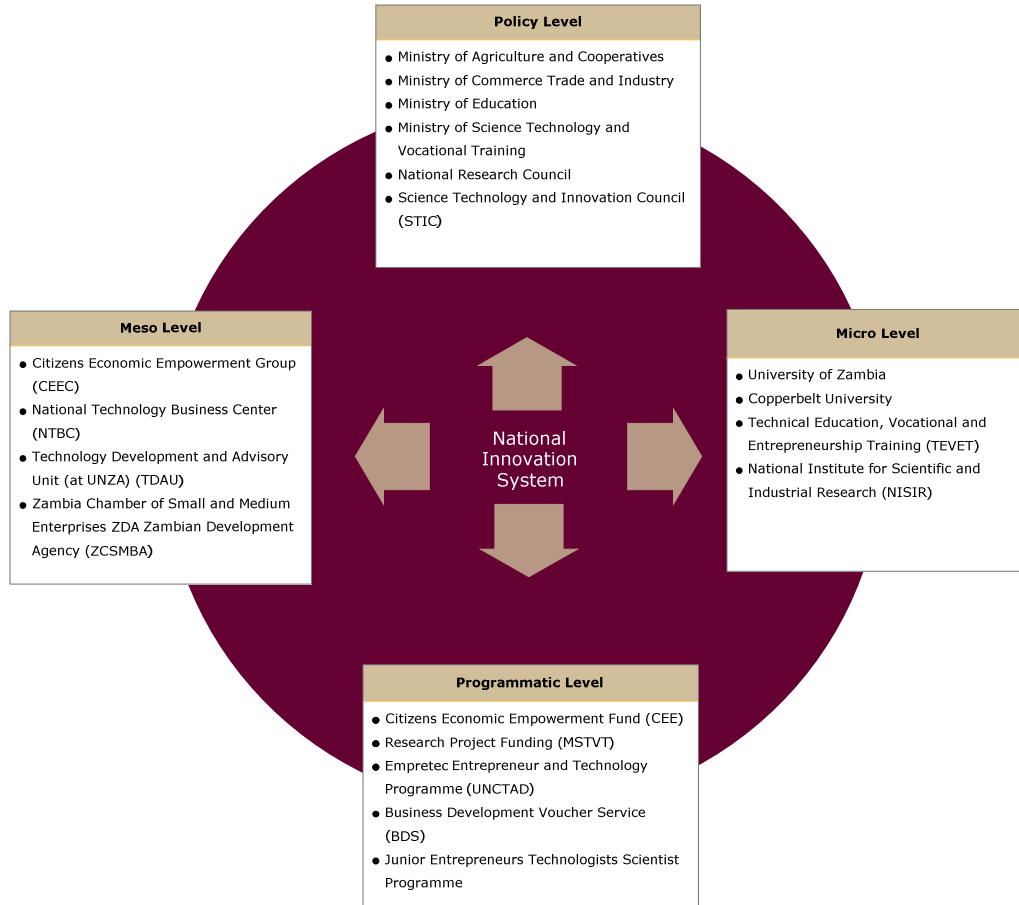


Figure 4 The main players in the Zambian innovation system (except industrial micro level actors)

The main actors of the Zambian NIS are mentioned in Figure 4. In the following the main findings, based on the assessed 28 determinants are displayed.

4 Assessment Results for Zambia

4.1 Scope, Data Generation and Self-Assessment of Zambian Innovation System Representatives

This report was drawn up based on information gathered between December 2009 and January 2010. The following sources were used:

- Expert (self-) assessments from high ranking (executive level) representatives and practitioners on the actor, meso and policy maker level of the Zambian innovation system.
- Questionnaire feedback from 15 institutions of Technical Education, Vocational and Entrepreneurship Training (TEVET) across Zambia

This input information was presented during a three day workshop, held in the Mulungushi Conference Centre in Lusaka on Jan 19-21, 2010. This workshop was initiated and organised by the MSTVT, while its structure and content followed the ANIS concept. App. 40 high ranking representatives from innovations system organisations contributed to this workshop through presentations, discussion or written input¹⁵. It was agreed with the MSTVT, not to measure two determinants related to Master Plans and Foresight R&D Agenda. Thus only 28 out of 30 determinants were measured and analysed.

During the first two days of the workshop, the input information was presented to workshop participants, and consecutively discussed in a consensus oriented manner in order to agree on a maturity rating. The third day of the workshop targeted the identification of the main challenges and the elaboration of interventions.

The primary objective on Zambian behalf was to identify these interventions, to be included in the 5th revision of the Zambian National Development Plan. In the same instance, priorities for the cooperation with Germany were extracted from the list of ideas for intervention.

4.2 Results

In the view of the known low level of innovation capacity as indicated earlier by the WEF, Zambia's MSTVT is currently addressing this issue with enhanced intensity. On all levels, a number of concepts and measures for improvement are under design or in early phases of implementation. Nevertheless, it shall be noted that only approved policies and realised facts were respected for the assessment rating.

¹⁵ In distinction to this consensus discussion oriented self-assessment, the second pillar of the meso level – the programmatic determinants – were assessed through expert assessment by the MSTVT.



