Developing Strategies for University, Industry, and Government Partnership in Indonesia

Education Sector Analytical and Capacity Development Partnership (ACDP)

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The Government of Indonesia (represented by the Ministry of Education and Culture, the Ministry of Religious Affairs, and the Ministry of National Development Planning / *BAPPENAS*), the Government of Australia, through Australian Aid, the European Union (EU) and the Asian Development Bank (ADB) have established the Education Sector Analytical and Capacity Development Partnership (ACDP). ACDP is a facility to promote policy dialogue and facilitate institutional and organizational reform to underpin policy implementation and to help reduce disparities in education performance. The facility is an integral part of the Education Sector Support Program (ESSP). EU's support to the ESSP also includes a sector budget support along with a Minimum Service Standards capacity development program. Australia's support is through Australia's Education Partnership with Indonesia. This report has been prepared with grant support provided by AusAID and the EU through ACDP.

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KEMENTERIAN AGAMA

BAPPENAS

EUROPEAN UNION

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ADB

The institutions responsible for implementation of the study were PT. TRANS INTRA ASIA in cooperation with the Institute of Public Administration of Canada (IPAC).

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Developing Strategies for University, Industry, and Government Partnership in Indonesia

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Abbreviations

ACDP	Analytical and Capacity Development Partnership
ADB	Asian Development Bank
AIPI	Indonesia Academy of Science / *Akademi Ilmu Pengetahuan Indonesia*
ATMI	*Politeknik ATMI Surakarta*
BATAN	*Badan Tenanga Nullir Nasional*
BAKOSURTANAL	*Badan Koordinasi Survei dan Pemetaan Nasional*
BAPPENAS	National Planning Agency / *Badan Perencanaan Pembangunan Nasional*
BAPETEN	*Badan Pengawas Tenaga Nuklir*
BHMN	State Owned Legal Entity / *Badan Hukum Milik Negara*
BINUS	Bina Nusantara University
BLU	Public Service Agency / *Badan Layanan Umum*
BMBF	Bundesministerium für Bildung und Forschung
BMZ	Bundesministerium Für Wirtschaftliche Zusammenarbeit
BPPS	*Beasiswa Program Pasca Sarjana*
BPPT	Agency for Assessment and Application of Technology / *Badan Pengkajian dan Penerapan Teknologi*
BPS	*Badan Pusat Statistik* / Statistics Indonesia
BSN	*Badan Standar Nasional*
DGHE	Directorate General of Higher Education
DI	PT Dirgantara Indonesia, state owned aircraft industry
DP2M	*Direktorat Penelitian dan Pengabdian Masyarakat*
EU	European Union
GDP	Gross Domestic Product
GRDP	Gross Regional Domestic Product
IDR	Indonesian Rupiah
INSTIPER	*Institut Pertanian STIPER Yogyakarta*
IPB	Bogor Agricultural University / *Institut Pertanian Bogor*
IPR	Intellectual Property Rights
ITB	Bandung Institute of Technology / *Institut Teknologi Bandung*
ITS	Sepuluh Nopember Institute of Technology / *Institut Teknologi Sepuluh Nopember*
KAI	PT Kereta Api Indonesia, state owned railway company
KAIST ME	KAITS - Mechanical Engineering Department
KAIST	Korean Advanced Institute of Science and Technology
LAPAN	*Lembaga Penerbangan dan Antariksa Nasional*
LAPI	*Lembaga Afiliasi Penelitian dan Industri*
LIPI	Indonesian Science Institute / *Lembaga Ilmu Pengetahuan Indonesia*
MALUT	North Maluku / Maluku Utara
MIT	Massachusetts Institute of Technology
MoA	Ministry of Agriculture
MoD	Ministry of Defense
MoEC	Ministry of Education and Culture
MoH	Ministry of Health

MoI	Ministry of Industry
MoPW	Ministry of Public Works
MoRT	Ministry of Research and Technology
MoT	Ministry of Trade
MP3EI	Master Plan for Acceleration and Expansion of Indonesia Economic Development /
	Masterplan Percepatan dan Perluasan Pembangunan Ekonomi Indonesia
NIS	National Innovation System
NRA	National Research Agenda
NTB	West Nusa Tenggara / Nusa Tenggara Barat
NTT	East Nusa Tenggara / Nusa Tenggara Timur
OECD	Organization for Economic Cooperation and Development
OUIC	Office of University Industry Cooperation, KAIST
PAPPIPTEK	*Pusat Penelitian Perkembangan IPTEK – LIPI*
PHKI	*Program Hibah Kompetisi Berbasis Institusi*
PNBP	Non tax state revenue / *Penerimaan Negara Bukan Pajak*
PP	Government Regulation / *Peraturan Pemerintah*
PTN-BH	Autonomous public university with legal status / *Perguruan Tinggi Negeri - Badan Hukum*
PUSKIM	*Pusat Penelitian dan Pengembangan Pemukiman*
PUSPIPTEK	Center for Research in Science and Technology / *Pusat Penelitian Ilmu Pengetahuan dan Teknologi*
QS	Quacquarelli Symonds Limited
R&D	Research and Development
RAPID	University - Industry Research / *Riset Andalan Perguruan tinggi dan Industri*
S3	*Strata 3 (PhD Level)*
S&T	Science and Technology
SME	Small and Medium Enterprises
THES	Times Higher Education Supplement
TPSDP	Technological and Professional Skills Development Project
TusPark	Tsinghua University Science Park
UB	Brawijaya University
UBAYA	University of Surabaya
UGM	Gadjah Mada University
UI	University of Indonesia
UICC	University Industry Cooperation Committee, Tsinghua University
UIG	University – Industry – Government
UIPG	University - Industry Partnership Grant
UNAIR	Airlangga University
UNAND	Andalas University
UNHAS	Hasanuddin University
UNSRAT	Sam Ratulangi University
UT	Indonesia Open Unversity / *Universitas Terbuka*
WEF	World Economic Forum


LOMBA KETERAMPILAN SISWA
TINGKAT NASIONAL KE XVIII
DI JAKARTA
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Executive Summary

The Government of Indonesia has launched an ambitious *Master Plan for Acceleration and Expansion of Indonesia Economic Development* or *MP3EI*, with a view to promoting geographically dispersed growth through establishing seven economic corridors across the nation. The objective of this study is to review the current status of universities in Indonesia in terms of their capacity to work in partnership with industry and government. The review will assess whether they can contribute to the realization of such a vision, and it will make recommendations about future strategies and actions. The study was commissioned by the Ministry of National Planning *(BAPPENAS)* and the Ministry of Education and Culture through the Analytical and Capacity Development Partnership (ACDP) program, which is funded by the European Union and the Australian-AID and administered by the Asian Development Bank (ADB).

The study set out to address three sets of questions related to:

a) The nature of Indonesia's innovation systems: at which stage of development are these systems and which kind of interactions are evident among the three institutional spheres: universities, industry and government?

b) The role of universities: what role should universities play, and which changes and development strategies do they need in order to be able to play such roles? and,

c) Future actions and programs: which specific actions and programs are needed, how should they be designed, and which resources are needed to develop UIG partnerships?

The initial findings of this study were presented at the 10th Triple Helix Conference, held in Bandung 8-10 August 2012. The paper that was presented has been published in the Elsevier's Procedia Social and Behavioral Sciences. The full manuscript of the article is presented in Annex I of this document, and is available at http://dx.doi.org/10.1016/j.sbspro.2012.09.468.

Our study found universities, industries and government to operate as three independent spheres, still quite distant from each other. We identified only a small number of examples in which the three spheres cooperated productively, and in which universities developed and shared essential knowledge with the other spheres. We found only one case in which actors from the three sectors developed a new organizational structure to work together to generate and implement joint ideas and strategies. However, the initiative was clearly an isolated example and not a regular feature of the regional innovation system.

We found none of the three spheres to be sufficiently equipped to lead the development of Indonesia's innovation systems. International study visits to Korea and China showed cooperative initiatives to be driven by their respective governments. Given its different political attributes and institutional

frameworks, the Indonesian government seemed unable to be as proactive and directive as the respective governments of countries like China or Singapore in realizing a framework for cooperative innovation. In addition, unlike Korea and Japan, Indonesia lacks leading industries capable of contributing to the creation of innovations. In sum, universities are left to the task of pushing UIG partnerships, which are essential for generating accelerated and geographically dispersed economic development, as outlined in *MP3EI*. For that reason, developing universities across the country into strategic institutions has a special significance for Indonesia.

The scale of Indonesia's higher education system is appropriate, and it needs to expand at an adequate rate to meet the needs of the economy. However, the institutional framework of the education system needs to change in order to meet Indonesia's needs for future economic development and to help reduce interregional inequality. To do this, every economic corridor will need the following:

a) at least one 'relevant research institution', which is an institution containing relevant expertise in fields critical to regional development. These institutions do not necessarily need research capacity to cover all fields relevant to regional development;

b) teaching institutions that offer practical instruction. Collectively, these institutions will offer short cycle and professional education that prepare students for the job market; and

c) generic teaching institutions, which will offer quality undergraduate education in a wide range of subjects to prepare students to meet unpredictable regional needs, particularly the emerging needs of the service sector.

d) at the national level, it is critical to have 'relevant research institutions' with a much wider range of expertise. These institutions should be able to conduct fundamental research as well as relevant and applied research for the most knowledge-intensive industries.

Arguably, despite the focus institutions place on generic research, the most serious issue is the lack of institutions dedicated to relevant research. It is not that institutions are incapable of carrying out relevant research. Some established universities have the eagerness and human capital to be research-active. However, because they emphasise internationally-publishable research, their institutional development naturally inclines them to focus on fundamental science. These institutions lack a commensurate push for academic collaboration with industry, an effort to remain 'relevant' and the desire to develop application-oriented ideas. In the current academic environment, even industrially-active academics voice difficulties in identifying with industrial partners. This difficulty is problematic and must be addressed.

a) According to our study, there are existing polytechnics and an increasing number of private universities which offer quality, flexible and **practical** education at diploma and undergraduate levels. In other words, institutions capable of creating workers able to meet employers' practical skills demands are already available. The next key step is to spread good practices more widely across institutions and regions. This is important as employers are often unsatisfied with the quality of graduates, particularly their soft skills, English competence and IT skills.

b) In general, education institutions lack quality teaching. Although most universities have the capacity to be quality teaching institutions, they focus more on becoming generic research institutions than on offering **quality** undergraduate **instruction.**

The '*quality movement*' which has been in place since the 2000s has lost momentum. The movement, which brought about significant improvements in the quality of education during the late 1990s and the 2000s, was characterized by emerging good practices at departmental and study program levels. However, because changes were not often institutionalized, particularly in public institutions, the 'quality movement' is believed to have faded in recent years. In general, the quality of undergraduate education

needs to be further improved. In addition, universities need to offer instruction in intangible skills that will be demanded by the job market as the economy changes. Therefore, the quality movement must be restarted, particularly at the institutional level and across all categories of institutions.

Also of concern is Indonesia's capacity for R&D. After reviewing such capacity, it is evident that the government must take significant action. In Indonesia, the percentage of the population represented by scientists and engineers is one of the lowest in the world. In addition, Indonesia invests very little in R&D activities. The Government of Indonesia invests just 0.08% of its GDP in R&D, which is low compared to the 0.7% invested by Malaysia's government, the 0.85% invested by India's and the 1.6% invested by China's. Universities are important players in the R&D sector. Although research funding for universities has increased in the past five years, the overall level of research funding remains small. There has been a small increase in funding allocated to strategic research, which incentivises universities to undertake research relevant to national needs.

While making changes to the institutional framework of the education system, there are several issues that need to be addressed. One of the most fundamental issues is the lack of understanding and mutual trust between the three sectors. Too many universities develop their strategies without recourse to industrial stakeholders, and many academics look down on industries, considering them 'greedy' and 'lacking idealism'. On the other hand, industrialists consider universities to be ivory towers, bureaucratic, and too focused on consensus building to meet industry needs. To bring the two sectors together, it is critical to create more 'hybrids' by encouraging industrialists to join academics, and by motivating academics to take leave to work in industry. In addition, there should be more opportunities for 'structured encounters', where industrialists and academics meet regularly to build better mutual understanding regarding the purpose and operation of one another's work. Governing boards and advisory committees in universities, businesses, professional societies, joint projects, alumni interactions and consultancies should all offer opportunities for individuals from the two sectors to gain exposure to the other sector. As the study visit to Korea and China indicated, it is possible and necessary for universities to create such structured encounters.

A second issue is that there is a serious flaw in the institutional framework allowing public universities to engage in partnership with industry. Public universities' lack of financial autonomy makes it difficult for them to run projects efficiently. And having no legal status gives them no credibility in negotiating contracts involving intellectual property rights. Without autonomy, institutional development occurs without the institutional mechanisms or structures for strategic actions.

Third, regional disparity is a debilitating factor, which could undermine the vision of *MP3EI*. Currently, university capacity is distributed very unevenly. Unless concerted efforts are made, universities will not be able to play meaningful roles in many Eastern regions.

Although the identification of appropriate follow up strategies and action programs is beyond the scope of this study, a few broader issues are worth noting. First, weaknesses exist in the incentive structures promoting industrial R&D and encouraging industry to move downstream and embrace higher value added products in sectors such as mining and agriculture. We believe that the growth envisioned in *MP3EI* is not feasible without considering incentives in industry, and developing strong affirmative policies to promote faster industrial upgrading. Second, we think that research capacity an Indonesia needs to be enhanced, particularly in the field of biological science, in order to build a future capacity for conserving and exploiting biodiversity. Both issues merit further work that explores the circumstances deeply and develops strategies and programs for action.

More specifically, this review recommends that universities become strategic institutions with a culture of innovation and relevance. First, becoming strategic means ensuring that their distribution

of expertise appropriately meets the needs of the surrounding region and/or the nation. Second, universities must develop UIG support facilities. These facilities should include corporate relations or industrial liaison offices and effective support for external contracts. Also, facilities should be equipped with specialized expertise for creating space for collaboration and commercialization such as science parks and incubation centres, staffed with dedicated professionals who understand the academic world, but who have individual expertise beyond that of most part-time academics. Thirdly, universities must offer incentives to encourage individual academics to engage in industrial partnerships and undertake commercialization.

Clearly, the framework for institutional autonomy must be reoriented to allow universities to develop into fully autonomous institutions. Because this problem will not be solved in the short-term, the government must develop workaround mechanisms facilitating universities to work better with industries. This effort includes ensuring that funds can be effectively channelled. It is likely that many public institutions will need to be involved to establish new organizational units facilitating cooperation between universities and industries.

This review recommends that the government win back the confidence of private businesses by, first, establishing national forums where leaders from government, industry and academia can meet and work with one another. Second, the government must develop a consistent set of policies and a credible program of public investment to enhance innovation in order to support economic growth. Innovation is encouraged not only by ensuring university autonomy but also by supporting the development of industries with higher value added, such as downstream industries in the agricultural and mining sectors. Thirdly, the government must revamp and increase its investment in R&D.

Although improving R&D investment is critical, we do not recommend doing so simply by expanding existing types of research funding. Research funding from DGHE and MoRT have increased significantly, as is evident in their improved abilities in funding good research projects. It is important to improve the mechanisms of channeling funds by pushing block grants, encouraging faster disbursement, and allowing multiple year projects to use funds more effectively.

Increased government funding is also needed for 'strategic research'. Strategic research is needed to promote the specific research that will have national relevance for future development needs. Although MoRT already provides similar funding, other sectoral agencies could be more active in providing grants or contracts which would push universities to undertake nationally relevant research and development projects.

A set of competitive funding programs is needed to promote a culture of industrial engagement and relevant research among universities. Creating competition in funding may provide incentives for institutions to innovate. Requiring proposals for all programs to be developed in consultation with stakeholders in industry and government officials will also promote the development of institutions with a mind towards collaborative planning. More specifically, we recommend three types of programs:

1). A program in which fellowships are awarded to individual academics (both prospective and future) and industrialists. Selected academics and industrialists will gain work exposure in each other's spheres so that they develop 'hybrid' perspectives.

2). A program offering institutional grants to strengthen professional support for UIG partnerships. Specifically, these grants will support corporate relations, industrial liaison work and commercialization.

3). A program promoting the development of universities with research expertise in new fields relevant

to industry. We recommend 'tiered' competition to directly address regional disparity and target support at universities in the Eastern region. For the programs that can start immediately. we recommend sequencing grant programs to ensure effective preparation and implementation.

In the medium to long term, we expect DGHE and other government funding bodies to enlist individual industrialists, who can advise them on strategies, policies and funding program design and implementation. However, it is unlikely that identifying such personnel is easy. Therefore, in the short-term, we recommend that DGHE start new programs with a concerted effort towards ensuring that industrial views are solicited when (a) designing programs, by encouraging individual consultation with industrial experts; (b) selecting programs, by engaging industrial experts in their monitoring and evaluation; and (c) making individual grant proposals, by requiring universities to consult stakeholder industries when submitting proposals.

Chapter 1

Framework of the Study

1.1 Introduction

Despite the global economic downturn, Indonesia's economic growth has so far remained resilient. Indonesia has successfully maintained growth above 6 percent (projected 6.4% in 2012), a budget deficit below 2.5 percent of GDP and a public debt to GDP ratio of 25 per cent. As an emerging economy, Indonesia is now considered to be a low middle income country entering the third stage of economic development, called the "efficiency driven economy" by the World Economic Forum (WEF 2012).

To improve its competitiveness within the efficiency-driven global economy, Indonesia currently needs to address higher order skills, knowledge and innovation. Higher education is critical to achieving economic growth and national competitiveness. Having well-educated human resources, excellence in scientific research and better linkages to industry and government are key policy priorities for the higher education systems of practically all OECD countries. More governments are developing explicit innovation strategies which include various programs that support universities in taking on greater economic roles. Emphasis on university-industry-government partnerships is a global trend not only in OECD countries, but also in emerging economies, and increasingly in developing countries.

Indonesia is no exception. The Government of Indonesia has recently launched the *Master Plan for Acceleration and Expansion of Indonesia Economic Development* (*MP3EI*), intended to drive the realization of high, balanced, fair and sustainable economic growth, through two key factors: acceleration and expansion [*MP3EI*, 2011]. Indonesia plans to accelerate its existing development plans by boosting the value added of the prime economic sectors, increasing infrastructure development and energy supply and developing human resources, science and technology. Indonesia plans to expand economic development so that every region in Indonesia and all communities across Indonesia gain from the positive effects of growth. This economic development strategy requires strong university, industry and government (UIG) collaboration and partnership.

This study was commissioned by the Ministry of National Planning *(BAPPENAS)* and the Ministry of Education and Culture under the Analytical and Capacity Development Partnership (ACDP) program. The study was funded by the EU and AusAID and administered by the Asian Development Bank (ADB). The main purpose of this study is to review the current status of universities[1] in Indonesia in terms of their capacity to develop partnerships with industry and to contribute to Indonesia's economic development strategy.

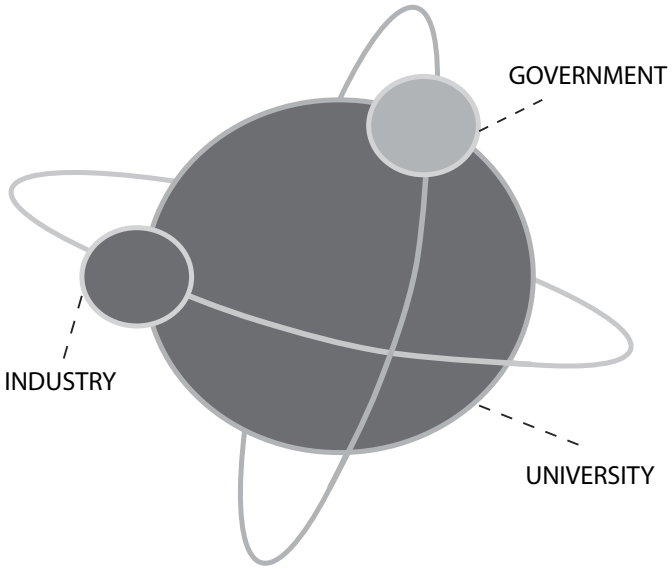
1 The term "universities" is used throughout this paper to represent all types of higher education institutions, i.e. university, institute, college (sekolah tinggi), academy, and polytechnics.

Figure-1.1: The economic corridors in the *MP3EI*

1.2 University Role in the Innovation Space

The role universities can play in regional economic development depends not only on their current level of interaction with government and industry, but also on their capacity to play a proactive role with respect to other actors. Considering the capabilities required of universities, the extended triple helix model for regional development provides a helpful framework for our analysis (Etzkowitz 2002, Casas et al 2000, Etzkowitz and Ranga 2010). According to Etzkowitz's model, the three separate institutional spheres - universities, industry and government - will initially operate independently from each other. In the first stage of the development of regional innovation systems, each sphere develops a 'knowledge space', where knowledge institutions begin to concentrate certain R&D activities related to the region, with some networks emerging around them. In the second phase, the region develops a 'consensus space', where actors from the three spheres begin to work together to generate new strategies and ideas. In the third phase, the region develops a 'innovation space', where new organizational mechanisms are developed or introduced to realize strategies developed in the previous stage.

Figure-1.2: Triple helix III innovation space



The model has also been extended to describe the positioning of the UIG spheres with respect to one another. In a statist regime (Triple Helix I), government plays the leading role in driving academia and industry. In a laissez-faire regime (Triple Helix II), industry is the driving force, and the other two spheres act as ancillary support structures [Etzkowitz and Ranga, 2010]. In a knowledge-based society, universities and other knowledge-producing institutions increasingly partner with industry and government, often leading such joint initiatives, in a balanced model (Triple Helix III). In a university-led developmental model, the university takes the lead and becomes the gravitational center that initiates partnership, as illustrated in figure-1.2. In this case, the first step in forming a productive partnership is to have a preliminary encounter with industry and the government.

1.3 Mission Differentiation

In order to understand the different roles that universities can play in economic development, we propose a framework which distinguishes four types of institutions: basic research institutions, relevant research institutions, teaching focused institutions and practically oriented institutions[2]. As shown in Figure-1.3, these four types are distinguished by two dimensions which define the nature of their research interest: application orientation and fundamental-science orientation.

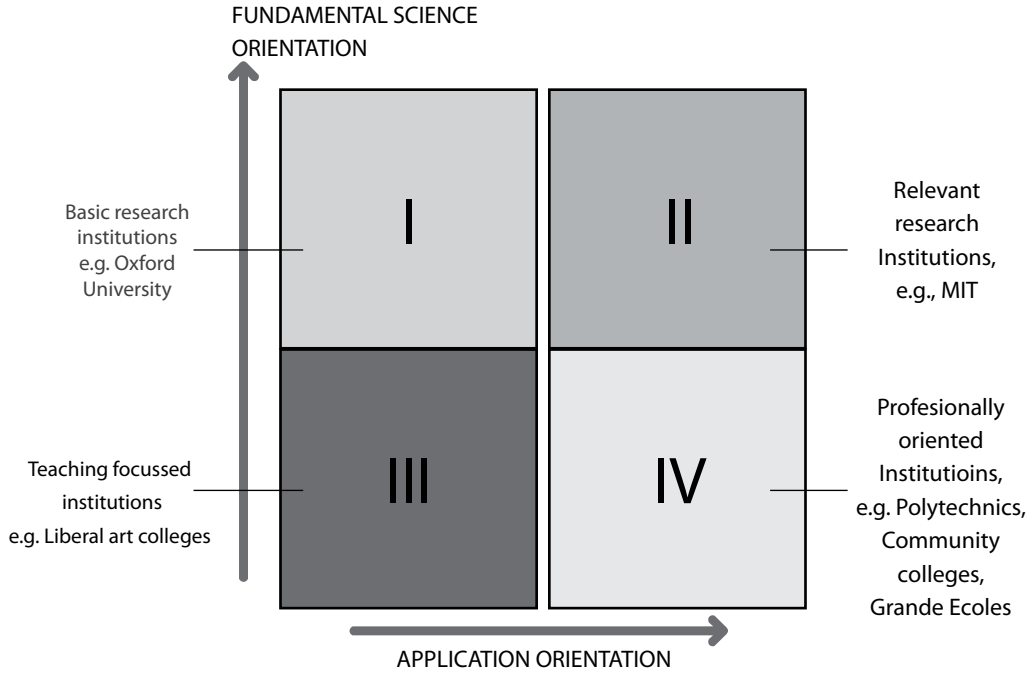
In relevant research universities (quadrant II), academics conduct fundamental research that creates new knowledge to unravel fundamental principles but that is inspired by its relevance to society and possible application. Primary examples of relevant research universities emerge from a small group of American research universities which embrace the value of relevance such as MIT, Stanford and land grant universities, which have the tradition of serving the needs of the society. Such institutions typically have extensive institutional systems that support academics in working with industry and other stakeholders in society. These institutions also emphasize and have institutional mechanisms that support interdisciplinary research relevant to societal challenges.

Basic research universities (quadrant I) are driven principally by the core values of fundamental science. In these universities, there is little interest in or institutional capacity for responding to external needs. These universities give rise to the idea of the classic ivory-tower university with well-developed research capabilities. Indeed, the great majority of research universities in the world have belonged in this category, at least until recently, when economic relevancebecame a global catchphrase.

The bottom right-hand cell represents the *professionally oriented* (quadrant IV) institutions, which aspire to meet the economy's needs for practical skills and knowledge. These universities offer courses that teach skills which produce workers relevant to the needs of employers, and they often conduct consulting and application-oriented research with and for industry. The objective of their research is not to discover fundamental principles for publication, but to develop solutions to specific problems. Examples of these universities are diverse, ranging from the grandes écoles in France, which were designed to provide elite professional education (although they have begun to develop basic research capacity in the past couple of decades), to the German universities of applied sciences (previously fach-hocheschules) and many polytechnic schools and their equivalents in other countries. Such institutions may have multiple and direct linkages with employers and industry.

2 This is a classification built upon conceptual framework proposed by Stokes (Stokes 1997), which proposed that fundamental research can be inspired by its application – in a striking contrast to the orthodox belief that fundamental science must be autonomous from interest in applications [Hatakenaka, 2008].

Figure-1.3: Institutional Characteristics [Stokes, 1997; Hatakenaka, 2008]



In teaching-focused institutions (quadrant III), the main purpose of research is to keep the academic staff updated with developments in their fields; their research can be more appropriately called scholarship. U.S. liberal arts colleges provide good examples of teaching-focused institutions. These institutions are committed to offering broad curricula, with an emphasis on generic skills rather than vocational or professional content.

In many developing countries, most institutions fall into the teaching-focused category simply because they have not yet acquired the resources or developed the capacity to be highly active in research, either fundamental or applied. In addition, many institutions are not fully developed, with only a limited range of subject coverage, or with less than fully qualified personnel. Indonesia is no exception. And yet, if Indonesia is to achieve the objectives of *MP3EI*, it must develop at least a handful of well-developed relevant research institutions (Quadrant II). Each of the key corridors must also have universities with relevant research capacity, at least in a limited range of fields that are critical to the region. This study will refer to these universities as *regionally relevant research institutions* (Quadrant II). Each of the main 'centers' within corridors should have both professionally-oriented institutions, capable ofproviding industry-relevant education in an efficient manner(Quadrant IV), and teaching-focused institutions, capable of offering good education in a diverse range of academic specializations and providing an adequate pool of flexible human resources (Quadrant III).

1.4 Objective of the Study

The objective of the study is to contribute to the achievement of the National Medium Term Development Plan 2010-2014 *(RPJMN)* and the Master Plan for Acceleration and Expansion of Indonesia Economic Development 2011-2025 *(MP3EI)* by supporting economic growth, productivity, and national competitiveness. The aim is to develop strategies for UIG partnerships and collaboration, thus creating opportunities for innovation geared towards stimulating economic growth. Although UIG partnerships require active participation from all three players and issues associated with the role of government and

industries have been explored, the central focus of the study is higher educational institutions. Thus, the study will look primarily at the role of these institutions in creating and enhancing innovation systems.

The specific research questions that we addressed in this study are:

- *What are the development stages of Indonesia's innovation systems?*
  The study assesses the stage of development of the 6 economic corridors in the context of the *MP3EI* strategy. Particular attention is given to assessing how far they are from developing necessary knowledge and consensus space. The study further develops strategies that might be needed to prepare higher education institutions to contribute to the national *MP3EI* strategy.

- *What roles should universities should play? What changes and development strategies are needed?*
  The study assesses the capacity of university's in taking a leading role, particularly in understanding the feasibility of reaching stage three of the Triple Helix. In the context of *MP3EI*, some requirements of universities, which allow them to play the intended role in developing the UIG partnership, are defined. In cases where these requirements have not been met yet, the study recommends necessary changes within university, government and industry environments.

- *What specific actions and programs are needed? How should they be designed? And what resources are needed for developing UIG partnership?*
  The study develops a blueprint for programs to be supported with government funding, the shape of institutional arrangements necessary for implementating such programs and possible options for their locale and the required resources.

The deliverable outputs are:

- *Inception Report:* The report was discussed in a preliminary workshop held on the 1st of June. The report was presented and discussed on 14 June 2012.
- *The Paper, entitled "University, Industry, and Government partnership: present and future challenges in Indonesia",* was presented at the 10th Triple Helix Conference, held in Bandung 8-10 August 2012. The paper has been accepted and published in the Elsevier's Procedia Social and Behavioral Sciences. The full text of the article is presentedin Annex I of this document, and is also available at http://dx.doi.org/10.1016/j.sbspro.2012.09.468 [3].
- *Interim report:* The initial plan was to focus the report on good practices and approaches in developing UIG partnership by drawing lessons from national and international experiences. However, the schedule of study trips to China and Korea was delayed due to technical reasons. In addition, and simultaneously, we concluded that information deriving from local experiences has been adequate in providing materials for developing a preliminary analysis. Therefore, we decided to adjust the report by expanding it to include local analysis and limit its coverage of international experiences to literature study. An interim report was presented at a stakeholders' workshop held on 5 September 2012. The report was well received, and the participants in the workshop have provided many valuable suggestions for the final report.
- The study team was invited to present its findings before the USAID HELM workshop in Jakarta on 7 November 2012 and the Japan Indonesia Innovation Convention in Bandung on 1 December 2012.

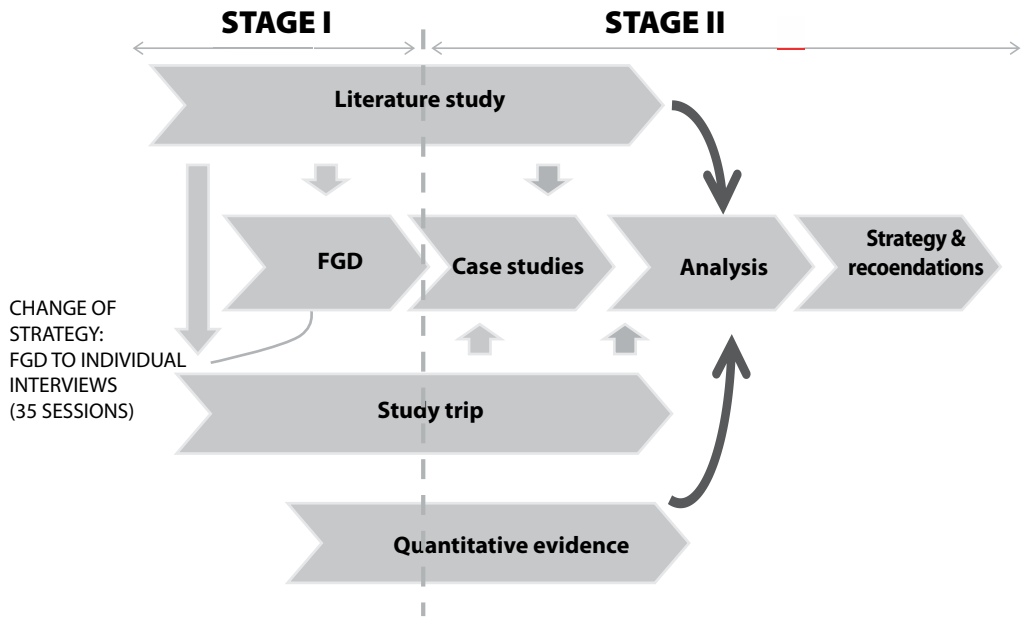
3 Facebook: http://www.facebook.com/share.php?u=http://dx.doi.org/10.1016/j.sbspro.2012.09.468
Twitter: https://twitter.com/share?original_referer=http://dx.doi.org/10.1016/j.sbspro.2012.09.468

- *Strategy for facilitating UIG partnership:* this is part of the final report and includes a report on relevant aspects of the higher education sector, capacity in research and development, the needs of industry, the issues in UIG partnerships and recommended strategies.

