# ANIS

**INDICATOR-BASED ANALYSIS OF NATIONAL INNOVATION SYSTEMS**

# Indonesia

Summarising Report
of the Determinants of the
Indonesian Innovation System

INSTITUTE FOR
INNOVATION AND
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# List of Abbreviations

| | |
|---|---|
| ANIS | Analysis of National Innovation Systems |
| ASEAN | Association of Southeast Asian Nations |
| BIC | Business Innovation Centres |
| BMBF | Federal German Ministry for Education and Research |
| BPPT | Badan Pengkajian Dan Penerapan Teknologi (Agency for the Assessment and Application of Technolgy) |
| BTC | Business Technology Centre in Indonesia |
| CIM | Centre for International Migration and Development |
| DLR | German Aerospace Centre |
| FhG | German Fraunhofer Gesellschaft |
| GCR | Global Competitiveness Report |
| GDP | Gross Domestic Product |
| IB | International Bureau of the Federal Ministry of Education and Research |
| iit | Institute for Innovation and Technology, Berlin |
| MTCI | Modular Training Concept Innovation |
| PERISKOP | *Proyek Evaluasi Sains Teknologi untuk Pembangunan* (Evaluation of the Indonesian Science, Research and Technology Landscape to Strengthen the National Innovation System) |
| RISTEK | Ministry for Research and Technology Indonesia |
| NIS | National Innovation System |
| SME | Small and Medium-sized Enterprise |
| STI | Science, Technology and Innovation |

# 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.

Nowadays, innovation has become a high priority in emerging and especially in 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 statistical data is often missing or outdated. Policy makers from these countries can benefit from clear advice with regards to overcoming weaknesses within a national innovation system and to identify 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.

The conduction of this specific ANIS study on Indonesia would not have been possible without the support of the CIM[1] expert Mr. Franz Gelbke and his assistant Ms. Kristina Kusdiana who are installed in Jakarta, Indonesia in order to set up a network of business technology centres. Thanks to the proficiency of these two experts, it was easy to establish trust among the participants of the study. We are therefore very grateful to them for making this project a success.

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[1] CIM – The Centre for International Migration and Development installs managers and technical experts from all over the world in Asia, Africa, Latin America, and Eastern and South Eastern Europe in order to contribute to the countries' development with regards to economic, social, technological and political challenges. The objectives of these missions are defined jointly by each partner country and the German Federal Ministry for Economic Cooperation and Development (BMZ).

# 1 ANIS – Analysis of the Indonesian 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 a 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.[2] 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.[3] 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.[4]*

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 these actors' cooperation within a global knowledge creation system on the one hand 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.[5]

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 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

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[2] Nordic Innovation Monitor 2009.

[3] Freeman, 1995.

[4] OECD, 2010.

[5] OECD, 2005.

which describe the essential features of an NIS and summarise its main strengths and weaknesses, the benefits in terms of usable results were limited unfortunately. 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 turned into practice.

Policy makers, especially in emerging and developing countries, usually look for well-structured descriptions of an NIS and clear recommendations of how to improve the functionality of an NIS including a description of specific measures. They are rather not interested in 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 to those that are matured. As a consequence plenty of weaknesses were found and recommendations were derived from only from the discovered weaknesses. 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 BMBF and RISTEK it is of interest to:

- **identify areas for improving innovation systems on a national and on a regional level**

- **identify areas for bilateral future R&D-based cooperation between Indonesia 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)[6], the European Scoreboard and 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.[7] 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 may be grouped according to a three level hierarchy:

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[6] Schwab, 2010.

[7] We are fully aware of an NIS being influenced by determinants outside of a country as well. However, as these determinants need a different approach of adjustment, they are not regarded as important in our analysis.

- **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.
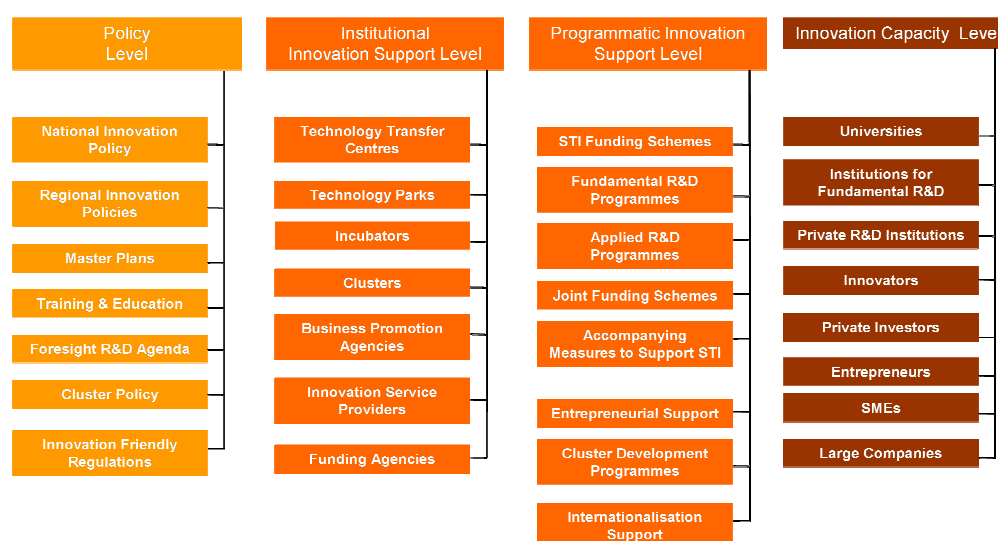
| Policy Level | Institutional Innovation Support Level | Programmatic Innovation Support Level | Innovation Capacity Level |
|---|---|---|---|
| National Innovation Policy | Technology Transfer Centres | STI Funding Schemes | Universities |
| Regional Innovation Policies | Technology Parks | Fundamental R&D Programmes | Institutions for Fundamental R&D |
| Master Plans | Incubators | Applied R&D Programmes | Private R&D Institutions |
| Training & Education | Clusters | Joint Funding Schemes | Innovators |
| Foresight R&D Agenda | Business Promotion Agencies | Accompanying Measures to Support STI | Private Investors |
| Cluster Policy | Innovation Service Providers | Entrepreneurial Support | Entrepreneurs |
| Innovation Friendly Regulations | Funding Agencies | Cluster Development Programmes | SMEs |
| | | Internationalisation Support | Large Companies |

**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 Indonesian 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 2010 -2011.  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. According to the GCR, the Indonesian economy is in transition between factor-driven and efficiency-driven countries.[8] Other countries that are in this category are Botswana, Egypt, Guatemala and Syria. They serve as comparative portfolio in

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[8] Please note that the latest Global Competitiveness Report (2011-2012) considers Indonesia as having fully arrived at the second stage of economic development, thus, it is now a country with an efficiency-driven economy. However, in this ANIS study, Indonesia is still considered as transition country, since the expert interviews were conducted in 2010.

this ANIS study. The data of these countries have also been collected by the iit with the ANIS tool.[9]

According to the GCR, factor-driven economies mainly rely on their facilities and basic competencies which mostly are "unskilled labour and natural resources".[10] 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 […]."[11]

The efficiency-driven countries are characterised through products with better quality, mainly due to more efficient production processes. Economic advancement is achieved through "higher education and training […] efficient goods markets […], well-functioning labor markets […], developed financial markets […], the ability to harness the benefits of existing technologies […], and a large domestic or foreign market […]."[12]

Countries in between these two stages, such as Indonesia, have developed some of the characteristics of the efficiency-driven economies but are still struggling with some of the features of the factor-driven economies. These "moving" countries are often in the focus of economic research, since the factors that leverage the economic benefit within a country, can be more precisely defined than in "static" countries.

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 Indonesian policy makers or third party donors are willing and/or able 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.

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

[10] Schwab, 2010.

[11] Ibid.

[12] Ibid.