4.2.1 Macro Level: Innovation Policy Level

Within an NIS, the policy level very much influences the framework conditions for innovation as well as for the actors operating in the NIS. The status of maturity is described by six determinants. Figure 4 shows the pattern of the values across the six determinants of the policy level.

A dedicated national innovation policy does not exist as it is known in fully industrialised countries. Also on regional level such policies are missing, because the regional policy making and implementation levels are very weak in Zambia. Nevertheless the findings reveal that elements of a national innovation policy are scattered over certain other policies, e.g. the Zambian Development Agency Act, the SME policy and the private investment policy. Furthermore, the policies are continuously completed. E.g. an intellectual property rights protection act recently passed legislation.

Moreover, a combined science, technology and innovation policy is under preparation. Currently, it is at the draft stage, and discussed with stakeholders, also under the aspect of appropriate implementation strategies.

Regional innovation policy in a narrow sense of “elaborated through regional policy makers” is non-existent. In practice, many policies are implemented with a major effect in the capital. In discussions at the workshop, a top-down (central-regional) or roll-out strategy for a national approach is discussed rather than implementing regional authorities. This proceeding resembles e.g. the successful South Korean approach.

Although “natural” clusters exist for example in mining and agriculture, there is no national or regional policy addressing the cluster issue. Some aspects of cluster management functions are performed through private sector initiatives (see meso level).

As stated in an actual expert assessment through the Sector Advisory Group - SAG, the curricula for higher education are currently outdated, and its state of the art is depending on the initiative of the education organisation. It has also been stated that currently, various actor level activities are under way to update these. Nevertheless, a lack of mandatory national guidelines for the generation and updating of curricula has been identified. This includes the involvement of “customers” (industries or their associations) in the mandatory updating structures. Nevertheless, according to GCR the quality of university education is considerably higher than in peer countries of Zambia.

In comparison to Zambia’s peers¹⁶, the assessment shows the following results:

¹⁶ The comparative portfolio is described on page 7.

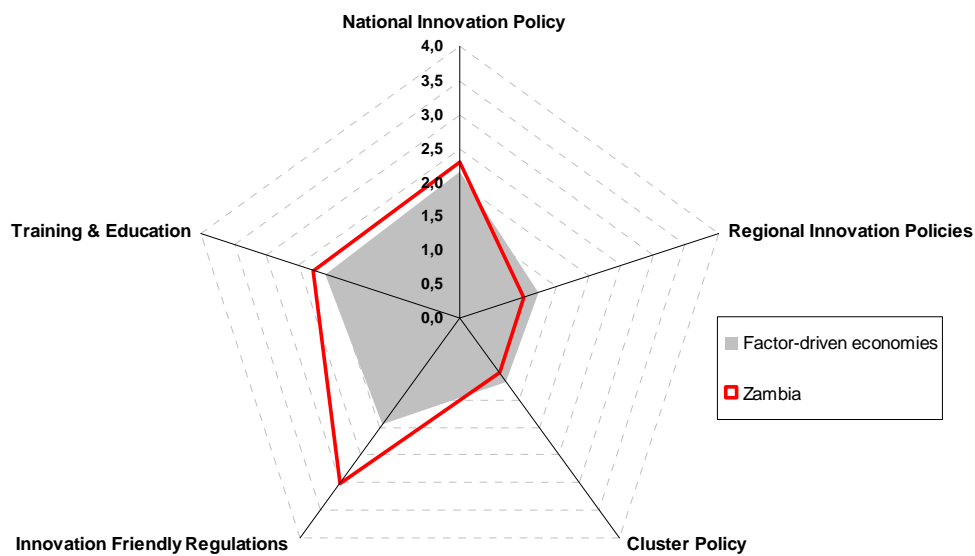


Figure 5 Pattern of the determinants on policy level – Zambia, compared to the average of factor driven economies

On the policy level, Zambia has comparatively well developed innovation friendly regulations, especially with regard to IPR policies and acts in place, which was the main reason for the comparatively high rating. With regard to training and education policy, as well as national innovation policies, Zambia has rated itself slightly better than its peers, especially based on an above average technical and vocational training infrastructure. Regional innovation – in terms of decentralised Zambian policy approaches – is fairly seldom. A dedicated cluster policy is not in place, which is the main reason for a very low rating, in line with its peers that also do not engage in cluster-oriented policies.