1.5 Methodology

This study began with a review of literature related to UIG partnerships, and an overlapping series of discussion sessions and focus group discussions (FGDs). The findings are based on a review of government documents, existing data within Directorate General of Higher Education (DGHE), preliminary interviews with individuals and discussions with groups representing key players from university, industry and government.

Figure-1.4: Methodology of the study



During the course of the study, we made adjustments to overcome the problems we encountered, as highlighted in the following points:

Study trip

In addition to holding discussion sessions, we also planned a study trip to 2 overseas locations for a comparative study. The main purpose of the study trip would be to learn from successful international experiences, and we submitted a proposal to China (industrial parks in Tsinghua University) and Korea (KAIST, and Daedeok Innopolis in Daejeon). The initial plan was to conduct the study trip in the early stage of the report. However, after deciding we would need more information on the condition in Indonesia before knowing which information to look for in our selected countries, we changed our plan and rescheduled the study for the second stage of the report.

Unfortunately, due to unanticipated technical problems in travel organization, i.e. late responses from the host institutions, we ended up conducting the study trips in the second part of November 2012.

Case studies

From the beginning, we realized that our available resources and time frame would limit our ability to conduct an extensive and quantitative based survey. With only 4 members, the team was unable to cover the entire spectrum of sectors, corridors, and institutions. Therefore, we selected a few case studies for further study and analysis. We also conducted follow up sessions consisting of discussions with experts and officers relevant to the case studies. The purpose of the case studies was to explore and analyze factors that contributed to successful UIG partnerships in Indonesia. Stories of failures were also rigorously analyzed in order to find potential remedies.

Initially, we planned to focus our study on just a few cases involving institutions with different missions, i.e. research, professional and teaching-oriented institutions. However, during the course of the study, we found that interesting cases were distributed among many different institutions rather than being concentrated in a few institutions. Therefore, in selecting cases, we started being more flexible and stopped limiting our selection to a particular unit, department or institution. Some interesting small cases were drawn from several different institutions. The selected cases are presented as boxes in this document.

Interview sessions

We realized that identifying the appropriate people to be interviewed was an important factor in gathering the right information. Initially, we conducted group discussions by sending formal invitation letters to the targeted organizations. Later, we found that many attendees of the focus group discussion were not the right people to represent the organizations.

Table 1-2: List of interviewees

	Workshop	Interview	Total
Public universities	5	63	68
Private universities	1	21	22
Central government	7	12	19
Regional government	0	5	5
International organization	2	4	6
Industries	0	17	17
ACDP	5	0	5
Study trip	0	6	6
Total	**20**	**131**	**151**

Therefore, we adjusted our strategy after the first session and replaced formal group discussions with direct informal interviews with selected, well-informed individuals. The individuals we interviewed were informally invited to and informed of the intention of the interview. We used email or text messages to invite individuals and to set the interview's date and time before finally conducted the interview. This strategy seemed to be more effective than the previous one, though it required more time and effort on the part of the study team. In total, and as presented in Appendix D, we interviewed 131 individuals and conducted group discussions with 20 persons during this study.

- *Government*

  Due to limited resources and time frame, the team did not cover the entire spectrum of government research institutions in its interviews. In some cases, conflicting schedules prevented high ranking officers from meeting the requested schedule. However, an extensive literature study was conducted to acquire more information on these research institutions. We interviewed key officials who are responsible for developing research policies in BBPT, MoRT, DGHE, MoI and MoPW.

- *Industry*

  The private sector was represented in interview not only by large corporations, but also small and medium enterprises. To solicit the corporations' vision and future strategy, we aimed to hold interview sessions with corporations' top executive or chairman of the board. We interviewed senior members of the pharmaceutical, financial, property, fishing, manufacturing, plantation, food and cocoa industries. The smaller industries represented included the food and software industries.

  Admittedly, we only succeeded in interviewing a number of industrial representatives as not all industrialists that we contacted agreed to our requests. Nevertheless, the team was satisfied with the quality of the interviewees, who proved to be good representatives in depicting the views of the sector. The names of the interviewees are given in Appendix E. As the list makes clear, the opinions of these individuals carry great weight.

Quantitative evidence

Acquiring secondary data from government institutions was not as simple as we thought. In many cases, data is scattered, and, therefore, difficult to analyze. The only fairly comprehensive information we acquired was based on a survey conducted by *LIPI*'s *Pappiptek* a few years ago on government research institutions.

Chapter 2

Economic Context and Needs for UIG Partnerships

What is the economic environment in Indonesia and which needs will UIG partnerships help Indonesia meet as part of efforts to generate future economic development? In order to explore these questions, this chapter provides an initial description of Indonesia's past development, its current industrial structure, and it looks to potential future economic development paths.

Today, Indonesia's stage of development could be described in the terms of the WEF as the efficiency-driven phase of economic development. In this phase, Indonesia can no longer rely on labor intensive industries based on low wages, nor can it continue to depend on natural resource-based industries. Instead, the country's competitiveness will increasingly be driven by factors that enhance productivity. Although Indonesia is ranked 50th globally for its competitiveness, it has low scores in three of the six factors upon which this phase of economic growth depends. These critical factors include higher education and training (ranked 73rd), well-functioning labor markets (120th), and the ability to harness the benefits of existing technologies (85th). This section explores Indonesia's current economic and industrial landscape. In addition, against this backdrop, it assesses the country's needs and the implication those needs have on university-industry-government partnerships.

2.1 Economic Context and Industrial Structure

In the past two decades, Indonesia's economy has changed dramatically and has made significant progress. The economy grew rapidly between 1990 and 1997, experiencing an average GDP growth of 7 percent. The country underwent a profound change in its employment structure as its agriculture sector shrunk and its service sectors expanded [World Bank, 2011]. Its rapid industrial growth was led by manufactured exports. Exports that were at first labor-intensive simple consumer goods and basic resource processing evolved into a wide range of manufactured products reflecting increasing technological sophistication [Aswicahyono et al, 2010; Hill and Tandon 2010]. The Asian crisis hit Indonesia's economy hard, leading to a massive economic contraction of over 13% in one year. The country has made a remarkably fast economic recovery, particularly when considering that recovery occurred while the country was also building new democratic processes [Hill and Tandon, 2010]. Economic growth resumed in 2000. By 2009, Indonesia was the third fastest growing economy of all G20 countries, with a projected GDP growth of 6.4% for 2012 [World Bank, 2012].

Although industry has recovered, the manufacturing sector slipped from occupying a leading position to becoming an average sector within the economy. The content of 'manufacturing' also changed. Labor intensive subsectors like textile and footwear gave way to capital intensive subsectors including resource-based industry and electronics. Indeed, post-crisis manufacturing growth has been described as 'jobless'. Restrictive labor regulations are increasingly identified as one possible cause of jobless growth in this sector [Aswicahyono et al., 2010].

There is no obvious group of businesses capable of championing effective technology transfer or innovation [Hill and Tandon, 2010; Aswicahyono et al., 2010]. The high-tech oriented state owned enterprises retain their past image of being massive concentrated investments, and despite having concentrations of highly trained human resources, Indonesia's successive democratic governments have not restructured them into a viable force for Indonesia [Brodjonegoro, 2012]. The financial performance of these enterprises is generally poor, and it is often 'saddled with social responsibilities and subject to political influence' [Hill and Tandon, 2010]. Foreign-owned firms are major players in the Indonesian economy, and their role has increased during the crisis. For example, the share of manufacturing output from foreign owned firms rose from 22% in 1990 to 37% in 2005. The greatest contribution was made by automotive products and electronics [Aswicahyono et al., 2010].

Some foreign owned firms who were not major players in innovation in the past have been increasingly interested in rapidly growing Indonesia's domestic markets. Therefore, these firms may become interested in using upstream and/or downstream investment to consolidate their positions within Indonesia[4] (see box: China and India: attracting R&D from Foreign Direct Investors).

Box 1. China and India: attracting R&D from Foreign Direct Investors

With the rise of R&D type operations, most notably in China and India, the past decade has seen drastic change in the mode of operations of multinational companies in developing countries. Today, foreign direct investors are widely acknowledged to be motivated to invest in R&D in emerging economies for several different reasons. One reason might be their need to better access new markets and to develop products that meet local market needs, as in China. Proactive policies can help with this. The Chinese government has been particularly proactive in its joint venture policies aimed at demanding local content, technology upgrading and collaborations with local institutions including universities. As was found in India, the availability of highly educated cheap labor can also be an inducement.

The Czech Republic found that Hyundai, its main foreign direct investor in automobiles, was not interested in establishing R&D facilities. Instead, the inflow of associated suppliers led to local capacity building that caused a much greater collaboration with local higher education institutions. Similarly, Shanghai's proactive policies not only resulted in developing the capacity of local companies, but also the formation of many R&D projects, and establishment of chairs and facilities in local universities. These were all funded by foreign investors (Tuijl et al., 2012)

2.1.1 Promoting Higher Value Added in Natural Resource-Based Industries

The Indonesian government made special effort to encourage foreign direct investors to explore and exploit Indonesia's rich natural resources in agriculture and mining. While past efforts led to the production of large volumes of commodities that generated significant additional revenue, more typically, products were raw materials or products with relatively little added value. Most of the technology currently applied in the agriculture and mining industries is foreign-based, produced and developed outside Indonesia. Furthermore, foreign investors recruit overseas experts for middle and

4 One Japanese businessman (interviewee) observed that the nature of Japanese investment is changing. More supply chain firms are arriving in automobile or electronics, which could lead to industrial deepening and provide opportunities for Indonesia to go well beyond simple assembly operations. Their motivation is different in neighbouring countries such as Malaysia, where the domestic markets are too small to 'anchor' foreign production

upper level management. Partly resulting from such recruitment patterns, and partly resulting from the global commodity price boom of the mid-2000s, Indonesia's export of primary commodities increased from 15% of the total non-oil and gas exports in 2001 to 34% in 2011. Agriculture-based manufactured exports increased from 18% to 22% [World Bank, 2012]. Non-oil and gas exports accounted for 80% of total exports in 2011.

Box 2. Cocoa Sustainability Partnership [CSP, 2011]

Cocoa is important for Indonesia for at least 3 reasons. First, it provides employment for more than a million rural small cocoa farmers (large cocoa plantations are inefficient). Second, Indonesia is the third largest producer of cocoa beans in the world, after Ivory Coast and Ghana. Indonesia produced 900 thousand MT beans in 2009 from more than 1.5 million hectares of smallholder plantations. Thirdly, the cocoa yield in Indonesia is the highest in the world (up to 800 kg/hectare with potential to reach 1-1.5 ton/hectare), compared to only 300 kg/hectare in West Africa. Experts said that Indonesia's primary competitive advantage was its ability to supply large quantities of beans.

However, the future of cocoa production in Indonesia is currently at risk. Problems facing cocoa production include land conversion to palm oil plantation, deteriorating productivity, deteriorating quality resulting from farmers' unwillingness to use fertilizer and improper post-harvest handling. Most cocoa beans in Indonesia are unfermented, which affects their suitability for producing quality cocoa powder or liquor. To make it worse, the marketing structure of the value chain in the global market does not provide adequate incentives for quality. Instead, incentives promote volume-based transactions regardless of the quality of the product, and place demands on low priced beans.

In 2006, a forum called the *Cocoa Sustainability Partnership* (CSP) was established in response to a call from the local cocoa processing industries. Members of the CSP include local and international industries, associations, universities, individual experts, provincial and district offices (Dinas), MoA and MoT. The scope of the CSP's work covers coordinating development activities, transferring cocoa farming technology and cocoa farming business skills, identifying cocoa sustainability issues, empowering cocoa farmers, supporting a healthy and transparent free market cocoa economy and guiding the sustainable cocoa certification process. Currently, two working groups have been established, namely the *"R&D and technical transfer" and the "Farmers empowerment and sustainable cocoa production".*

In early 2000, a modest demonstration plant was established in Hasanuddin University (*UNHAS*). The plant aimed to provide students with practical experience in the cocoa industry and also provide training for cocoa SMEs. In conjunction with the establishment of CSP, *UNHAS* has expanded the facilities by providing an additional IDR 10 billion investment.

Gerakan Percepatan Revitalisasi Kakao Nasional is perhaps the best example of a UIG partnership, initiated by the mutual needs of stakeholders instead of a government decree. The CSP foundation, established in 2011 to provide the initiative with a proper legal infrastructure, is currently funded by corporate donations, government and other international donors (big bettor). In order to encourage local downstream industries, the government introduced a 5% tax on raw cocoa beans exports.

In 2012, Indonesia is expected to produce 400,000 tons of processed cocoa, a significant increase from the 280,000 metric tons produced last year. The upward trend in production will significantly affect the national economy and global cocoa industries in 2016, when production will reach a capacity of 1 million tons of processed cocoa and the country will export 250,000 tons of processed cocoa.

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To boost the exports of a greater number of processed commodities with higher added value, the government has strongly encouraged the construction of new plants for processing raw agricultural commodities. New export taxes on primary commodities have been introduced and increased, while taxes on processed commodities have been reduced. These measures have resulted in a significant increase in the export of processed commodities, a decline in the export of raw commodities and a simultaneous boom in the construction of new processing plants.

Box 3. A shift from exporting crude to refined palm oil

Palm oil, the world's most traded and consumed edible oil, is used mainly as an ingredient in food such as biscuits, margarine, and ice cream, or as a biofuel. Indonesia is the world's top producer, having exported 17.6 million tons in 2011. Although the price has decreased to less than USD 1,000 per ton in recent months due to weaker market demand in Europe, China, and India, rising volumes have offset price declines.

Palm oil is part of Indonesia's efforts to attract investment and squeeze more from its agricultural resources, a policy that is sometimes controversial. In 1994, taxes on crude palm oil export were introduced to ensure the availability of palm-based cooking oil for the 200 million Indonesian people. However, the system fell apart when the Rupiah currency collapsed during the 1998 financial crisis, prompting palm oil firms to export more. With this in mind, export taxes on crude palm oil, which were kept much lower than export taxes on refined oil to shore up domestic supply, frustrated the processing industry, led many firms' to think of exiting Indonesia, pushed the government to raise tax on crude oil export to 20% (lowered to 13.5% recently) and slashed export duties for refined oil.

Responding to the government's message, Indonesia expects a wave of investment worth more than USD 2.5 billion to build a refining industry that will double its capacity to supply the entire needs of Asia's top consumers: India and China. A survey of 30 firms operating in Indonesia shows plans to nearly double refining capacity to 43 million metric tons of palm oil, or 80% of total world output [Reuters, 2012]. Industries had aggressively lobbied Jakarta to cut duties on refined palm oil to half of those levied on crude. Under its refining plans, Indonesia will be able to meet annual domestic needs of around 10 million metric tons and also supply the combined 20 million metric tons of edible oil required by top buyers, China and India. Despite the 7.5% tax India places on refined palm oil from Indonesia, it is still USD15 cheaper a ton to import Indonesia's processed palm oil than to refine crude oil that has been imported.

Government incentives meant to encourage businesses to move downstream have been successful, as exemplified by the cases of cocoa and palm oil (see boxes: Cocoa Sustainability Partnership and A shift from exporting crude to refined palm oil). However, indigenous technology innovation and university R&D seem to have made little to no contribution.

2.1.2 Future Industrial Development Needs

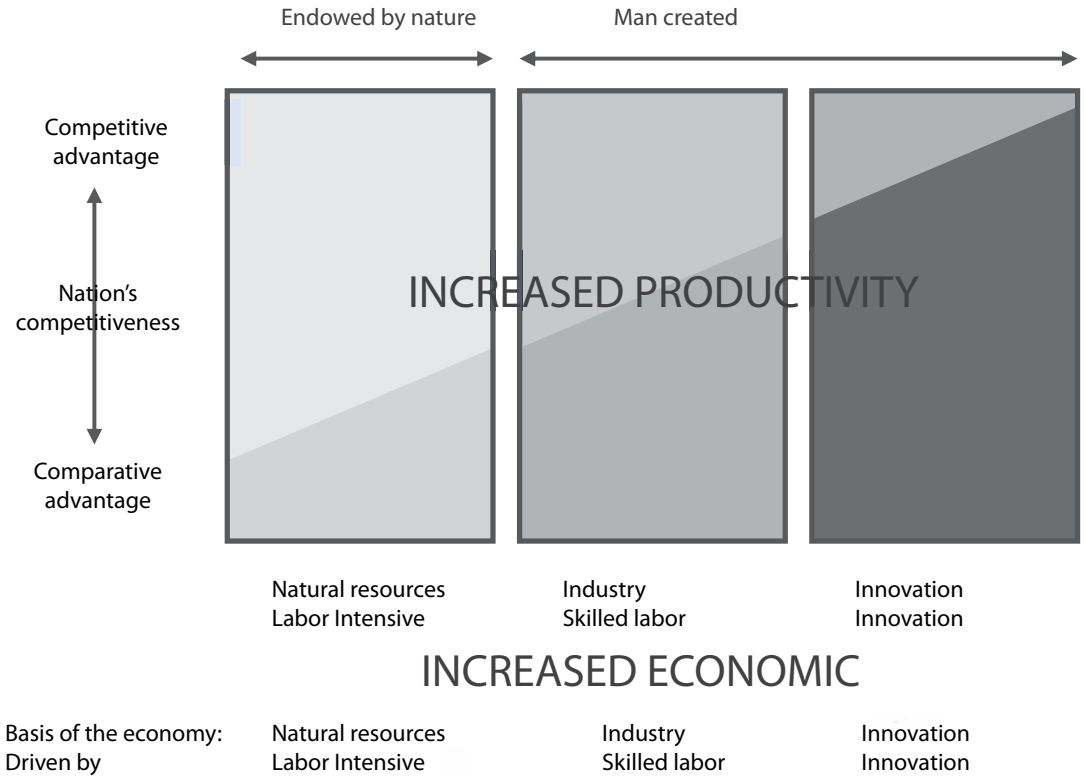
For the Indonesian economy to grow further, more effort must be made to increase added value of Indonesian industry. Figure 2.1 illustrates the strategy laid out in *MP3EI* to improve national productivity, competitiveness and excellence.

Although, in the case of palm oil, Indonesia has successfully shifted from exporting crude oil to refined palm oil, there are still problems to consider. First, plantations were expanded aggressively and currently cover 8.2 million hectares, which is an area about the size of Ireland. This expansion has earned strong criticism from environmental organizations worldwide due to its environmental destruction. Biodiversity conservation also becomes a complicated issue considering that many of the natural resources being destroyed could have been valuable economic resources if they had been exploited properly. Second, while most new innovations in breeding, harvesting, and processing technology are currently being

supplied by Malaysia, the role of local government remains limited to providing licenses. Furthermore, local universities are playing virtually no role in furthering the processes of technological adaptation.

A much more comprehensive strategy is needed to achieve the goal set in the *MP3EI*, and to build relevant academic capacity to ensure university involvement. University involvement will be critically important in guaranteeing Indonesia has a better domestic capacity to innovate, even as technologies are imported, and to create a solid base for future engagement in R&D.

Figure 2.1: Increased productivity for competitiveness and excellence [*MP3EI* 2011]



2.2 Skills as an Emerging Constraint

In 2008, the World Bank undertook a major survey of 473 manufacturing and services firms, mainly in Java. The Bank concluded that skills mismatch had emerged, particularly as the growing segments of the economy, export-oriented and service sectors, demanded a more capable workforce [World Bank 2011]. The Bank's analysis was that the overall quantity of graduates mattered less than the quality of graduates and their relevance to labor market needs.

In a 2009 survey of over 1400 firms in Indonesia, the World Bank found that 'inadequately educated workforce' ranked fifth along with 'concern about transportation' in the top 10 business environment constraints [World Bank, 2009]. However, firms were not voicing acute skills shortages. The number of companies expressing concern was still only 4.3%, far less than the 23% in East Asia and Pacific or 27% in the world [World Bank, 2009]. Nor were firms expressing extreme concern about the quality of higher education. In the 2008 World Bank survey, firms were surprisingly upbeat about the general quality of universities. 88% of these firms rated universities as either "fair" or "very good" [World Bank,

2011]. Rating varies somewhat between 95% for public universities and 83% for private universities. Intrestingly, the difference was not as big as might have been expected given the general perception that a massive and growing private sector experiences low quality as the norm.

According to the World Bank's interpretation, 'fair' is not a positive rating. According to our interpretation, most established firms in services and manufacturing in the modern sector, particularly in Java, probably have a well-identified set of institutions from which to recruit and are capable of identifying them. For those, who are in the environment of 'jobless growth', the general quality of graduates should have improved over the years as upper-tier institutions upgraded institutional practices to enhance the quality of education, which is documented in the next section. Therefore, there should be no reason to complain about any reduction in quality.

The implication this mismatch has on the emerging future is more serious. If the current trajectory of growth continues, or worse, if the economic growth is accelerated as planned, the mismatch identified in 2008 will rapidly become more acute. This is because the current mode of 'jobless growth,' which results from stringent labor regulations and skills shortages particularly at the lower end [World Bank,2012], will demand that firms go for capital intensive growth, which typically requires a higher order of managerial and professional skills from future graduates, particularly in adapting to foreign technologies and in undertaking process innovations.

Also worth considering, government plans to make growth more geographically equitable and include regions outside Java, will create a large amount of skills mismatch. In our interviews, which focused on more global and larger companies, we did not detect a serious concern about the academic content of teaching for those graduates recruited from the 10-20 top universities in Java. However, several voiced serious concern about the extreme difficulty in recruiting for positions outside Java from among graduates educated outside Java. Several companies also expressed concern about variations in academic quality across institutions. In particular, many expressed concern over the low quality of most institutions outside Java, which suffer triply from a generally poorer quality of staff, worse equipment and facilities and less prepared students.

2.3 Employer/Employee Views about Universities

Referring to the same set of firms, over 80% of them thought that the strengths of universities were their teaching quality (85%), teachers' skills (87%), facility quality (86%) curriculum balance (80%) and curriculum coverage (80%). However, only about half of those companies thought universities were strong in relation to the needs of the labor market (55%), in their specific curriculum content coverage (53%) and in their linkages with industry (50%). Interestingly, they were also critical of their costs – however; only 30% of companies thought that universities' strength was in their cost-effectiveness and "value for money."

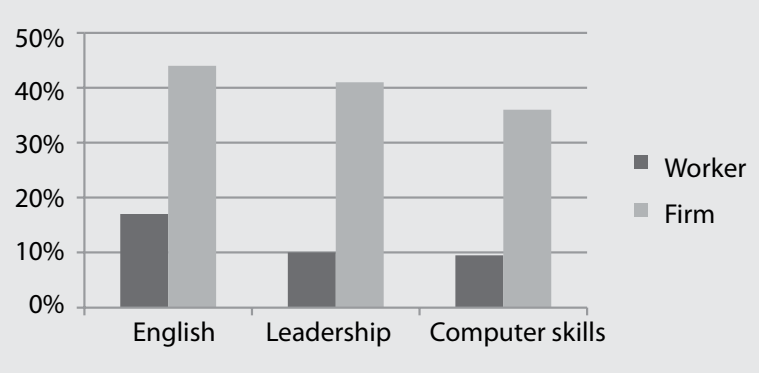
The employee survey tells a slightly different story about the strengths and weaknesses of universities. Nearly half of employees saw length of study as a weakness. Other weaknesses were ranked as follows: quality of teaching and learning (13%), specific skills (11%), quality of facilities (8%), relevance to labor market (7%).

2.3.1 Nature of Skills Mismatch

The World Bank 2008 survey sheds some light on the nature of the skills mismatch as it relates to higher education, based on views expressed by firms about the skills of their managers and professionals, who are predominantly graduates [World Bank, 2010]. The Bank's findings are further confirmed by the preliminary analysis of the tracer studies conducted by some universities [IMHERE, 2012].

The World Bank survey found that 80% of the surveyed firms found difficulties in filling managerial vacancies and 60% found difficulties in filling professional positions. Although the relative importance of the three most important worker's weaknesses are the same, the percentage of those who selected each of the three aspects are strikingly different when firm and employee opinions are compared, as illustrated in Figure 2.1.

Figure 2.2: Discrepancy between firm's and employee's assessment of workers weaknesses

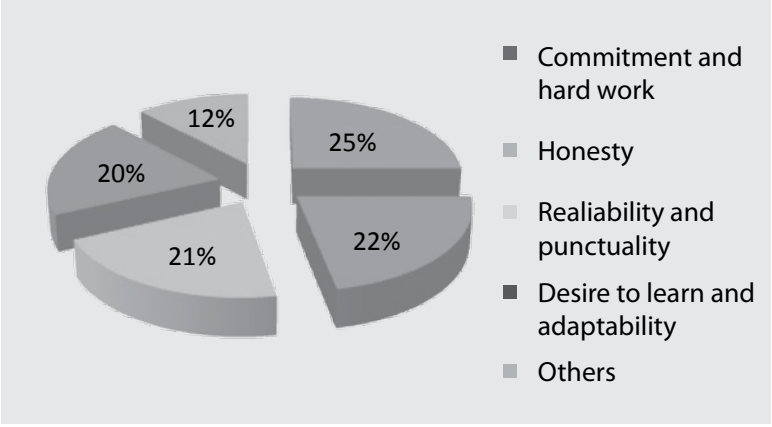


According to firms, the lack of skills most noticed when recruiting managers and professionals includes English (44% of firms reported skills gap), leadership (41%), and computer skills (36%). These top four are followed by organization (35%), communication (33%) and higher-order thinking skills (33%). The firms also found out that managers and professionals lacked practical knowledge (18%) and theoretical knowledge (18%) associated with their jobs.

Young workers who were surveyed noticed and reported a lack in skills such as English (17%), problem solving (11%), leadership (10%), computer skills (10%), creativity (9%) and technical skills (8%). Leadership was not reported as an important weakness according to the workers surveyed.

Figure 2.2 presents the responses given by the surveyed firms when asked about the strengths and weaknesses of a manager's personality.

Figure 2.3: Personality characteristics of Managers [World Bank, 2010]



The report suggests that skills shortages will likely increase as competition, increasing quality requirements, and changing work environments exacerbate business demand for such skills. Our

findings in this study further confirmed the report. Our interview with the policy maker at MoI revealed that manufacturing industries have already experienced a serious shortage of workers with specific skills, not only in Indonesia but in the Asian region at large. In response to the high demand of qualified welders in Batam Industrial Estate, MoI conducted a training program for 1,000 workers to acquire welding certificates. After receiving their certificates, more than half of the graduates were directly recruited to work in Korea, leaving the Batam industries to suffer a shortage of hundreds of welders.

In 2012, a preliminary analysis of the tracer studies was conducted by 19 universities and covered 7,440 graduates under the I-MHERE project. According to the analysis, which converged with the World Bank survey[5] [IMHERE 2012], only 62.84% of the graduates thought that their field of education was relevant to their current jobs; 16% of them said that their education was irrelevant to their current jobs. 17.10% needed more than 6 months to acquire their first employment. Therefore, as the analysis indicates, job opportunities are available, but relevant positions and assignments are still difficult to acquire. Some university leaders seem not yet to have a clear understanding of the benefits of conducting a tracer study. For them, the study is just a requirement to be met for the accreditation process.

Overall, the picture shows there to be a serious problem with the link between universities and employers. In particular, universities have little understanding of the skills employers are demanding, ranging from more obvious ones such as English and computing skills, to behavioral and thinking skills such as leadership, problem solving and creativity. Although specific job related skills tend to be problematic, both in terms of practical and theoretical skills, they appear to be considered less important compared with these other skills. During our interview, one company was extremely articulate in expressing concerns about contemporary students from elite institutions. These students were considered to be generally much more competent and motivated, but to lack certain 'emotional intelligence', or the ability to empathize with people from different backgrounds. Interestingly, both employers and graduates criticized the 'value-added' of university education while employers expressed this by rating cost as the lowest, graduates expressed this by rating cost as the highest.

2.3.2 R&D needs

An interview study on 12 manufacturing and service companies in Jakarta found that most of their innovations, which were called 'process innovations', required adapting existing technologies, including ICT, and little fundamental research or significant development work [Hill and Tandon, 2010].

Box 4. Industrially active academics

In our interviews with a small minority of academics who are highly active in industrial collaboration, we noted a certain common element in their background: they all had an early exposure to industrially relevant research during or shortly after their PhD experience overseas.

One professor from *ITB* obtained a PhD from a university in Denmark and filed for several patents while he was a student. Before returning to Indonesia, he worked in several companies both in Europe and the US, and at a university in Australia.

Another professor from *UGM* had had an early interest in the commercial applications of a given technological field before he left the country for PhD education in Australia. As a result of his early interest, he used his years of study in Australia to take notes of industrial activities related to the technological fields, which helped him orientate his own work after returning to Indonesia.

5 I-MHERE Project is a World Bank assisted project aimed to improve education quality and management capacity of selected public and private universities. The list of universities involved in the tracer studies is presented in the Appendix C of this report.

Another professor from the engineering faculty of *UNAND* was appointed to the position of department head as a fresh graduate from *ITB*. He had worked with local industries to develop an institutional development plan for the university which was relevant to local industrial needs before he went to Germany for his PhD. Upon his return, it was easier for him to work with local industries and with other academics who were brought in to the department in a similar manner.

Most of our interviewees already had some relationships with universities and looked forward to developing more in the future. They expressed a desire for university academics to develop a much broader understanding of the practical application of research and learning in general. More generally, companies are eager to have greater opportunities to explore working relationships with individual academics, and welcome opportunities such as structured meetings, science parks, exchange programs, and institutional partnerships.

According to the study, while some companies expressed the need to learn about international best practices, others expressed frustration that their staff had limited international exposure. In most cases, interviewees wanted universities to develop better international linkages so that both academic staff and students developed better international exposure.

Our interviews focused on a range of companies, from those working with fairly simple processes like adapting existing technologies following existing norms, such as plantation mechanization in Malaysia, for example, to those operating at a global level where they habitually sub-contract development work to professional technological consulting companies. Even the most R&D intensive companies were undertaking applied research and did not expect to generate innovations based on fundamental research. As said by one chairman of a pharmaceutical company: *'leave the fundamental stuff to advanced countries, we have enough to do on application'.*

Consistently, Indonesia is expected have a far more strategic focus on agro processing in palm oil, rubber, cocoa and seaweed, with an emphasis on automation to catch up with Malaysia, which is of high importance, and also to become leader in mechanized tropical agriculture, an area in which most advanced countries lack expertise. Universities were unable to play the 'huge role' they will be expected to play in helping Indonesia develop relevant human capital. According to our own interviews, understanding international practice was expected to be important to many of the future application related developments. We also found that most industrially-active academics not only had extensive overseas academic experience such as in completing a PhD, but also had exposure to the commercial world while abroad. All types of overseas experience appear to enrich these academics' ability to assist Indonesian companies (see box: Industrially active academics).

2.4 Industrial Needs on the Role of Government

Our interviewees were generally less optimistic, due largely to regulatory impediments, about the ambitious industrial paths implied by *MP3EI* for Indonesia. One pharmaceutical company thought that companies would be unable to undertake serious work on drug development until the regulatory environment of drug approval was streamlined, with less concentration of power placed in a single agency. One palm oil processing company saw no future in moving into downstream biofuels, since he saw it as impossible to compete with heavily subsidized domestic fuel. Such regulatory impediments, combined with poor intellectual property protection, are considered to be the most serious obstacles in developing industrial R&D. Although this was not mentioned in our interviews, it was found by others [Hill and Tandon, 2010], and appeared to be more important than the lack of R&D specific incentives, which was mentioned by only one company which had already conducted a lot of R&D. Our impression was that a lot more problems exist in creating an environment conducive to industrial R&D to increase value added than creating simple financial incentives for R&D.


:29.2

Chapter 3.
Higher Education Sector

This chapter analyzes the condition of Indonesia's higher education and whether it can meet Indonesia's economic development needs, especially if the pace of growth continues to be high and its impact is felt equitably across regions. The chapter first discusses the appropriateness of the sector in terms of: (a) the scale of educational access offered; (b) the "differentiation" (or different specializations of studies and research offered both nationally and at different geographical locations) would deliver relevant education and R&D services; and (c) the quality of education.