# 2 Indonesia's Economic & Innovation Background

Before explaining Indonesia's innovation system in detail, a brief look at its economic situation and the German contribution to its innovation landscape will be helpful for understanding the status quo.

## 2.1 Indonesia's Economic Situation in Brief

Indonesia's membership in the G20 with "one of the best-performing economies" in 2010[13], and its rise to rank 44 in 2010 (from 54 in 2009) in the Global Competitiveness Report of 2010-2011, could make it a contender for a position in the "BRIICs"[14], as it aspires to be[15]. Furthermore, the country has a population of more than 245 million (est.), making it the fourth largest world-wide[16] and largest among its ASEAN members, of which it chaired the rotating presidency in 2011[17] and is a founding member (its secretariat being located in Jakarta).

The countries' GDP in terms of growth in 2010 was at 6.1% and is expected to reach 6.4% in 2011.[18] The economic trend for 2011 in sectors such as cars, construction, electronics, energy and infrastructure are seen to be on the increase.[19] Additionally, the consumer sector such as cosmetics with a 10-15% annual growth rate, food with an average growth rate of 10%, retail[20], and the export of raw materials regarding coal, tin, copper and palm oil[21] are testimonials of a sound economy.

Nevertheless, some factors like high poverty can cause a negative impact on the current economic growth. More than 32 million people live below the poverty line.[22] Other factors like "rising inequality and high prices for food, fuel, and gas" bear a potential for social unrest.[23] With a GDP per capita of USD 4.200 (2010 est.), Indonesia is ranked at the 155th place in the world, while its unemployment rate is estimated to be at 7.1% (2010), placing it on number 70 world-wide.[24] Listed according to occupation, nearly 49% (2010 est.) are employed in the services, followed by 38% in the agricultural and only about 13% in the industrial sector.[25] It is interesting to note, that in the composi-

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[13] The Economist, 2011a.

[14] The BRIC countries comprise of Brazil, Russia, India and China.

[15] The Economist, 2011a.

[16] CIA World Fact Book, 2011.

[17] Geiger, 2011.

[18] Bagoglu, 2011a.

[19] GTAI, 2011.

[20] Bagoglu, 2011b, c, d.

[21] The Economist, 2011b.

[22] World Bank, 2011.

[23] Geiger, 2011: 1.

[24] CIA World Fact Book, 2011.

[25] CIA World Fact Book, 2011.

tion by sector in relation to the GDP contribution, 47% are employed in the industrial, followed by the services with about 38% (2010 est.) and only 15% in the agricultural sector.[26] Among its agricultural produce, Indonesia has rice, cassava (tapioca), peanuts, rubber, cocoa, coffee, palm oil, copra, poultry, beef, pork, and eggs.[27] Whereas in its industries one will find petroleum and natural gas, textiles, apparel, footwear, mining, cement, chemical fertilizers, plywood, rubber, food and tourism.[28]

Furthermore, the business environment with its inefficient government bureaucracy, corruption, and inadequate supply of infrastructure – to name just a few – are not conducive for doing business in Indonesia, as stated in an Executive Opinion Survey by the World Economic Forum.[29] However, as Geiger notes "businesses are becoming increasingly sophisticated thanks to relatively deep clusters, efficient management, and the migration of firms to higher segments of the value chain".[30] These factors will certainly help Indonesia in achieving an innovative business environment, once the national innovation system has strengthened.

## 2.2 Indonesia's Innovation Situation in Brief and the German contribution

In the context of the German federal governments' internationalisation strategy, innovations and innovation systems – especially the creation of a harmonised knowledge basis – are gaining more importance for the German Federal Ministry of Education and Research (BMBF). As innovations tend to be international, the BMBF also supports international R&D cooperation. Even though such international innovation cooperation between developed industrial nations is of common practice, it tends to be difficult with new global players. Once innovation systems achieve a certain basic maturity level, the bilateral R&D cooperation will be of mutual benefit.

The BMBF has supported many topics within bilateral R&D projects in Indonesia in the past. One such measure is the sustainable development of a national innovation system as an element of cooperation between the BMBF and Indonesia's Ministry of Research and Technology (RISTEK).

"In 2000 the German and Indonesian governments, represented by the Indonesian Ministry of Research and Technology (RISTEK) and the German Federal Ministry of Education and Research (BMBF) agreed to cooperate in a project called PERIS-KOP[31], which was executed by experts of RISTEK and the German Fraunhofer Gesellschaft (FhG). The objective of PERISKOP was to strengthen the Indonesian National Innovation System (NIS) as formulated in the Strategic Policy for Science and

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[26] Ibid.

[27] Ibid.

[28] Ibid.

[29] Geiger, 2011.

[30] Geiger, 2011: vii.

[31] PERISKOP: *Proyek Evaluasi Sains Teknologi untuk Pembangunan* / Evaluation of the Indonesian Science, Research and Technology Landscape to Strengthen the National Innovation System.

Development 2000-2004 by RISTEK. It also attempts to draw a picture of the performance of the Indonesian science, research and technology (SRT) landscape and to give some suggestions and recommendations on how to improve the overall situation of SRT in Indonesia".[32] The study initiated so-called „BTCs" – Business Technology Centres, since one of the main drawbacks of the Indonesian innovation system is the lack of knowledge about initiating and implementing sustainable innovation through companies.

A lasting change occurred in 2009, with the re-election of the Indonesian president Susilo Bambang Yudhoyono, as at the same time the upper level of RISTEK was exchanged. The new strategic approach and policy of the government[33] and at RISTEK supported innovation and the establishment of a national innovation system – both being of highest priority. Consequently, RISTEK started substantial activities including public investments. So far, the Indonesian government and especially RISTEK made some niche progress in setting up innovation systems on a regional as well as on a national level. However, much work still has to be done, to really turn Indonesia's innovation policy into practise.

At this time, the idea of the Business Technology Centres (BTCs) came into focus again at RISTEK, despite the lack of a practical implementation concept. This is where the so-called "Modular Training Concept Innovation"(MTCI) started. It was implemented in 2010 by VDI/VDE Innovation + Technik GmbH (VDI/VDE-IT) as a pilot project and was supported by the BMBF. It contains three modules (Module 1: Main elements and success factors of a national innovation system, Module 2: Training of innovation managers, Module 3: Regional innovation potential analyses as basis for tailor-made R&D policy), which were implemented in close cooperation with the BTCs and RISTEK. The aim is to give a better understanding to the relevant stakeholders of the framework conditions and measures necessary for innovation. This leads to a better implementation of political ideas and policies into specific measures. The modules were taught in a training course specifically designed for the policy level, intermediaries and managers.

The focus of the activities conducted by the VDI/VDE-IT on behalf of the BMBF is on further training of Indonesian policy makers regarding innovation management and policy. Furthermore, short analyses on the regional and the national innovation systems were conducted in close collaboration with Indonesian stakeholders working in the area of innovation management und innovation policy. The aim was to derive specific support measures of innovation policies based on the existing strengths and weaknesses. Then these results were evaluated and discussed in detail with representatives of RISTEK to identify possible innovation policies and activities to alleviate the identified weaknesses.[34]

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[32] Kusdiana, 2010.

[33] The Indonesian programme on the National Innovation System (NIS) – which had been enforced through the Presidential Decree No. 1 2010 – coordinates policies in different sectors such as economy, social infrastructure, education, human capital, finance and S&T. (ITB 3. Schwerpunktausgabe, 2011).