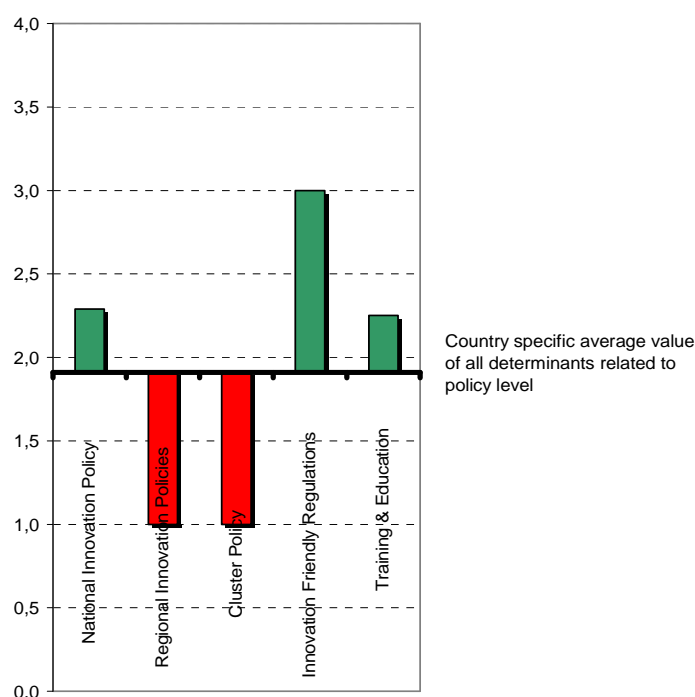


Figure 6 The five determinants compared to the Innovation Policy Level average

Consequently, the policy rating for Zambia shows a slightly unbalanced result. The lack of regional policies as well as the lack of – usually also region and sector based – cluster policies become evident in the chart above, where the single factor rating is compared to the average rating of the policy level of Zambia.

4.2.2 Meso Level: Institutional Innovation Support

The determinants of the institutional innovation support level provide an overview of opinion of the interviewed experts of how far certain determinants related to institutional innovation support are developed. Although not complete, and in most cases restricted to the capital region, there is a considerable landscape of institutions designed to support entrepreneurship and technology implementation that shows impacts demonstrated through examples. Nevertheless, it was stated that the Zambian innovation system lacks the ability to bring its own inventions “onto the shelf”.

Two dedicated technology transfer centres (TTC) exist, one of them attached to the University of Zambia, the other dedicated to support founders and SMEs in general. Both are located in Lusaka. They are considered to play an important role for innovation, but their impact is limited due to their limited number and resources. The national technology business centre (NTBC) may act as a kernel organisation for the interventions foreseen: a dedicated (policy level) scheme for technology transfer to initiate the foundation of TTCs at the other national universities and research organisations, and to staff them adequately. At the same time, neither publicly organised technology parks nor incubators exist as a means to support innovative SMEs.

Public funding organisations on the meso level are restricted to the public venture capital fund CEEC, but their funds and other resources are very limited. NTBC also has limited funds for inventors, which is, however, hardly more than a drop in the ocean. Public funding for research is distributed through national policy level organisations.

Innovation support organisations like law offices and offices for the support in matters of intellectual property protection are considered to be comparatively well developed and available. Business promotion organisations – namely the Zambian Development Agency (ZDA) - are considered to play a major role. Yet here too, ZDA needs a further rollout to the regions in order to extend its impact and to increase its role for the promotion of business. Associations are considered to actively support their member's interests and to play a major role for the national innovation system, in this case, partly also in the regions. In addition, the existence of cluster management approaches has been reported for a few cases, e.g. a "Women's Miners Association" that works on a regional level is networking these actors.

In comparison to Zambia's peers¹⁷, the assessment shows the following results:

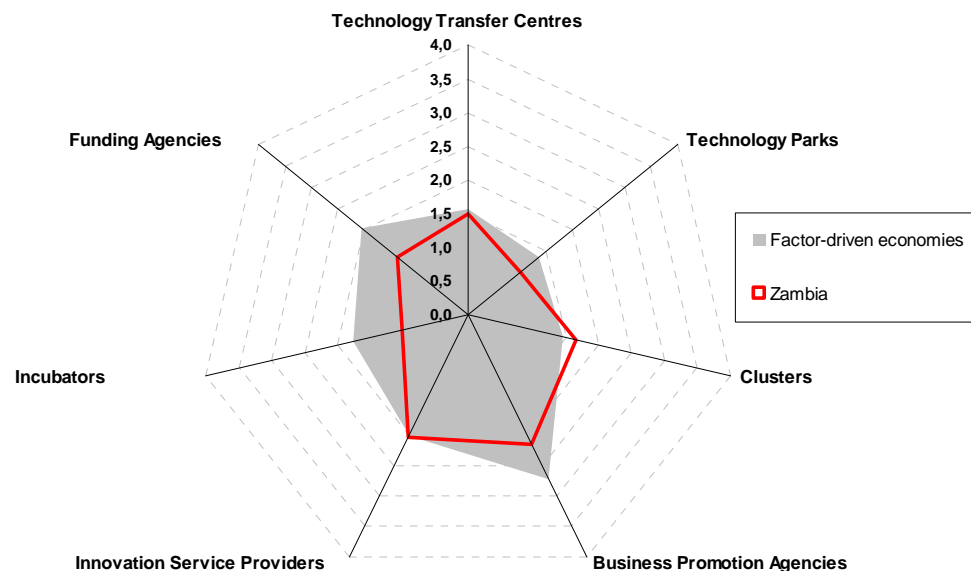


Figure 7 Pattern of the determinants on organisational innovation support on the meso level – Zambia, compared to other factor driven economies

¹⁷ The comparative portfolio is described in chapter 1.



In this important aspect of implementation of innovation related services, Zambia scores comparatively low. Funding agencies are not existing yet (but are under planning), and the landscape of technology transfer centres is basically restricted to Lusaka. Incubators and state-driven technology parks do not exist. Yet, “natural” clusters and their chamber-driven networking activities account for a comparatively high rating (e.g. women in mining). CEEC and ZDA account for a rating that nearly reaches its peers with regard to business promotion agencies.