Although the size of the sector is considered to be appropriate and its speed of expansion is expected to meet the needs of the economy, further differention of institutional missions will be critically needed to serve economic development needs, and to make geographical distribution even in order to offer education and R&D services related to individual local needs. The chapter also highlights the need for a continued national 'movement' for quality upgrading of undergraduate education. In the final two sections, the chapter will focus on two underlying policy issues, funding and institutional autonomy, both of which are critical for shaping incentives for future institutional development. These come at a time when urgent changes are needed.

3.1 Size, Differentiation, and Distribution

The higher education system in Indonesia is a very large and highly complex system, accomodating more than 5.23 million students and achieving a gross enrollment ratio of 27.4% [DGHE, 2011]. Although enrollment is small compared with China, which has 31 million students (GER 26%), and India, which has 25.9 million students (GER 16%), Indonesia still boasts the largest number of students in the ASEAN region [Eastasia, 2012]. In addition to its large enrollment, Indonesia's diversity and geographical spread have significantly impacted the complexity of its education system.

Indonesia's education system appears to be highly diverse, with 92 public and more than 3,200 private universities, dozens of service institutions, 52 institutions under the Ministry of Religious Affairs and one Open University. However, the system is not as diverse as it initially appears. As described later in detail, the system is characterized by: (a) a small but growing group of practically oriented institutions (Quadrant IV); (b) a small number of research-oriented institutions, which are not yet fully developed to be classified as basic research institutions (Quadrant I) or relevant research institutions (Quadrant II; and (c) a large number of institutions which cannot be classified.

The education system's lack of adequate differentiation poses a problem for implementing *MP3EI*, as every corridor needs support from a group of universities, each of which can contribute in different ways. Regions need nimble practically oriented institutions to quickly meet nearby companies'

emerging needs for specific professional skills. For any region, it would also be important to have general teaching institutions capable of creating a diverse human resource pool, which is essential for regional development. In addition, it is also essential for each corridor to have relevant research universities with appropriate specializations to support the corridors' industrial profile. By doing so, the regions will gain expertise and human resources allowing them to move to higher value added production and services.

3.1.1 Practically Oriented Institutions (Quadrant IV)

In Indonesia, two types of institutions should aspire to fit into the "practically oriented institution" category: polytechnics, which provide short-cycle training to secondary school graduates, and many private universities, which offer undergraduate degrees in professionally oriented subjects popular for their apparent utility. However, it is unclear whether these institutions actually possess the necessary capacity to conduct the required activities, or whether they are distributed evenly across regions. We doubt that they have the institutional capacity to develop new specializations to meet new, emerging demands outside their main domain of expertise, or whether they can develop a more multidisciplinary education relevant to the world job market.

While all of the polytechnics should, in theory, fit into this category, not all of them have been successful yet. We assume that there are a dozen or so reasonably robust polytechnics in Indonesia including several excellent ones (see box on three exemplary polytechnics).

Box 5. Three exemplary polytechnics

The Bandung Polytechnic for Manufacturing (Polman) has a good reputation as an institution dedicated to its mission by implementing the concept of "production-based education", which attracts industries to outsource production through contracts. These contracts enable Polman to emulate an industrial environment in its workshop, provide invaluable industrial experience to students and staff and generate revenue to top up the insufficient government budget allocated for operational and maintenance. Their expertise has been recognized internationally; they are now working for the Malaysian government to help them develop production-based education. In addition, they plan to work with Japanese universities to deepen their expertise in foundry technology.

ATMI Surakarta is another institution which has its own company to produce its own products and to undertake customized production for industrial clients, both of which are used to expose students to real work. ATMI also undertakes significant production-oriented research and development work. Since 2001, ATMI has been collaborating with the Municipality Government of Surakarta and neighboring industries to provide short vocational training to secondary graduates. The success of this collaboration led to the jointly established Solo Technopark in 2011, which has trained thousands of trainees who have been recruited by about 60 companies.

The Electronic Engineering Polytechnic Institute of Surabaya (EEPIS) is another reputable polytechnic offering relevant skills in electronics, IT and multimedia. Although EEPIS places a little more emphasis on teaching theory, they carefully achieve balance by providing students with practise both in their own laboratories and through internships and soft/general skill development. They explain their educational approach, which emphasizes 'basics' such as theory and math, as one that caters to fast changing technological fields such as electronics in which simple vocational skills can quickly become outdated. EEPIS has several production-oriented 'R&D centers' in well defined fields such as 'hazard and disaster research' and 'education and agricultural robotics research' for which they conduct significant collaborative research often with foreign industries and foreign universities. In addition, they are expecting institutional development collaboration with Toyohashi Gijutsu University, one of Japan's best applied technology universities.

Polytechnic education in Indonesia does not live up to the expectations that it will lead directly to employment opportunities. Table 3.1 shows that the unemployment rate for Diploma (including polytechnics) graduates is disturbingly and consistently higher than for university graduates. Although the *BPS* does not disaggregate data on Diploma by specific types of educational institutions (polytechnic, Diploma program within universities, or academy), it is clear that the bulk of short cycle diploma education is not providing employment relevant education.

Table 3.1 Unemployment rate 2009-2011 [Statistics, 2012]

Education attained	2009 (Febr)	2010 (Febr)	2011 (Febr)	2012 (Febr)
Primary education and less	4.51	3.71	3.37	3.69
Junior secondary	9.38	7.55	7.83	7.80
Senior secondary	12.36	11.9	12.17	10.34
Vocational Secondary	15.69	13.81	10.00	9.51
Diploma/Polytechnic	15.38	15.71	11.59	7.50
University/Institute	12.94	14.24	9.95	6.95
Total	**8.14**	**7.41**	**6.80**	**6.32**

Why do many polytechnics fall outside of this category? While it was well beyond the scope of our study to examine the sector in depth, our impression from the experts interviewed was that many polytechnics have not yet developed the necessary 'organizational culture' of practical orientation. Unlike some of the national champion institutions, most polytechnics did not have the benefit of significant foreign assistance or inputs in their founding years, and many polytechnics are still struggling to stay loyal to the initial mission.

In addition, several recent policies have made it particularly difficult for them to stay grounded as practically oriented institutions. DGHE's policies, which require all teaching staff to have S2, do not help these institutions recruit staff with practical skills rather than academic training. Their inability to achieve financial autonomy has also made it extremely difficult for them to undertake and manage industrial contracts of any form. And yet, it is critically important for such institutions to engage with and keep themselves abreast of industry and to supplement their financial revenues with contract work, which also provides critical opportunities for enriching student learning and staff professional development. These institutions must also be able to recruit freely outside of civil service norms, so that they can deal flexibly with their own skills needs.

In regards to private universities, we found that some fit well into the category of practically oriented institutions – mostly as professional education institutions with expertise in fields such as IT, business, law and engineering. These institutions offer full fledged S1 and, often, S2 degrees. They sometimes even offer S3 degrees. Syllabi for S3 degrees are often more pragmatic, commensurate with changing practices in the world. These institutions have well established institutional cultures and practices, which ensure close linkages with industry and excellence, as shown through the examples of *Universitas Bina Nusantara* and *Universitas* Surabaya (see box: two examples of entrepreneurial private universities).

Box 6. Two examples of entrepreneurial private universities

Universitas Surabaya (UBAYA) provides undergraduate education in seven 'professionally relevant' areas ranging from law, psychology and pharmacy, to industrial engineering. *UBAYA* prides itself on differentiating its engineering education from more academically oriented institutions such as *ITS*. As *UBAYA* sees it, their students learn much more practically relevant knowledge and skills and are far more 'job-ready' than students from more academically oriented institutions. And yet, the best graduates can still find positions in graduate schools in good overseas institutions such as NUS and NTU in Singapore.

UBAYA has well-structured linkages with employers who have well organized career service units with five-full time staff, who organize biennial job fairs and obtain inputs from visiting employers systematically. Each program annually reviews employer relevance. Each faculty has distinct collaborative relationships not only with industries but also with the public: ranging from 'teaching industry' which functions rather like a 'teaching hospital' in engineering and business faculty which offers business and consulting services to industries, to a pharmacological center which offers public information about traditional medicine. These centers also offer activities which serve as key professional development opportunities for their staff. Whenever there is a need to upgrade either the skills or competence of their staff, they have the relevant industries teach industrial relevant practices.

Universitas Bina Nusantara (BINUS) started as a training program conducting computer short courses in the 1970s, and has since developed into a fully fledged entrepreneurial university offering S1, S2 and S3 degrees. *BINUS* is still well known for its IT related programs, but today it offers a range of subjects from business, engineering and law to languages (Chinese and Japanese).

Similarly, *UBAYA* also has highly structured links with industries to define curricula and to ensure effective placement. *UBAYA* is extremely business like; it manages its institutional strategy by regarding itself as a university capable of producing both global-level employees and entrepreneurs and capable of establishing key performance goals, which it is determined to achieve immediately. Senior staff regularly undertake international benchmarking trips to learn from best practices. The institution pays much attention to 'soft skills' such as team work, communication and foreign languages, and they offer all students courses in entrepreneurship, English and character building. *UBAYA*'s entrepreneurship program, which started about a decade ago, has recently tripled its credit requirement to 6 credit-points, by regularly inviting industry speakers, and offering business plan development activities undertaken by groups of students. The institution has an innovative 'tutor' system where some 300 students engage in teaching other students and have formed a 1000+ learning community. The S3 program teaches students international outstanding practices in management and engages in internationally based research activities with a view of creating research skills relevant for academically oriented researchers, consultants and business managers. *UBAYA*'s aggressive institutional development strategies are beginning to look at future needs for international accreditation as well as global ranking. As such, their performance goals are beginning to include more conventional research metrics like international publication. Accordingly, it will be interesting to see how long *BINUS* remains within Quadrant IV.

Not only do they work systematically with industry to keep their curriculum updated and relevant, but they also understand the importance of teaching such material in a way that enables students to acquire skills, knowledge, and very important generic skills such as English and soft skills. The manner in which some of these institutions are meeting such needs is quite impressive. Although we did not have enough time and opportunity to assess a larger number of private universities, our past observations and current interviews allow us to guess that only a small proportion fit the bill. Judging from the patterns of recruitment of these institutions located outside Java, it is likely that the successful ones are those concentrated in larger cities of Java.

However, as was the case with polytechnics, we suspect that the bulk of private institutions offering similar degree programs do not operate with quality standards appropriate to ensuring labour market relevance. Though the sector-wide assessment of private institutions was well beyond the scope of our study, our past observations indicated that only a small proportion of private universities have succeeded in sufficiently developing the institutional practices required to be classified into Quadrant II. We also noted that private institutions tend to offer fewer "equipment intensive" subjects and are therefore at risk of leaving significant gaps in their curriculum such as laboratory-based engineering or medicine. The successful universities are also likely to be concentrated in the larger cities of Java, where they have easier access to qualified staff and the ability to work with modern businesses.

Clearly, Indonesia already has a group of institutions that are pushing the frontiers of cooperation with industries within Quadrant IV – to provide practically relevant education and skills (see box: An extreme case *INSTIPER)*. However, it is not clear that these institutions are evenly distributed across sectors, or across regions. In addition, it is unclear whether they have the capacity to develop into new areas outside

of their main domain of expertise to meet with new needs. Nor is it clear whether they can develop a more multidisciplinary education that is relevant to the world of work. Some private institutions have developed systematic and institution-wide linkages with employers to shape their education programs.

Box 7. An extreme case: *Institut Pertanian STIPER Yogyakarta (INSTIPER)*

Since its founding in 1958, *INSTIPER* has chosen plantation as its core competence. In the last decade, there has been a declining number of applicants in all the agricultural study programs across the country, and *INSTIPER* was not immune to this trend. Since private universities in Indonesia depend almost entirely on student's tuition and fees for their revenue, the trend was a serious threat to their survival. In order to cope with the challenge, in 2005, *INSTIPER* shifted its education programs to cater more to employers' needs. Making use of its alumni, it developed cooperation with almost all the major palm oil industries. In conjunction with *INSTIPER*, each individual employer was invited to develop a curriculum suitable for their needs. Full scholarships were provided by each company for students taking this specific program. In addition to gaining technical competence in palm oil plantation and processing related work, students are also trained in the company's organization culture, and they are given one month basic military training. Students even wear the company's uniform while on campus; it is not uncommon to see students with different uniforms around the campus. Basically, the education program has become an in-house training that companies outsource to *INSTIPER*.

Despite the many criticism of *INSTIPER* for having a too narrowly focused learning outcome, the number of applicants has been steadily increasing. The current enrollment is 2020 students, which is far beyond the 500-1000 enrollment commonly used as a survival threshold. Additionally, most of *INSTIPER's* graduates were employed even before their graduation. *INSTIPER* perhaps represents an extreme example of how an educational institution can respond to the call for more relevant education.

3.1.2 Research-Oriented Institutions (Candidates for Quadrant I and II)

Today, none of Indonesia's existing universities can be defined either as basic or relevant in their research orientation, but a small number of established universities (e.g. *UI, IPB, ITB, UGM*, and *UNAIR),* all located in Java, have sufficiently qualified human resources and are beginning to be research-active. At this stage, these universities are best described broadly as 'research-oriented', as they have some, although an insufficient, track record either in internationally competitive fundamental research or strong enough linkages with industry to undertake application-inspired research. There are probably half a dozen more institutions which are in a reasonable position, given the staff profile, to become research-oriented in at least some areas. We see that these institutions are potential contenders to become relevant research institutions (Quadrant II), though their main 'drive' today appears to become fundamental research institutions (Quadrant I), through a focus on internationally publishable research rather than that which is locally relevant. This tendency is occurring not because of a lack of interest in Quadrant II related concerns. In fact, most of these institutions emphasize some aspects of 'relevant project work', particularly for generating income, while others are aggresively developing capacity for working proactively with industry. Indeed, for older institutions, whose academic profile was defined by the colonial power, nationally relevant utilitarian subjects composed the main components of their work. Although unsurprisingly, these institutions have a sufficiently 'relevant' disciplinary coverage to develop into 'relevant research institutions', their organizational ethos is not sharply focused on relevant research (see box: Chinese higher education reforms).

Box 8. Chinese higher education reform

In China, the government has, since the 1980s, been actively reforming the higher education system to ensure economic benefits. The measures they have employed have been remarkably consistent in pushing key universities toward the American relevant research university model (Ma, 2007). In the science and technology reform that began in the 1980s, the role S&T played in economic development was strongly emphasized. For the first time, public research institutes were directed to reorient the content of their research to meet economic needs, and universities were directed to develop research capacity relevant to society. Just because reform received official endorsement did not mean that government funding for research was forthcoming. Despite the establishment of the Chinese National Science Foundation in 1986 to provide competitive grants for basic research projects in public research institutions, as well as in universities, university budgets had been cut and had become extremely tight. Thus, universities were given strong incentives to generate their own incomes through industrial contracting (Ma, 2007). This was the context in which universities began to develop responsiveness to industry through contract research, consulting and setting up their own enterprises.

Through a series of special programs, the government has also supported the emergence of elite research universities. These programs include: (i) the key university and key laboratory programs, which were established in the 1980s; and (ii) the more famous Projects 211 and 985, which were established in the 1990s. These programs concentrated government funding on the top 100 and top 9 universities, respectively (Ma, 2007). Together with the gradual development of competitive funding for research, these initiatives gave universities strong incentives to be research-oriented and compete globally to become world-class institutions (Ma, 2007). Unsuprisingly, one of the first global rankings of universities was designed by a Chinese university; Chinese institutions were developing such indicators to gauge their positions in the world.

Many of the academic staff in most of these institutions supplemented their income with consulting work, an activity called 'moonlighting'. These institutions also had a track record of engaging in a fair number of service contracts or projects, which were funded by external entities such as government agencies and industries. Some efforts at engaging in service projects were through staff development or training contracts, perhaps for government agencies, or academics from other universities. Other efforts were through technical service projects, with government agencies or large companies. So, the significant experience academics are building in working with government or industries, either through individual consulting or joint projects, should form a solid platform on which more sophisticated UIG partnerships can build. However, even at *ITB*, where the engineering profession is generally closer to industry, the academic staff complain about the difficulty in moving from consulting to meaningful collaborative work with industry. This is a striking contrast to the situation in other countries, where consulting experience is regarded as a valuable step in becoming a credible partner to industry. The question is: why is it different in Indonesia?

From our interviews with various academics from research-oriented institutions as well as industries, we saw two possible reasons for such a discrepency. First, the bulk of consulting or project work may not be technically demanding, or it may not be directly related to individual academic's respective fields of expertise, resulting in their operation as intelligent generalists rather than as qualified specialists. Second, it is possible that academics are not yet sufficiently research active to have the recognizable domain expertise that makes them important technical experts or industry collaborators. There are several different reasons that could give rise to the second possibility. Having under developed domain expertise may result from universities' lack of appropriate research facilities. Or, it may result from an unwise selection of domain expertise, which academics conducted without referencing industrial needs.

Box 9. Level of technological requirements and nature of engagement

Two of our industry interviewees had diametrically opposed views about the value of *ITB*. While one said that *ITB* had solved all of his company's problems over the years, the other said that in spite of repeated attempts over a significant period of time, *ITB* had offered very little. As we discussed the matter further, we discovered that several differences between the interviewees' companies might explain the discrepancy between their views: the level of technological sophistication, the nature of engagement and their different industrial expectations. The happy company was a plantation company whose technical problems were by and large simple ones that could be resolved by intelligently combining existing technologies. The unhappy company was a globally active defense manufacturer, whose technological requirements were much more stringent and closer to the cutting edge. It was not surprising that *ITB* had been able to solve the plantation company's problems more easily than those of the defense contractor.

However, there was another important difference. The plantation company had a manager who knew *ITB* well from his previous work experience. Therefore, when he worked through *LAPI*, he regularly took his own initiative to identify specific individuals to bring into the projects (which *LAPI* should have done instead) and collaborated with *ITB* staff to explore the nature of the problem. A company never found they could depend on *ITB* to solve a problem by itself, and they never expected a solution to arise within the six months. Instead, they would work together to explore the nature of the problems and probable soultions. Such research programmes proved unstructured and therefore entailed risk taking. However, it appeared that the company was willing to take the risk of failing to find solutions to its problem.

In contrast, the defense company was much more accustomed to working with efficient technology consulting firms, which, when given structured problems, were able to work fast to give solutions. We suspect that the company tried to 'use' *ITB* in the same way that they 'used' such consultants. Again, and on an international scale, universities are not good at working on overly structured problems with stringent deadlines – they are far better at solving unstructured problems with less time pressure.

In our view, neither of these companies was a good fit for *ITB*. By asking it to solve mundane problems that national leading institutions should not be asked to solve, the plantation company was probably pushing *ITB* downwards. The opportunity cost for using *ITB* to solve simple problems is too high for the nation. For its part, the defense company was probably too specific in the nature of demands made of *ITB*, given that *ITB*'s technical expertise was not geared to solve narrowly defined and specific problems against a tight deadline. This company did not know the best way to work with university academics. However, this company might have drawn a different conclusion, which is that *ITB* did not have the requisite technical expertise to cope with its sophisticated problems. Over time, these could introduce several dynamics that would be unhelpful for the institutional development of *ITB*. The more *ITB* is asked to solve mundane and technically undemanding problems, the less time its staff will spend developing the cutting edge technical expertise that the country truly needs. The more technically sophisticated companies grow suspicious of *ITB*'s capacity, the fewer opportunities *ITB* will have to update its technological frontier in the practical world. It is essential that: (a) *ITB* works with companies with the right technological sophistication; and (b) companies are given opportunities to learn to work better with universities.

The only way of solving such dilemma is to systematically create a second and third tier institution, which are capable of solving the problems of plantations. Hopefully, these institutions will be a better match for the companies, so that *ITB* can focus on higher order issues, which are 'challenging' for their staff.

There may be other reasons for the difficulty academics have in finding appropriate industrial partners. Possibly, there is a problematic 'search process' for identifying appropriate industrial partners due to there being a lack of information on both sides. Institutions are doing very little to 'bridge' the gap

between individual academics and potential industrial partners. Nor are institutions providing better information to the public about their resident expertise or having professional units which function as intermediaries to undertake the 'match-making'. It is also possible that industries have an insufficient understanding about the importance of working with universities and therefore tend to treat them as normal technical subcontractors, which is an unrealistic expectation most universities around the world may find hard to fulfill. Our suspicion is that all of these factors are actually at work (see box on Level of technological requirements and nature of engagement).

Our final observation is that none of these institutions have working institutional leadership. Therefore, it is not yet possible for them to be strategic in their institutional development. Some of these institutions do not have the ambition in trying to develop relevant research capacity.

3.1.3 Unclassified

Although the majority of Indonesian universities can be described as teaching-oriented, because they do not offer research or practical education, vocational or professional, they cannot be categorized as 'teaching-oriented institutions' because most of them are aspiring to become something else – usually research-oriented institutions. Indonesia lacks a set of teaching-oriented institutions which offer a diverse range of academic or interdisciplinary subjects and a demonstrated commitment to teaching. Because most or all public universities aspire to become research universities, they have not considered the option of pursuing excellence as teaching universities. This is unfortunate because most of them do not have the resources or vision to become research universities. Private institutions are more likely to be realistic in recognizing the limitations they face in becoming research-oriented. However, the best of these tend to offer utilitarian subjects and lean towards Quadrant IV to become practically oriented rather than pursue excellence as broad based Quadrant III teaching-focused institutions (see box: Broadening undergraduate program).

Box 10. Broadening undergraduate programs [Chronicle 2010, Peterson 2012]

There is a strong international trend in broadening undergraduate education. Traditionally, there have been two models of undergraduate education: a European model of specialized disciplinary training and an American model of broad-based and interdisciplinary education. Over time, by adding 'general education components' to disciplinary education programmes, many institutions around the world have been moving towards the American model. The most significant development in this trend is Hong Kong's decision to add general education components by developing a fourth year in all undergraduate education starting in 2012. Indonesian universities have also trended towards adding general education components to all undergraduate education programs.

In the last decade, however, there has been a more structured effort to broaden undergraduate education, both to develop a more integrated interdisciplinary experience and to develop teaching methods more conducive to promoting critical thinking. For example, the Melbourne Model, started in 2008, is Melbourne University's attempt to offer integrated interdisciplinary training by offering undergraduate degrees in six broadly defined fields. The other is the emerging wave of global interest in liberal arts education to introduce breadth of education combined with critical thinking to prepare the new generation of elite. Eight universities in the Netherlands have established liberal arts colleges in the last decade (Peterson, 2012). Several Chinese universities have established liberal arts undergraduate colleges targeting the most able students (Chronicle, 2010). In 2011, a couple of UK universities began offering liberal arts programs (UCL and Kings College). Singapore is currently collaborating with Yale University to develop a liberal arts program.

The situation is worse when the regional distribution of higher education institutions is taken into account. *The Master Plan for Acceleration and Expansion of Indonesia Economy (MP3EI)* 2011-2025 establishes 6 corridors for economic development, each with its own specific competitive and comparative advantages. The 6 economic corridors are: 1) Sumatera, 2) Jawa, 3) Kalimantan, 4) Sulawesi and North Maluku 5) Bali, NTB, and NTT, and 6) Maluku and Papua [*MP3EI*, 2011]. Higher education institutions and student enrollment are not evenly distributed among the 6 economic corridors, as illustrated in Table 3.2. When we consider the characterization and quality of such institutions, it is clear that the bulk of non-Java corridors are underserved by institutions with the potential to play an active role.

Table 3.2: Distribution of higher education institutions in the *MP3EI* corridors [Dikti, 2012][6]

	Public		Private	
Economic corridors	Polytechnics	Higher education institutions	Polytechnics	Higher education institutions
Sumatera	7	16	17	762
Jawa	9	23	68	1102
Kalimantan	2	4	7	84
Sulawesi, North Maluku	4	8	6	336
Bali, NTB. NTT	5	6	11	151
Maluku, Papua	3	5	5	130
Total	**30**	**62**	**114**	**2565**

3.2 Quality of Undergraduate Education

'Quality' is an ambiguous concept, usually interpreted and defined differently by different stakeholders. For instance, for parents, quality may indicate an institution's ability to promote the likelihood of their children's admittance to a world class graduate school. For others, quality may represent how well graduates are placed to get better jobs. Rectors might measure quality by the institutional success of acquiring competitive grants, achieving better accreditation results, enabling graduates to perform better in the certification process, or attaining better resources, i.e. infrastructure, equipment, books and teachers. To quote one senior official from international quality assurance organizations: *"quality is in the eye of the beholder"*[7] [Vroeijenstein, 1995].

For this reason, it is critically important that the ultimate responsibilities for quality assurance should rest at the institutional level, where key stakeholders are directly visible. In addition, internal quality assurance systems should be used by institutions thoughtfully to continually make efforts to improve. To define accountability structures, compliance with "external requirements' is important, though alone these rarely achieve sustained improvements in the quality of education since 'compliance' is not enough to create the 'culture of quality improvement' as shown by the example in the US (see box: Introducing the culture of quality in the US).

6 For private institutions: a) 2010 figure, and b) North Maluku is consolidated under corridor 6.

7 Ton Vroeijenstijn was the Secretary General of the European Association for Quality Assurance in Higher Education (EAQAHE) and International Network of Quality Assurance and Accreditation of Higher Education (INQAAHE)

In the last twenty years, Indonesia has made significant national efforts on all fronts to improve the quality of education. The country has put incentives and institutions, with established accountability structures, in place to develop 'institutional capacity to strive for quality' (as documented fully in Annex II).

In 1995, competitive funding started in Indonesia to incentivize quality upgrading of undergraduate programs through the Quality of Undergraduate Education (QUE) project assisted by the World Bank. In 1998, competitive support for quality improvement was further developed through the ADB-supported TPSDP, which provided key innovations such as the inclusion of private institutions. TPSDP led to a range of other programs funded directly by the government in the 2000s. The awarding of grants has not necessarily provided a yardstick for judging the quality of programs. Failure to do so is mainly because competition was conducted in tiered system to ensure that 'weaker' institutions had a fair chance of winning grants given motivation and commitment. Of interest, competitive funding appears to have created a sense of 'quality movement' within the higher education sector in Indonesia, somewhat akin to foundation-supported programes in the US (see box: Introducing the culture of quality in the US).

In 1995, a system of accreditation was established to develop an accountability mechanism for the quality of higher education. The proportion of undergraduate programs rated 'excellent' or ranked A by *BAN PT* has increased from 9.1% in 2000 to 13% in 2006 (World Bank 2012) and to 14% in 2009. Table 3.3 shows that the proportion of programs offered by public institutions is significantly better, in terms of accreditation results, compared to private institutions.

Box 11. Introducing the culture of quality in the US (Brint, 2009)

In the past 30 years, quality of teaching and learning has been a key issue in the US. To achieve better quality, there have been broadly two types of reform efforts in US colleges and universities: the teaching reform movement, led by liberal philanthropists, and accountability reforms, led by states and, later, regional accreditors. Steven Brint, a well known education sociologist who is currently a vice provost of undergraduate education in one of California's universities, argues powerfully that the teaching reform movement was far more successful in improving teaching practices than were the reform measures enforced through 'accountability.' The philanthropy-supported teaching quality movement successfully questioned 'research-focused' university orientation and helped spread progressive education methods throughout academia. The accountability reforms, by contrast, have had little impact so far. Their failure is, in part, because 'rules' or 'norms' to be supported by external agencies were not always consistent across time or space, but also because universities tend to 'comply minimally' with such accreditor demands. Whereas the former movement captured the imagination of academics and pushed educators in universities to re-think what they do, leading them to create better bottom-up teaching practices, the latter merely pushed them to 'comply' with external rules, which did not lead to sustained changes in internal thinking.

Although the majority of programs in private institutions are lower in quality and have small enrollment, some programs offered by larger private institutions are better than programs offered by the weakest public institutions.

Table 3.3: Accreditation result [*BAN-PT*, 2009]

	Diploma program[8]				Undergraduate program[3]				Graduate program[9]		
	A	B	C	D	A	B	C	D	A	B	C
Public	12.81%	65.45%	21.51%	0.23%	30.63%	55.19%	13.84%	0.34%	49.62%	41.92%	8.46%
Private	6.57%	50.10%	42.02%	1.31%	8.41%	47.11%	42.36%	2.11%	18.73%	48.21%	33.07%
Islamic	0.00%	100.00%	0.00%	0.00%	10.42%	54.35%	30.34%	4.88%	64.71%	11.76%	23.53%
Service	4.00%	56.00%	40.00%	0.00%	5.88%	61.76%	29.41%	2.94%	0.00%	100.00%	0.00%
National	**8.38%**	**54.91%**	**35.74%**	**0.96%**	**14.27%**	**49.99%**	**33.77%**	**1.97%**	**39.85%**	**43.63%**	**16.52%**

8 A=very good, B=good, C=accredited, D=not accredited
9 A=very good, B= accredited, C=not accredited

In 2010, only 11,185 programs had gone through the accreditation process, which is around 63% of 18,298 study programs, either due to their inability to meet the quality standard or to the limitation of the National Accreditation Agency's (*BAN PT*) capacity to conduct assessment each year. In order to keep up with the ever increasing work load, *BAN PT* is in the process of shifting its strategy to evaluate institutions rather than study programs.

There has also been a gradual tightening of regulatory requirements. In 2005, the DGHE began to require all institutions to establish a quality assurance (QA) unit. In order to make teaching staff more effective in conducting the QA process within their respective institutions, a training program was conducted nationally for staff who were assigned to QA units. In 2008, all institutions were requested to submit a document describing their internal QA operation, and a review team was assigned to assess the documents and conduct site visits. After the DGHE imposed the requirement for establishing internal QA units in 2008, there were 24 public and 44 private universities considered to already have a good QA mechanism. Currently, almost all universities already have such a unit in place, though their effectiveness still needs to be further assessed.

Nevertheless, today, the quality of Indonesian universities remains highly diverse. Only three Indonesian higher education institutions have made it into the top 500 in the world ranking of any kind of university, as presented in table 3.4. Although a few established universities have been ranked as world class institutions, many have not been accredited by the *BAN-PT*. Some study programs that we reviewed in the professional stream have also acquired the accreditation status issued by international professional organizations such as ABET (Accreditation Board for Engineering and Technology) and WFME (World Federation of Medical Education).

Table 3.4: Institutional ranking according to THES and QS [THES 2009, QS 2012]

Institution	2009 (THES)	2012 (QS)
University of Indonesia	201	273
Gadjah Mada University	250	438
Bandung Institute Technology	351	555

Although we do not regard S-3 as a staffing requirement for teaching institutions, the availability of S-3 programs is a reasonable indication of institutional capacity to undertake basic research. The fact that more than two thirds of S-3 holders are from universities in Java, as shown in table 3.5, illustrates a serious geographical disparity in the research capacity across regions. There is also a worrying qualitative disparity; the bulk of staff training for S-3 for institutions located outside Java takes place in Java, and only a few go abroad.

While this provides a steady flow of good talent for domestic graduate programs, it does not create a flow of human capital capable of returning institutions' critical 'ethos of organizational culture', which is critically important in higher educational institutions, or insights in the international economic contexts, which are critical for the region. If serious knowledge spheres are to be created outside Java, a much more concerted effort is needed to train a critical mass of staff in key fields with relevant advanced research training abroad.

Table 3.5 Qualification of teaching staff [DGHE, 2010]

	D3/D4	S1	S2	S3	Sp1/Sp2	Profession	Total
Public outer islands	214	12,001	18,238	3,337	525	756	35,071
Public Jawa	160	5,920	14,105	5,181	1,178	518	27,062
Private outer islands	2,218	33,057	10,919	458	176	526	47,354
Private Jawa	2,707	34,455	24,212	2,705	539	946	65,564
Total	**5,299**	**85,433**	**67,474**	**11,681**	**2,418**	**2,746**	**175,051**
All Jawa	2,867	40,375	38,317	7,886	1,717	1,464	92,626
All outer islands	2,432	45,058	29,157	3,795	701	1,282	82,425
% Jawa	**54.10%**	**47.26%**	**56.79%**	**67.51%**	**71.01%**	**53.31%**	**52.91%**

Today, the nation urgently needs higher education institutions to become pioneers in continuous educational quality improvement and to carefully analyze labor market needs and graduate career paths. And yet, there is very little push for continued quality improvement today. In 2010, in a push towards regulatory enforcement, competitive funding was terminated, depriving universities of the liberties that they once had and pushing institutions into a 'compliance' culture. We noted a strong sense of crisis within the sector, particularly among the leading lights in quality improvement of public institutions. If institutions innovatively meet future economic needs, they would be expected to have the ability to operate independently. Never before was the need greater for institutions to develop a culture of independence and accountability to tackle complicated issues surrounding further quality improvement upon which Indonesia's future depends.