[34] The mutual interest of the BMBF and of RISTEK has been confirmed during a high level meeting between RISTEK's Minister Suharna Surapranata and the BMBF State secretary in Berlin on 23 September 2010.
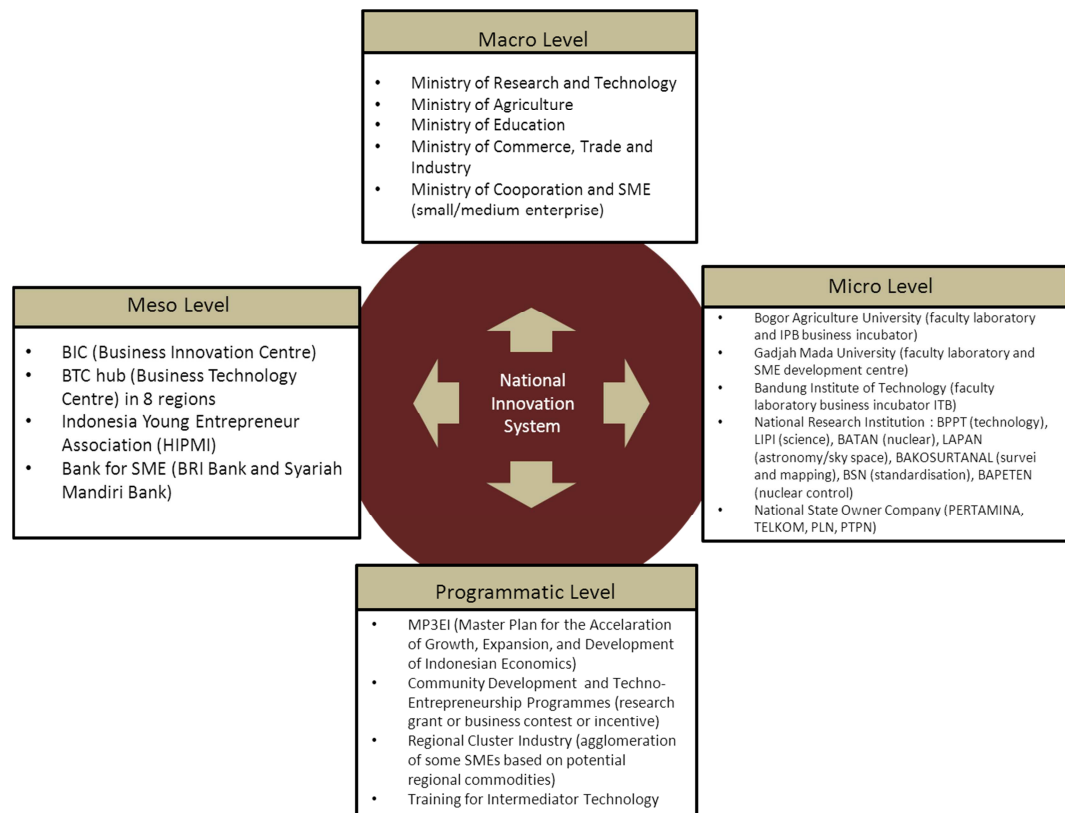
# 3 Indonesian Innovation System Organisations



**Figure 2  The main players in the Indonesian innovation system (except industrial micro level actors)**

The main actors within the Indonesian innovation system (regional and national level) are mentioned in figure 2. Due to the fact that Indonesia is divided into a huge number of regions and for most of these specific actors are available on different levels, the authors are fully aware of the above mentioned list being considered as a small selection. The future challenge for Indonesian policy makers is not to set up more innovation actors, but rather to strengthen their role in the innovation systems.

In the following the main findings, based on the assessed 30 determinants are displayed.

# 4 Assessment Results for Indonesia

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

This report was drawn up based on information gathered between February and November 2010. The following sources were used:

- About 150 expert (self-) assessments from high ranking (executive level) representatives and innovation practitioners on the micro, meso and macro level of the Indonesian innovation system (see figure 1 and 2).

- In-depth interviews with experts and policy makers from RISTEK, BPPT[35] and the Business Technology Centres Network (BTC Network)

The assessments were conducted between 30 October and 7 November 2010, in four regions (see figure 3):

- Palembang / East Sumatra,

- Bantul / South Java,

- Pontianak / West Kalimantan and

- Jakarta.

The expert groups were organised and briefed by RISTEK and local intermediaries, mainly regional developing agencies (called Balit Bang). After a short introduction in the analytical approach and the rational of ANIS, a joined discussion session took place, where the experts had the opportunity to debate on certain questions or determinants. The questions were available in the local language. After gaining consensus about the approach, the determinants and the questions, the experts provided their opinion by completing the questionnaires. After all the different expert groups had finished their work, the completed questionnaire from about 150 experts was evaluated accordingly. This was done by the authors, supported by BTC Networks staff.

The preliminary findings were presented to the RISTEK Minister during a closed workshop (on 8 and 9 November 2010). This verification workshop was initiated to assure that the findings and deducted recommendations were fully understood and backed by the RISTEK management. Therefore, this workshop did not only focus on presenting the key results as such, but also on a logical deduction of the recommendation for corrective actions (see chapter 5).

Shortly after the ANIS main assessment in November 2010, the ANIS analysis was conducted in several regions. This facilitates discussion among the relevant stakeholders in the different regions and stimulates mutual learning.

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[35] Badan Pengkajian Dan Penerapan Teknologi – Agency for the Assessment and Application of Technology.
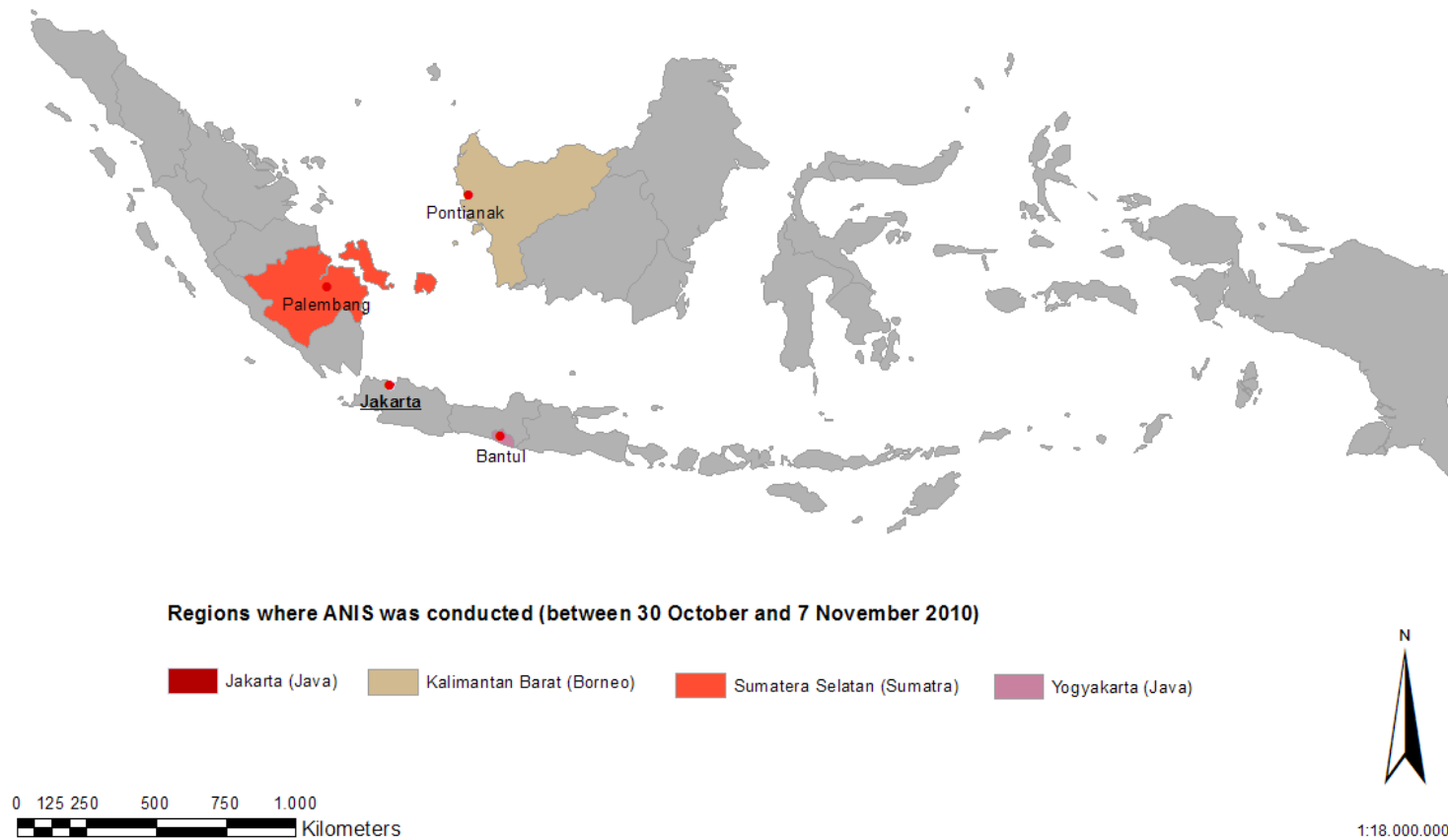
Figure 3    Regions where ANIS was conducted (between 30 October and 7 November 2010)