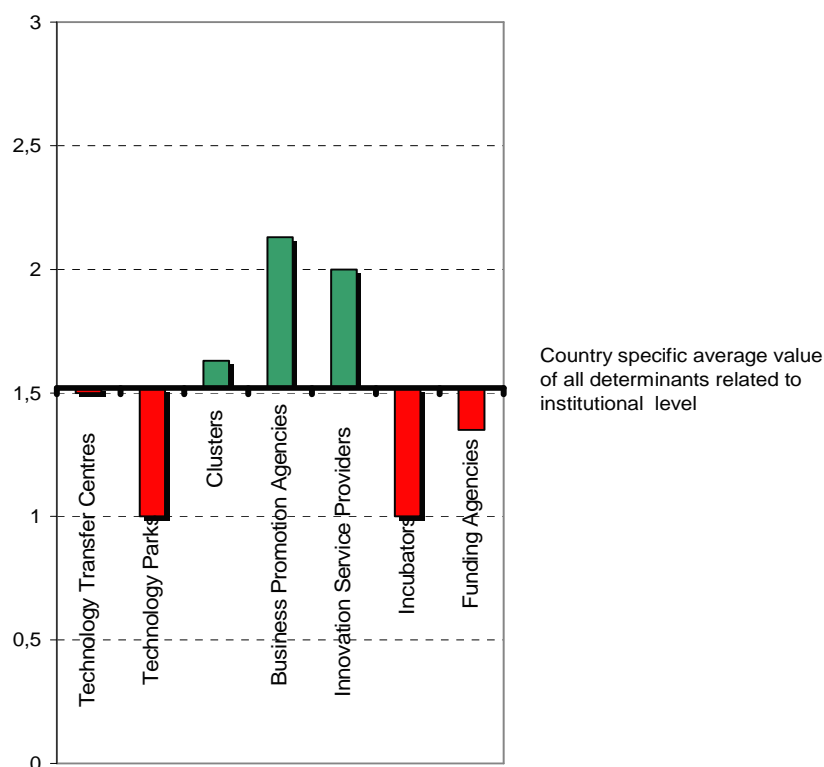


Figure 8 The seven determinants of the Institutional Innovation Support Level average

Consequently, the rating for meso level support in Zambia shows a result with only comparative highs in business promotion and (non state) innovation service provision. This may not be misinterpreted as a sufficient rating. The only indication is that they are rated better than the practically non-existent incubators and state-organised technology parks.

4.2.3 Meso Level: Programmatic Innovation Support

There are few examples of programme approaches to science, technology and innovation funding in Zambia. A programme in the ANIS sense indicates a targeted, time bound set of funds to support research or innovation in order to implement the national science and technology policy - through projects that result from several competitive calls, a practice that is quite common in matured science and technology administrations.



In Zambia, most innovation support is taken care of through budget funding of organisations. Due to the often limited number of organisations and the innovation systems, concentration on the capital, competitive programmes in the sense described above may not always be appropriate to support innovation.

A first directed technology funding programme was launched only a few years ago, but it represents only a very small fraction of research funding in Zambia. Very few companies or even SMEs are beneficiaries of these programmes. Due to the short running period of the programme, none of the projects have been finalised yet, and its impact remains unexplored until today. Collaborative research schemes do not yet exist in Zambia.

Most research organisations, including NISA, the national fundamental research organisation, receive budget funding. But, moreover, the respective budget negotiations do not include the research topic alignment of fundamental or even applied research. NTBC and CEEC remain exemplary organisations to account for support of technology oriented founders and SMEs. NTBCs and CEECs high potential with regard to the technology transfer implementation has been identified and it is intended to cover technology entrepreneur support on the policy level with a dedicated support scheme.

Cluster management organisation schemes are not existent in Zambia. It is considered to set up a policy and a dedicated implementation programme. Internationalisation support schemes are not existent in Zambia. Public understanding of science and entrepreneurial spirit are encouraged through the JETS scheme that intends to interest children and adolescents in science and technology topics.

In comparison to Zambia's peers¹⁸, the assessment shows the following results:

¹⁸ The comparative portfolio is described in chapter 1.