As pressure mounts for Indonesia to expand its higher education programmes, it should also work to achieve greater relevance. Although the percentage of unemployed graduates has slightly decreased in the last 2 years, as illustrated in Table 3.1, most industries are still complaining about the difficulty of recruiting competent graduates. The industries are particularly critical about universities' ability to conduct relevant R&D and produce results that benefit the industrial sector.

3.3 Innovation-Oriented Initiatives

In the last decade, there has been a gradual change in initiatives occurring in the national context. Increasingly, emphasis has been placed on the need for universities to improve their cooperation with industry. To do so, new university roles and expectations in entrepreneurship or innovation should be voiced not only by various government agencies and the Indonesian Academy of Science but also by business organizations through hosted events. In the past, these have been 'sporadic' and by no means consistent in pushing universities to develop better UIG partnerships.

3.3.1 Patenting

Universities are beginning to respond, mainly through a renewed emphasis on patenting, entrepreneurship and science parks. Although these are 'common' first institutional responses around the world, it will be explained later that this is by no means sufficient. The future success for each of these will depend not only on the improved individual expertise of the professional involved in such initiatives but also on a deeper cultural change within higher education institutions themselves so that they become the 'source' of new ideas and innovations.

More universities, with government support, have begun the process of completing patent applications. In contrast, normal practice in the past was for individual academics to give away intellectual property rights to industrial partners. DGHE has facilitated patent applications for universities by providing some

funding in support of such activity. As shown in the table depicted in appendix D, universities with a strong research tradition dominate the number of patents granted. This number only represents a fraction of all patents granted to universities; others are granted without the assistance of DGHE.

While the number of patents is certainly increasing, universities still contribute to only a small part of all patent applications, which has been granted by the Directorate General of Intellectual Property. In the future, universities need to develop a better capacity for patenting. In addition, it is critically important to recognize that Indonesian institutions are barely making the 'first step' in this journey. Most institutions only have vague ideas about what lies beyond patent application. These institutions have little capacity for marketing patents and have hardly any understanding about how 'revenues' might be shared between institutions and individual academics.

It is unlikely for institutions to receive significant surplus revenues from IPR in the short to medium term. Such an early push for patents typically emphasizes the 'number' of applications without taking note of the quality of underlying technologies. A significant number of 'industrially active academics' are required to come up with not only better quality, patentable technologies but also with the institutional capacity to screen which technologies are suitable for patenting and to write the right kind of applications. In addition, if these initiatives are to lead to successful licensing, these academics will also need a greater capacity to market patents.

Generating surpluses from IPR is even harder. Because patenting requires professionals to develop patent applications and market licenses, it can be expensive. Even in the US, unless universities had a significant portfolio of patents, developed by a professional support unit, and a significant size of overall research activities from which to draw patentable ideas, many found difficulties in breaking even in patenting/licensing.

3.3.2 Incubator/Spin Off

The concept of entrepreneurship support has become popular, and in the last 10 years, many institutions have developed entrepreneurship education or entrepreneurship centers. In the past, academic professors or graduates working closely with academics occasionally formed companies, though these companies remained largely invisible. Nowadays, more universities are engaged in incubation efforts and provide entrepreneurship education to their students.

Box 12. PT Ecomindo Saranacipta

PT Ecomindo Saranacipta is a company founded in September 1999 by the Faculty of Computer Sciences *UI*. The company is considered by faculty to be a pilot experiment for a spin-off company, whereby the initial paid up capital is provided by the faculty by allocating its self-generated revenue. The company survived difficult times when it drew from insufficient skills and knowledge of running a business and had limited assistance and mentoring. At a later stage, it changed its strategy from spin-off to start-up and changed its focus from marketing its own product to outsourcing its services.

PT Ecomindo Saranacipta started with 3 full time staff and currently employs around 60 graduates, including 40 full time computer science graduates and 4 administrative staff. Generating around IDR 12 billion in revenue in 2011, the company's services are primarily in application sofware development and professional outsourcing, and it serves a considerably wide spectrum of clients, from banks, financial industries and government agencies to universities. Faculty involvement is currently limited to providing advice through the Board of Commissioners.

However, most initiatives appear to be at an early stage of development, with incubation programs looking similar to generic entrepreneurship education programs (see box PT Ecomindo Saranacipta). Since 2009, seed funding from DGHE was made available at a time when individual students could receive up to IDR 8 million support as seed grants.

A structured incubation program which makes use of external expertise, in the form of seasoned entrepreneurs and venture capital communities, to mentor promising ventures does not exist yet. When mentoring assistance was given, we found that the implementation was still general in nature and did not span the necessary professional range from market analysis to management team formation or venture finance. China has a different experience. In China, universities have actively created enterprises since the late 1980s, even when they had little research capability (see box: Chinese university experience of spinning off).

Box 13. Chinese university experience of spinning off

Although the newly established enterprises are sometimes described as spin-offs, they are significantly different from normal practice in that they are owned and managed by universities (Eun, Lee, and Wu, 2006). Some of these companies have been spectacularly successful. Three of the most successful personal computer (PC) companies: Lenovo, Founder and Tongfang were created by the Chinese Academy of Sciences, Beijing University and Tsinghua University, respectively. About 40 university enterprises are already listed on stock markets in China and Hong Kong (Eun, Lee, and Wu, 2006).

Interestingly, the knowledge content of these spin-off companies often did not derive from significant scientific research. Rather, the spin-off was the mechanism through which skilled personnel moved from universities to the commercial sector (Chen and Kenney, 2007). These enterprises were a simple mechanism through which universities could contribute to an environment of very limited industrial capability (Eun, Lee, and Wu, 2006). In this respect, the spin-off companies resembled Japanese university start-ups in the early phase of industrial development (Odagiri and Goto, 1996), when academics could behave as arbitragers of western technology and were in a good position to create companies, given the underdeveloped industrial context.

It is not clear how long the practice of university enterprises will continue in China. Both the government and many universities have gone through a rethinking process, as many enterprises have not been successful and managerial responsibilities are increasingly demanding (Ma, 2007; Kroll and Leifner, 2008). Various revisions have been made in their strategies [Wu and Zhou, 2011]. China's university enterprise experience was likely a phenomenon produced within the specific context of underdeveloped industry and due to a high concentration of talent in universities

3.3.3 Entrepreneurial Training

Because of high graduate unemployment, MoEC has actively promoted entrepreneurial education in the last 3 years. Since 2010, the DGHE has allocated budgets for public universities to develop entrepreneurial training programs for students and staff. According to one academic, who has been active in national efforts promoting entrepreneurship centers, Indonesia has around 100 entrepreneurship centers, and most likely one third of these centers are reasonably active.

Most training aimed at developing effective competency by providing 1-day workshops with national TV star motivational hosts for incoming students. Workshops were followed by 1-2 credit courses on business practices for more advanced students. Although such training might work for highly motivated students who need competency in certain skills, it might be less effective for those who are less motivated. Unless the motivation and incentives are addressed within the teaching process and relevant course content, it might be difficult to achieve the intended learning outcomes. Examples of more serious efforts come from initiatives carried out by private universities, e.g. conducting competition for seed capital involving industries (see box: two exemples of entrepreneurial private universities, in section 3.1.1).

3.3.4 Science Parks

Several universities, such as *UI* and *UGM*, are in the early process of establishing science parks either in or near their respective campuses, though the direction and content of such ventures still need further clarification. According to the advanced information we acquired, neither *UI* nor *UGM* had yet conducted meaningful R&D. So far, these universities are limited in providing activities and offer only advice and consultancy services for university staff on IPR related issues.

In addition to universities, several other institutions have collaborated to establish science and technology parks. Worth mentioning are a few initiatives driven by regional governments like Solo Techno Park, Jababeka in Bekasi industrial estate, and Sragen in Central Java, among others. Others, jointly initiated by regional and central government, focus more on a specific sector or field. Examples of such joint initiatives include agro science parks in South Sumatera, Cianjur, and Jembrana (Bali). Currently, more attention is being focused on technology diffusion and dissemination through training and similar gatherings.

In 2010, Bandung Techno Park (BTP) was established as a merger of TDC (Telecommunication Design Centre), ISC (ICT Service Centre) of Telkom Institute of Technology and one Business Incubation Centre. BTP occupies an area of 54000m2 inside Telkom Education Park and adjacent to Telkom Institute of Technology (ITT)[10], Telkom Institute of Management, Telkom Polytechnic, and Telkom School of Art and Design. BTP serves as an intermediary and synergy builder for academics, the business sector/industry, government and community in ITC industry. Though still in its infancy, BTP is a good example of an industry-support science and technology park.

Box 14. Developing Eco-System

Starting in 1951, with the establishment of the Stanford Industrial Park, there has been a steady rise in science parks, first in the US and Europe, and then globally. In the US and in Europe, science parks tended to develop in close ties with universities, while in Asia, many emerged without formal ties with universities. In China, science parks have been developed since the late 1980s as part of national policy to establish special technology zones. Today, there are 53 national and nearly 200 state-level science parks in China, along with 63 university-owned science parks.

Today, common understanding tells us that universities should play a much more interactive role in these parks. Some parks are literally designed to encourage the development of a single community of university and industrial researchers. Because there is much greater interest in incubating new high-tech companies, recruiting industrial and other R&D organizations into these parks is no longer adequate. It is also common to add other critical cpomponents of the "innovation eco-system" such as seed/venture capital arrangements, management support and business networking. Today, even though a larger number of venture capital firms operate globally, many of them are less willing or capable of funding and supporting early university spinoffs. Specialized arrangements for early venture funding and management support directly linked with universities are increasing, often backed by government money. However, because it is difficult to replicate the true needed expertise, many fail. Israel and Taiwan were unusual in taking early actions to build direct relationships with Silicon Valley and also to make concerted effort in building expertise for the domestic venture capital industry.

10. ITT is a university founded and supported by PT Telkom, Tbk.

Older establishments that have been around for quite some time are the *Puspiptek* in Serpong, under MoRT, and the Inter University Centers (IUC), within the university auspices. But most of these have been less active in the last decade, and much of their infrastructure and equipment have become outdated.

3.3.5 Small and Medium Enterprise Support

Providing consulting or project support to small and medium scale companies in the vicinity of institutions can be an important role all institutions can play. For teaching-oriented institutions, consulting or project support may take place by providing special training or consulting work. For research-oriented institutions, this may take the form of partnership in conducting R&D with technologically ambitious small companies. For both activities, external funding is usually needed, as SMEs are the last in the industry to be able to pay for university help. Examples, which were recently found by the study team, are the Bogor Agricultural University and Hasanuddin University, which provide training and assistance to the neighbouring SMEs. Other universities might have similar programs, and further information will be solicited at a later stage.

An interview with one quite successful SME in North Sulawesi revealed that it had not received support from local universities. In this specific case, the owner is actually a university lecturer and, although dozens of students earn credit from the practical work conducted in this company every year, neither the institution nor its staff wants to provide support. This case illustrates the "mental block" that has to be overcome in developing real partnerships with industry.

3.3.6 Developing Support Infrastructures

One salient issue is that university academics lack opportunities to meet industrialists. In response to this perceived need, some higher education institutions have begun to create events that bring industry and government representatives together with university academics. The study team found that at least one leading university has initiated a series of UIG forums in several thematic areas of regional interest. A few other universities have taken proactive steps in organizing their own networking events to forge meetings between industrialists and their own academics.

Some established universities such as *LAPI* in *ITB*, *Daya Makara* in *UI*, or *Gama Multi Usaha Mandiri* in *UGM*, are 'commercial arms', which provide contracting support between industry and university academics. However, even in *ITB-LAPI* (the oldest of the three), this appears to have a long way to go before it is 'professionally capable' of: (a) identifying and assembling *ITB* expertise to benefit industry; and (b) marketing *ITB* academics' specific expertise to the outside world. *UGM* is perhaps one of a few exceptions in which the institution developed its institutional capacity to identify appropriate industrial partners and topics of mutual interest. *UGM* is making progress in increasing cash support from industry for research. The institution even created a special outreach office in Jakarta to connect specific academics with specific industrial partners. It is critically important that such an 'institutional support infrastructure' becomes a better developed means of assisting academics in their relationship with industrial partners.

3.4 Funding

3.4.1 Government Funding

The total higher education expenditure in 2011 was around 1.2% of GDP, which was still low compared to that of Malaysia (1.69%), but higher than that of Vietnam (1.18%), Thailand (0.71%), and the Phillippines (0.34%). In 2012, the allocated budget for the Directorate General of Higher Education (DGHE) has reached IDR 32.6 trillion, which is almost three times the 2007 figure of IDR 12.9 trillion

and approximately 53% of the entire MoEC budget, as shown in Table 3.6. This rapid increase in overall funding for higher education was accompanied by a dramatic increase in self-generated revenues (largely coming from student fees) which rose from 24% to 34% of the total budget. The proportion of cost recovery in teaching costs, which can be approximately obtained by dividing self-generated income by non-investment expenditures, increased from 28% to 53% in 5 years.

There was an aggressive increase in investments, which rose almost 4 fold between 2007 and 2012, and a lesser increase in operation and maintenance, which increased less than twice. In order to cope with the rising operational costs, public universities had to raise student tuition and fees. The decoupled planning processes of investements, on the one hand, and operations and maintenance on the other, have always been an issue. However, during a period of rapid expansion, their consequences have led to an unannounced policy change increasing fees and tuition.

A second important issue is the dominance of personnel expenditure in the operation and maintenance budget, which constantly squeezes non-salary expenditures. The situation has become worse now as the government has started providing additional incentives for professors and certified lecturers in public and private institutions in addition to the regular salary allocated within the operation and maintenance budget[11]. In 2012, DGHE's allocations of more than IDR 1 trillion for such incentives significantly affected its capacity to invest and maintain. Moreover, it is also important to anticipate the risk that staff expansion and promotion will cause an ever increasing budget in the near future.

Table-3.6: Allocated budget for DGHE 2007-2012, in IDR trillion [Dikti, 2012]

	2007	2008	2009	2010	2011	2012
Operation & maintenance	5.062	5.269	6.315	6.849	7.409	9.817
Investment	4.746	4.521	7.380	9.764	10.753	11.672
Self generated	3.150	4.268	5.317	6.627	10.712	11.116
Total	**12.958**	**14.058**	**19.012**	**23.240**	**28.874**	**32.605**

Another issue is the underfunding of research in universities. Research activities in universities are funded by various sources, i.e. DGHE, other government agencies, industries, philanthropic organizations and other private entities. The DGHE provides research funds under the investment category, through 2 different channels. The first channel runs through the Directorate of Research and Community Services (as elaborated in Chapter 4 of this report), and the second is through direct allocation to some public universities as small block funding.

The budget allocated for the Directorate of Research and Community Services DGHE has been increasing and has reached IDR 436 billion or 1.34% of the DGHE's entire current budget. Within this allocation, the budget for R&D related activities in DGHE was only IDR 290 billion in 2012. If we compare it with the IDR 200 billion spent annually by PT Kalbe Farma[12] for its research and development [Setiawan, 2012], the relatively low position of research and development in the government priority setting becomes clear. Universities receiving block funds were previously selected based on their track record in research. The fund is earmarked for staff research through internal competition. The government budget allocation

11 The incentives for staff in public institutions are allocated from operation and maintenance budget, whilst for staff in private institutions are allocated from the investment budget.

12 PT Kalbe Farma is the largest pharmaceutical company in Indonesia, even Southeast Asia.

for 21 public universities with *BLU* status and 7 autonomous universities *(BHMN)* for this purpose is depicted in Appendix B of this report. The percentage of the block funding earmarked for this particular purpose is less than 1% of the total budget (investment, operation, and self generated) for each public university selected as sample. The recently passed Law 12/2012 on Higher Education creates a new 'source' of research funding by requiring public universities to allocate at least 30% of their operational budget for research and development[13].

However, since, by constitution, the total government funding of the education sector is 'capped' at 20% of the total government budget, additional pressure is placed on operation and maintenance budgets. This new regulation is expected to be effectively implemented in the 2013 government budget.

3.4.2 Self Generated Revenue

Before 2000, public institutions received most of their funding from the government budget allocation. Until early 1990, revenue from students was insignificant and contracts for services were rare. The major shift began in 2000, when the changed legal status of the 4 most established public institutions turned them into autonomous universities. In the last decade, self-generated revenue has increasingly gained importance as a source of funding for public institutions. In 2012, self-generated revenue exceeded the budget allocated for operation and maintenance, as illustrated in Table 3.6.

Public institutions generate their own revenue from sources such as students, contracts and other sources. It is not possible to use the existing financial reporting system to accurately extract the value of revenue acquired from R&D and industrial contract in each individual institution. More detailed financial reports are only available for the 21 public institutions with *BLU (Badan Layanan Umum)*[14] status and the 7 *BHMNs* institutions, as presented in Appendix-B. In order to estimate the extent of collaborative activities these universities have with industries, we tried to estimate the revenues generated from various contracts by subtracting student related revenues and "other" revenues (e.g. rental of facilities, parking) from the totals. It should be noted that activities under contracts also include non-R&D activities, such as training, data processing and assessment.

Even in the 21 *BLU* and 7 *BHMN* institutions, which we expect to be better at generating revenue than non-student sources, more than 80% of self-generated revenue comes from students in the form of tuition and other fees, and only 10.5% revenue comes from contracts. This means that contract incomes constitute only about 3% of total revenues. Therefore, R&D and industrial collaboration continues to be insignificant. Regardless of their status and stage of development, these 2 types of institution generate a similar percentage of revenue from contracts, which is around 10 %. However, the nominal value from contracts is much higher in the *BHMNs* (IDR 448 billion for 7 institutions) as compared to *BLU* institutions (IDR 572 billion for 21 institutions), due to their higher total self-generated revenue.

BHMNs are considered to be the most established institutions, since their capacity to generate revenue from non-student sources is commonly assumed to be greater than other institutions. As demonstrated in Appendix-B, not all *BHMNs* lead in revenue generation. The nominal value of a contract in a *BLU* institution such as *UNHAS* (IDR 70 billion) far exceeds the value of a contract in *BHMN* institutions such as *USU* (IDR 25 billion); indeed, it is almost similar to that of *UNAIR* (IDR 72 billion).

13 Article 89.6

14 *BLU* is not a legal entity. It is still operated as an implementing unit under the Ministry, with a special authority in managing its revenue.

Among the 21 institutions with *BLU* status, six do not report any revenue from these sources. We suspect that they do have any collaboration but that any which does exist are unsuccessfully managed under the central administration. However, the proportion of revenue from industrial collaborations is not expected to be significant in these institutions. These institutions may still be in the process of restructuring their internal financial management and struggling to enforce "single account" policy, particularly after being converted into *BLU* status. In this context, *Universitas Terbuka* whose nature of operation does not require too many opportunities to conduct industrial collaboration is likely to be an exception.

3.5 The Road toward Institutional Autonomy in Indonesia

Under the Indonesian legal framework, public universities are not self-standing legal entities. Instead, these universities are legally defined as integral parts of the Republic of Indonesia and as implementing units of its legal entity. Therefore, they have no authority to enter into legally binding agreements with other parties. Authority and autonomy currently enjoyed by public universities are delegated by the Minister of Education and Culture on behalf of the state, and consequently can also be revoked or cancelled depending on the government policy[15]. This became clear in the recent past when the government prohibited the teaching of Marxism and when the financial management regulations were tightened. In contrast, in many other countries, public universities have a much stronger legal basis for independence and structures that ensure accountability to the public.

Institutional autonomy is not limited to the process of giving public universities a separate legal status. Instead, it is a complex process of establishing a framework, for achieving different kinds of institutional autonomy ranging from academic to financial. Autonomy also involves achieving accountability including financial and quality accountability as well as governance structures to bring in key stakeholders. Today, it is internationally accepted that without autonomy, institutions can neither adapt themselves to the changing needs of society nor operate efficiently. It is also well established that autonomy should come with a well defined set of accountability structures. An autonomy process not only involves regulatory changes but also a serious institutional building process of capacity building to plan, strategize and manage resources.

From the perspective of UIG, autonomy and accountability structures are important for three reasons. First, a healthy UIG partnership demands that universities are able to make the independent, innovative and diverse inputs to partnership that only universities can make. In regards to education, unless universities are organizationally 'nimble enough' to respond to the changing needs of society, and to be quality conscious as an organization, willing and able to continually improve, they are unlikely to be able to deliver the kind of education that is needed in Indonesia.

Table 3.7: The structure of autonomy and accountability

	AUTONOMY STRUCTURE
Academic autonomy	Involving not only the academic freedom for individual staff to undertake research and teaching, but also for institutions to grant degrees, determine curricula and pedagogy and decide on the areas and scope of academic research and teaching
Financial autonomy	For raising and managing funds without government permission, accumulating surpluses, flexibly planning budgets and spending without external approval

15 Actually, a similar situation is also applied to private universities, whereby the Foundation is the legal entity. In this case, authority and autonomy are delegated to the universities by the Foundation.

AUTONOMY STRUCTURE	
Structural autonomy	For allowing universities to establish their own internal structures for academic units (e.g. faculties, department) so that they are able to adapt to meet changing circumstances
Administrative autonomy	For managing resources in a way that is consistent with the mission of good practice in transparency and internal accountability
ACCOUNTABILITY STRUCTURE	
Legal accountability	Requirement that universities operate as independent legal entities which can be held legally accountable
Financial accountability	Financial audit requirements
Quality accountability	External accreditation and other requirements
Governance accountability	Requirement that universities have a governance structure, such as a governing board comprising key stakeholders, which can oversee strategic decisions as well as operations to ensure accountability to stakeholders.

The fact that private universities appear much more aggressive in 'innovating' and 'linking with skill needs', as discussed in the previous section, is a good indication that the institutional autonomy they enjoy also enables them to become better organizations. However, generally, private institutions are neither strong contenders for achieving a broader academic education nor for research. It is critically important that the institutional structure of public universities be revamped so that their high caliber academics can play a far more proactive role in UIG than was hitherto possible.

Second, proper management capacity is critical not only in developing appropriate partnership agreements but also in supporting effective implementation. Businesses around the world are impatient with the slow bureaucracies and inflexibilities under which some public universities operate. It is important to enable universities to become credible organizations with which businesses can collaborate.

Third, it is important that universities have mechanisms for having industry and government as key stakeholders. Governing boards in many countries operate as a key mechanism for enforcing university accountability to the public, including to industry and government, as individuals representing the board are in a unique position to influence the strategic decisions and operations of universities.

In Indonesia, the road to autonomy started two decades ago. Since that time, the DGHE has increasingly decentralized its authority by providing institutional autonomy to universities. The first step was the issuance of Government Regulation *PP* 30/1990, which provided universities more flexibility in designing their own organization structure according to the local needs. In the early 1990s, the introduction of block grants for research, introduced explicitly with a view of building better planning and management capacity in public universities, marked another turning point. This is in preparation of introducing greater autonomy in the future, i.e providing more autonomy and decentralizing some authority to universities, and later budgeting envelopes for developing study programs. Important to note is that these changes had been introduced when centralization was still the national credo before the 1998 "reformation" took place.

An important milestone was the implementation of *PP* 61/1999, which provided the four leading public universities with the opportunity to change their legal status, enabling them to establish Boards of Trustees with fairly autonomous financial as well as human resource management. Later, the pilot program was followed by three other public universities. When the bill on Education Legal Entity (*BHP*) was passed by parliament and became Law 9/2009, many assumed that the ultimate goal was achieved. The law laid the foundation for a coherent legal structure and established an overarching regulatory

framework to support all aspects of institutional autonomy. The purpose of the law was to allow all universities and schools, public as well as private, the ability to convert their status into legal entities after meeting a certain set of prerequisites. Unfortunately, the Law was short lived and was cancelled by the Constitutional Court in 2010.

Box 15. Higher education reform in Japan [MEXT, 2010]

In Japan, 89 national universities were awarded a new legal status, which made them legally independent of the Ministry of Education and Science and Technology for the first time in 2004. Japan's governance reform was similar to the one taking place in Indonesia both in its large scale, involving many organizations, and its broad scope, which includes not only the legal change, but also changes made to regulatory and funding frameworks. The objective was to provide greater organizational autonomy to national universities so that they could become strategic organizations, capable of developing unique characteristics in their education and research, capable of meeting the diverse needs of the nation.

In 2010, the first post-autonomy review conducted by the Ministry concluded that national universities had become much better at orchestrating their efforts to contribute to the society (MEXT, 2010). Between 2003 and 2008, data relating to the number of cases of collaborative research and contracts with industry and other non-university organizations show that they doubled. Universities' contribution to regional development improved as they established themselves as significant collaborators for small and medium businesses, increasingly focusing their research and education efforts in areas relevant to regional needs. In contrast, improvement in other areas was only recognized with caveats.

In the absence of the necessary legal infrastructure, the DGHE depended on using existing regulations on public finance as a basis for promoting financial autonomy (*PP* 23/2005, and its revised version *PP* 74/2012). The *Badan Layanan Umum* (*BLU*), or "Public Service Unit" concept, was designed by MoF as a generic solution for all public institutions with the potential to generate revenue, e.g. hospitals, engineering workshops and R&D units. However, as it was initiated by MoF, its coverage was also strictly limited to regulating the management of public finance, and other aspects of university management, such as governance and academic freedom, which have not been covered by this regulation.

The *BLU* limits university autonomy to financial management matters; autonomy in other aspects is delegated by MoEC. The lack of adequate legal protection implies that the Minister's delegation can be revoked at any time. Nevertheless, bureaucrats and some academics considered the move to be an attractive option due to its practicality and ability to provide a short term solution. In order to prevent public universities from operating in a vacuum, the government issued *PP* 66/2010, which provided guidelines that allowed a transition period into *BLU* and to accompany *PP* 23/2005.

In August 2012, the Law 12/2012 on Higher Education was enacted. Although far from perfect, the new Law provides the legal basis for developing the derivative Government and Ministerial regulations required by the new Law. Some academics are still skeptical and suspicious about whether the new regulations, which need to be developed and followed up, are capable of moving the national system back to the centralistic system. Others are worried that the new law tends to micro manage public universities, while also failing to provide adequate regulation for private universities.

The legal infrastructure is a critical issue in fostering UIG partnerships and in providing an environment conducive for conducting research and developing innovation in universities. University autonomy is necessary for universities to develop and to carry out a strategic plan by involving the stakeholders in industry and the productive sector, among others. The mindset of being autonomous will provide universities with the necessary platform for effective UIG cooperation. In Japan, where national universities went through a similar governance reform, the impact of their ability to work with industries in new ways, was particularly visible (see box: Higher education reform in Japan).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Chapter 4.
R & D Capacity in Indonesia

4.1 National Council on Innovation

In order to improve national productivity and enhance national economic growth, a Presidential Decree 32/2012 has recently been issued. The Presential Decree established the National Committee on Innovation *(Komite Inovasi Nasional – KIN)* , whose mandate can be found in Annex III of this report.

In light of India's success in fostering innovation (see box: Innovation system – the case of India), the government should strengthen and empower *KIN* as an advisory unit for the President. Unlike the committee in India, by law *KIN* has no portfolio and may not execute any innovation project/program. The power to execute and conduct innovation program is partly done by the MoRT, by the Indonesian Institute of Science (*LIPI*), and by the well-developed Indonesian HEIs.

Box 16. Innovation system - the case of India [Mathew, 2010]

"Innovation is the central issue in economic prosperity" – Michael Porter
Although initially stifled by an inward looking and disjointed agenda, India has achieved great success in implementing a national innovation system.

The early post-independence period was characterized by protectionist industrial policy that aimed to foster self-reliance and coerced Indian industry, military and the public sector to innovate within their means, which often resulted in substandard, low-quality outcomes. Isolation of research and development activities from the outside world for over 44 years since independence has meant that there have been no attempts at sharing of best practice or external benchmarking or other reference mechanisms to judge processes. This has resulted in India "re-inventing the wheel" many times.

Recently, there has been a change in thinking. There is pressure from the government to change India from within. Competition with China particularly has exerted pressure on India which has also been criticized for failing to demonstrate leadership in producing new products for its own markets in spite of claiming to possess the best and brightest talent. India believes that a National Innovation the development of an effectivenisystem can increase momentum, raise profiles, build transparency and scale and increase focus on both national growth and global competitiveness.

What should the national innovation system achieve? Fundamental models for innovation globally have remained unchanged, but the nature of innovative activity has become more sophisticated. Notable shifts have occurred from a focus on new products and identifying critical technologies, to processes and individual outputs, and to the mechanisms for producing those outputs. Innovation is rarely seen as a set of isolated activities that somehow add up to the sum of the constituent parts of a national innovation agenda. Innovation is no longer an independent discovery activity but a collaborative process with multiple participants.

India has traditionally looked at innovation as a three-tiered model, primarily as a process of layering, with the scale of innovations related to the impact on its massive population and multi-pronged objectives. At the bottom of the model are the grassroots innovators engaged in the task of contributing to the improvement of rural GDP (i.e. farmers, artisans, housewives, and ordinary Indians developing small innovations to improve their livelihoods). Entrepreneurial and social innovation occupies the middle tier, while the top layer reflects the need for private-public partnerships to produce cutting edge research and innovation for global thought leadership and competitiveness. A multi-tiered model conceptually reflects the current emphasis on a layered approach, which given the diverse needs of the country, is regarded as necessary for shaping national innovation, including the demands of India's mature industries, the need for accelerating domestic consumption and the need for multiplying rural GDP. However, what is missing is a coordinated effort of national significance. This is where a NIS (National Innovation System) fits in, providing the required independence for innovators at each tier and, at the same time, providing an osmotic effect accross tier boundaries in such a way that innovation performance is enhanced.

In effect, the NIS operates like a national grid to which innovation change agents can be plugged in. An NIS will also provide a framework where common issues can be abstracted raised and dealt with separately or horizontally, as a shared service. For example, basic scientific and engineering infrastructure, including the data required for researchers, technologies needed to conduct R&D, rapid prototyping, measurement, and test apparatus, can be centrally procured and developed for common use by all innovation system participants. The NIS should have an apex body that serves as a policy-oriented intellectual property think tank. It is at this level that the government can help steer the agenda through its policy on innovation. The government has three roles: first, to ascertain that there is a portfolio of national interest; second, to ensure that there is adequate funding and incentives for the actors at the various tiers to function independently; and third to ensure that there is sufficient collaboration and integration amongst the various actors in such a way that better results are achieved faster.

The role of government in an innovation system is vital and varied. First, the government is a catalyst and mobilizer of different interests, helping to connect various disciplines, upstream and downstream activities. Governments can mobilize capital in directions that are difficult or of little interest to industry. Government is also a large and influential buyer of goods and services and thus has influence on how products are developed. The government is also responsible for the administration of policy that helps to keep the system healthy and honest. Rigid organizational structures and territorial mindsets negate and harm innovation. There are varying levels of resistance to new ideas, experimentation, process changes, transparency and accountability.

In 2008, the government of India released a draft of the National Innovation Act. The purpose of the legislation was to facilitate public, private, or public-private partnership initiatives for building an innovation support system to encourage innovation. The Innovation Act visualized an integrated science and technology plan. The Act has given due thought to private and public partnerships, including an exchange or marketplace for trading in innovation. The Act represents a good start but fell short of expectations with regard to identifying a comprehensive agenda, a robust funding mechanism and innovation subsidy program, and, most importantly, incentives to collaborate and work together.

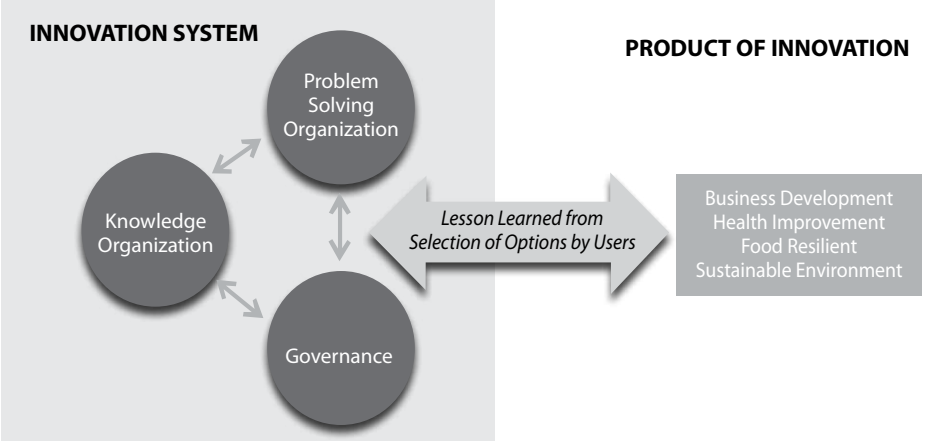
We visited Pekalongan, a city in Central Java, where one of the pilot projects was implemented as part of the *BPPT's* program to develop local innovation systems. We found that the level of understanding, strategy, implementation and involvement is still in its infancy. Innovation Municipal officers perceive it to mean performing better than last year, and university involvement is still limited to conducting policy studies for the local government. The involvement of local industries is also very limited; R&D strategies have yet to be developed. It seems that *KIN* still needs to learn from India as to how to successfully implement a National Innovation System. At the same time, the government needs to reposition *KIN* to create synergy among R&D institutions as well as with R&D policy makers.