## 4.2 Results

In the view of the known unsatisfying level of innovation capacity of many actors in the Indonesian innovation system, the Indonesian President and RISTEK are addressing this issue with enhanced intensity since 2009. On all levels, many ideas and approaches have been discussed how to best improve the innovation capacities, especially by universities and SME. Thus, the results from the ANIS approach were highly appreciated and intensively discussed among RISTEK high level management since it is a base for a more structured discussion about which specific steps are needed. The authors came to the conclusion that the Indonesian government is really willing to proceed, but is still uncertain as to what to do specifically. In addition, it seems the legal and administrative issues should not be underestimated, e.g. there is a high uncertainty amongst RISTEK staff, whether and under which framework conditions SMEs are allowed to be funded directly. Although RISTEK is fully aware that SMEs are the key drivers of innovations and one of the key target groups of future innovation support measures, this uncertainty makes all discussions and concepts quite difficult considering how to best address SMEs in future innovation support measures.

### 4.2.1   Macro Level: Innovation Policy Level

The policy level in an NIS influences the framework conditions for innovation and for the actors operating in the NIS a great deal. The status of maturity is described by six determinants. Figure 5 shows the pattern of the values across the six determinants of the policy level.

A national innovation policy as known in fully industrialised countries does not exist. However, this determinant was assessed with a value of 2.3, since many participants were under the impression that relevant policy makers have at least started some discussion about key items of what an Indonesian innovation strategy should be all about. As mentioned before, there is an increased awareness given to innovation matters by the President and relevant Ministries since 2009. This might result in the comparable positive impression that elements related to an innovation strategy do exist. However, the formulation of an Indonesian Innovation Policy is not on RISTEK's agenda so far. Innovation policy on a regional level seems to be further developed compared to the one on the national level; at least in many regions because the corresponding determinant was assessed to be quite high. A value of 2.6 ranks top among all values given for the policy level. This is not really a surprise, since some regions in Indonesia are comparably advanced in innovation matters, examples have been given in the previous chapter.

Although many "natural" clusters do exist in Indonesia, like the rubber cluster (Palembang) or the peanuts cluster (Japara / Semerang, see figure 4), there is no national or regional policy addressing the cluster issue. Some of the clusters are supported by regional developing agencies or big companies (e.g. Garuda in the peanuts cluster), but this is done on a comparably low level and not really based on policies. Thus, it is not surprising that the corresponding determinant was ranked quite low.

**Figure 4    Peanuts cluster in Japara / Semerang (left: experience exchange among cluster actors, right: test field area)**

Currently, the curricula for higher education are partly outdated in many fields, and their state of the art is depending on the initiative of the education organisation. It is consensus that some appropriate actions are on-going. 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. In comparison to Indonesia's peers[36], the assessment shows the following results:
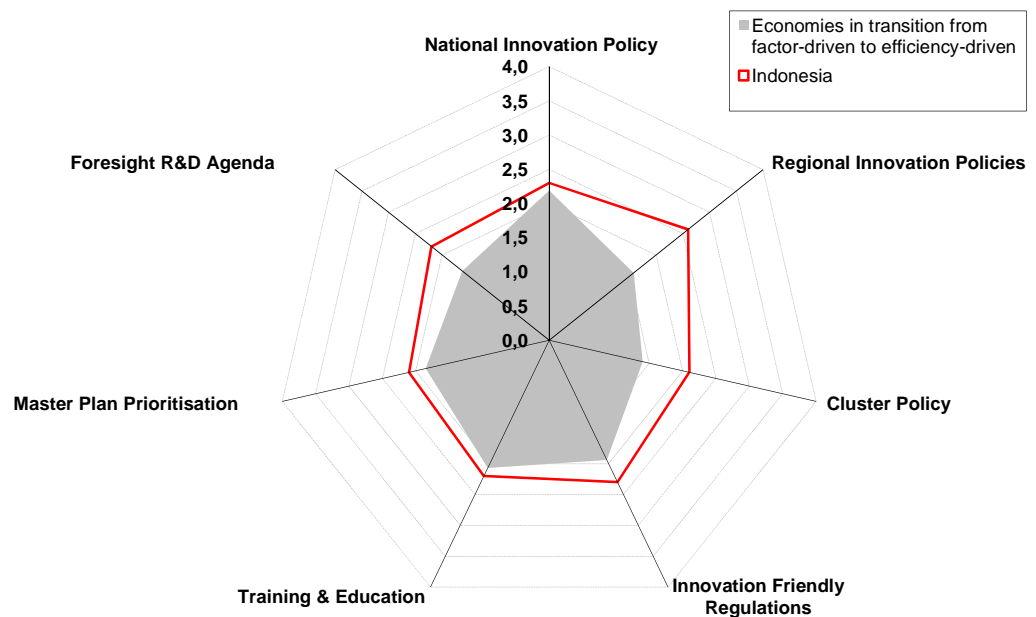


**Figure 5    Pattern of the determinants on policy level – Indonesia, compared to the average of countries that are in transition from factor-driven to efficiency-driven economies**

[36] The peer countries that were used for the comparative portfolio are Syria, Egypt, Botswana, Guatemala as mentioned in chapter 1.

However, the overall spectrum of the seven determinants on policy level seems to be well balanced. This is quite important, since an unbalanced spectrum is always an indicator for policy actions and measures being not co-ordinated at all. As far as Indonesia is concerned, all the values are between 2 and 2.5 indicating that there is still room for improvement, especially concerning the large innovation potential which exists in this country. Figure 6 summarises that the determinant "regional innovation policy" is clearly above the average value (2.26 for the overall policy level), whereas those like "cluster policy" or "master planning" are quite low compared to this average.
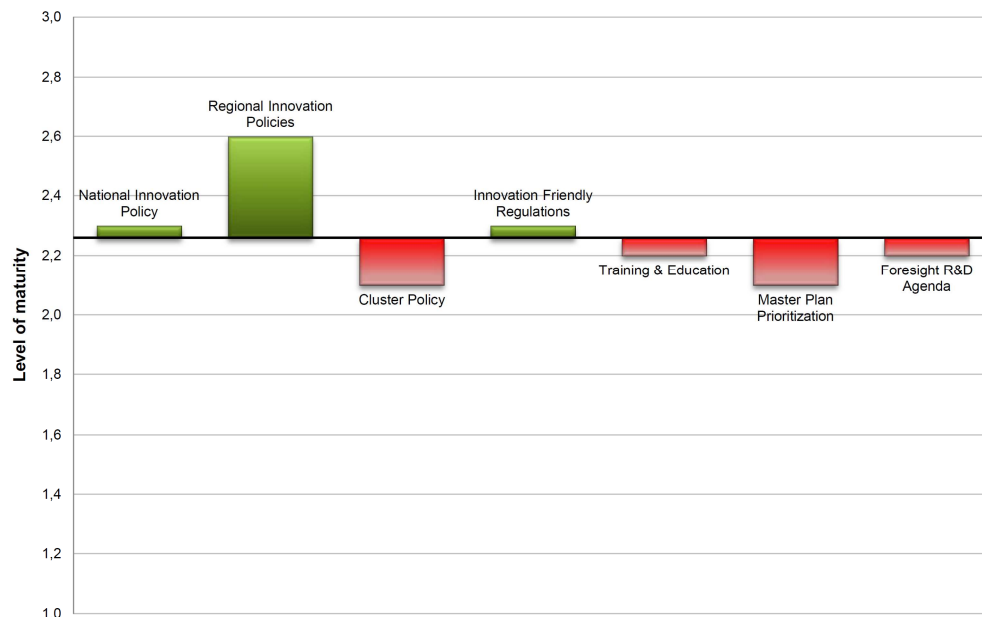