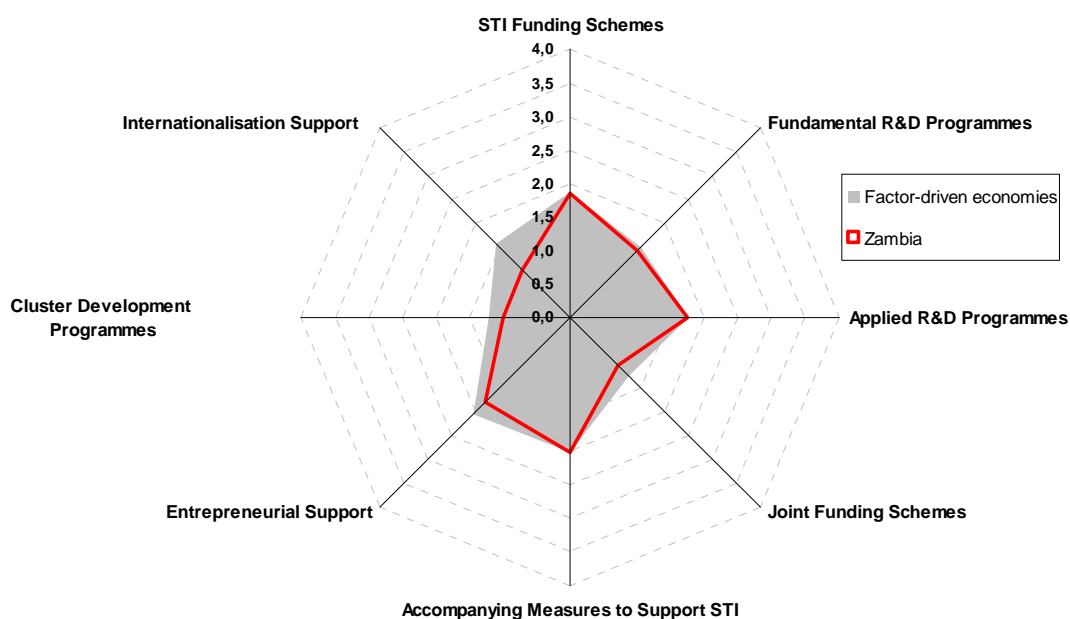


Figure 9 Pattern of the determinants on programmatic innovation support level
- Zambia, compared to other factor-driven economies

Zambia is almost in line with its peers regarding the programmatic approaches towards innovation enhancement. Cluster development and collaborative funding hardly exist at all. With regard to internationalisation support, Zambia stays behind its peers which have at least initial low level approaches concerning internationalisation. Moderate activities in line with the peers are observed in basic and applied science funding schemes, in entrepreneurial support and accompanying measures to support innovation.

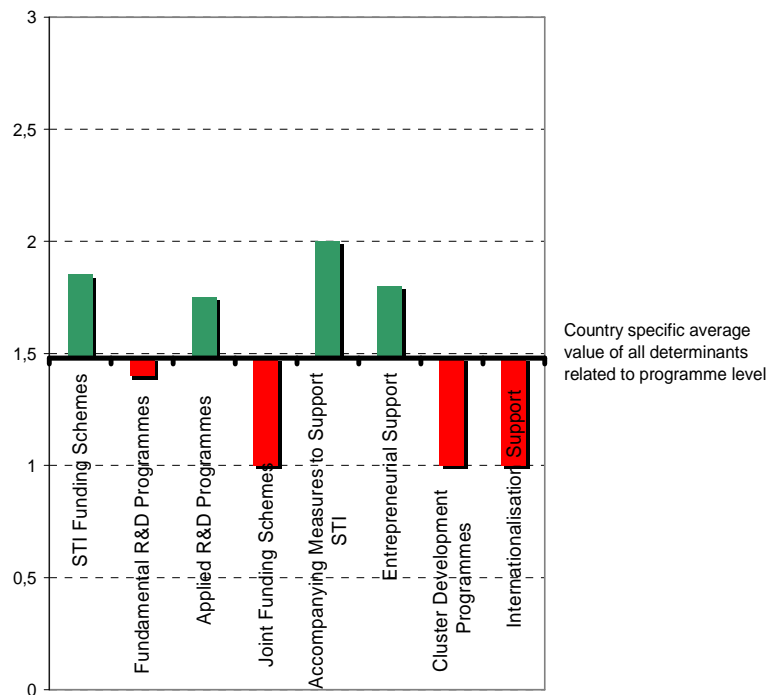


Figure 10 The eight determinants compared to the Programmatic Innovation Support Level average

Consequently, the rating for programmatic support shows a specific lack in schemes for collaborative R&D funding programmes, and in cluster management/support initiatives. Although little developed, in comparison to these, STI funding, applied R&D funding and entrepreneurial support only seemingly are well developed.

4.2.4 Micro Level: Innovation Capacity Level

The determinants reflect the status of development of the main actors of the Zambian NIS. Zambia has 3 public universities, almost 20 technical and vocational training organisations (TEVET) and a smaller number of research organisations which form the backbone of the technology, education and application development.

With regard to the curricula, universities and TEVET organisations align their curricula on a case by case basis with (representations of) regional employers. Universities – just like TEVET organisations – are more often poorly than well equipped and struggle with old equipment and scarce resources to perform their important roles. Scientific excellence of universities and their international visibility is low, international exchange programmes being the exception rather than standard.

The innovation activity of the Zambian industry – large or small – is considered very low. A few successful collaborations between universities and companies exist, e.g. in the mining and oil sector.

Fundamental research organisations are limited in number and impact. They are partly out of focus of the national policy priorities and hardly follow Zambia's needs. Their scientific excellence is low and their international visibility is limited.