4.2 Government Policy

4.2.1 Coordination and Synergy

Under the law, the Ministry of Research and Technology is responsible for national policy on science and technology. Its responsibilities include formulating strategic policy and setting the direction of national R&D. Strategic policy for national science and technology development recognizes the role of three important users of science and technology: the government, business and industry, and society. Figure 4.1, shown below, sets out the structure of a successful innovation system.

Figure 4.1: Main Structure of Innovation System [MoRT, 2010]



Interaction between business entities, S&T organizations, government institutions and wider society facilitates improvement in the capacity and performance of the innovation system. Universities and other R&D agencies, both public and private, are the prime movers in the innovation system. These organizations make a significant contribution to the productive sector. Government agencies should play an important role in fostering an environment that is conducive to the creation, testing and adoption of new technologies and the formation of new business entities.

The Strategic Policy on National Development of Science and Technology 2010-2014, as stipulated in the Ministry of Research and Technology's decree 193/ M/Kp/IV/2010, aims to:

a) Increasing the capacity and capability of science and technology resources to conduct productive R&D that is beneficial to the national production sector;

b) Increasing the capacity and capability of R&D institutions and supporting institutions to support the transfer process from the idea-laboratory of prototype-industry to the prototype-commercial product (strengthening the national innovation system);

c) Develop and empower institutions and individual researcher networks at national and international levels to support productivity improvement and the empowerment of national R&D;

d) Increasing the creativity and productivity of national R&D to meet the demand for technology in the industrial sector and to improve the competitiveness of national products and innovation culture;

e) Improving the application of national science and technology to support economic development, creating ande new jobs to increase people awareness of the importance of science and technology ; and

f) Establish seven priorities for science and technology: *i*) food security, *ii*) energy, *iii*) information technology and communication, *iv*) transportation technology and management, *v*) defense and security technology *vi*) health and medicine, and *vii*) advanced material to support other priority areas of focus.

MoRT decree 193/ M/Kp/IV/2010 implements article 31 - paragraph 4 of 1945 Constitution (amendment 4) and Law no 18 – 2002 on National System for Research, Development and Application of Science and Technology (Sisnas P3 Iptek), and Law no 17 – 2007 on Long-term National Development Plan 2005-2025. Thise decree clearly statedes that the National Research Agenda 2010-2014 should be applied to all executing elements of science and technology of national development. Science and technology executing elements include:

a) individuals and or groups of people who are conducting research, developmenting and applicationying science and technology, and
b) science and technology institutions, such as universities, R&D institutes, business entities, and supporting institutions

While thise decree recognizeds the importance of having the National Innovation System (NIS,) the function of the National Research Agenda (NRA), which is the basis for all science and technology programs, and the need for better synchronization and coordination amongst various science and technology executing elements, it does not clearly describe how its fuction will be executed and what the policy for the national R&D funding incentives will be. For example, NRA only applies to R&D programs at units and agencies coordinated by MoRT. Other ministries, such as MoEC, MoH, MoPW, the Ministry of Transportation, the Ministry of Agriculture, have their own R&D programs, which may or may not be synchronized with the NRA. Although they are using the government budget, R&D units and agenciesin other government institutions are not required to follow NRA. Unless they are seeking funding from MoRT's incentive program Broadly, R&D programs in government institutions focus on either supporting the development of science and technology and engineering, or supporting policy formulation for the ministryinir respectiveies.

The success of government policy on the national R&D can be measured by, among other things, the number and quality of researchers, the proportion of the R&D budget allocated to R&D activities (input), and the output of R&D activities. The effectiveness of such R&D policies has yet to be measured, simply because the data is scattered and there is no integration among actors in national R&D activities.

4.2.2 Government Budget

National R&D is financed mainly by the government. In 2010, government spending on R&D standsood at approximately 0.08% of national GDP. Compared with other large developing or newly industrialized countires, including Brazil, Russia, India and China, Indonesia spends a very small fraction of its national GDP on R&D. Similarly, compared to neighboring countries, such as Australia and Singapore or Malaysia, Indonesia lags behind.

Table 4.1: Gross Domestic Expenditure ofn R&D (GERD), in billions of US Dollars for Selected Countries

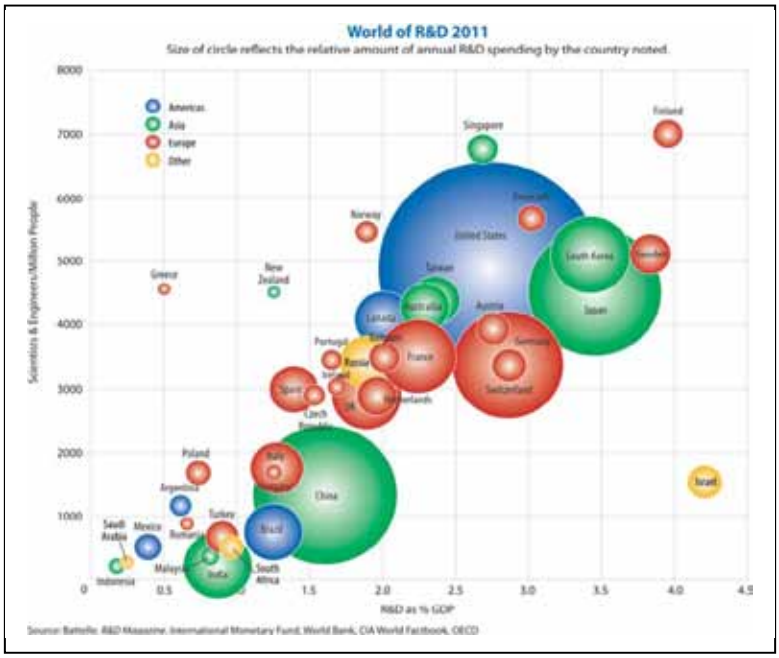
Global Rank	Country	2010 GDP PPP	2010 R&D as % GDP	2010 GERD PPP	2011 GDP PPP	2011 R&D as % GDP	2011 GERD PPP	2012* GDP PPP	2012* R&D as % GDP	2012* GERD PPP
1	United States	14,660	2.83%	415.1	15,203	2.81%	427.2	15,305	2.85%	436
2	China	10,090	1.48%	149.3	11,283	1.55%	174.9	12,434	1.60%	198.9
3	Japan	4,310	3.44%	148.3	4,382	3.47%	152.1	4,530	3.48%	157.6
4	Germany	2,940	2.82%	82.9	3,085	2.85%	87.9	3,158	2.87%	90.6
5	South Korea	1,459	3.36%	49	1,549	3.40%	52.7	1,634	3.45%	56.4
6	France	2,145	2.21%	47.4	2,227	2.21%	49.2	2,282	2.24%	51.1
7	United Kingdom	2,173	1.81%	39.3	2,246	1.81%	40.7	2,305	1.84	42.4
8	India	4,060	0.80%	32.5	4,472	0.85%	38	4,859	0.85%	41.3
9	Brazil	2,172	1.10%	23.9	2,294	1.20%	27.5	2,402	1.25%	30
10	Russia	2,223	1.03%	22.9	2,367	1.05%	24.9	2.491	1.08%	26.9
13	Taiwan	822	2.30%	18.9	883	2.35%	20.7	938	2.38%	22.3
14	Australia	882	2.21%	19.5	917	2.25%	20.6	958	2.28%	21.8
22	Singapore	292	2.52%	7.4	314	2.60%	8.2	331	2.65%	8.8
33	Malaysia	414	0.64%	2.6	445	0.70%	3.1	472	0.70%	3.3
36	**Indonesia**	**1,030**	**0.08%**	**1**	**1,120**	**0.08%**	**1.7**	**1,203**	**0.09%**	**2.4**
40	New Zealand	118	1.18%	1.4	123	1.20%	1.5	129	1.22%	1.6

The total government budget allocated for R&D activities is shown in Appendix D of this report. From total of national government budget (IDR 1,344,476 billion), almost IDR 10,063 billion were allocated for R&D or just 0.75% of the total 2012 budget. Off course, this is a very small amount compared to other nations, and one can expect that with such a limited amount of budget, the process of disbursement will be comparatively smooth, allowing R&D to succeed in achieving the planned target (Government Regulation 38/2012).

4.2.3 R&D Personnel

As shown in Figure 4.2, the total number of R&D personnel in Indonesia is also low. There are fewer scientists and engineers in Indonesia than in Singapore and Malaysia. The majority of R&D personnel in Indonesia employed in government sectors are either researchers in government institutions or professors/lecturers-researchers in public universities. Since Indonesian industry spends little on R&D, the number of R&D personnel in industry is consequently much lower than those in government R&D institutions and universities. Unfortunately, this study was unable to collect data on the current total number of R&D personnel.

Figure 4.2: R&D Spending and science and technology personnel



As data collected from the 2006 survey [*LIPI* 2009] shows, the ratio of R&D personnel in government institutions was only 11.04 per 1,000 employees consisting of 40.77% research personnel, 27.78% technicians, and 31.45% support staff. Recently, the percentages have slightly increased for personnel classified according to educational background: 5% for doctoral degree holders, 14.8% for master degree holders and 21% for S1 holders and lower.

Not only are the quantity and the quality of R&D personnel relatively low, but their performance is also considered less than satisfactory, as measured by the number of its full time equivalent (FTE). According to the *LIPI* survey in 2006, government R&D institution personnel only spent 0.57 of their time performing R&D activities. Although this is an improvement compared to R&D activities performed in 2005 and 2004, it was still far from satisfactory. The current number of FTE in government R&D institutions needs to be substantially increased.

Although there is no accurate figure available, we estimate that a maximum for of 25% of the total number of university lecturers engage in R&D activities, while others focus more on teaching and perhaps a little research. In some universities, such as *UI, UGM, ITB, IPB, UNAIR*, and *ITS*, this percentage might be higher, but in most universities (especially in small private universities) the percentage is considerably lower. In most universities only a handful of lectures are able to earn research grants from DGHE, MoRT and other sources. The heavy teaching workload given to lecturers by the universities, most of which focus mainly on teaching, the lack of research capability and inadequate funding and research infrastructure are often the main causes of the lack of research output of many university lecturers.

4.3 Funding Mechanism

R&D activities are executed using limited funds for a limited span of time. In all cases, the R&D personnel sign a contract for specific R&D projects with the funding provider. There are various R & D mechanisms, depending on the source of funding. All R&D activities granted government funding, regardless where they are performed, must follow government budgeting, disbursal, reporting, and

auditing mechanisms. Government funding also determines the ceiling and allowable cost item, which are often not compatible for all R&D activities. Individuals or organizations undertaking government-funded research activities are also required to follow government regulations concerning procurement of research materials. Researchers in universities and government research institutions often complain about the complexity and strictness of regulations. The long and bureaucratic process involved in securing government funding is often considered to be the source ineffective R&D activities.

The government R&D funding process also suffers from delays in disbursement. Due to these delays, researchers have to find ways to pre-finance their research activities. The lack of competency and capacity of the support staff, who are responsible for administrating and funding disbursement, exacerbates the problem.

Similar problems affect private sector R&D funding mechanisms. These problems will remain as long as the capacity of the administrative system and competency of the supporting personnel remains inadequate. Such problems do not affect private companies working on their own R&D facilities using their own funds However, in university-industry R&D collaborations, complaints were made about universities not being sufficiently responsive to external requests from industry. For industry, the commercial benefit of research output is essential, so that research schedules will determine the success of the R&D. In many cases, university researchers cannot carry out research activities as scheduled because of bureaucratic university finance and procurement processes. Therefore, although adequate funds are available, the execution of R&D activities requires more effective support from the administrative office.

To promote R&D in industry, the government has provided incentives for private sector organisations that are willing to invest in research and development in Indonesia. Although the government has promoted a range of tax incentives and other policies directed at increasing investment in R&D, industry has yet to spend more on in-country R&D. Some companies even utilize foreign R&D agencies to conduct R&D on their behalf. Again, this can be interpreted as a signal that industry is either not yet interested in - or has the demand for - R&D, or that it simply assumes that local R&D capacity is not yet available. At any rate, this suggests that Indonesian companies have little faith in local R&D capacity.

Likewise, in many practices, funding for R&D are typically very limited, and therefore the competitive funding mechanism is the most commonly used mechanism for awarding R&D projects. Therefore, the competitive mechanism is applied in allocating the government research fund, allocating the university internal research fund, both at universities as well as government R&D institutions.

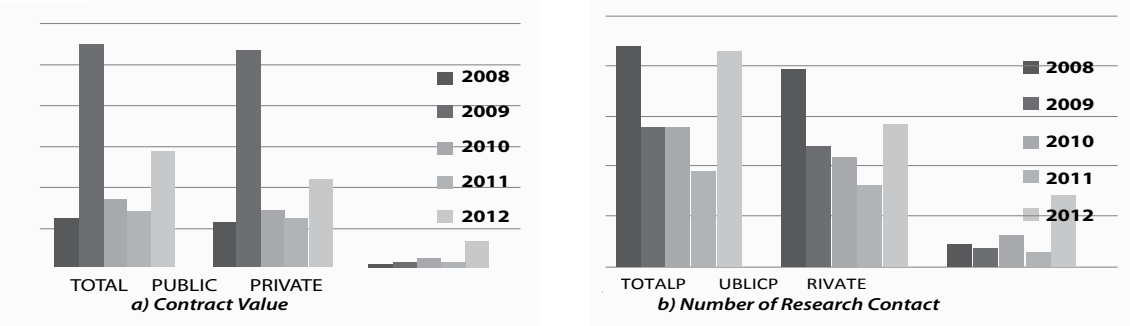
4.4 R&D Activities in Universities

Science and technology activities in Indonesia are performed in various institutions, extending from universities to government agencies and industry R&D units. As the largest system that comprises the highest involvement of intellectual resources, the university system plays a dynamic role in national science and technology activities. The Indonesian university system is a very complex mix of public and private universities, including those under the coordination of MoRA. Such a complexity increases according to the variety of capability and capacity of R&D institutions. However, universities are still widely considered as having the greatest potential for the development of science and technology through their role in producing capable science and technology personnel.

R&D institutes are established in universities to facilitate the institution's research activities. The research is conducted at centers for research and studies, which are generally coordinated by the university research institute and community services. However, university faculties and departments, which are not affiliated with the R&D centers, carry out some of the research activities.

Traditionally, the main role of universities has been to provide education and to produce graduates to meet the manpower needs of industries. However, the rapid growth of the national economy and the expansion and changes in industry call for more relevant education to produce graduates with the required skill sets. Universities have responded accordingly by changing their roles and characters. While the majority of universities remain focused on teaching, more universities are becoming research-oriented institutions. To facilitate such moves, the DGHE has launched a number of initiatives to support university research and community service.

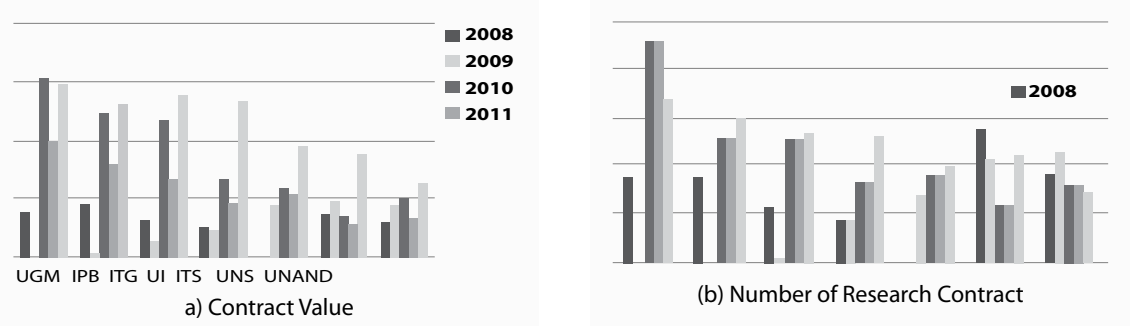
Figure 4.3: Distribution of research grants [*DP2M*, 2012]



Since early 1990s, the DGHE has provided more than 20 different grant schemes, ranging from grants for fundamental research to grants for applied and collaborative research, in addition to various schemes of community service programs. Initially, grant schemes aimed to improve the quality of higher education through the enhancement of university R&D capacity, and through years of implementation the quality of university R&D has received higher appreciation. As capacity improves, the focus of research also shifts towards that with greater potential for industrial application. In recent years, the DGHE has placed considerable attention on establishing and fostering university - industry research collaborations. Although still small compared to the allocation for other activities, government funding for research has increased more than three-fold in the last 6 years, from IDR 76 billion in 2006 to almost IDR 290 billion in 2012, in addition to the IDR 10 billion allocated to research related to community service programs [*DP2M*, 2011]. A significant number of grants are allocated for collaborative projects between industry and community organisations.

In 2012, DGHE awarded 4,297 grants, totalling IDR. 286,441,722,162 to researchers in both public and private universities. The distribution of grants in the last five years is shown in Figure 4.3. The distributions show a considerable gap between public and private universities, suggesting that there is either a lack of R&D capacity in private universities or that private universities focus more on teaching than public universities. A more detailed analysis of the data reveals that even amongst public universities, research excellence is concentrated in a group of elite universities. As shown in Figure 4.4, the top five universities consistently receive the majority of DGHE's research grants.

Figure 4.4: Top Seven DGHE Research Grant Recipients [*DP2M*, 2012]



The ability to win competitive grants is correlated with the quality of research output, as depicted in Figure 4.4. The number of patents granted to and scientific papers produced by these top universities, as illustrated in Appendix E of this report, demonstrates their quality and capacity to carry out R&D.

To promote the commercialization and application to industry of university research output, DGHE funds collaborative university-industry research through a range of grant schemes. Although in general all DGHE-supported research grants are available for collaborative projects, two programs are specifically designed to accommodate the needs for university and industry collaboration.

The first program, *RAPID*, aims to synergize university R&D activities with industry. Under this scheme, industry will be the entry point for the university researchers to support and supply the required technology. Researchers working under the scheme are grouped into 6 scientific fields: energy, ocean & fisheries, health, agriculture & food, information technology and manufacturing. The *RAPID* program was first launched in 2007 and still continues today. As illustrated in Table 4.3, while universities with strong R&D backgrounds continue to receive the majority of *RAPID* funding, a large number of universities have benefited from *RAPID* grants during the last five years. These include a number of private universities: an encouraging sign of the growing ability of private higher education institutions to establish partnerships with industry.

The Hi-Link program, first launched in 2006, is the second grant scheme designed to foster university-industry collaboration. Unlike *RAPID*, Hi-Link also brings in local government as a partner in research collaboration. Under the scheme the universities partners with SMEs in a multi-year research collaboration program, with the local government expected to facilitate implementation and assure the benefit to society. DGHE has acknowledged the success of this tripartite mechanism and has significantly increased the number of Hi-Link grants given to the universities in recent years.

In addition to the *RAPID* and Hi-Link programs, other grant schemes, such as national strategic (Stranas) and Petranas *MP3EI*, also require universities to collaborate with industry and government agencies to conduct research in one of twelve strategic/priority areas. While the number of grants awarded through these schemes is on the rise, the outcome and benefit of these multi-year programs are yet to be measured.

Table 4.3 *RAPID* grants distribution 2008-2012 [DP2M, 2012]

Universities	Grants	Value (IDR)	Size per Grant (IDR)
INSTITUT TEKNOLOGI BANDUNG	13	3,584,970,000	275,766,923
INSTITUT SEPULUH NOPEMBER	7	1,756,550,000	250,935,714
UNIVERSITAS NEGERI SEMARANG	6	1,478,500,000	246,416,667
UNIVERSITAS PADJADJARAN	6	1,289,220,000	214,870,000
UNIVERSITAS HASANUDDIN	5	1,281,150,000	256,230,000
UNIVERSITAS MUHAMMADIYAH SURAKARTA	5	1,175,500,000	235,100,000
UNIVERSITAS BRAWIJAYA	4	1,003,800,000	250,950,000
INSTITUT TEKNOLOGI TELKOM	4	929,700,000	232,425,000
UNIVERSITAS TADULAKO	3	809,620,000	269,873,333
UNIVERSITAS MUHAMMADIYAH MALANG	3	790,000,000	263,333,333
UNIVERSITAS INDONESIA	3	708,000,000	236,000,000
UNIVERSITAS MURIA - KUDUS	3	702,500,000	234,166,667
UNIVERSITAS SUMATERA UTARA	2	567,650,000	283,825,000
UNIVERSITAS SAM RATULANGI	2	540,000,000	270,000,000
UNIVERSITAS WIDYA GAMA	2	533,333,000	266,666,500

UNIVERSITAS PENDIDIKAN INDONESIA	2	525,000,000	262,500,000
UNIVERSITAS MATARAM	2	490,000,000	245,000,000
INSTITUT PERTANIAN BOGOR	2	479,700,000	239,850,000
UNIVERSITAS WIJAYA KUSUMA	2	415,000,000	207,500,000
UNIVERSITAS GADJAH MADA	1	299,650,000	299,650,000
UNIVERSITAS SEBELAS MARET	1	287,300,000	287,300,000
UNIVERSITAS JENDERAL ACHMAD YANI	1	275,000,000	275,000,000
INSTITUT TEKNOLOGI ADHI TAMA	1	272,500,000	272,500,000
POLITEKNIK MANUFAKTUR BANDUNG	1	272,100,000	272,100,000
UNIVERSITAS CIPUTRA	1	270,760,000	270,760,000
UNIVERSITAS NEGERI MALANG	1	270,000,000	270,000,000
UNIVERSITAS NEGERI YOGYAKARTA	1	270,000,000	270,000,000
UNIVERSITAS HALUOLEO	1	250,000,000	250,000,000

The government takes a similar approach to the implementation of university community service programs. Starting from the traditional community service program, DGHE initiates S&T based service schemes for the universities to engage with small-medium enterprises and community [DP2M, 2011]. Unlike traditional community service programs, under this program the university collaborates with the community to establish new S&T based entrepreneurs or to improve the S&T capacity of SMEs (see box: Center for research in Development of Cultural Product – *ITB*). In addition, the Hi-Link program builds the capacity of universities to apply S&T through collaborative work with industry and local government [*DP2M*, 2012].

Box 17. Center for Research on Cultural and Environmental Products – *ITB*

R&D units in public universities are not commonly considered to be government R&D institutions. However, because of their strategic role in national R&D they are often asked to serve the government (central and local) by performing R&D activities for them. A good example of this is the role played by the Center for Research in Development of Cultural Products.

The Centre for Research in Development of Cultural Products, one of many research centers at *ITB*, was established in 2000 to promote and develop local and indigenous culture through the empowerment of small and medium enterprises. With the abolishment of the National Design Center in 2009, the center became an alternative unit to continue the Indonesia Good Design Selection award, which was formerly under the Ministry of Industry and Trades. However, the need for independence from the government has resulted in locating this center as part of *ITB*, under the coordination of *LPPM-ITB*.

Currently, this center works closely with small and medium sized companies to develop cultural products using locally available materials, mainly bamboo and natural fabrics. With support from engineering faculties at *ITB*, this center was able to introduce modern technology into the production of local cultural products

4.5 R&D Activities in Government Institutions

In general, R&D in government institutions is undertaken by three types of organizations: a) R&D institutions under the coordination of the MoRT, b) R&D divisions of technical ministries, and c) Local R&D institutes which are either under the coordination or a part of local government organization. These institutions operate using government budget (central and local).

4.5.1 Non-Ministerial R&D Institutions

There are seven non-ministerial R&D institutes or government bodies whose activities are coordinated by MoRT:

- The National Nuclear Agency (*BATAN*),
- The Nuclear Energy Regulatory Agency (*BAPETEN*),
- The Agency for the Assessment and Application of Technology (*BPPT*),
- The National Coordinating Agency for Survey and Mapping (*BAKOSURTANAL*),
- The National Institute for Aeronautics and Aerospace (*LAPAN*),
- The National Standardization Agency of Indonesia (*BSN*), and
- The Indonesian Institute of Science (*LIPI*).

In addition to the aforementioned institutions, the government owns other R&D facilities that serve both the government and private sector. The Center for Research in Sciences and Technology or *PUSPIPTEK*, for example, is an integrated research infrastructure environment with various state-of-the-R&D-art activities. This facility also undertakes other activities, including science and technology training and technology transfers. *PUSPIPTEK* was established in 1976 and is currently under the coordination of Ministry of Research and Technology. Later it was dedicated to become the model for a national science technology park. The Ministry of Research and Technology also coordinates and manages the following R&D institutions: The Eijkman Molecular Biology Institute, the Agro Techno Park in Palembang and the Business Technology Center.

4.5.2 R&D Institutions in Line Ministeries

R&D units at line ministries are under the auspice of the corresponding ministerial organization structure. Their duties are to execute R&D activities relevant to and supporting the main functions of the government ministry. The functions of these units vary according to their duties and the scope of responsibility of the ministry. R&D units under the technical or line ministries are responsible for national resources and infrastructure in performing research supporting the development of science & technology, and the development of engineering within the scope of authority of the ministries (the Ministry of Energy and Mineral Resources, the Ministry of Transportation, the Ministry of Health, the Ministry of Forestry, the Ministry of Public Works, the Ministry of Maritime Affairs and Fishery, the Ministry of Communication and Informatics, and the Ministry of Education and Culture – DGHE). Meanwhile, R&D units under the other government ministries (such as the Ministry of Religious Affairs, the Ministry of Justice & Human Rights, the Ministry of Trade, the Ministry of Education and Culture, etc.) perform R&D activities which are focused on supporting policy formulation in these ministries.

Box 18. R&D at the Ministry of Public Works

Ministry of Public Works (MoPW) provides an example of the implementation of R&D in the public sector. As an institution that is responsible for the planning, construction, operation and maintenance of public infrastructure, although it often relies on external resources, the ministry needs to conduct its own R&D. Formerly, all R&D facilities under MoPW functioned as research divisions that served the technical needs of the ministry. The R&D units under this ministry are structured according to the technical scope of the General Directorates: 1) Roads and Bridges *(BINA MARGA)*, 2) Water Resource Management *(PENGAIRAN)*, and 3) Buildings and Human Settlements *(CIPTA KARYA)*.

Each Directorate General is supported by several centers giving technical support (*BALAI* or *BALAI BESAR*), mainly engineering support, for the day to day operation of technical units at central and local level

(provincial, district, and municipality). While in the past the main and only function of *BALAI* and *BALAI BESAR* was to provide technical solutions for the ministry, with the expansion of works and the limitation of funding and other capabilities, some *BALAI* and *BALAI BESAR* have gradually shifted the focus of their R&D activities to areas that are no longer the sole responsibility of MoPW.

The Center for Human Settlement, or *Pusat Pemukiman*, is an R&D center under the Directorate General *Cipta Karya*. About 10 years ago this center started to apply research in building construction and other human settlement facilities, such as sanitary systems, simple housing, and many others. Unlike the other two Directorate Generals, *PUSKIM* was no longer the sole entity responsible for the availability of affordable and reliable human settlement infrastructure, as more and more private sector firms are investing in buildings and other human settlement facilities. This enables *PUSKIM* to compete with the private sector in producing innovations to meet the needs for buildings and human settlements. With JICA's technical assistance, *PUSKIM* often collaborates with private companies to develop innovative technology. This improves *PUSKIM's* capability, professionalism, as well as the ability to generate additional revenue (although this has proved difficult).

The leadership of *PUSKIM* has developed this institution to become a model for other R&D centers and *BALAI* within the Ministry of Public Works. A strong leadership that believes in the value of professional researchers has transformed the skills of its workforce, developing professional researchers from traditional government employees. Currently, the center manages 250 personnel, including 80 full researchers, at the main offices, and another 340 personnel, with 95 full time researchers, at its regional branches. With the assistance of AusAID and other donors, *PUSKIM* regularly provides scholarships for its researchers to undertake graduate studies at master and doctoral level.

As this institution was able to convince the management of its capability, it succeeded in increasing its annual budget from around IDR 50 billion to IDR 100 billion in 2012. With the enactment of Government Decree no. 38 – 201, *PUSKIM* is expected to generate more revenue from external contracts in order to be able to optimize the use of *PNBP* (non-tax government revenue). In addition, the center is also able to produce, among others, two prototypes of building/housing construction (RISA and RIKA), which are specifically developed for small and medium construction companies. Its focus on SMEs is one of the driving forces that have enabled *PUSKIM* to become a professional government R&D institute.

Of course, what was successful at *PUSKIM* would not necessarily be successful in other *BALAI* or R&D centers as the nature of public infrastructure, which is mostly developed for non-commercial proposes, still needs full government support and control. Therefore, all efforts similar to those conducted in *PUSKIM* must be carefully examined before they are applied elsewhere.

4.5.3 Local Government R&D Institutes (*LitBangDa*)

LitBangDa perform R&D activities at various levels of local governmental (provincial, district, and municipality). These institutes can take the form of an agency or division within the local government structure, depending on the organizational structure of the local government. *LitBangDa* are funded using local government budgets, and focus only on the R&D areas that are considered important and/or relevant to local needs. In performing their duties, these local government R&D institutes often work in cooperation with the local branches of national government R&D units.

To improve the capacity of R&D institutions in Indonesia, the government, through the Ministry of Research and Technology, supports the establishment of Science Parks or Techno Parks, which facilitate productive interaction between researchers, industry and the community. Moreover, the Ministry of

Research and Technology administers programs for the development of centers of excellence in science and technology. In 2012, grants were given to four institutions: 1) the Center for Palm Oil Research, Ministry of Agriculture; 2) the Center for Study on Suboptimal Land, Sriwijaya University; 3) the Foundation for Tropical Diseases, Airlangga University; and 4) the Center for Horticulture Research, *IPB*. In 2013 the Ministry of Research and Technology will award grants to 3 research centers and 4 consortia comprised of multiple research centers.

4.6 R&D Activities in Industry

The majority of Indonesia companies do not yet perform R&D as part of their typical industrial activities. While many companies, for economic reasons, use imported technology in production, others have started to perfect their products and production processes through R&D activities. Some of the reasons for the lack of R&D activities in industry given during interviews for this review were: a) a lack of recognition of the availability and capability of local R&D institutions, b) restrictions imposed by principal companies located overseas, and c) a lack of immediate need for R&D because of good revenues generated by current products and the existing production system. The last reason clearly betrays industry's preference for short-term economic gains based on the availability of abundant resources over investing in long-term added value products.

Table 4.4: Source of R&D budget in Indonesia [*LIPI* 2009]

SECTOR	Budget (IDR billion)	%GDP
Higher education	1,821	0.031%
Manufactiring industries	880	0.017%
Government	2,019	0.036%
TOTAL	4,720	0.084%

As illustrated in Table 4.4, a substantial share of R&D is financed by the government. According to a survey conducted by *LIPI* in 2009, the total expenditure was as small at 0.084% of the national GDP, a significantly smaller proportion of GDP than that spent by neighboring countries in Asia. While the trend of the share of industrial R&D expenditures in other countries shows an increasing trend, its share in Indonesia remains small at a mere 880 / 4,720 or 18.64%.

The lack of domestic investment in R&D is perhaps best illustrated by the palm oil sector. It is quite easy for investors to establish new plantations and expect to harvest palm oil fruits, which they can readily export at a reasonable price. As long as the land is available, opening a new plantation is a profitable business, as the costs can be easily covered by the selling of raw materials at an attractive margin. Meanwhile, government efforts to encourage investors to preprocess the crude oil into refined palm oil often fail to attract support from palm oil producers, since the costs associated with the refinement process are not met by additional revenues. As long as exporting raw materials or crude palm oil remains attractive, research in the area of palm oil processing will not be undertaken by producers on a large scale.

However, some individuals still believe that any degree of research, no matter how seemingly insignificant, can potentially benefit industry. A producer who wishes to improve productivity in the harvesting process may ask friends or a university to provide R&D services. For example, a professional at one palm oil plantation (CT Argo), who uses his engineering knowledge to find solutions by applying

engineering R&D to regularly solve problems, maintains a valuable network with his old engineering school (*ITB*) to support his research.