**Figure 6   The seven determinants compared to the innovation policy level average**

### 4.2.2   Meso Level: Institutional Innovation Support

The determinants of the institutional innovation support level provide an overview of the interviewed experts' opinion on how far certain determinants are developed related to institutional innovation support. As shown in figure 2 (see chapter 3), there is a considerable landscape of institutions designed to support innovation, entrepreneurship and technology implementation that shows impacts demonstrated by examples. When it comes to the regional level, this picture is more ambivalent. There are some regions that feel committed to support innovation (Jakarta region, Yogyakarta or Palembang). In these cases, the landscape of innovation support institutions is comparably well developed. In other cases, the landscape is more embryonic and many institutions do not exist. Therefore, in the following, we focus on the national level.

Funding organisations on the meso level do not really exist in Indonesia. In those cases where funding (on a low level as far as the so called "Incentive Programme" by RISTEK is concerned) is provided, the corresponding Ministries are actively involved – from the call design via the assessment procedure to the financial management. RISTEK considers the outsourcing of those activities that are typically done by funding agencies in industrialised countries. But these discussions are only just beginning. Consequently, the related determinant was assessed to be quite low (see figure 7), slightly lower than the average of the corresponding comparative portfolio. Compared

to other determinants on this level the innovation service providers are also ranked low. Many administrative burdens have hindered Indonesian entrepreneurship during the last years. [37] Consequently, two years ago RISTEK started supporting the BTC-approach (Business Technology Centres), and first positive impacts are already visible. The network itself was initiated by RISTEK based on the previously mentioned PERISKOP study. There are other initiatives, e.g. Business Innovation Centres (BIC)[38] or KIN (KOMITE INOVASI NASIONAL)[39], but the community's awareness still needs to be increased. If consequently implemented and well-coordinated, this determinant is expected to improve considerably.

Technology Transfer Centres and Technology Parks have been ranked comparably high. Further interviews have revealed that many Technology Transfer Centres exist. BPPT is one of the most promising ones, but others are implemented in many regions too (e.g. in Palembang). However, most of them are still lacking clear strategies, objectives and adequate staffing and equipment, in order to provide a higher impact on the innovation capacity building so far.[40] In the future it will also be important to see that the work of these centres is well co-ordinated and none of them gets into a monopoly position.

According to the Expert Opinion Survey, clusters as entities providing innovation support for their actors are not yet fully developed. As already mentioned, it is not a lack of clusters as such. Clusters are nothing more than natural agglomerations of actors in a given region. The corresponding number in Indonesia is quite high. But they are comparably weak and not really operational in terms of providing added values towards their actors, having a governance, etc. In most cases, regional support is weak and no real co-ordination is given. In some cases, the regional developing agencies are trying to co-ordinate the activities of respective clusters, but this is often a top-down approach and the regional developing agencies are not really considered networking institutions by the actors, but rather a governmental (controlling) institution. Consequently the respective determinant is rated low, but the potential is quite high.

In comparison to Indonesia's peers[41], the assessment shows the following results:

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[37] OECD, 2011.

[38] Business Technology Centres (BTCs) support technology transfer between Indonesian science and Indonesian industry. Business Innovation Centres (BICs) act as business innovation intermediaries, in order to promote Indonesia's economic and business competitiveness.

[39] KIN's mission is to support Indonesian National Development Plan by establishing a National Innovation System that facilitates interactions between various actors and institutions involve in innovation processes: universities, scientific laboratory, bank for venture capital and government agencies, to improve eight essential and strategic areas: (1) Food, Energy, and Water Security; (2) Education; (3) Health and Medicine; (4) Maritime; (5) Military and Defence Technology; (6) Transportation; (7) Communication and Information Technology (Government, Education, Business); (8) Industry/Creative Economy.

[40] For further information about success factors for Technology Transfer Centres in Emerging Countries: Hahn, Meier zu Köcker: The Egyptian Innovation System - An Exploratory Study with Specific Focus on Egyptian Technology Transfer and Innovation Centres, 2008, www.iit-berlin.de/veroeffentlichungen.

[41] The peer countries that were used for the comparative portfolio are Syria, Egypt, Botswana, Guatemala as mentioned in chapter 1.
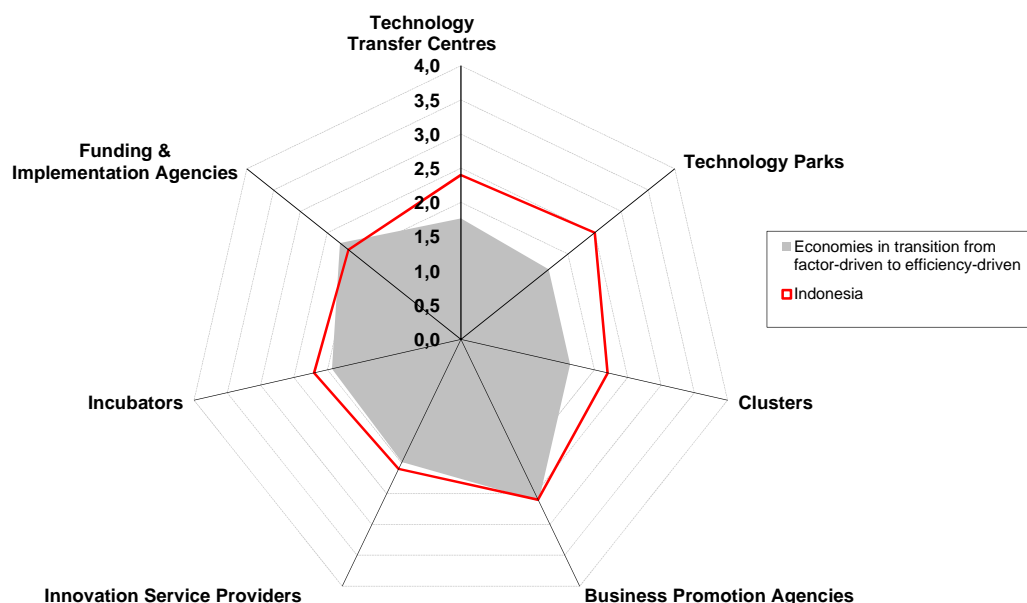
**Figure 7  Pattern of the determinants on organisational innovation support on the meso level – Indonesia, compared to the average of countries that are in transition from factor-driven to efficiency-driven economies**