Just as universities, the Zambian research organisations hardly attract foreign researchers to permanently perform research. The public attraction of science is currently enhanced through the attraction of mobile communication. In comparison to Zambia's peers¹⁹, the assessment shows the following results:

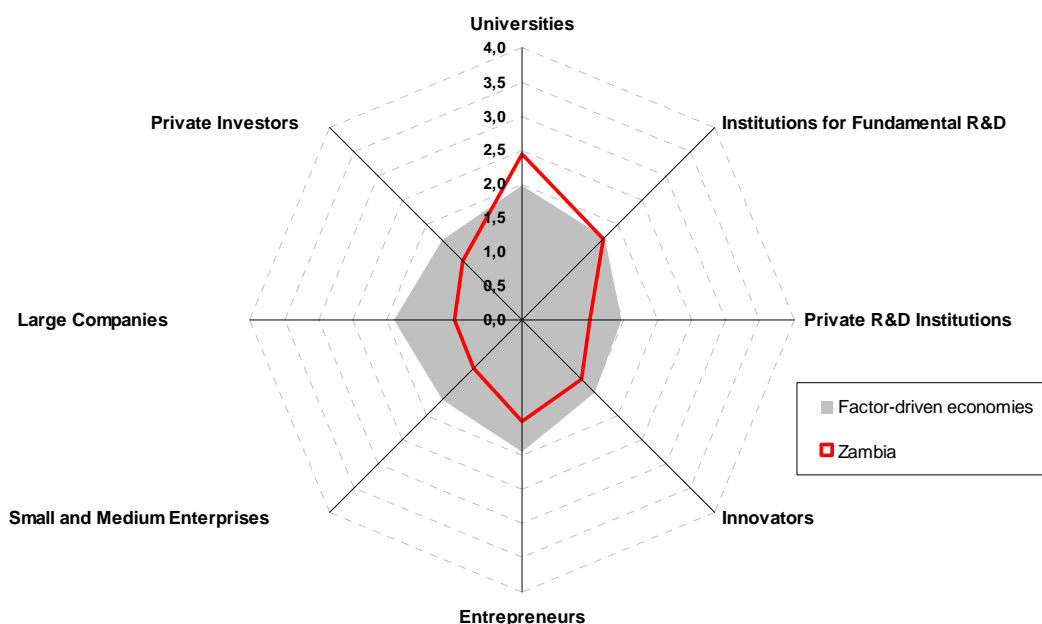


Figure 11 Pattern of the innovation capacity on actor level. Zambia compared to other factor driven economies

According to the self-assessment the comparative strengths of industry - whether it concerns SMEs or large companies - are very low regarding innovation. Private investors and innovators are few and low performers concerning the real situation of innovation. In distinction to these very low rated aspects, only the university performance is

¹⁹ The comparative portfolio is described in chapter 1.



better than barely existent. This is documented through single examples of industry collaborations in the field of mining and livestock orientation with regard to farming.

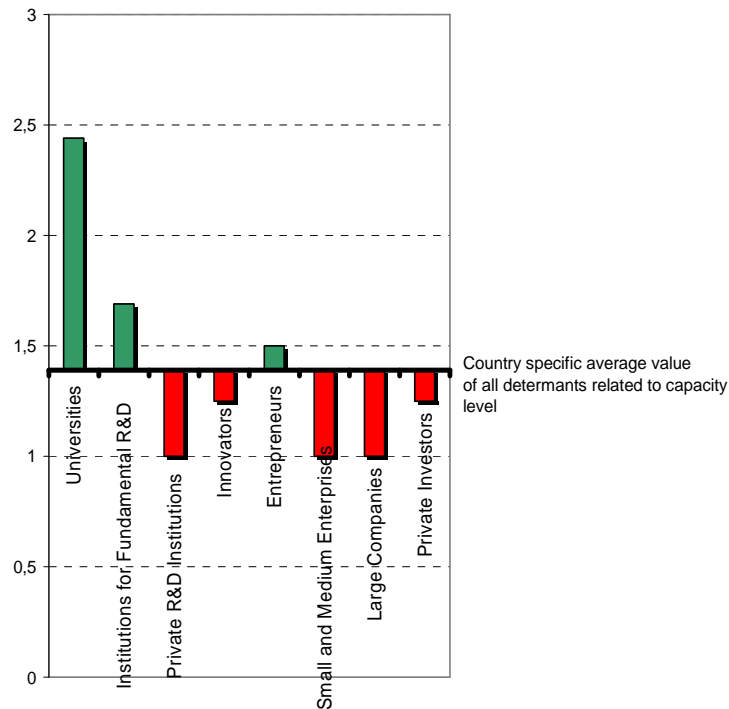


Figure 12 The eight determinants compared to the Innovation Capacity Level average

Consequently, the rating for innovation on the actor level shows a specific lack of innovation in all industrial aspects. Although little developed, university and research institute activities only seemingly are well developed compared to these.



5 Main Challenges and Interventions

The status of maturity of an NIS as well as the performance of its actors can be improved by policy measures and their implementation addressing single determinants or a group of them. The potential impact can be expected on several determinants, also vertically on meso and actor level if policy targets them adequately and implants them.