However, some individuals may undertake R&D activities on a small scale, for example by applying their own professional knowledge or consulting friends or contacts in universities, to solve production problems or to boost productivity. For example, one professional at a palm oil plantation (CT Argo) interviewed during consultations reported that his company performs their own engineering R&D to solve problems on the plantation and maintains a network of contacts at his former engineering school to support his own R&D activities (*ITB*).

A large company such as *PT PINDAD* might have a slightly different approach to R&D. Having limited in-house R&D capacity, *PT PINDAD* can only resolve small production problems through in-house R&D and seeks outside assistance, including from universities, to overcome more complex problems. However, university R&D is not always compatible with the nature of the industry, which often puts a premium of accuratcy and a quick turn around. In general, universities do not have the requisite instruments and equipment to conduct R&D for industry, except in highly specialized institutions such as Polman. This generally leads to dissatisfaction on the part of industry and companies purchasing off the shelf products instead of developing improved products through a long process of R&D.

PT PINDAD is not an isolated case, as many other similar industries are facing the same problems. Other state owned enterprises, such as *PT INKA, PT PAL*, have limited R&D capacity and as the demand grows for their products and services the need for more R&D becomes apparent. Unfortunately, the universities, the main source of R&D outsourcing, are not quite ready either. Not only are they not equipped with adequate facilities, if the collaboration went through regular university bureaucratic channels, the R&D process may also be delayed or disrupted.

Most if not all university R&D facilities are not adequately prepared to undertake R&D for industry, even on the smallest scale. There is always a gap between university R&D output and what industry needs. This gap needs to be narrowed and, ultimately, eliminated.

Chapter 5.

Issues in UIG Partnership

5.1 Lack of Understanding and Mutual Trust

We found that too many universities develop their research strategy in isolation from industry, apparently assuming that they know what is best for industry and the nation. In some cases, they even look down on industry as 'greedy' or 'lacking idealism'. From the perspective of industry, higher education institutions are an ivory tower, bureaucratic and too focused on consensus building to be able to provide useful assistance. Many academics do not understand the problems faced by industry, and worse, many in industry do not have the capacity to present their problems in a structured manner. Both parties are still operating in an *"institutional sphere"* instead of *in "consesus space"*, lacking mutual trust [Etzkowitz, 2002].

Unfortunately, the government is not in a good position to help either, as both university academics and industrialists are deeply suspicious of government intentions and ability to operate effectively. There is a pervasive lack of understanding about the respective roles and different characteristics of the three sectors, particularly the fact that they could each benefit from each other's diverse insights and strengths. For instance, universities are not generally 'specialized enough' to be able to solve routine problems or to work under pressing deadlines. Their intellectual resources and creativity are far better suited to solving 'unstructured problems' over an extended period though collaboration with industrialists. They would not make a good 'contractor' for simple tasks, but are better as partners for complex tasks. Until industry understands this, they will not give universities the opportunity to excel. On the part of the universities, unless academics understand the complexity of industrial operations, and respect what they do, they will equally be unable to grasp the nature of the problems they face.

Part of the problem is the lack of a long-term commitment of industry both to stay in Indonesia and to invest in R&D in order to remain competitive in the local and global markets. Once Indonesia has industries committed to achieving productivity in a given locality, requiring innovation and technological development, and once universities can demonstrate adequate capacity in relevant fields, there should be much greater interest on the part of industry to work with universities as potential partners as well as sources of competent human resources for solving their technical problems and offering state of the art laboratory facilities. It is critically important that industry begins to invest its own production-oriented budget including funds designated for R&D – rather than just CSR funds – in working with universities, with professional commitment and interest in the outcome, so that they become more effective working partners.

Box 19. PT Semen Padang

PT Semen Padang is the only sizeable industry in West Sumatra, located in proximity of Andalas University (*UNAND*). The close collaboration between the company and the Laboratory of Structural Dynamics, Department of Mechanical Engineering, was initiated by a professor, who had just returned from studying in Germany.

During the 1990s, over the period of a year, he routinely visited the plant without any compensation from either the company or his Department. With strong support of the then company Director, Ir Johan Samudera, he successfully earned the trust of the company's management, not only from the top ecxecutive but also from the middle managers working on the plant floor, who are the key personnel in identifying problems. The professor is now considered an insider, a person to whom top and middle managers consult whenever problems arise, and most of his proposed solutions are accepted. Some successful solutions are currently even duplicated at sister plants in PT Semen Tonasa in South Sulawesi and PT Semen Gresik in East Java. In 2011, the partnership between the Laboratory and PT Semen Padang reached around IDR 300 million in contract value.

What is missing is an entry point, or a forum for 'structured encounters' where university academics and industrialists can start building a better understanding about each other's functions and operations. Many universities around the world recruit academics with industrial experience, or allow their staff to take leave to work in industry, and regularly have postgraduate students who end up working for private sector firms and, in turn, provide a critical link with industry.

Indonesia may need to think about its own options for facilitating such an exchange, such as encouraging industry to second its R&D staff to work as special research fellows at universities, developing industrial R&D emersion programs for university staff and creating better incentives for conducting collaborative research. Alumni already employed in industry could play a critical role in fostering mutual understanding and trust between the two parties. The initiative of one of the CEOs of the largest palm oil plantation in developing various collaborative research and development activities with *ITB* is an example of such good practices. Such research is a long term endeavour for which both parties should be prepared to make a long-term commitment.

Box 20. Networking opportunities or structured encounters

It is clear that academics and industrialists work in very differently defined professions, with contrasting goals, performance targets, and values. It is not surprising that they experience 'cultural differences' and find it difficult to understand or work with each other.

There are a number of ways in which individuals can overcome such a cultural gap. One may be by taking the opportunity to work together in a 'board' or 'committee' that performs some specific tasks. From 'competitive councils' to 'technology foresight committees' there are a number of bodies to which individual experts are invited to undertake a common task. These also provide excellent opportunities for individual academics or industrialists to get to know each other, to share their perspectives, and often to develop mutual respect.

Some organizations deliberately arrange 'structured encounters' between academics and industrialists. MIT's Industrial Liaison Office offers services to set up meetings for industrialists to visit MIT campus to meet academics with relevant expertise. Since this is something that happens on a regular basis, with a number of academics visited by industrialists, in meetings small and large, they effectively 'train' young academics to be able to talk about what they do to a non-academic community. They develop the ability to conduct what they call a 'dog and pony show' – to be part of a group of academics presenting their research results to industrialists. Over time, these meetings prepare academics to be able to communicate better with industrialists. In Scotland, a non-profit network organization CONNECT used to organize networking events – for instance, a breakfast gathering - where academics were invited to present their research to a relevant industrial audience, mimicking similar but more entrepreneurially driven meetings organized by UCLA. Some Japanese universities started out with 'open campus day' events as part of which industrial representatives were invited to campus to meet multiple academics. Over time, the need for structured meetings can change, as networks become denser and other set-ups such as academic or professional conferences develop, providing alternative structured encounters where industrial as well as academic participants meet.

Meanwhile, our study has identified several close partnerships, which individual academics have managed to develop with organizations and individuals in industry, through years of perseverance and effort to gain their trust (see boxes: PT Semen Padang and Cocoa Sustainability Partnership). This indicates that universities should make greater efforts preferably with more adequate institutional support, to engage with industry.

The key questions concern what kind of research and/or education capacity universities should build, how to make them relevant to the future of Indonesian industry, and whether universities can gain from knowledgeable stakeholders in industry and government. Indeed, international experience shows that proactive universities have done much more to work with industry compared with Indonesian universities.

Many proactive institutions around the world, including MIT, have specific units dedicated to establishing strategic contacts with key industries, and ensuring that its leaders and researchers routinely engage in dialogue with industry, through membership of various boards, both within companies and within universities, through research and other collaborative projects, through contacts with alumni, and through consultancy work (see box, MIT's relationship with industries).

Box 21. MIT's relationship with industries [Hatakenaka 2004]

There is a strong belief at MIT that it contributes to society principally by creating well-educated students. It is widely believed that academics themselves must be intellectually engaged with real world issues if they are to educate students with relevant scientific knowledge in preparation for the changing world. As an institution, they make significant efforts to interact with industry, through a variety of mechanisms.

The Industrial Liaison Program

The Industrial Liaison Program is considered as an 'entry-level' membership program for companies that have had little previous interaction with MIT. The program grants them access to academics and research information in return for a modest membership fee. It is organized by dedicated professional staff whose job is to connect individual companies with specific academics on the basis of their interest. The program provides incentives for faculty to engage in these discussions with industry, and assists junior academics to establish networks with key figures in industry.

Consulting activities

MIT policy, like that of many US universities, allows faculty to spend up to an average of one day per week working as consultants outside MIT, so long as consulting work does not interfere with accomplishing the duties of the institution. What is interesting is that most MIT academics believe that engaging in real problem-solving for industry provides critical feed back into their teaching, keeps them abreast of developments in industry and increases their understanding of their field.

Industry-funded research projects.

MIT works with over 1000 companies at any given time on industry-funded research projects. Consortia are membership programs which bring together a group of interested companies to give them access to research results from a given research group. The 'industrial affiliate programs' at Stanford, is a system working with multiple companies often characterized by an advisory group or board with key industrial representatives. It is very helpful in creating access to multiple perspectives from industry on a topic, while preventing the possibility of undue influence by any single company. It also provides valuable network opportunities for companies. However, it is not easy to set up, and is demanding to run – the reason why it helps institutions to develop a certain collective understanding about how to manage well.

Strategic partnerships

In the late 1990s, MIT began developing large-scale, longer-term partnerships with a select group of companies. Today, having strategic partners is a standard practice in large interdisciplinary research programs, each of which will have a small number of 'strategic partners,' who are more actively engaged in the research program financially and otherwise. Developing and maintaining strategic partnerships, however, is not an easy task and one in which MIT had to place significant institutional level effort. MIT's corporate relations office has professional staff who work tirelessly to identify and attract potential major companies not only for special relationships in research and education such as strategic partnerships but also for soliciting corporate gifts and endowments.

Visiting Committees.

Advisory committees including industry representatives are common across universities globally. However, as a couple of former MIT Presidents acknowledge, it is a well calibrated and effective system, which is critical for defining MIT's strategies. In MIT, a Visiting Committee reviews strategic issues related to content and directions of the research and education of a department, and reports ultimately to MIT's Board of Trustees. Each one typically comprises 15-20 individuals, carefully selected by the President, Provost, Deans and Department Heads on the basis of individual expertise and merit, with roughly a third of members coming from industry, a third from alumni and the other third representing the leading lights in academia in that field. They visit the department every year to review education programs and departmental activities including proposals for new developments through a 1-2 day visit, where they meet academic staff, undergraduate and graduate students behind closed doors, so that they can really hear about what is going on in the department. Their findings are reported informally to the president and provost at the end of the visit, and the formal report is sent first sent to the department, discussed by the dean with his/her academic council, and finally sent to the Board of Trustees, where the chair of the visiting committees makes an oral presentation to the Board. In the words of one former President of MIT, "It is much more valuable than accreditation."

The international study visits also confirmed that having dedicated units is the key to establishing and maintaining productive university-industry partnerships. KAIST's OUIC and Tsinghua's UICC have proven effective in facilitating university-industry engagement (see Annex VI).

Universities also need to define their mission in the context of *MP3EI*, i.e. whether they are to focus on research, professional education, or human resource development through academic education. This might be the hardest task for universities since most aspire to become research-oriented institutions without sufficient capacity. However, once the appropriate mission is defined, resource allocation can be targeted to achieve the mission's objectives. For institutions with sufficient capacity to conduct research, activities need to be directed toward more applied research.

The current institutional framework that governs public higher education institutions significantly limits the ability of universities to engage in serious partnerships with industry or government. According to the prevailing regulations, only the Government of Indonesia has the status of a legal entity. Public universities are merely considered as the government's implementing units *(satuan kerja)*, and their authority is granted to them by the MoEC instead of being autonomous and protected by the law. With such a legal status, collaborations with other organizations are difficult establish, and are subject to unduly cumbersome bureaucratic procedures. Complications surrounding intellectual property rights and the use of funds are particularly difficult barriers to overcome.

Without legal status, universities cannot operate as an effective owner of intellectual property rights. As discussions about collaboration with industry require clarity regarding ownership and use of intellectual property rights, Indonesian institutions cannot meet such expectations. Various 'workaround' solutions

such as setting up separate foundations or companies 'associated' with universities exist, but they are only second best solutions, as there is no systematic mechanism to ensure 'accountability' in relationships between a university that does not have legal independence from the government and such foundations/companies.

Channeling norms for government funding are just as difficult. Any external revenues generated from industry through collaboration have to be deposited in the state treasury, and can be used only after submitting a proposal for approved specific activities, using a standardized tariff. The process is extremely complicated and lengthy. Bureaucratic requirements to access government sponsored research grants that are supposed to be used to promote university - industry partnerships are similarly complex. Public funding also suffers from other bureaucratic problems. For instance, most public funding comes with seriously delayed disbursement (in some cases up to 6 month delay). Funds are subject to an annual disbursement rule, in accordance with which no funds may be carried across financial years. This creates a serious obstacle to multi years projects, which are commonplace in R&D. Government standard procurement procedures are often unfit for the operational procurement needs of universities, particularly their need to purchase specialized equipment.

In order to avoid bureaucracy, many academics opt to carry out industrial collaboration as individuals, without involving institutions. Such arrangements are neither optimal for the individuals themselves nor for the institutions. They leave the academics, who enter into the contract, without the benefit of legal counsel, without consideration of the liabilities, and without institutional mechanisms to reconcile disputes, at risk. For institutions, it is a serious loss because the rest of the institution cannot benefit from or contribute to the relationship, and staff may neglect their regular campus duties. The most serious problem is that the partnership will not become an institutional asset, which means that the partnership cannot grow beyond what an individual academic can offer, and is lost as soon as the individual leaves the university.

Much more fundamental is the issue of the role and culture of universities. Globally, universities are considered a critical party in innovation or in UIG partnerships because they are independent knowledge institutions, capable of generating, reflecting, integrating and disseminating knowledge. They are key institutions because they provide insights different from those of industry or government, and are 'creative' in offering unique solutions by generating knowledge. The problem with inappropriate institutional framework is that it does not allow Indonesian universities to develop into the fully-fledged independent knowledge organizations that universities are expected to be. The bureaucratic regulatory environment affects the very 'mindset' of the academics – forcing them to be bureaucratic rather than creative in their contributions. Without an appropriate framework for academic freedom and institutional autonomy, it is not possible for universities to develop into organizations that are guardians of creativity and innovation (see box: Introducing culture of relevance).

Box 22. Introducing the culture of relevance

International experience shows that there are several avenues through which a culture of relevance may be introduced into higher education institutions.

One avenue is in founding new institutions – particularly collective institutions. The most famous example is the Land Grant institutions in the US, which were created in the late 19th century to support agricultural development through providing services such as agricultural extension. Their 'founding ethos' has had a powerful impact on their subsequent development.

MIT is one example which, despite developing from a teaching-dominated technical institution into a world class research university, has a founding ethos of practical relevance which has always acted as a key

guiding principle. Ireland provides a more recent example, having founded multiple new practically-oriented education institutions in the 1970s, which collectively pushed established research institutions to pay more attention to practical relevance.

A national (or regional) crisis can also compel universities to engage more actively with industry. Many US universities became more serious about their contribution to the economy during the 1980s when the US was undergoing a competitiveness crisis. In Japan, after a decade of economic stagnation, politicians, industrialists and the media urged the universities to become active as agents of economic restructuring. **The societal needs were so compelling that many academics felt a moral pressure to contribute more to economic development.**

A lack of funds can also help push universities to forge stronger ties with industry as they seek alternative funding. Katholik University of Leuven (KUL) was forced to become more entrepreneurial in the late 1960s and work more closely with industry after it experienced a shortage of funds. In its early days, MIT encouraged its professors to undertake consulting assignments as they had insufficient funds to pay full salaries to professors. In the 1980s and 1990s, a perception emerged that there was little federal funding available led many US institutions to turn to industry. However, money as a driver often leads to only superficial changes. For instance, in many countries, academics moonlight extensively and have extensive ties with industry, yet their institutions may have little to show in terms of relevant research or updated curricula from these connections. This highlights the importance of organizational commitment to creating university-industry relationships that are beneficial to universities as institutions; KUL and MIT not only legitimated industrial ties, but actively built them and used them as an organizational mechanism to remain connected to the external world.

Changing academics' attitudes usually requires more than changing rules and policies; role models who can provide active support and guidance are effective vehicles for cultural change. Chalmer University of Technology in Sweden provides one of the early examples of universities recruiting an industrially active academic to serve as a role model and support younger academics. More universities are following suit including by recruiting new categories of 'academics' such as adjunct appointments, professors of practice, or entrepreneurs in residence.

5.1.1 Lack of Shared Vision about the Autonomy Process

One key constraint in the attempt towards negotiating increased autonomy has been the lack of shared understanding about what autonomy means in Indonesia. Many academics take for granted that academic freedom and institutional autonomy are already embedded in the existing governance system, and do not understand that the autonomy they enjoy is not legally protected and can be revoked at any time through a change in ministerial policy.

There are other misconceptions. Some assume that autonomy is limited to managing financial matters. Others, including some officials in MoEC and MoF, further assume that the *BLU* concept could solve the issue of inadequate institutional autonomy. They do not understand that autonomy in financial management should only be granted if a proper governance system and organizational mechanisms are in place, and such a system could only be implemented when a proper legal framework for institutional autonomy is in place.

Some high ranking government officials are still confusing autonomy with privatization by publicly defining university autonomy as the ability of a public institution to generate revenue to substitute government funds. Such misinterpretation and misunderstanding are also shared by a significant part of the society, demonstrating the ineffective socialization of the concept of autonomy. Worse, faculties and departments are commercializing their education programs by charging exorbitant admission fees to incoming students. Among an albeit small section of Indonesian society, there will be an endless

ideological debate between those who consider higher education a pure public good as opposed to those who consider it an entirely private good.

5.1.2 Impact of Uncertainty in Autonomy Policy

The recent policy developments have not only left the university community deeply suspicious of government intentions regarding the autonomy process, but also seriously undermined university willingness to implement strategic initiatives. Since the early 1990s, the DGHE had been taking gradual steps to prepare public universities for autonomy by developing the internal capacity necessary for institutional autonomy. The introduction of "block grants" and "budget envelopes" in fund channeling marked a fundamental shift in policies. The concept applied in the new funding scheme, popularly called "the new paradigm", was first introduced by allocating budget for research activities, whereby institutions were requested to submit proposals to be competitively reviewed and evaluated. For the first time in their history, study programs were given an opportunity to develop their own proposals, defining objectives, designing activities, planning implementation and developing performance indicators. They had to conduct resource planning and implement their plans; this was intended as the critical first step in implementing autonomy given to grantees. The managerial impact of competitive grants was significant.

Until the introduction of the new funding scheme, individual researchers were only accountable to their direct supervisors. The concept of "stakeholders" was unknown to research staff when the new paradigm was introduced, and many confused it with "shareholders"; civil servant status does not encourage university staff to be accountable to their stakeholders, i.e. students, parents, employers and the public at large. The momentum of preparation for autonomy was strengthened when the Government Regulation *PP* 61/1999 was enacted in 1999. The movement toward greater autonomy culminated in the passing of Law 9/2009 by the Parliament, which opened opportunities to all public and private universities to become legal entities.

The abolition of Law 9/2009 by the Constitutional Court was a major setback to efforts to promote institutional autonomy and effectively eliminated all momentum gained. Higher education experienced a legal vacuum until the new Law 12/2012 was passed by the Parliament in July 2012, which left the entire sector in limbo. Even after the Law 12/2012 was enacted, lingering uncertainty remains due to the large number of government regulations required for its implementation.

The uncertainty in the legal framework and the lack of confidence in the government's commitment to provide institutional autonomy has dampened any appetite for new initiatives in universities. Many institutional leaders prefer being on the sideline to leading new initiatives, particularly when given the current climate of punitive measures and the high risk of being indicted. For some, such a situation is too much and frustrates those who are actively championing the development of partnership with industry. They have given up on the institutional bureaucracy, and develop partnerships through their own initiatives. For example, one interviewee in *ITB* holds international patents and has successfully developed cooperation with international industries through his own endeavours [Tempo, 2012].

Currently, such individual initiatives tend to be discouraged, either formally by university regulations in an attempt to control and discipline its staff, or socially by the academic community who still consider individual initiatives to betray academic ethics of "disinterestedness". In the academic world, publications are used as performance targets, and industrial collaboration is still considered as a revenue generating activity without academic merit. It might be important for universities to provide organizational support to encourage any potential initiatives, including individual initiatives, to develop industrial partnership. Recognition and credits are also needed to encourage champions who have successfully developed partnership with industry. In order to be successful in developing partnerships with industry, it is important to foster champions within the university environment.

5.2 Financial Management

Public universities' lack of capacity to manage their financial resources generates serious bottlenecks to effective participation in UIG partnerships. Recently, driven by the need to have better financial control over all units within the university and comply with MoF's requirement for a 'single account' in each university accounting system, public university leaders have been taking steps to centralize management. In most cases, the system has successfully centralized all revenue that had been scattered over a several dozen different accounts. However, most universities do not yet have adequate capacity in effective financial management, including planning, budgeting, disbursing, reporting, and evaluating. Complaints about long and difficult disbursement processes are numerous, demonstrating the insufficient capacity of the universities' central administration to carry out effective financial management. One possible explanation is that most financial officers are trained to disburse the budget allocated by the government, without any consideration of efficiency and effectiveness, since their performance is measured by disbursement capacity. Another explanation is that the government's move to fight corruption has driven financial officers to prefer "extreme prudence" over taking any risk that might lead to future indictment. Clearly, industrial partners are not likely to tolerate such bureaucratic operating conditions.

Under the existing public finance regime, all revenues in public universities are state revenues. The implication is that all disbursement and procurement activities have to comply with the bureaucratic and cumbersome mechanisms of public finance regime. Moreover, goods procured become state assets, while, in most cases, industry demands full ownership of the product prototype (including the goods procured).

Another potential problem is the inability for public universities to undertake fundraising activities, which is a common practice in the US universities, and increasingly adopted by universities in other countries. Unless donations are channeled through other separate legal entities, e.g. foundations or cooperatives, all the funds raised will need to be deposited in the state treasury, removing any possibility for endowments. However, getting around the regulation through a separate legal entity, such as foundation, does not comply with the norms of good governance.

It is important to note that the success of Tsinghua University and KAIST in developing and maintaining university-industry partnerships depends largely on the ability of those universities to implement good financial management policy and mechanism at both departmental and university levels. In addition, KAIST's OUIC and Stinghua's UICC models, Tsinghua's TusPark, are excellent examples of how a university can establish alternative funding generation mechanisms. (See Annex VI on TusPark).

5.3 Balancing Individual with Institutional Interest

It is ultimately the individual staff in universities who will develop partnerships with industry and come up with innovations. Institutions, however, have a critical role to play in enabling, facilitating and enhancing what individual staff can accomplish, and, through doing so, they also enrich the nature of partnerships with industry.

Researchers and professors at both KAIST and Tsinghua universities are very active and successful in engaging in research collaboration with the industry. The keys to that success are the ability of the university to establish policies and mechanisms that enable professors/researchers to carry out research within the university premises and facilities without placing too much administrative and bureaucratic burden upon them. Units at departmental levels as well as at university level (KAIST' UOIC and Tsinghua's UICC) have been successful in creating conducive university-industry partnership environments that involve staff (professors-researchers), students, alumni and private/industry sectors (see Annex VI for university-industry partnership model).

The relationship between 'institutions' and 'individuals' within universities in Indonesia are still not what they should be. Individual academics often have much more freedom in what they do than their peers in more developed systems of higher education. They are free to undertake outside project activities like consulting and teaching in private universities with almost no time limit or restrictions on the content of activities. Although it has been much improved in recent years, staff absenteeism is still a problem and has been tolerated too often because of low staff salaries, particularly in relatively lucrative fields, e.g. accountancy, management. Such a situation is not unusual in developing countries where universities do not have the organizational capacity to 'manage' the conditions around staff work –not only because of their lack of administrative and managerial autonomy, but also partly because of the lack of institutional capacity to develop and enforce organizational norms and rules. The situation has been improving in many universities, but the problem can still be found in the majority of universities.

As the Indonesian economy matures, however, inadequacies in human resource management in universities are increasingly problematic, particularly if academics are to play roles that are so critical to the acceleration of economic development. The recent emphasis on university autonomy, along with the significant increase of staff salaries, have created a new institutional environment in which universities as organizations are expected to be much clearer about what responsibilities individual members of staff should take on and to ensure that staff are accountable for performing these tasks – more specifically, by clarifying how much, and what kind of work they expect from their staff.

The standards reached by Indonesian universities over time will probably be similar to those implemented by their international peers. They will expect specific time and professional work commitment in exchange for an academic status and salary. This may be expressed in terms of rules and norms such as limits to time they spend outside universities, requirements that some/all external activities must be reported to institutions or even approved by them, and/or rules about conflict of interest and commitment.

However, reaching such standards is by no means simple. This is because inexperienced institutions are usually too clumsy in developing rules/norms. There is a tendency to impose too many rules too quickly without adequately justifying to academics why the change is needed, or without adequate upgrading the administrative staff needed to ensure a smooth transition without becoming a source of intolerable bureaucracy. This issue of administrative capacity is particularly critical: rules can quickly become bureaucratic nightmares when enforcing officers are unable to be 'reasonable' in making pragmatic judgments about how rules/policies are to be implemented.

5.4 Incentives to Promote R&D Culture in Industry

Another problem industries are facing is the apparent lack of technological orientation in companies; however, does this matter considering that Indonesia is now still at a stage of economic development in which industries are adapting existing technology rather than creating new technologies? In our view, it does, because even though our study is limited in scope, we heard too many complaints made against a policy environment that is detrimental to the long-term technological ambitions of private firms.

We learned from several interviews that various government initiatives to provide incentives tend to fail at the level of implementation for one reason or another. Government Regulation *PP* 35/2007 on incentive for industries, Presidential Decree Perpres 28/2008 on National Industrial Policy, and Law 25/2007 on capital and licensing facilities, are just few examples. The complaints against these regulations related to the lack of coordination between sectoral ministries which had resulted in unworkable regulations. In the case of *PP* 93/2010, which was the regulation that introduced a tax deduction for R&D expenditures, adopted in 2010, an interviewee complained that in reality it was difficult to get tax deduction. This was true even with the clarifying decree from the Minister of Finance No 76/*PMK*/2011, which elaborates

procedures for deducting R&D expenditures in the available tax forms. We suspect that a possible reason for this may simply be the inability of tax officers to interpret what R&D expenditure qualifies. In this particular case, it is possible that implementation capacity will improve over time given that it has merely been a year since the regulations were enacted.

However, loss of confidence or will on the part of the private companies is also a factor that can perpetuate the ineffectiveness of policies. Another example of policy failure was the allocation of an IDR 50 billion grant by MoI for developing battle tank technology in a state-owned enterprise. The program was endorsed by the President himself and, yet, the company declined the assignment and returned the grant. The reason for this was that such a grant could significantly lower the profit to asset ratio in the company's financial report, risking the dismissal of the CEO.

The government is clearly making consistent effort to create a 'conducive environment' for domestic capacity building. Parliament has just passed the Bill on Defense Equipment, which makes it mandatory for the Indonesian Arm Forces to use defense related equipment produced by state owned enterprises. Procurement of imported equipment could only be done when local capacity is not available within these industries. The idea is to embed technology transfer in the procurement process. This is a reasonable objective and a policy undertaken by other governments with the expectation of being able to contribute to capacity building among the most technology conscious in local companies.

However, the lack of confidence in the policy environment is pervasive. Some interviewees pointed out that companies often prefer giving donations in order to reduce taxable incomes to bothering themselves with cumbersome schemes such as R&D deduction. Donations for sports or scholarships are easier, pose little risk, and improve the company's public image. Investing in R&D activities is risky and requires a long term commitment.

It is clear that the existing competition in the domestic market for manufacturing goods does not create sufficient pressure on the existing manufacturing players to invest in R&D. Currently, wholesaling and retailing are more attractive due to higher margin and fewer risks in these markets. The policy environment must be much more coherent, consistent and credible to bring about a change of culture in the private sector.

5.5 Agricultural based Downstream Industries

In recent years, Indonesia has increasingly shifted towards exporting agricultural resource-based manufactures and primary commodities exports at the expense of non-resource based manufactured exports. The importance of exports of agricultural commodities e.g. rubber and palm oil, has increased significantly as a result of the global commodity price boom between 2003 and 2008. In the last decade, Indonesia's exports of primary commodities have expanded from 15 percent of total non-oil and gas exports in 2001 to 34 percent in 2011 (non-oil and gas exports accounted for 80 percent of total exports in 2011), while the share of agriculture-based manufactured exports rose from 18 percent to 22 percent [World Bank 2012].

In an effort to boost earnings by exporting more processed commodities with higher added value, the government has encouraged the construction of new plants for processing raw agricultural commodities. New taxes on the export of primary commodities were introduced, while taxes on processed commodities have been decreased. The result is a significant increase in the export of processed commodities and a decline in the export of raw commodities, while the construction of new processing plants is booming. In this report, we would like to present the cases of two different primary commodities, namely palm oil and cocoa (see boxes: 'Cocoa sustainability partnership' and 'A shift from crude to refined palm oil').

In both cases, government incentives for down-streaming seem to have worked although two distinct strategies have been employed: while central government took the initiative in the palm oil industry, downstreaming was led by private companies and universities in the cocoa industry. The central government joined downstreaming initiatives in the cocoa industry at a later stage. University's involvement was mainly initiated by an individual who later acquired support from the Rector.

Although the cultivation of palm oil is often blamed for destroying rainforest, Indonesia focused on expanding palm oil plantations, which currently cover 8.2 million hectares, about the size of Ireland. Despite strong criticism from international environmental organizations of the impact of palm oil cultivation practices on the environment, universities have contributed little to developing sustainable industries. Most new innovations in breeding, harvesting and processing technology are currently supplied by Malaysia, while the role of local government is limited to providing licenses. As a result of the current government policy of high fossil fuel subsidies, expanding processing industries to meet the large domestic demand for biofuel is not financially attractive to private firms.

It seems that a much more comprehensive strategy is needed to achieve the goal set in the *MP3EI*, as illustrated in figure 2.1. FA fiscal policy will only work for short term objectives, and will not attract industries to invest in a long term R&D, as elaborated in the following section.

5.6 Research in Biological Resources

MP3EI emphasizes that Indonesia needs to move from the export of natural resources to products with higher value added. *MP3EI* focuses on a set of specific primary industries such as palm oil or minerals, but Indonesia is facing a greater challenge since it is one of the most bio-diverse countries in the world, with the world's second largest tropical rain forest and strategic marine resources. However, realizing such potential requires significant research and development capacity, not only to identify the potential economic use, but also to develop the extraction and production technology, and to take appropriate action for the conservation of biodiversity.

The few examples we came across of collaborations between universities and industry in biological resource research and development did not assure us that these were representative of the general state of university-industry interaction. In many cases, we found that Indonesian academics played a secondary or relatively minor technological role. Industries – particularly multi-national companies - appeared to be motivated to work with universities principally to gain access to biological resources, rather than to collaborate technologically. The bulk of R&D work, which was economically valuable in terms of identifying a use for biological resources, or in developing production technologies, appeared to come from foreign sources, thus leading to a little value added for Indonesia. Only a handful of such collaborations appeared to be enriching Indonesia's expertise and supporting future economic development. The team's impression was that academics were often engaged in such collaborations without understanding the risk of having potentially conflicting interests among industries, government and society. Individual academics were only too happy to be engaged in projects benefitting their personal academic performance, and institutions were providing limited support to help academics develop future strategies for building relevant expertise.

Our interviews with experts in relevant fields indicate that there are differences of opinion regarding the adequacy of Indonesia's human resource capacity for R&D in biological resources. Some were pessimistic. For instance, the capacity in R&D for biotechnology that Indonesia had built in the 1990s was seriously depleted after the Asian crisis; Indonesia, once a regional leader in biotechnology R&D, now trails behind neighbouring countries. Others were much more optimistic that some established institutions, including leading universities and national research institutions, collectively have sufficient capacity to carry out the needed research and training. This includes an adequate number of staff

holding PhDs, an excellent research track record, and adequate research laboratories, with sufficient resources and capacity to be able to enter collaborative research activities.