However, the overall spectrum of the seven determinants on the institutional innovation support level compared to the policy level is well balanced. This is quite important, since an unbalanced spectrum is always an indicator for policy actions and measures being not co-ordinated at all. As far as Indonesia is concerned, all the values are between 2.1 and 2.6. Figure 8 reveals which of the relevant determinants are higher and which are lower than the level-specific average of 2.3. Especially innovation service providers and funding agencies seem to be under-developed compared to the others.
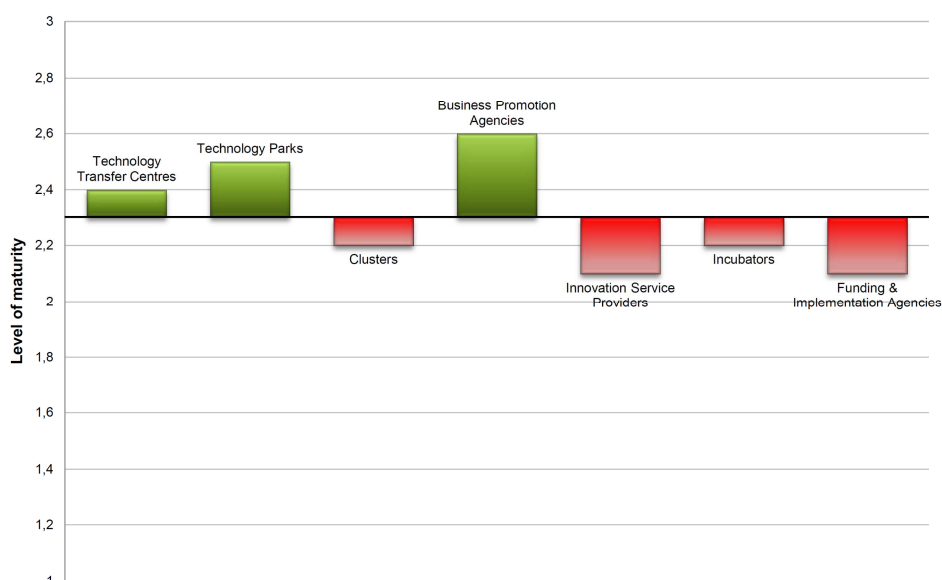


**Figure 8  The seven determinants compared to the institutional innovation support level average**

### 4.2.3 Meso Level: Programmatic Innovation Support

On the federal level, there are some programme approaches to science, technology and innovation funding in place in Indonesia. However, most of them are dedicated to universities or publicly owned institutions, dealing with innovation. A programme the authors believe to be directly intended for companies is the so called "Incentive Programme" by RISTEK. Some of the other programmes have existed for many years and currently there are considerations to evaluate the impact of those. However, it is not a surprise that the determinant "STI programmes", is assessed comparatively high since there are some programmes in place already. Application-oriented R&D programmes do not really exist as well as fundamental R&D programmes as we understand them in Europe. There, some programmes intended for universities, are similar to institutional funding. These do not have any market or industrial orientation and thus, can be considered "fundamental". BPPT is in charge of some of these fundamental-oriented R&D activities on behalf of RISTEK.

As far as accompanying measures are concerned, there are some smaller programmes existing in Indonesia. One of the newest is the so called BTC^pro-Programme. It aims to train would-be staff of BTCs in Indonesia and in Germany. The trainees should provide active support of companies in the field of innovation, business development and networking. It is run in close connection with the Indonesian BTC Network. The programme is jointly funded by RISTEK and by the German BMBF. There are other accompanying measures, like innovation awareness seminars and training courses in order to inform interested parties about the benefits of innovation and how to turn them into practise.

There are also some isolated entrepreneurial support measures implemented, but the corresponding support activities are quite small and not very effective. There is a strong demand for entrepreneurial support, which is understood to be more than only providing incubator facilities.

In comparison to Indonesia's peers[42], the assessment shows the following results:

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[42] The peer countries that were used for the comparative portfolio are Syria, Egypt, Botswana, Guatemala as mentioned in chapter 1.
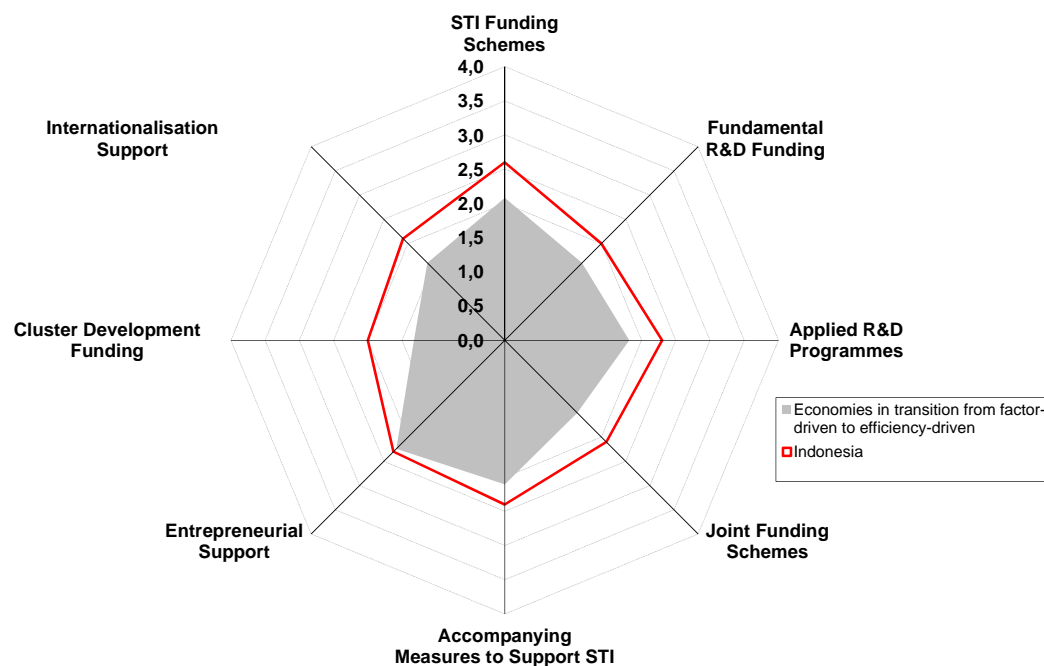
**Figure 9** **Pattern of the determinants on programmatic innovation support level –
Indonesia, compared to the average of countries that are in transition
from factor-driven to efficiency-driven economies**

When it comes to other innovation support programmes such as cluster development
programmes or internationalisation support schemes, there are no such initiatives at
all or if these are, they might be rudimental.

However, the overall spectrum of the eight determinants on the programmatic innova-
tion support level is not as well balanced as the one on the policy level. This is due to
some programmatic support schemes that are better developed than others (see fig-
ure 10). Some STI funding schemes and accompanying measures are already imple-
mented, some of the others are about to be implemented. Other programmes like Joint
Funding Schemes or Cluster Development Programmes are not yet available or exist
on a very rudimental level. The average value of all eight determinants is about 2.2,
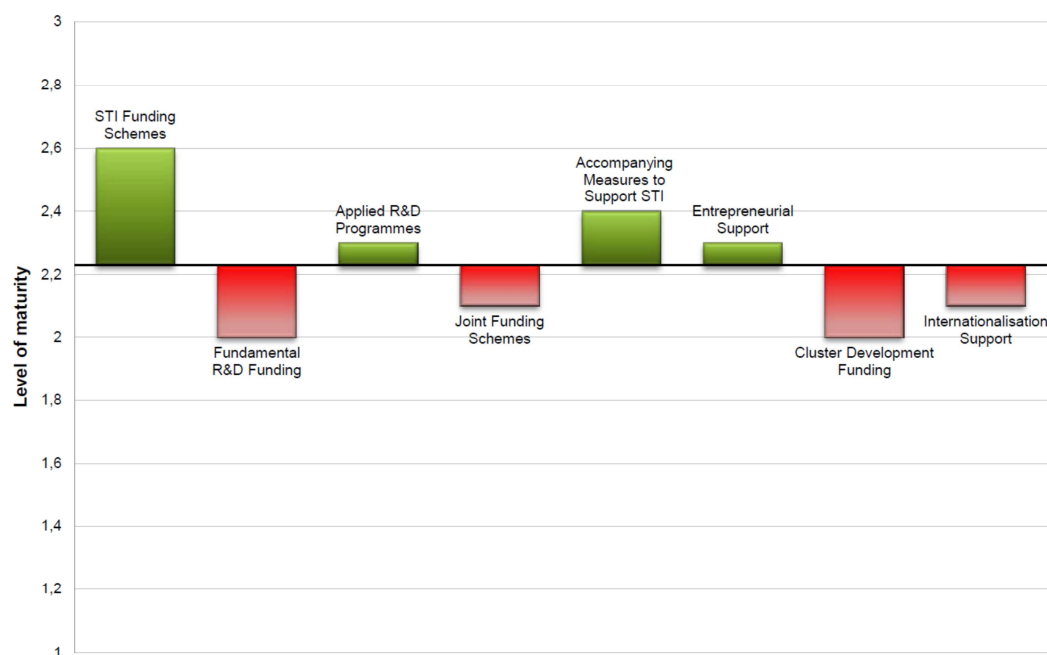ranging from 2.6 to 2.0.