In Zambia, the assessment workshop was used to immediately list main challenges and ideas for interventions. Here is a comprehensive overview:

No	Challenge	Intervention
1	Outdated curricula	a) Guidelines on regular updating of curricula with involvement of stakeholders b) Establish structures for sector-wide curricula reviews including TEVET
2	No dedicated innovation policy	a) Develop mechanisms for continuous production of information on STI b) Develop innovation policy
3	Lack of cluster policy	a) Develop a cluster policy b) Develop an implementation plan to foster regional sector based networks of innovation
4	Inadequate provisions for technology transfer in HEIs and public research institutions	a) Regulation for establishment of technology transfer offices at institutions of high education and public research institutions b) IPR for publicly funded research c) Employee invention policy
5	Inadequate visibility of innovation support provider	Marketing the usefulness of innovation support providers such as NTBC, CEEC, ZDA, TDAU
6	Independence of technology transfer centres, low staffing levels, inadequate resources	National scheme to ensure independence adequate staffing levels, finances and equipment to perform a full role in technology transfer

...



No	Challenge	Intervention
7	Low scientific and technological excellence of innovation actors such as HEIs and research institutions	<ul style="list-style-type: none"> a) Increase postgraduate programmes on national scientific priorities and technological needs b) Increase funding opportunities for S&T c) Establishment of excellence centres d) Increase international cooperation efforts on S&T
8	Fundamental R&D is not aligned to addressing national needs	<ul style="list-style-type: none"> a) Develop a national agenda on R&D and innovation, and align the institutions to national development b) Enhance the brokerage role between agenda and researchers
9	Low private participation in R&D	<ul style="list-style-type: none"> a) Provide incentives for private participation in R&D b) Identify the needs for private and large enterprise participation in R&D c) Promote PPP in R&D d) Development of human resource for R&D
10	Poor participation of SMEs in NIS	<ul style="list-style-type: none"> a) Promote the concept of innovation to SMEs b) Establish technology parks and incubation facilities
11	Low innovation culture	<ul style="list-style-type: none"> a) Sensitisation of key stakeholders on innovation b) Training for researchers on innovation and information communication c) Training for journalists specialised on STI d) Develop a programme to engage retired scientists, Zambians in the diaspora and foreign experts on STI e) Develop a dedicated programme at MSTVT for promoting STI in the education system
12	Low levels of networking among innovators	Create platforms to encourage collaboration
13	Lack of linkages between universities and the TEVET institutions	Develop a mechanism to link TEVET institutions to universities (local and international)

Table 1 Challenges and interventions Zambia



All these interventions are considered important aspects for realisation, and are regarded in the upcoming review and update of the national development plan.

In order to prioritise the measures in view of scarce resources, a portfolio analysis is undertaken to distinct effective measures from those that are rich in effort and high in risk with regard to implementation. On the vertical scale, the “Quality+Quantity of Impact” accounts for innovation support quality multiplied with diffusion enhancement of the measure, as an indicator of the effectiveness of expected impact on innovation.

On the horizontal scale, “Effort+Risk” accounts for the cost of the measure and its implementation risk. Implementation risk includes e.g. difficulties in coordination between ministries, insufficient authority to implement measures, or complexity of a measure, making it risky to realise.

As a result, the measures in the upper left quadruple are the promising ones, recommended to be executed as quick wins – high in quality and impact and low in effort and implementation risk.