Box 23. STORMA

The Stability of Rainforest Margins in Indonesia (STORMA) is a collaborative research project conducted by Bogor Agricultural University (*IPB*), Tadulako University (*UNTAD*), Georg-August-University of Göttingen, and University of Kassel, which focuses on integrated concepts of sustainable land use and rainforest margin stabilization - concepts which have been identified as critical factors in the protection of tropical forests. The main sponsors of this cooperation are the Deutsche Forschungsgemeinschaft (*DFG*), the Federal Ministry of Education and Research (*BMBF*), and the Federal Ministry for Economic Cooperation and Development (*BMZ*) representing the Federal Government of Germany, and the DGHE representing the Government of Indonesia.

The German DFG provides research funding for the German staff and students, including funding for travel to Central Sulawesi. On the Indonesian side, however, most university researchers have to compete individually for various available research and scholarship schemes provided by DGHE and MoRT, e.g. Hibah Bersaing, BPPS. Since the research topics submitted for funding were not aligned with the project objectives, the Indonesian researchers tend to propose topics that increase their chance to be accepted for the funding. The government scholarship scheme (*BPPS*) is in some cases also difficult to align and synchronize with the initial schedule, causing graduate students to fail to meet the deadline for participating in the project. Such obstacles might have been solved if the DGHE had been able to provide a special quota of research grants and scholarships for this project so that the institutions involved were able to play a more pro-active role in finding alternative solutions.

Without specific guidelines requiring a research umbrella as a means to prioritise research topics, coherence is difficult to maintain and a critical mass of reserach on specific topics is also difficult to achieve. While the personal benefits for individuals involved in the project is undeniable, universities themselves receive few benefits except for increasing their numbers of PhD graduates. The inadequate government guidelines and support, as well as insufficient leadership have contributed to this outcome

Our own suspicion is that while Indonesia has certainly a good stock of human capital not only in academic and government research organizations, but also increasingly in active civic organizations, the framework for balancing private economic interests, national economic interests and conservation needs related to biological resources is yet to be established. The absence of an appropriate national framework is partly due to the inadequacies in international conventions, in which significant issues relating to intellectual property rights surrounding biodiversity remain unresolved (ICTSD 2010)[16] . We also suspect that research capacity may be patchy and not necessarily cover the whole spectrum of expertise needed in related domains, with expertise scattered in pockets around the country with insufficient institutional abilities to fill the gaps or to integrate into serious national efforts. Clearly, more effort needs to be put into capacity building, not only in basic research, but also in institutional capacity building and in the raising of awareness among key research institutions so that the intellectual community can play the evolutionary role that they must play on behalf of Indonesia.

16 For instance, issues around revenue sharing of intellectual property rights on rare biological resources between inventors and countries of origin, and issues around traditional knowledge and practices versus IPR.

Although the Indonesian Biodiversity Strategic and Action Plan (IBSAP) has been published, the level of compliance is still unsatisfactory. Given this, Indonesia's intellectual community has a critical role in helping to build a national framework for exploiting and conserving biodiversity. It is the roles of national experts to not only keep abreast of the scientific and technological progress of extraction and production, but also to make significant contributions in R&D to improve the efficacy of such technologies. National experts must understand scientific and technological development issues related to conservation and learn from the rest of the world. It is also their task to be engaged in such activities, being fully aware of what is at stake for Indonesia. It is essential that more Indonesian academics gain first-hand experience in working with the international community both in industry and academia, in a full range of domains related to biodiversity.

In this respect, the increasing number of international collaborative research projects on biodiversity is a promising trend. However, we also see that in (many) of these projects, Indonesian academics are not yet playing leading or proactive roles. In addition, we found that Indonesian academics were not sufficiently resourced to participate properly and benefit fully from such collaborations.

A standard government guideline currently either does not exist or is too general to be used as a reference. The involvement of an established institution is in many cases considered a guarantee that national interest will be well protected. But in some cases the legal aspects of collaborating in research involving biological resources are not adequately considered, and implications to the community at large are not well understood by those involved. In such cases institutions involved in the collaboration could play a critical role in filling the gap caused by overly generic government guidelines.

5.7 Regional Disparity

Geographical disparity in Indonesia is mostly due to the unavailability of social and economic infrastructure in the less developed regions, though the unavailability of natural resources also has a significant impact. Table 5-1 shows the striking disparity in economic development between regions. The highest provincial gross regional domestic product (GRDP) per capita (Kalimantan Timur) is more than 16 times higher compared to the lowest (Maluku Utara).

The most serious challenge is to provide the necessary infrastructure, facilities, and teachers in remote and isolated locations. The disparity becomes potentially structural, since school leavers from basic education cannot afford, financially and academically, to be admitted to better schools in more developed regions, and have to stay at local senior secondary schools with inadequate quality due to lack of quality teachers and sufficient infrastructure. After graduating from secondary education, they have less ability to compete with graduates from more developed regions to get into quality higher education institutions, so that as university graduates they do not have the capacity to compete for better jobs outside the region. Companies investing in such regions do not have a choice to recruit human resources from other regions for fear that it may create envy among the locals, causing social friction. The segregation based on geographical location will then become a threat to national integrity.

Table 5-1: The highest and the lowest per capita GRDP by province (IDR thousand) in 2007 [*BPS*, 2010]

HIGHEST		LOWEST	
Province	GRDP	Province	GRDP
Kalimantan Timur	70,120.04	Maluku Utara	3,346.52
DKI Jakarta	62,490.34	Maluku	4,377.09
Riau	41,412.85	Nusa Teng. Timur	4,301.53

5.7.1 Institutional Capacity

Implementing the strategies developed by the National Commission on Innovation (*KIN*), *BPPT* introduces a pilot program which develops innovations based on the local initiative of a few Kabupaten/ Kota (districts). Our visit to Pekalongan, a city in Central Java, reveals that the level of understanding, strategy, implementation and involvement is still in its infancy. Innovation is perceived by the municipal officers merely as performing better than last year: universities' involvement in conducting policy studies for the local government is still limited, so is the involvement of local industries. R&D strategies are yet to be developed.

Since Pekalongan is located in a relatively well developed region and is only a few hours' drive from Jakarta, it seems that other regions without such advantages are in a worse condition. Perhaps only a few regional governments located in the proximity of more established universities, e.g. Kota Bandung, have already developed an innovation strategy involving universities and industry.

5.7.2 Limited Human Resources

It would be logical to have high expectations for university staff to play a proactive role in initiating innovation in the outer island regions. A significant number of them have been trained in more established universities or even overseas. In most cases, universities have the most capable human resources compared to other institutions in the outer island regions. Unfortunately, most universities as institutions are still shackled by bureaucracy that believes that it is the individual staff who should take the initiative.

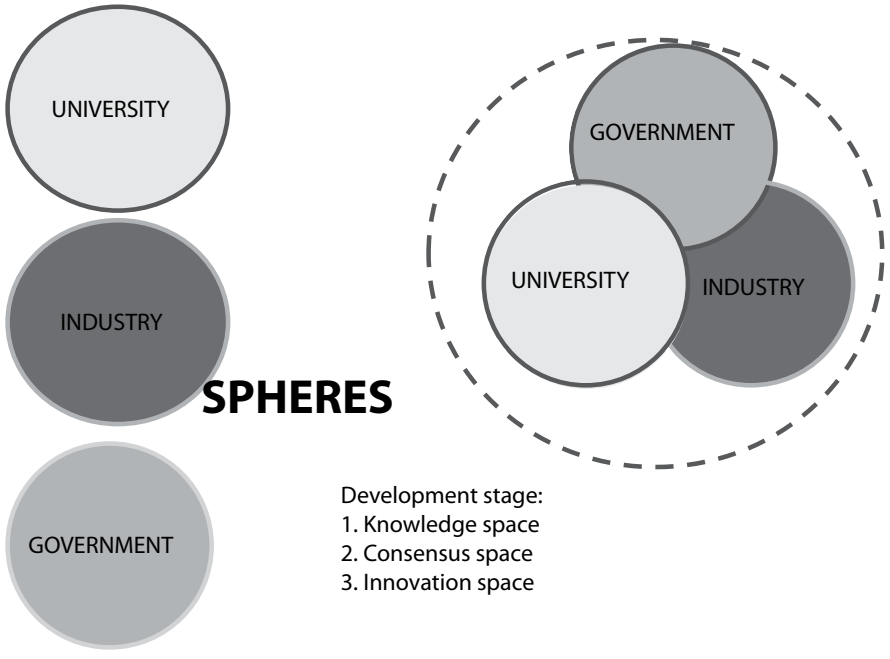
Due to their experiences during their study in more established universities, champions in local universities are in many cases also good teachers. However, they often have to make difficult choices between teaching students and carrying out industrial related activities. Because the number of staff holding an advanced degree in most universities is small, the expectation from the surrounding academic community is high for such champions to provide leadership in both teaching and research within the university.

Some individual initiatives from local champions have been quite successful, as illustrated in section 5.1 of this report. Given the scarcity of highly educated human resources, it is essential to make use of the available local potential. But it needs outside intervention, such as through DGHE, in order for the implementation and institutionalization of the mechanism to be carried out. It also requires good quality leadership to fully capitalize the fullest on the champion's potential.

Chapter 6.
Recommendations

Our study found that the Indonesian government, universities, and industries are still in their respective 'institutional spheres', isolated from each other, and unable to interact productively with one another. A strong commitment and hard work is needed to develop 'knowledge, consensus and innovation spaces' with greater interactivity, as illustrated in Figure-6.1. Much progress has been made in the past decade, a wider range of experimental partnerships has emerged and more institutions have built capacity for playing a more proactive role in fostering better relationships. Although a decade of exploration has seen some success, there is a growing awareness among university communities that a host of efforts, which will require high professionals, still needs to be made.

Figure-6.1: Institutional spheres and knowledge, consensus, innovation space



Our conclusion is that in Indonesia's endeavour to develop regional innovation systems, developing universities that become strategic institutions has a special significance. This is because we think it is unlikely that government-led UIG partnerships, in a style similar to China, would work in Indonesia, due to the different political systems of the two countries. We also think the industrial circumstances

in Indonesia make it extremely difficult to expect industries to lead in this respect. We believe that universities offer the only feasible entry point for pushing for UIG partnerships, which are essential for accelerated and geographically dispersed economic development strategies as outlined in *MP3EI*.

In the sections that follow, we give our recommendations for our vision of institutional development.

6.1 Universities

Universities can offer powerful and unique inputs when partnering with industry and government. But for Indonesian universities to do so, they must become autonomous institutions capable of developing and undertaking strategic initiatives to work with industry. They must be able to make strategic decisions about which new fields of expertise to build and to take steps toward creating an interdisciplinary work environment. They must be capable of creating high caliber support facilities for UIG partnerships and providing better incentives for individual academics to work with industry.

6.1.1 Developing Relevant Expertise and Promoting Interdisciplinary Works

Universities can be much more strategic in ensuring that expertise is distributed appropriately in universities to meet the needs of the region and the nation. Universities can obtain good mechanisms for keeping academic content current and relevant, as many universities do worldwide, by creating new fields based on a sound analysis of societal needs, closing or reducing outdated fields and enabling bottom-up interactivity across different disciplines through interdisciplinary work. In many cases, universities are eager to open new programs but reluctant to close, merge, or terminate irrelevant programs

Box 24. Developing internal mechanisms for interdisciplinary work

> Many universities are undertaking interdisciplinary research and education to address real world issues. However, developing internal mechanisms for interdisciplinary work is not easy. American universities have a long tradition of interdisciplinary research units which draw from the expertise of academics from multiple departments. From Beckman Institutes at the University of Illinois in the 1980s, Huckman Institutes at Penn State in the 1990s, to Bio-X at Stanford in 2000s, larger pioneering interdisciplinary initiatives continue to emerge. MIT's Energy Initiative is an institute-wide initiative which addresses the world energy crisis. MIT's initiative is not a research institute; it is set of programs, covering not only research and education but also campus energy management and outreach. Today, such initiatives in Stanford and MIT will automatically have affiliated industry partnership programs – to ensure that interested industrial partners can participate and contribute.

Most industrial problems are so interdisciplinary in nature that mono-disciplinary approaches to finding solutions are inappropriate. Therefore, as a starting point, university leaders must be in touch with the external world – with leading industrialists and government thinkers (see box: Developing internal mechanism for interdisciplinary work).

6.1.2 Quality Support Facilities

Universities must develop 'support facilities' to enable academics to keep in touch with the industrial world. Proactive universities elsewhere typically have a broad range of support offices such as:

- A high caliber corporate relations or industrial liaison support office, which helps channel relevant industrial contacts to individual staff;
- Efficient and effective support offices for administering research and other project contracts;

- Specialized expertise to offer realistic advice and services for commercialization activities such as starting up support (which is distinct from student entrepreneurial programs), intellectual property protection and management; and
- Special facilities such as science parks, incubation and entrepreneurship centers to enable an environment that promotes different types of interaction.

It is critical that the primary goal of such support offices for collaboration must not be to generate revenues. We found that many university offices established to develop collaborations, e.g. Vice Rector for Cooperation, had unrealistic targets of revenue generation. Instead of improving their services to support individual and unit initiatives, many officers responsible for collaboration are pushed to meet the revenue target by collecting "taxes" from subordinate units. While external revenues are certainly one important indicator of universities' external orientation, revenues should never be the objective of partnerships. These officers and units should shift their focus back to their initial mandate, which is to foster and develop collaboration to improve relevance.

6.1.3 Rewarding the Champions

Universities must develop appropriate rewards and incentives for individual academics to engage in the desirable type of work. They must create an environment that supports and rewards "champions" of industrial partnerships, rather than one that alienates them, as they often do today.

Recruitment and promotion criteria must take the 'relevance' and impact of individual expertise into account. In research-oriented universities, promotion criteria typically narrowly focus on internationally peer reviewed publications. However, it is crucial that research expertise is judged more broadly, taking into account any significant industrial projects, commercialization experience and other contributions made to the society.

It is not enough to simply add 'patents' or 'spinoffs' to 'publications' as promotion criteria. Successful patents and well-cited papers are certainly good indicators for making the first cuts. However, any tendency to simply rely on the numbers of such 'products' can and will result in distorted incentives. Such incentives will encourage staff to indiscriminately file patents or artificially increase efforts to produce more and more international publications, irrespective of these publications' true impact or quality. Ultimately, it is essential that universities develop the internal capacity to qualitatively evaluate the value of research. Finally, if universities are to become key players in accelerated economic development, it is important that building institutional capacity will be the key asset.

6.1.4 Flexible Human Resource Management Practices

It is important that universities develop the capacity to manage human resources more flexibly. By doing so, they will enable the needs of intensive industrial projects to be met effectively. Most universities around the world have a system of recruiting fixed-term staff for R&D activities or teaching assistance. These universities also have mechanisms which allow their academic staff to take special leaves, focus their energy on particularly intensive UIG initiatives, short-term work within an industry, or the development of spinoff companies. This is particularly important, given that one key concern raised by many academics in Indonesia is the heavy teaching load. Flexibility is also needed in order that industrial R&D staff, who are temporarily assigned to universities to teach and conduct R&D, can serve as professors and lecturers.

In the long term, autonomous universities should be able to make these policies on their own. In the short term, the DGHE needs to facilitate such initiatives by relaxing mandatory promotion credits for lecturers, or even by granting academic credits for successful and high caliber industrial collaborations.

6.1.5 Leadership, Strategic and Managerial Capacity

The ultimate goal is for institutions to create a better environment so that individual academics' efforts are broadly aligned with societal interest and needs. For example, it is essential that university leaders become champions in working with industry by proactively encouraging other leaders in industry and government to work together. Universities will also need to develop the central capacity for decision making and management, as indicated above. This is not something that institutions can do overnight. Instead, it is an essential part of the institutional development processes associated with autonomy.

For most universities, certain centralization of control, which will be resented by individual academics and academic units, is needed. But in the case of fostering partnership with industry, universities must develop a better balance between centralizing control and empowering individual academics or units to have the autonomy to flourish.

6.2 Strategies for Central Government

6.2.1 Confidence Building through Structured Encounters

The important objective for the central government is to win back the confidence of private businesses. The government has less credibility than expected in the eyes of private business leaders, indicated by the fact that many business leaders did not even attend events organized by government bodies, let alone actively collaborate. We believe that building trust between government, industry and universities requires a multiple action strategy, which must be initiated by the government.

There must be national fora where leaders from government, industry and universities meet and work with one another. The recent establishment of the National Commission on Innovation is a critical step in this direction. However, we believe that unless the Commission has 'work' to do and decisions to make, it will be unlikely to be effective in helping bridge the gap dividing the three sectors. Regional fora should also be established to bring together leaders from three sectors at the provincial and kabupaten/kota levels.

Whenever government provides funding relevant to industry, leading lights from industry must be involved in the decision-making process. For instance, if the government provides strategic research funding, it is critically important that industry leaders are involved in the process of 'fore sighting the future needs of the country.' If the government is engaged in funding UIG collaboration, it is important that some industry experts be involved in the process of program design as well as the grant awarding, monitoring and evaluation processes.

We also recommend that governing boards for autonomous universities include key leaders from industry, which should provide these leaders the direct opportunity to participate in the governance of universities. All such 'fora' will provide opportunities for structured encounters across sectors, which will ensure better dialogue and understanding between them.

6.2.2 Consistent Policies

The government must develop a consistent set of policies and public investments to support its vision of economic growth filled with innovations. The government, in particular, must ensure an effective development of autonomous higher education institutions (as will be discussed in the next section) and promote industries with higher value added, particularly in the downstream industries of agricultural and mining products. Affirmative industrial policies are needed to support high value added strategic industries, such as the defense industries.

The 'incentive structure,' arising from various taxes, subsidies and licensing conditions must be right to promote private investment in high value added industry. An appropriate incentive structure will also create a better environment for Indonesian businesses, including some state owned enterprises, to compete in more sophisticated products and services. It is also critically important that foreign investors have sufficient incentives to work with Indonesian businesses and universities, so that key technology transfer takes place to pave the way for the future. Incentives should also be used to proactively promote philanthropic donation, as they can powerfully shape university development and provide an effective alternative to government funding (see box: The role of philanthropy).

Box 25. The role of Philanthropy

Philanthropy can play a critical role in transforming universities into entities which benefit society. In the US, foundations such as Ford Foundation and Carnegie Foundation played a pivotal role in shaping university capacity to undertake 'useful research' in the early 20th century (Geiger, 2004). Foundations such as Carnegie, Pugh and Ford continue to play critical roles, as they have been powerful in shaping and disseminating best practice in teaching and learning between 1985 and 2010 (Brint, 2009). In 2012, philanthropy contributed a lion's share; 30 billion USD was raised by colleges and universities in the US in 2011 (CAE, 2012). Stanford University, the top performer in fund raising in 2011, managed to achieve its rank through a powerful campaign, which 'sold' its institutional vision to develop critical capacity to meet societal needs.

6.2.3 Increase R&D Funding

The government must dramatically increase and revamp its investment in R&D. It is urgent to correct the current low level of government R&D spending. As stated in the *MP3EI*, the country's R&D expenditure will be increased from the current 0.084% to 1% of the GDP in 2025. In addition, it is equally important to develop the 'right structure' for channeling government funding to avoid an expensive waste of financial resources. It is inappropriate that the government pay for R&D in its own laboratories. Therefore, to truly support innovations in private businesses, and to complement what universities can offer, it is essential that the 'roles' of such government laboratories be carefully defined. A significant amount of government R&D funds must be spent in order for non-government owned laboratories to develop a more generic capacity for research and training in universities, and to develop key linkages with the private sector.

Government funding is the most appropriate in the following five areas to support the innovation agenda, particularly to support the development of innovative universities.

- Significant funding can be provided either to fund or support cultural change in existing universities. In England in the late 1990s, competitive grant programs were introduced to encourage institutional experimentation and innovation in so called 'third leg' activities. These programs have since evolved into formula-based allocation, and cultural change is now explicitly recognized as a major objective of the funding.
- Governments should fund basic science relevant to strategic fields of application. There are different ways of doing this. After the Japanese experience, foresight programs have become widespread. Another approach is used in the US, which involves having diverse mission-oriented funding agencies.
- Governments should be responsive to consumer demand for the "intelligent" public goods and services that universities can provide. The Department of Agriculture (USDA) and the Department of Housing and Urban Development (HUD) in the US provide good examples of making funding available for universities to provide service to the relevant communities (e.g. for agricultural extension or for community development).

Box 26. Diverse R&D funding in the US

The US has an extraordinary environment in which R&D funding is made available through diverse avenues. In the early 20th century, a group of corporate foundations emerged as potentially effective sponsors for university research, thereby consolidating their capacity for research useful to the society (Geiger, 2009). Subsequently, many US government agencies also developed into critical clients for strategic research, creating a funding context in which universities were pushed to conduct 'relevant research' (Geiger, 2004; Mowery et al., 2004). From energy to agriculture, housing and urban development, there is a dominant culture among government departments for investing in research and experimentation in universities – not just to contract out studies. When the Department of Homeland Security was established in the aftermath of 9/11, one of its early activities was to invest in basic research – to create the basis for future technologies. Together with private foundations, which have an even longer history than the government of funding universities, these agencies collectively represented future technological and social needs for research for the nation.

Of particular interest is the fact that diversity of funding sources also means diversity in the way in which these sources select what to fund. The Defense Advanced Research Projects Agency (DARPA) is a particularly interesting funding body which has helped US universities engage in strategic research. Its funding is characterized by program directors (who are themselves scientists) who have a powerful influence not only in deciding what to fund, but in setting the direction for research through key interactions with scientists. DARPA is designed to be risk-taking and forward-looking – and, indeed, its funding has led to many practical innovations whose influence has extended well beyond military applications. This type of funding is very different from research funding, determined by academic peer review, which tends to be conservative with respect to breaking into new fields or promoting selective applications. Peer review by other scientists can ensure that good single disciplinary science is supported, but it often results in an under-investment in interdisciplinary research and a lack of strategic interest in practical applications. The role played by the Defense Advanced Research Project Agency (DARPA) in funding application-oriented basic research was legendary; so much so that the American National Academies recommended the creation of a 'DARPA-like' agency in energy to ensure the continued competitiveness of US science (NAS 2007). ARPA-E was created precisely for that purpose in 2007 and today invests in research seeking to make fundamental breakthroughs in energy.

- Governments should support key interactions between universities and industry, particularly with small businesses. These interactions provide experimental opportunities for companies to engage in research and to work with universities. In the US, Small Business Innovation Research (SBIR) provides financial support for small businesses to engage in R&D; each of the multiple funding agencies designates a small proportion of their funding for this purpose. In the Netherlands, the government offers voucher support for small businesses to be able to gain consultancy help from universities. The government also helps the process of cultural change in industry – including the change in mind-sets- regarding the role of science. This cultural change must occur before industry can actively participate in collaborative work.

17. Although the organizational direction of DARPA has not been stable over time – it has had its own fluctuations and changes [ref].

- Governments should subsidize the development of future scientists and engineers so that there is a sufficient supply of these experts who are able to work in industry as well as in academia. Therefore, it is important to provide funding for research postgraduate students, particularly for *S3* students. There is a great difference, for example, between the US, where any bright student can hope to get financial support for *S3* study, and Japan, where students have to pay to continue their graduate study. In the former, a large number of *S3s* were produced as early as the 1960s, creating 'real world markets' for *S3* graduates, which resulted in the overproduction of *S3s* graduates. The result was that many *S3s* left academia to join industries and government, which in turn led to the creation of a better absorptive capacity in both spheres. In contrast, in Japan, *S3* studies have been narrowly pursued by those who are academically-minded as they are often expected to inherit particular academic positions. Industries have typically recruited bright but less qualified candidates for all positions, including those of research.

6.2.4 Channeling Government Funds Effectively

It is clear that government funding of UIG collaborations will be of critical importance in the short to medium term. And yet, industries are particularly sensitive to the 'bureaucratic requirements' surrounding government funding because they are impatient for faster turnaround, have far more demanding deadlines and do not have enough patience to work with academics who are burdened with bureaucracy. It is essential to use the block grant scheme for channeling any government funds to support industrial partnerships.

In the long term, when all higher education institutions operate in an autonomous manner, it is clear that block grants will become a norm, and will be implemented without problem. During the transition period of the autonomy process, there will be serious issues, as government use of block grants is limited to the "bantuan sosial" scheme, which can be used only for universities with the status of legal entity (*PTN-BH*)[18]. For other public universities not included in these schemes, funds from industrial partners also entail onerous requirements since they are deposited as non-tax state revenue (*PNBP*) and are subject to all public financing regulations.

In the near future, we recommend that the government take steps toward creating certain work relevant to:

- Creating 'research' as a single budget line item so that expenditure within such a category can be flexible – as proposed by DGHE;
- Creating 'Fraunhoffer-type' organizations such those found in Germany that are legally separated from - yet linked to - target institutions so that they have the flexibility needed to undertake specific industrially relevant activities with universities. This is a serious option, particularly for regions with weaker institutions which may not be ready for autonomy, although we believe that autonomy is eventually important for all categories of institutions, the newly-established as well as the well-established ones. Indeed, we would argue that autonomous governance and management structures should be built from the start in order that institutional capacity can develop naturally;
- Introducing other 'flexibility' around grants awarded to universities for specific activities, such as the ability to spend funds over multiple years and to get quicker disbursement; and
- Taking initiatives such as the Indonesian Academy of Science's (*AIPI*), which creates a special endowment funding body outside the government.

The current governance norms rightly discourage "off-budget" schemes, such as funds channeled from different foundations, due to a national commitment to good governance. We fully agree with such

18 Previously called *BHMN*, and under the Law 12/2012 called *PTN-BH*

principles, but universities represent a special case. Although the government plans to give universities autonomy, the process cannot be made 'hastily.' While these institutions gain autonomy, the nation needs them to function effectively as 'productive units', similar to state owned enterprises. These universities must rapidly develop the innovative capacity to work with industry and government to accelerate economic development. So that we do not have to wait for another 10 years for all universities to develop into autonomous and accountable institutions, 'workaround' options are essential.

6.3 Strategies for DGHE

6.3.1 Supporting the Development of Autonomous Universities

It is critical that DGHE demonstrates leadership and commitment in developing institutional autonomy so that all higher education institutions have appropriate governance and management arrangements in the medium to long term. It is clear from Law 12/2012 on Higher Education that dozens of government regulations (*PP*) will have to be designed as follow-ups and will collectively determine the nature of the autonomy process. It is essential that such regulations are consistently written in the spirit of decentralizing authority and providing greater autonomy to universities. During the transition process, it is particularly important that all officials representing DGHE should have a common understanding and interpretation about university autonomy. Officials should also speak consistently about future directions in establising regulatory frameworks and transition arrangements.

DGHE's role in the internal reforms taking place within universities also needs to be clear. It is important that the government is supportive of the development of better leadership and management structures within universities, which will require a certain centralization of power as well as the introduction of new rules and policies. However, government support should be expressed not by mandating detailed rules to be enforced by the central administration, but by making principles clear. For instance, all parties should expect a dramatic change in the way institutions clarify staff responsibilities and accountabilities after the salaries are increased. Additional resources should be made available for the central administration to exercise its allocative functions to support the reforms.

6.3.2 Supporting the Improvement of Universities in the Eastern Regions

It is essential that higher education institutions in the Eastern regions are given a special boost to serve the critical human resource needs of regions, which is essential to the *MP3EI* strategy. Industries can only operate in those regions when adequate capable human resources are available. Recruiting from developed regions such as Java, Sumatra and Bali is unlikely to be sustainable as it creates jealousy among locals, which becomes the root of social and political problems.

DGHE should use economic development plans such as *MP3EI* to initiate a significant program of capacity building for higher education institutions in such regions. By doing so, these regions can develop the education and research capacity vital for regional economic development.

National experts as well as leading universities in the Western regions would be mobilized to assist such institutional development initiatives. Twinning arrangements can last from medium to long term and should be supported with adequate resources to ensure institutional commitment.

Table 6.1: Recommended strategy and its possible mitigation actions

	Strategy	Time frame	Probability of Failure	Impact	Risk	Possible Mitigation Action
6.1	**Universities**					
6.1.1.	Developing relevant expertise and interdisciplinary work	short	Low	Medium	Medium	Development and implementation of solid plan consistent with university's interdisciplinary academic roadmap; (2) Starting up an industrial linkage program
6.1.2.	Quality support facilities	medium	Medium	Medium	Medium	Changing attitude and paradigm for supporting administration from revenue to program orientation through training and nurturing
6.1.3.	Rewarding the champions	short	Medium	High	High	Development and implementation of solid plan consistent with university's interdisciplinary academic roadmap; (2) Starting up an industrial linkage program
6.1.4.	Flexible human resource management	long	High	High	High	Changing attitude and paradigm for supporting administration from revenue to program orientation through training and nurturing
6.1.5.	Leadership, strategic and managerial capacity	long	Medium	High	High	Developing and implementing policies that reward key players in successful industrial collaboration
6.2.	**Central government**					
6.2.1.	Confidence building through structured encounters	short	Medium	High	High	Creating UIG fora at both central and regional level (2)Securing government funding and policy encouraging industry to collaborate and conduct R&D
6.2.2.	Consistent policies	medium	Medium	High	High	Better coordination to implement policies on R&D to support the achievement of national economic growth
6.2.3.	Increasing R&D funding	medium	High	High	High	Educating the public to secure government and parliament commitment to increase R&D funding up to 1% GDP by 2025
6.2.4.	Channeling government funds effectively	medium	Medium	High	High	Pilot program to implement new funding mechanism allowing more flexible fund channeling
6.3.	**DGHE**					
6.3.1.	Developing autonomous universities	short	Low	High	medium	Securing university autonomy through the implementation of policies and regulations that are in line with such a spirit
6.3.2.	Improving universities in the Eastern region	medium	Low	High	medium	Maintaining government and parliament commitment to improve universities in the Eastern region; developing capacity building program through twinning; creating conducive business atmosphere and infrastructure in Eastern region

	Strategy	Time frame	Probability of Failure	Impact	Risk	Possible Mitigation Action
6.4.	**Creating better information and strategies**					
6.4.1.	Improving the information base in DGHE on UIG	short	Low	High	Medium	Enhance DGHE units' ability to provide information through better implementing higher education database (PDPT)
6.4.2.	Strategy for promoting high value added industry and industrial innovations	short	Medium	Medium	Medium	Establish and implement policy and regulations that provide incentive for industry R&D
6.4.3.	Strategy for capacity building in biological research	short	Medium	Medium	Medium	Establish program and R&D roadmap for biological research; (2) Provide assistance for universities to develop their technical and managerial capacities

6.4 Follow-up Actions for Creating Better Information and Strategies

Our study identified several important gaps in information, which makes it difficult to monitor progress and develop more specific strategies. Three areas described below require particularly urgent attention on the part of the government.

6.4.1 Improving Information base in DGHE on UIG

Our study found there to be no comprehensive data or information at the national level to use in gauging the level of university engagement in UIG partnerships. For UIG partnerships to become an important policy objective, it is essential for the government to develop a better information base to monitor progress. The first step is to change financial reporting requirements in order that 'contract and grant revenues' can be separated both by nature of incomes, separating R&D contracts and grants from other incomes, and by source, separating DGHE sources from other government sources and from industry sources. Steps to develop such an information base can be taken immediately, though it may take some time for the quality of information to become adequate.

One viable method of improving information is to conduct a periodic and repeated survey of all public institutions and select a good sample of private institutions (perhaps selected on the basis of their excellence in accreditation). This is the route taken by the UK universities for which an annual survey helps create viable metrics for them to work better with industry and community. For Indonesian universities, such an effort will have an added value of informing university communities about valuable activities, including setting up support offices, providing better incentives for academics and developing specific arrangements to work with local industry. Surveys will be expected to include significant qualitative components, to ensure that they go well beyond 'bean counting', and to be conducted perhaps every five years.

6.4.2 Strategy for Promoting High Value Added Industry and Industrial Innovations

There is a significant concern about the lack of industrial interest in both R&D and moving to a higher value added production. From various industry representatives, we gained the impression that providing tax incentives on R&D and developing a better environment for intellectual property are not simple tasks. Instead, there is a much broader issue of 'incentive structures' that results from a wide range of industrial policies. It is also the case that while many 'believe' that there are hardly any R&D in industry, there is paucity of information about the true state of industry-based R&D. Our own interview revealed that industry consists of a wide range of sectors conducting something like R&D. These sectors range from food processing, defense, palm and cocoa plantation, to pharmaceutical industry. To develop proper strategies, it is essential that a much more comprehensive study is conducted to capture the changing state of industrial R&D and their constraints.