**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.

### 4.2.4    Micro Level: Innovation Capacity Level

The determinants reflect the status of development of the main actors of the Indonesian NIS. Indonesia has plenty of universities und public research facilities. However, the quality, equipment and overall standing differ considerably, but some of them are well known in the ASEAN region. With regard to the curricula, universities and vocational training organisations align their curricula on a case by case basis with (representations of) regional employers. Universities 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 the standard.

The innovation activity of Indonesian SMEs is considered to be low, the bigger companies are more active in this respect (e.g. Garuda, etc.). A few successful collaborations between universities and companies exist in some cases, but comparatively seldom. BPPT is often the driver for such joint activities. Fundamental research organisations are limited in number and impact. They are partly out of focus of the national policy priorities and hardly follow Indonesia's needs. Their scientific excellence is low and their international visibility is limited.

Just as universities, the Indonesian research organisations hardly attract foreign researchers to perform long-term research. The public attraction of science and innovation is currently enhanced through many policy driven awareness campaigns. In comparison to Indonesia's peers[43], the assessment shows the following results:
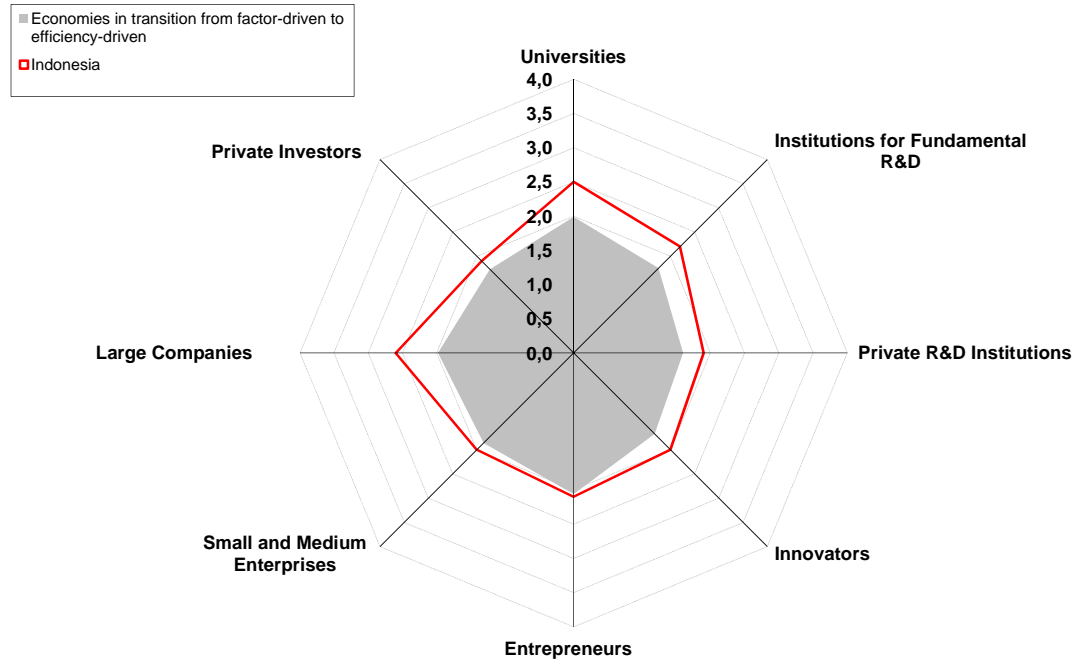


**Figure 11    Pattern of the innovation capacity on actor level - Indonesia, compared to the average of countries that are in transition from factor-driven to efficiency-driven economies**

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's and the large companies' performance is better than barely existent. This is documented through single examples of industry collaborations in the field of food production and farming.

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[43] The peer countries that were used for the comparative portfolio are Syria, Egypt, Botswana, Guatemala as mentioned in chapter 1.
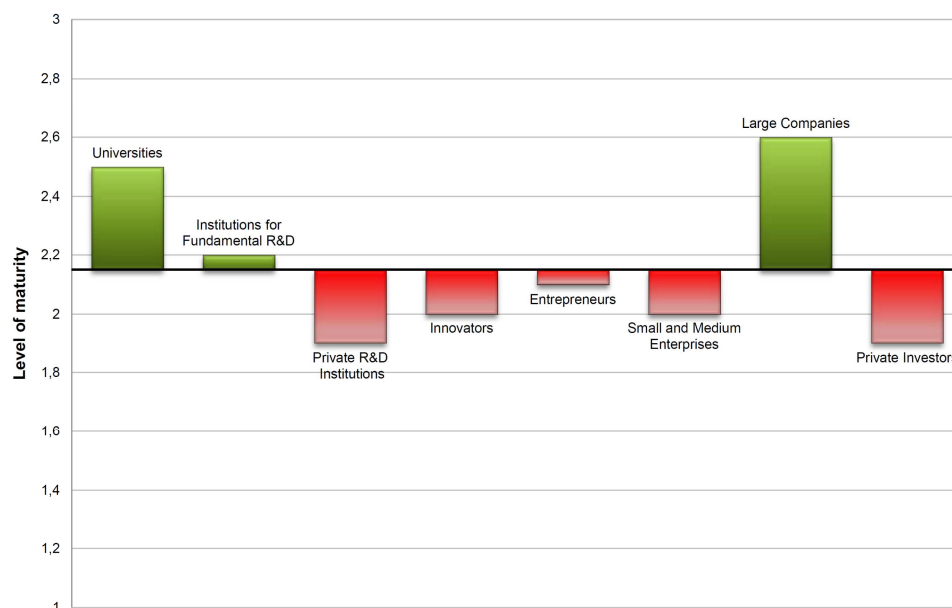
**Figure 12    The eight determinants compared to the innovation capacity level average**

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.

However, the overall spectrum of the eight determinants on innovation actors is quite well balanced, meaning that almost all determinants are developed similarly. Only the innovation performance of universities and large companies are rated considerably higher than the average (average for determinants on this level: 2.15 (see figure 12). Others which only barely exist are rated below average.

# 5 Main Challenges and Interventions

The status of maturity of an NIS and the performance of its actors can be improved by policy measures and their implementation addressing the improvements of single determinants or even several of them. The prospective impact can be expected on several determinants, and also vertically on the meso and the actor level, if the policy targets the potentialities adequately and implements them.

In Indonesia, in-depth interviews and further discussions have been carried out to better understand the main challenges and to define areas for interventions. In order to prioritise the measures that improve given determinants, especially those who were rated below average with respect to scarce resources, a portfolio analysis is embedded within the ANIS methodology to distinguish effective measures from those that involve a lot of effort and high risks with regard to implementation. When improving a given determinant, two indicators can be calculated. Firstly, the **Impact Index** (Quality & Quantity of Impact) which accounts for innovation support quality multiplied with diffusion enhancement of the measure. This indicator describes the effectiveness of an expected impact on the NIS.

Secondly, the **Effort Index** which accounts for the cost of a certain measure and its implementation risk. Implementation risk includes e.g. difficulties in coordination between ministries, insufficient authority for the implementation of measures, or complexity of a measure making it risky to realise.