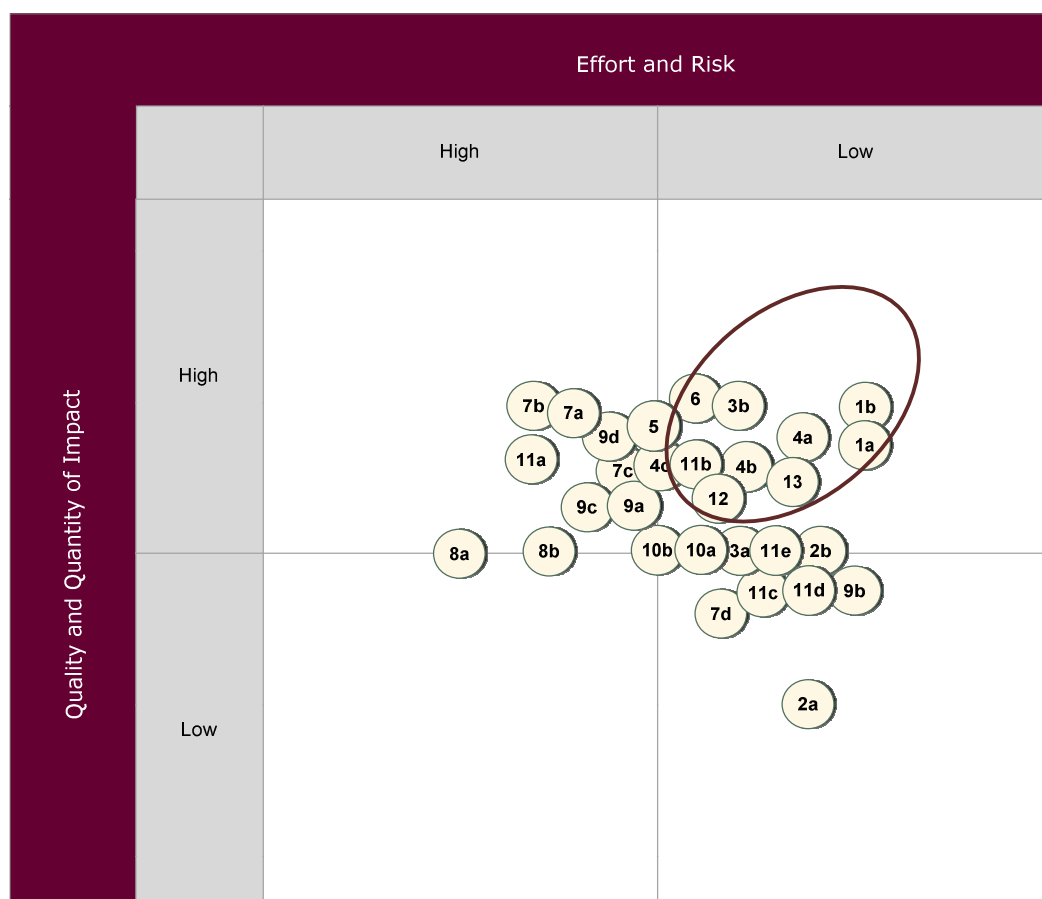


Figure 13 Portfolio – Scope of intervention in Zambia

The upper right quarter of the portfolio shows the interventions that are most probably suitable for “quick wins”. This is notwithstanding possibly different results which may occur if systemic approaches are considered that propose multiple-intervention strategies.

6 Analytical Design of ANIS

These are the major objectives for the ANIS studies:

- Analysing of existing literature regarding NIS
- Conducting interviews with experts regarding NIS
- Evaluating and measuring of the outcomes
- Identifying determinants having a high impact with little costs
- Formulating recommendations to improve the prioritised determinants

ANIS takes up this challenge by providing an indicator-based assessment of these determinants, each of which reflects an aspect of the complex reality of the innovation system. The determinants can be grouped according to a three-level hierarchy. Table 2 describes the different dimensions and its actors.

	Level	Actors	Functionality within an NIS
Macro	Policy	Public authorities, policy makers	Governing and setting up framework conditions of an NIS
Meso	Institutional innovation support Programmatic innovation support	Institutional innovation support organisations or public funded initiatives / programmes	Institutions and initiatives are tools to turn innovation policies into practice
Micro	Innovation capacity	Firms, academia, educational institutions, etc.	Main beneficiaries of support measures and main producers of knowledge, innovation, technologies, products

Table 2 Levels and actors within a national innovation system

Macro Level – Innovation Policy Level

In macro-dimension, national and regional innovation policies directly influence the framework conditions of an NIS. Laws, decrees and regulations, etc. at that level may often be path breaking, in a positive or a negative way. Public investment in innovation directly relies on decisions made at a policy level. However such political decisions may only influence the framework conditions for innovation and might not turn innovation into practice.

Meso Level - Institutional Innovation Support Level

Institutions operating at meso level are typically technology transfer centres, clusters, innovation service providers and funding agencies. They may be considered as the relevant tools to turn any political decision regarding innovation into practice. In emerging countries such institutions are often publicly-owned. They mainly aim at fos-



tering stakeholders' competitiveness and capability to innovate. Rather than own different programmes to support innovation, those institutions usually provide in-kind contributions such as training, consultation, conducting applied R&D or products' improvement. These institutions remain a key instrument for improving and encouraging the innovation capabilities of firms, especially in countries where public investment is limited.

Meso Level: Programmatic Innovation Support Level

Programmatic innovation support includes public funding programmes and initiatives which aim at turning innovation policy into practice. This represents the second pillar in improving the innovation capabilities of stakeholders within an NIS. Such programmes might be managed either by policy makers or by innovation support institutions. Any measures at that level would require significant public investments.

Micro Level: Innovation Capacity Level

The micro level provides an umbrella for the main actors and enablers within an NIS such as SMEs, entrepreneurs, universities, public or private R&D institutions, innovators or financial organisations.

Identifying the Determinants of National Innovation Systems

The different dimensions may be influenced by some determinants. As far as our research analysis is concerned, these determinants require our special attention since they can be improved with appropriate measures. To sum it up, all four levels of the pattern of determinants affect an NIS. Although we use the four levels separately, we acknowledge that there are plenty of interdependencies and links between them. However, it might be appropriate to consider these levels separately during the analytical phase. Besides, each one of the determinants may differently influence an NIS. The ideal way for a country to improve the outcomes of its NIS will not necessarily be the same as for any other country. Furthermore, it is important to point out that an NIS may be influenced by factors coming from outside the country. Within a globalised world all NIS may be affected by external influences. Therefore, in this analysis we will not consider the external factors that may affect NIS, since they cannot be controlled by national policy makers and actors of an NIS.

In total, we identified a core set of 30 determinants grouped into three levels to support this analysis. All of them may directly influence the efficiency of an NIS (Figure 1). By means of different approaches of measuring all determinants may directly be addressed. In the short term, some of them would only require low input whereas others would need longer periods of time for improvement, combined with significant investment. Improving any determinant might generate magnified positive impacts.

A set of three to five questions has been elaborated to characterise the 30 determinants properly and assess their stage of development. In assessment practice, single determinants that are less relevant may be excluded from specific examination, or combined with others.



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