Impact and Effort Indices have been calculated for all those determinants of the Indonesian NIS that have been rated below average (see figures 6, 8, 10 and 12). The findings are given in figure 13.
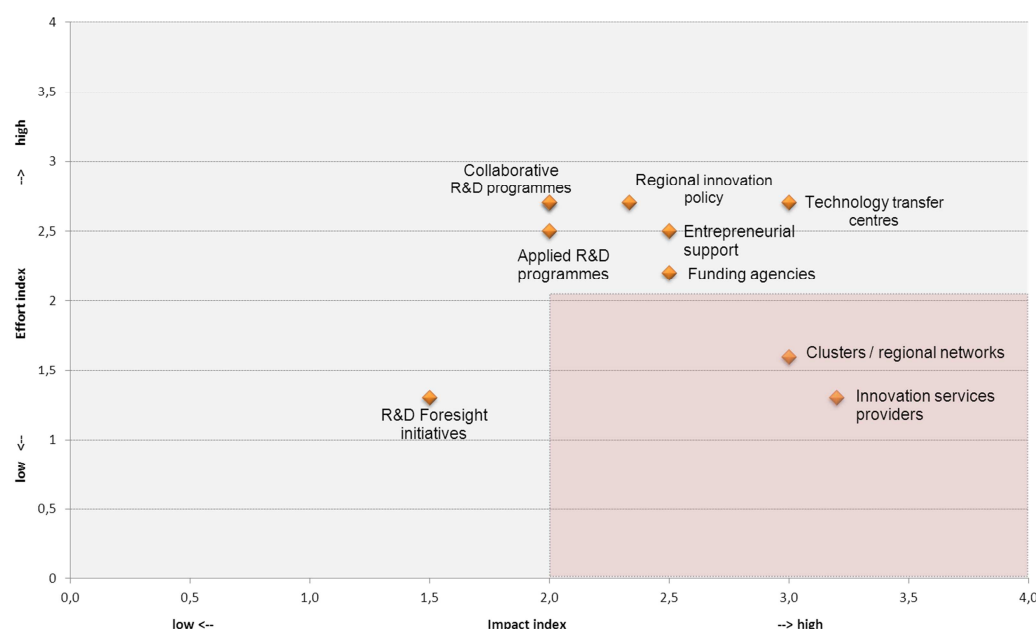


**Figure 13 Portfolio – Scope of intervention of innovation support schemes in Indonesia**

The lower right area of the portfolio (marked in green) reveals a set of determinants that can be improved efficiently by certain interventions that are most probably suitable for "quick wins" - high expected impact combined with comparably low efforts.

From the Portfolio of Interventions it can be concluded that, consequently, two determinants have moved in the focus for improving actions. On the national level, RISTEK, the Indonesian Ministry which is mainly responsible for Science, Research and Innovation, has decided to set up a support programme to increase the limited capabilities for innovation management. In the framework of the so called BTC$^{pro}$-Programme, around 30 Indonesian experts were trained in the field of innovation management, network management and business development in Germany within the last quarter of 2011. These experts have returned to Indonesia in the beginning of 2012 and are going to become employees in existing innovation support bodies on the meso level, like BTCs or BICs. This implementation process, according to the current planning, is flanked by further support actions from German experts.

Adding to that, especially on the regional level, the cluster approach has moved more into the focus of regional policy makers. As an example, the regional government of Palembang will pay closer attention to further strengthening existing clusters in its region. Since clusters can be understood as nationally given agglomerations of entities operating in a certain sector, future support actions will focus on setting up and training cluster management organisations which will improve the networking and co-operation among the cluster actors. Bridging the gap between academia and industry will be an additional focus. It is intended that they employ some of the BTC$^{pro}$ trainees as cluster managers for further clusters in Palembang.

# 6 Recommendations

Basically, Indonesia is on track to build and launch a sustainable future-oriented innovation landscape. A few notes and recommendations for future implementation - as a result of the analysis - should be given at this point: In our assessment the key stakeholders in the innovation activities need continuous support by the ministry RISTEK to manage the practical implementation of innovation management and policy. It is important that the key partners in the ministry, in innovation agencies and in the BTCs continue sharing knowledge, experience and coordinate their activities closely.

Implementing the BTC concept successfully requires the close involvement of the experts trained in Germany. They should be installed in their foreseen position in different regions of Indonesia in the short term. Most of these experts are able to introduce the training elements of the MTCI approach for further education measures in Indonesia at policy level, for intermediaries and managers of SME, bringing the train-the-trainer approach to life.

In 2011, the group of experts developed business models for future regional activities, e.g. building sustainable networks to exchange experience and know-how. Supporting the implementation of these activities appears to be quite easy and only little cost-intensive. The participants learned concepts, such as "how to involve SME in the innovation process", and now the practical implementation is needed to improve Indonesia's innovation capacities.

The remaining gap between developing countries and the developed industrial countries in terms of project management and processes should be solved. Matured innovation systems, such as Germany's, are able to start an executing phase after a decision is taken. They have a detailed and long forecast planning and people are normally working consistently from the start until the project has been ended. In Indonesia it is still different; almost every project mostly depends on the budgeting system, which means it is difficult to start a new project in the middle of the year. If there is a new project which shall be run in the middle of the year, it will take budget allocation from other projects. This disabling fact should be overcome.

A further recommendation concerns the management structure and the missing matrix organisation. Often a project manager in Indonesia also holds the position as department leader. This can lead to one person handling up to 10 projects at the same time which often causes delays in the projects.

During project management, it is necessary to appoint one person or an entire team, which is aware towards the different cultures and thus the different working processes within the country. This person or this team shall take on the role as intermediary to overcome cultural differences in order to establish trust and to provide strategies of working together.

One of the major success factors for the efficient and effective implementation of the BTC concept in Indonesia has been the installation of a CIM expert who has worked on the establishment of the BTCs in the ministry RISTEK. Mr. Franz Gelbke and his assistant Ms. Kristina Kusdiana were deeply involved in the planning process as well in the organisation and the implementation of the BTC project including the negotiation with other stakeholders throughout the entire process. Thanks to their outstanding expertise, this first step towards the improvement of the innovation culture in Indonesia is expected to have a major positive impact on Indonesian businesses.

**Some further recommendations:**

**Innovation Policy Level:**

- Development of a master plan to improve innovation capacities
- Introduction of a nationwide cluster policy with strong focus on regional circumstances


**Institutional Innovation Support:**

- Enhancing the valuable networking of existing institutions for innovation support in the different regions
- Strong political support of the already committed (towards innovation support) regions Jakarta, Yogyakarta and Palembang
- Development of funding organisations to manage national innovation-related programmes and the founding of small, innovative companies
- New activities to enhance the networking of technology transfer centres and technology parks - support for the definition of clear strategies and implementation pathways
- Building up the already existing cluster activities towards better performance
- Specific support to enhance the performance of innovation service providers and funding agencies


**Programmatic Innovation Support:**

- Adoption of application oriented R&D programmes
- Accompanying measures to support the transfer between universities and SMEs
- Strengthening the BTC$^{pro}$ concept to inform about the benefits of innovation and about implementation strategies
- Introduction of cluster development programmes
- More international visibility to reach innovation support programmes from global donors i.e. from the World Bank


**Innovation Capacity Level:**

- Enhancing the transfer capabilities of universities and public research facilities
- Enable the participation in international exchange programmes
- Set up measures to overcome the lack of innovation in the main industrial areas
- Provide training for the existing technology parks, e.g. Puspitek Management

# 7 Annex: 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 that have 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<br><br>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 the macro dimension, national and regional innovation policies influence the framework conditions of an NIS directly. At that level laws, decrees and regulations, etc. may often be ground breaking, in a positive or also in 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 fostering stakeholders' competitiveness and capability to innovate. Rather than their 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 in an NIS. Such programmes might be managed either by policy makers or by innovation support institutions. Any measures at this 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 influence an NIS differently. 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. In 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 an NIS, since they cannot be controlled by national policy makers and actors of the 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 (see figure 1). By means of different approaches of measuring all determinants may be addressed directly. 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 investments. 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 a specific examination, or combined with others.

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