6.4.3 Strategy for Capacity Building in Biological Research

An important subset of Indonesia's future innovations will have to do with research on the country's rich biological resources. It is not clear that sufficiently focused efforts have been made to upgrade biological research capacity in Indonesia. These efforts are urgently needed, given the way in which biological sciences are changing rapidly around the world today. One possible step will be to conduct an expert commission on the capacity building of biological research, involving international experts, to develop a national strategy and an investment program.

6.5 Proposed Funding Programs

In financing UIG programs, the government should not be the only source of funding. Indeed, universities should be encouraged to raise funds from multiple sources for developing relevant research and education capacity building. Fundraising is a powerful mechanism to align university capacity, societal and industrial needs because when universities ask for funding, sponsors naturally demand explanations as to why the money is needed and what it will be used for. For instance, many countries use endowed chairs for professorships as an extremely useful mechanism for creating new academic positions designated to specific fields of key relevance to industry/society. A certain proportion of government funding of UIG should be made conditional upon matching funds from industry.

In the grant schemes offered, DGHE and MoRT have implemented quite a few different ideas, including several ongoing programs that encourage team level research collaboration with industry, entrepreneurship centers and centers of excellence. First, we recommend making existing grant programs much more usable, as outlined above in the section about fund channeling.

We believe that the most urgent need is to promote a new culture of industrial engagement and relevance among universities by reintroducing competitive funding. Using competition is important as it provides incentives for institutions to innovate. The specific requirement that proposals for all programs be developed in consultation with industrial stakeholders and government officials will also help push collaborative planning for institutional development.

6.5.1 Capacity Development Grants

6.5.1.1 Programs description

Some funding programs can be started immediately. We recommend a certain sequencing of grant programs to ensure effective preparation and implementation, as elaborated in the following section. We recommend the following types of programs:

a) Individual level – short-term fellowships (up to 12 months). It is critically important to provide opportunities for individuals to have first-hand experience across sectors, particularly during the early formative years of their careers, so that they gain insight which they would otherwise not have as university academics or industry experts. To this end, two types of program are recommended:
   - Program-1: Pre-PhD exploration grants for students to have a short-term exposure to local industry before going abroad to undertake PhD study. The size of these grants should not exceed IDR 40 million per person per year.
   - Program-2: Industry university exchange for young academics to have one or two short stint internships in local industries, or for industry staff to have a short-term R&D assignment in a university to develop specific expertise or to undertake projects. The size of these grants could be up to IDR 40 million per person per year.

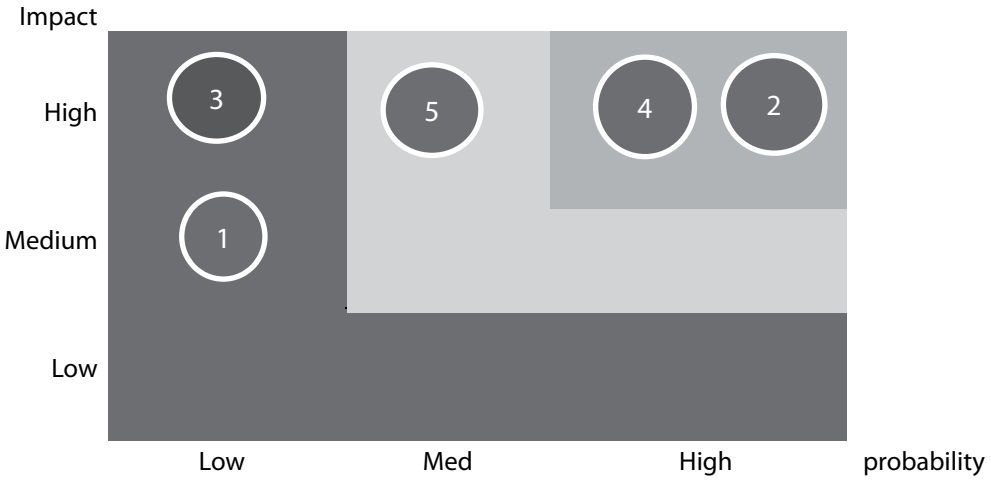
b) Institutional level grants would include:
   - Program-3: Small proposal development grants to be given to units for developing full institutional development plans and proposals to become better linked with local industry needs. Funding support will be given to personnel (time support) for conducting systematic interviews with local industry, examinations of different options and feasibility studies. The size of these grants should not exceed IDR 200 million and should last for 6-10 months. This program actually 'funds' the development of 'full proposals', which are then eligible for funding under Programs 4 and 5. The preparation of detailed guidelines for pre-proposal development of this program and the establishment of review mechanisms involving industrial experts can start immediately. The pre-proposal solicitation process and award will begin as early as 2013.

Table 6.2: Recommended new funding programs for UIG

	Program/grant	Fiscal	Beneficiary year	Type of grant	Objective	Duration	IDR	Eligible components
1	Pre-PhD fellowship	2015	Individual S2	Competitive	Provide support for S2 staff to find relevant R&D topics in industries for his/her S3 study	< 12 mos	< 40 million	Fellowship for internship, small R&D grants, additional training
2	Industrial fellowship	2015	Individual	Competitive	Provide support for exchange: academics work in industries or industrial R&D staff work in universities	< 12 mos	< 40 million	Fellowship for internship, small R&D grants, additional training
3	Developing strategy for institutional UIG partnership	2013	Unit, Lab., Dept., Faculty	Proposal based	Seed money for developing strategy	1-2 yrs	< 200 million	Domestic technical assistance, travel, training, workshop
4	Strengthening UIG support facilities	2014	Unit, Lab., Dept., Faculty,	Competitive	Strategy development, staff training, workshop, technical assistance	1-2 yrs	< 200 million	Technical assistance, travel, training, workshop
5	Capacity development grant for UIG partnership	2014-2018	university Unit, Lab., Dept., Faculty	Competitive, proposal based	Tiered grant support for units for improving capacity to work with industry in education and research	3-5 yrs	15-20 billion	Pre-PhD fellowships, domestic and international graduate fellowships, R&D grant, technical assistance, travel, twinning program, laboratory equipment, industrial exchange

Table 6.3: Risk and impact assessment of the recommended funding programs[19]

	Program	Time frame	Probability of Failure	Impact	Risk
1	Pre-PhD fellowship	Medium	Low	High	Medium
2	Industrial fellowship	Medium	High	High	High
3	Developing strategy for institutional UIG partnership	Short	Low	High	Medium
4	Strengthening UIG support facilities	Medium	Medium	High	High
5	Capacity development grant for UIG partnership	Medium	Medium	High	High



- Program-4: UIG support facilities grants to be given to institutions with a plan to upgrade or create administrative support units for better UIG partnerships (see Annex V). These could include corporate relations or industrial liaison offices, technical transfer offices, entrepreneurship centers, science park planning and management and incubation support. Funding support could be given for expenditures such as professional staff recruitment/training, short-term experts, equipment and facilities and studies. The size of the grant should not exceed IDR 200 million and should last for 2-3 years.
- Program-5: Capacity development grant for UIG partnership to be given to institutions to develop centers of excellence in a field relevant to the target industry, which may be local/regional for most universities, and national/international for some institutions. Any successful proposals must demonstrate involvement and support of local industries and government. Funding support will be given for, among others, staff training/scholarships, research grants, laboratory equipment, twinning arrangement, short-term experts and other facilities. The size of the grant should not exceed IDR 15-20 billion and should last for 3-5 years. A detailed description of this program is presented in Annex IV of this report. Grantees in this program are grouped into the following 3 tiers based on the following aspirations:

19 Mitigation actions are presented in section 6.5.1.2 and 6.5.2

- Tier 1: those aspiring to work with local (or potentially local) industry and government to provide relevant undergraduate and diploma level education;
- Tier 2: those aspiring to work with local (or potentially local) industry and government to develop strategic R&D capacity to address emerging or future industrial needs of regions; and
- Tier 3: those aspiring to work with national and international industry and government to develop S2 and S3 programmes relevant to industry so that they can contribute to R&D capacity development of industry.

We expect that the capacity development grants for UIG partnership (program-5) will be jointly supported by the government fund and by contributions from local industries and government. To ensure the organizational accountability and capacity to create interdisciplinarity, it may be worth developing new units/organizations, akin to Fraunhoffers in Germany, to interface university work with industry, with a separate governing structures, such as a governing board established to monitor the implementation of grant related activities. The institutional arrangement shall be done in such a way that the financial management is in compliance with the prevailing regulation. At the same time, these arrangements should provide sufficient flexibility to allow for the implementation of the program (see section 6.5.2).

A piloting exercise will ascertain the needs of Tier II institutions with identification through open solicitation of interest to participate in the pilot phase. Special invitations should be given to the following potential candidates identified by this study:

- CSP (Cocoa Sustainability Partnership) in Makassar with *Universitas Hasanuddin* as its anchor;
- There were other possible candidates identified by our study, such as *UNAND, ITB, UI* and *UGM*, but we have not yet had the opportunity to explore and deepen our analysis.

6.5.1.2 Necessary Steps in Preparing UIG Grant Programs

The abovementioned programs, as well as Annex IV and V, provide a blueprint for capacity development grants, the details of which will need further elaboration for implementation. One aspect which requires particular attention during the preparation stage is the design of potential technical assistance as well as twinning arrangements to be provided to weaker institutions.

While we expect Tier 3 institutions to be able to identify their own technical assistance needs as well as potential foreign collaborators as part of the proposal development, we are less certain of such prospects for either Tier 1 or 2 institutions. For Tier I institutions, we expect structured technical assistance to be needed during the whole proposal preparation process as well as implementation. We expect that technical assistance will be available nationally, and that twinning arrangements will be less problematic than when they are done domestically.

For Tier 2 institutions, the issue is slightly more complex, as the need for applied research capacity calls for the involvement of international experts and twinning arrangements. It is also not clear how well 'local collaborative discourses' will work across three sectors to identify the focal areas of research capacity to be developed. Therefore, we suggest some form of piloting exercise involving several potential candidate institutions to tighten the program design to meet the reality.

In selecting pilot elements, we recommend a simple open process of pre-proposal solicitation from eligible institutions, for which they are required to indicate:
a) the expected area where they want to develop their research capacity,
b) the rationale, and
c) the track record of work with industry and local government

Our study has identified a couple of potential candidates for such pilots who might be included in the pre-proposal solicitation. However, they could not be directly selected as pilot as our study was by no means comprehensive, and we have no idea the extent to which these elements are representative. The open pre-proposal solicitation process has an added value of providing a better national picture of the state of UIG partnerships in Eastern islands.

Fellowships to be awarded for individuals look simple, but their implementation entails two issues:
(a) the extent of 'subsidy' to the industries in accepting young academics/graduates or for sending their employees to universities; and
(b) the worthiness of beginning to 'invest' in such activities without any institutional readiness.

While it is possible to start such programmes on a small experimental basis, a simpler option is to start supporting such activities as part of institutional grants for capacity development, and to gradually develop separate programmes for them as experience grows nationally.

6.5.2 Institutional Arrangements for Channelling UIG Partnership Grants

We believe that government funding to encourage UIG partnerships with universities should be channeled through institutional arrangements, the input of which reflects the input of the industry. For instance, a significant funding program may have a high level decision-making board including industrial leaders whose views are reflected in the strategic directions and design of funding programmes. Industrial representatives may also become key members in 'selection commissions' and take part in the review of grant proposals.

In the short to medium term, however, it is not easy for government agencies to identify individuals who are suitable for undertaking such functions. We therefore recommend that the design and implementation of the above capacity development grant programs be actively used to identify such candidates, by engaging multiple industries both during program preparation as well as piloting and implementation. The cultural change programs is suggested to be initiated by DGHE, but with a concerted effort towards ensuring that industrial views are solicited in: (a) program design through individual consultation with industrial experts; (b) selection, monitoring and evaluation by experimental engagement with industrial experts; and (c) individual grant proposals, through the requirement that universities cannot submit proposals without consulting the stakeholder industry.

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Appendix A: Projection of self generated revenue in 2012 in IDR billion [Dikti, 2012]

BHMN	Sources of revenue			Total self generatedrevenue	Percentage of contract
	Student	Contract	Others		
INSTITUT PERTANIAN BOGOR	322,240	0	0	322,240	0.00%
INSTITUT TEKNOLOGI BANDUNG	590,021	123,850	42,736	756,607	16.37%
UNIVERSITAS AIRLANGGA	293,162	72,788	1,990	367,940	19.78%
UNIVERSITAS GAJAH MADA	709,735	100,000	213,645	1,023,380	9.77%
UNIVERSITAS INDONESIA	891,975	125,973	61,172	1,079,120	11.67%
UNIVERSITAS PENDIDIKAN INDONESIA	302,037	0	0	302,037	0.00%
UNIVERSITAS SUMATERA UTARA	399,603	25,300	19,372	444,275	5.69%
TOTAL BHMN	**3,508,774**	**447,911**	**338,915**	**4,295,600**	**10.43%**
BLU					
UNIVERSITAS NEGERI JAKARTA	121,743	15,183	148	137,074	11.08%
UNIVERSITAS PADJADJARAN	494,428	29,534	113,177	637,139	4.64%
UNIVERSITAS DIPONEGORO	317,046	58,207	30,774	406,027	14.34%
UNIVERSITAS NEGERI SEMARANG	86,175	6,246	22,053	114,474	5.46%
UNIVERSITAS SEBELAS MARET	193,725	-	34,884	228,608	0.00%
UNIVERSITAS JENDERAL SOEDIRMAN	116,136	30	3,468	119,634	0.03%
UNIVERSITAS NEGERI YOGYAKARTA	139,305	11,000	18,485	168,790	6.52%
INSTITUT TEKNOLOGI SEPULUH NOPEMBER	150,599	73,677	23,249	247,526	29.77%
UNIVERSITAS NEGERI SURABAYA	117,098	43,676	7,188	167,961	26.00%
UNIVERSITAS BRAWIJAYA	232,380	171,275	44,783	448,438	38.19%
UNIVERSITAS NEGERI MALANG	147,082	81,426	21,476	249,984	32.57%
UNIVERSITAS ANDALAS	165,232	327	28,567	194,125	0.17%
UNIVERSITAS RIAU	146,766	-	1,050	147,816	0.00%
UNIVERSITAS SRIWIJAYA	209,497	6,520	12,233	228,250	2.86%
UNIVERSITAS LAMPUNG	90,818	-	4,082	94,900	0.00%
UNIVERSITAS MULAWARMAN	127,070	4,210	17,527	148,808	2.83%
UNIVERSITAS HASANUDDIN	185,056	70,000	4,944	260,000	26.92%
UNIVERSITAS HALU OLEO	54,670	1,200	2,146	58,015	2.07%
UNIVERSITAS BENGKULU	82,789	-	1,945	84,734	0.00%
UNIVERSITAS TERBUKA	1,265,590	-	2,485	1,268,075	0.00%
UNIVERSITAS NEGERI GORONTALO	33,126	-	900	34,026	0.00%
TOTAL BLU	**4,476,331**	**572,511**	**395,563**	**5,444,406**	**10.52%**

Appendix B: Budget channeled as block to be competed internally for research in IDR [Dikti, 2012]

	Public university[20]	Alloated for research	Total budget	Percentage
1	INSTITUT TEKNOLOGI SEPULUH NOPEMBER	4,275,450,000	591,524,822,000	0.72%
2	UNIVERSITAS ANDALAS	1,652,244,000	561,552,706,000	0.29%
3	UNIVERSITAS BENGKULU	753,500,000	225,753,396,000	0.33%
4	UNIVERSITAS BRAWIJAYA	4,142,500,000	835,655,163,000	0.50%
5	UNIVERSITAS DIPONEGORO	1,934,500,000	724,023,293,000	0.27%
6	UNIVERSITAS HALU OLEO	1,199,250,000	246,652,997,000	0.49%
7	UNIVERSITAS HASANUDDIN	3,370,000,000	1,054,199,744,000	0.32%
8	UNIVERSITAS JENDERAL SUDIRMAN	1,401,551,000	321,038,910,000	0.44%
9	UNIVERSITAS LAMPUNG	1,531,007,000	306,508,921,000	0.50%
10	UNIVERSITAS MULAWARMAN	517,500,000	305,967,560,000	0.17%
11	UNIVERSITAS NEGERI GORONTALO	507,750,000	291,994,149,000	0.17%
12	UNIVERSITAS NEGERI JAKARTA	740,000,000	500,069,572,000	0.15%
13	UNIVERSITAS NEGERI MALANG	1,325,249,000	438,697,295,000	0.30%
14	UNIVERSITAS NEGERI SEMARANG	1,590,250,000	424,733,134,000	0.37%
15	UNIVERSITAS NEGERI SURABAYA	1,049,000,000	490,985,799,000	0.21%
16	UNIVERSITAS NEGERI YOGYAKARTA	1,215,000,000	367,770,896,000	0.33%
17	UNIVERSITAS PAJAJARAN	4,995,984,000	1,101,278,672,000	0.45%
18	UNIVERSITAS RIAU	955,500,000	349,132,674,000	0.27%
19	UNIVERSITAS SEBELAS MARET	5,221,500,000	657,733,338,000	0.79%
20	UNIVERSITAS SRIWIJAYA	1,362,762,000	444,918,657,000	0.31%
21	UNIVERSITAS TERBUKA	247,500,000	1,423,810,394,000	0.02%
22	INSTITUT PERTANIAN BOGOR	4,352,750,000	630,204,212,000	0.69%
23	INSTITUT TEKNOLOGI BANDUNG	5,433,400,000	840,737,456,000	0.65%
24	UNIVERSITAS AIRLANGGA	4,789,000,000	670,248,086,000	0.71%
25	UNIVERSITAS GAJAH MADA	6,304,000,000	1,503,445,727,000	0.42%
26	UNIVERSITAS INDONESIA	6,304,000,000	1,932,098,130,000	0.33%
27	UNIVERSITAS PENDIDIKAN INDONESIA	1,407,410,000	480,140,259,000	0.29%
28	UNIVERSITAS SUMATERA UTARA	1,665,405,000	673,050,711,000	0.25%
	TOTAL BLU	**39,987,997,000**	**11,664,002,092,000**	
	TOTAL BHMN	**30,255,965,000**	**6,729,924,581,000**	
	GRAND TOTAL	**70,243,962,000**	**18,393,926,673,000**	

20. No 1-21 are universities with *BLU* status, whilst No 22-28 are autonomous universities (*BHMN*)

Appendix C: List of universities conducting tracer studies in the I-MHERE project

1	Universitas Trunojoyo
2	Politeknik Negeri Bali
3	Universitas Malikussaleh
4	Universitas Negeri Makassar
5	Universitas Padjadjaran
6	Institt Pertanian Bogor
7	Politeknik Manufaktur Bandung
8	Universitas Negeri Malang
9	Universitas Airlangga
10	Universitas Pendidikan Indonesia
11	Universitas Bengkulu
12	Universitas Islam Malang
13	Universitas Riau
14	Politeknik Pertanian Pangkep
15	Politeknik Perkapalan Surabaya
16	Universitas Negeri Padang
17	Universitas Syiah Kuala
18	Universitas Udayana
19	Universitas Gadjah Mada

Appendix D: Government budget for R&D in 2012 (IDR)

		Budget Allocation
A	Allocation for Ministry of Research and Technology and Other National science and technology Institutions	
	Ministry of Research and Technology	672,266,000,000
	LIPI	727,928,300,000
	LAPAN	547,120,700,000
	BATAN	659,374,100,000
	BPPT	851,620,400,000
	BAPETEN	84,217,900,000
	BSN	97,996,500,000
	TOTAL	**3,640,523,900,000**
B	Allocation for Ministries and State Institutions to Support the Development science and technology and Engineering	
	Ministry of Energy and Mineral Resources	671,991,100,000
	Ministry of Transportation	207,047,400,000
	Ministry of Health	460,274,600,000
	Ministry of Health	266,339,000,000
	Ministry of Maritime Affairs and Fisheries	536,913,500,000
	Ministry of Public Works	419,822,000,000
	Ministry of Communication and Informatics	163,690,700,000
	Ministry Education and Culture (DGHE – Research and Community Services	693,700,000,000
	TOTAL	**3,419,778,300,000**
C	Allocation for Ministries and State Institutions for Supporting Policy Formulation	
	Ministry of Education and Culture	1,304,538,200,000
	Ministry of Internal Affairs	6,347,500,000
	Ministry of Defense	143,810,700,000
	Ministry of Justice and Human Rights	2,026,700,000
	Ministry of Finance	447,612,500,000
	Ministry of Religious Affairs	595,646,000,000
	Ministry of Labors and Transmigration	7,105,800,000
	Ministry of Social Affairs	187,157,500,000
	Ministry of Trade	4,456,000,000
	National Police	5,852,200,000
	National Population and Family Planning Board	8,044,000,000
	TOTAL	**3,002,597,100,000**
D	**GRAND TOTAL (A+B+C)**	**10,062,899,300,000**

Appendix E: Patents produced and publications by universities

DGHE's supported patent applications in 2011 [DGHE, 2012]

Universities	Patent granted
Institut Pertanian Bogor	35
Institut Teknologi Bandung	28
Universitas Brawijaya	14
Universitas Gadjah Mada	11
Universitas Sriwijaya	10
Institut Teknologi Sepuluh Nopember	6
Universitas Hasanuddin	5
Universitas Negeri Semarang	4
Institut Teknologi Nasional	3
Universitas Negeri Yogyakarta	3
Politenik Negeri Semarang	2
Politeknik Negeri Bandung	1
Universitas Indonesia	1
Universitas Mercu Buana - Yogyakarta	1
Universitas Syah Kuala	1
Universitas Widya Gama - Malang	1
TOTAL	**126**

Number of Scientific Articles in Scopus Index

Rank	University	Location	Number of Document
1	Institut Teknologi Bandung	Bandung	2491
2	Universitas Indonesia	Jakarta	2280
3	Universitas Gadjah Mada	Yogyakarta	1375
4	Institut Pertanian Bogor	Bogor	977
5	Institut Teknologi Sepuluh November	Surabaya	597
6	Universitas Diponegoro	Semarang	458
7	Universitas Airlangga	Surabaya	440
8	Universitas Padjadjaran	Bandung	417
9	Universitas Hasanuddin	Makassar	380
10	Universitas Brawijaya	Malang	313
11	Universitas Udayana	Denpasar	295
12	Universitas Andalas	Padang	291
13	Universitas Syiah Kuala	Banda Atjeh	266
14	Universitas Lampung	Bandar Lampung	166
15	Universitas Sam Ratulangi	Manado	137
16	Universitas Sumatera Utara	Medan	135
17	Universitas Trisakti	Jakarta	112
18	Universitas Kristen Petra	Surabaya	109
19	Universitas Sriwijaya	Palembang	109
20	Universitas Riau	Pekanbaru	107

	Name	Title	Organization
INDUSTRY			
1	Boen Setiawan	Chairman	PT Kalbe Farma
2	Erik Ridwan Santoso	President Director	PT Sanco Indonesia
3	Kamaluddin Zarkasie	Vice President Director	PT IPB - Sigata Animal Pharmaceuticals
4	Mochtar Riady	Chairman	Lippo Group
5	Maya Ludong	Director	CV Trikora Home Industries, Manado
6	Jos Luhukay	Director of Technology	National Banking Association (Perbanas)
7	Mohammad Nadjikh	President Director	PT Kelola Mina Laut
8	Adik A. Soedarsono	President Director	PT Pindad
9	Noel Janetski	Immediate past President Director	PT EFM, MARS Incoporated, Cocoa Industries
10	Christian P. Somali	Corporate Communication Division	PT Indofood Sukses Makmur
11	Nurulita Novi Arlaida	Corporate Public Relations Manager	PT Indofood Sukses Makmur
12	Stefanus Indrayana	GM Corporate Communications	PT Indofood Sukses Makmur
13	Ahmad Firdaus	Director	PT Ecomindo Saranacipta
14	Nike Farida Poespitarini	Director of Human Capital, General Affairs, Legal & System Development	PT Katim CT Agro
15	Tony Hermawan	Immediate past VP	PT Astra Agro Lestari
CENTRAL GOVERNMENT			
16	Kokok Haksono	Chairman	Polytechnic Education Development Unit
17	Sangkot Marzuki	Director	Eijkman Institute
18	Nizam	Secretary Board of Higher Education	DGHE
19	Dadang Sudiyarto	Head of Planning	DGHE
20	Tatang A. Taufik	Deputy for Assessment of Technology Policy	BPPT
21	Derry Pantjadarma	Director for Assessment of Competitiveness Policy	BPPT
22	Dading Ahmad Gunadi	Assistant to the Deputy for Relevance of Research in S&T	MoRT
23	Agus Subekti	Director of Research and Community Service	DGHE
24	Subandi Sardjoko	Director Education and Religion	Bappenas
25	Illah Sailah	Director of Learning and Student Affairs	DGHE
26	Bambang Indriyanto	Head, Center for Policy Studies	R&D MoEC
27	Mesdin Kornelis Simarmata	Director, Science d Technology, Industry, and State Enterprises	Bappenas
28	Usman Ch. Warsa	Board of Higher Education	DGHE
29	A.A. Ma'tjiek	Board of Higher Education	DGHE
30	Mahdiansyah	ACDP Team	MoEC
31	Sabar Budi Rahardjo	ACDP Team	MoEC

	Name	Title	Organization	
INTERNATIONAL ORGANIZATION				
32	Sutarum Wiryono	Project Officer	ADB	
33	Wolfgang Kubitzky	Principal Social Sector Economist	ADB	
34	Destriani Nugroho	Project Officer	EU – Delegation	
35	Kay Ikranegara	USAID/HELM		
36	Siwage Negara	The World Bank		
37	Christopher J. Smith	The World Bank		
ACDP				
38	Alan Prouty	Team Leader	ACDP	
39	Abdul Malik	Core Advisory Group	ACDP	
40	David Harding	Core Advisory Group	ACDP	
41	John Virtue	Core Advisory Group	ACDP	
42	Basilius Bengoteku	Program specialist	ACDP	
PUBLIC UNIVERSITY				
43	Mohammad Nurdin	Vice Director for Business and partnership	Politeknik Manufaktur Bandung	
44	Suharyadi Pancono	Vice Director for Academic Affairs	Politeknik Manufaktur Bandung	
45	Armyn Langie	Professor	Department of Electrical Engineering	ITB
46	IGA Wenten	Professor	Department of Chemical Engineering	ITB
47	Heru Wibowo Poerbo	Professor	Department of Architecture	ITB
48	Intan Ahmad	Professor	School of Life Science and Technology	ITB
49	Bagiono	Professor	Department of Chemical Engineering	ITB
50	Tutus Gusnidar	Professor	School of Pharmacy	ITB
51	IB Ardhana	Lecturer	Department of Engineering Physic	ITB
52	Trio Adi	Lecturer	Department of Electrical Engineering	ITB
53	Sri Widiantoro	Dean	Faculty of Earth Sciences and Petroleum Eng	ITB
54	Tutuka Ariadji	Vice Dean Academic Affairs	Faculty of Earth Sciences and Petroleum Eng	ITB
55	Eddy Agus Basuki	Vice Dean Resources	Faculty of Earth Sciences and Petroleum Eng	ITB
56	Budi Isdianto	Head	Research Center for Cultural Product and Environment	ITB
57	Srihadi	Dean	Faculty of Veterinary Sciences	IPB
58	Anas D. Susila	Director	ADC	IPB
59	Djoko S. Pamungkas	Director	Primate Center	IPB
60	Lilis Nuraida	Deputy Director	Seafast Center	IPB
61	Nuri Andarwulan			IPB
62	Dyah Iswartini		Biopharmaca	IPB
63	Damayanti Buchori	Lecturer	Biology	IPB

	Name	Title	Organization	
64	Aman Wirakartakusumah	Professor	Food science	IPB
65	T. Basaruddin	Dean	Faculty of Computer Science	UI
66	Abdul Muthalib	Director	Computer Science Center	UI
67	Widijanto S. Nugroho	Lecturer	Faculty of Computer Science	UI
68	Mirna Adriani	Vice Dean	Faculty of Computer Science	UI
69	Yugo K. Isal	Secretary	Faculty of Computer Science	UI
70	M. Ivan Fanany	Researcher	Faculty of Computer Science	UI
71	Hisar Maruli Manurung	Lecturer	Faculty of Computer Science	UI
72	Wisnu Jatmiko	Lecturer	Faculty of Computer Science	UI
73	Zainal A. Hasibuan	Professor	Faculty of Computer Science	UI
74	Yusril Yusuf	Research Institute		UGM
75	Lilik Sutiarso	Dean	Faculty of Agriculture and Technology	UGM
76	Wahyu Supartono	Researcher	Faculty of Agriculture and Technology	UGM
77	Ali Agus	Dean	Faculty of Animal Science	UGM
78	Cahyono Agus	KP4	Faculty of Forestry	UGM
79	Gede Bayu Suparta	Dept of Physics	Faculty of Mathematics and Natural Sciences	UGM
80	Alva Edi Tontowi	Dept of Mechanical and Industrial Engineering	Faculty of Engineering	UGM
81	Sutiman B. Sumitro	Professor	Faculty of Agriculture	UB
82	Djoko Agus Purwanto	Research Institute	UNAIR	
83	Niniek Fajar Puspita	Research Institute	ITS	
84	Dadet Pramadihanto	Director	PENS	
85	Eddy Rasyid	Professor	Faculty of Economics	Unand
86	Dedie Tooy	Researcher	Faculty of Agriculture	Unsrat
87	Jane Onibala	Researcher	Faculty of Animal Husbandary	Unsrat
88	Robert Molenaar	Vice Dean for Academic Affairs	Faculty of Agriculture	Unsrat
89	Arie Lumenta	Researcher	Faculty of Engineering	Unsrat
90	Erny Nurali	Researcher	Faculty of Agriculture	Unsrat
91	Meis Jacinta Nangoy	Researcher	Faculty of Animal Husbandary	Unsrat
92	Jefferson Longdong	Researcher	Faculty of Engineering	Unsrat
93	Romels Lumintang	Researcher	Faculty of Engineering	Unsrat
94	Mulyadi Bur	Professor	Deapartment of Mechanical Engineering	Unand
95	Zaidir	Professor	Deapartment of Civil Engineering	Unand
96	Henmaidi	Researcher	Deapartment of Industrial Eng.	Unand
97	Ramdan Panigoro	Director of Cooperation	Faculty of Medicine	UNPAD
98	Rina Indiastuti	Vice Rector for Finance And Administration	Faculty of Economics	UNPAD
99	Agung Kurniawan	Researcher, Plant Breeding	Faculty of Agriculture	UNPAD
100	Setiawan	Researcher	Faculty of Medicine	UNPAD
101	Arief Anshory Yusuf	Director, Center of Economic Development	Faculty of Economics	UNPAD
102	Miranda Misang Ayu	Head of IPR	Faculty of Law	UNPAD
103	Abdul Madjid Sallatu	Development Economics	Faculty of Economics	UNHAS

	Name	Title	Organization	
104	Deddy Tikson	Department of Sociology	Faculty of Social and Political Sciences	UNHAS
105	Sikstus Gusli	Department of Agronomics	Faculty of Agriculture	UNHAS
106	Salengke	Department of Agronomics	Faculty of Agriculture	UNHAS
107	Baharuddin Hamza	Department of Architecture	Faculty of Engineering	UNHAS
108	Elyas Palantel	Department of Electrical Engineering	Faculty of Engineering	UNHAS
109	Junaedi Muhidong	Department of Agronomics	Faculty of Agriculture	UNHAS
PRIVATE UNIVERSITY				
110	Stevanus Hadi Darmadji	Vice Rector Finance and resource development	Universitas Surabaya	
111	Nemuel Daniel Pah	Vice Rector Academic Affairs	Universitas Surabaya	
112	Joniarto Parung	Rector	Universitas Surabaya	
113	Yoan Nursari Sianjuntak	Institute of Research and Community Service	Universitas Surabaya	
114	Adi Tedjakusuma	Office of International Affairs	Universitas Surabaya	
115	Andreas Alfianto	Lecturer	Universitas Surabaya	
116	Dina Natalia Prayogo	Department of Industrial Engineering	Head	
117	Gunawan Tjahyono	Rector	Universitas Pembangunan Jaya	
118	Andre Sugijopranoto SJ	Director	ATMI Surakarta	
119	Saryono	Chairman of the Foundation	INSTIPER Yogyakarta	
120	A Ayusrie	Vice Rector II	INSTIPER Yogyakarta	
121	Idam S. S.	Research and Community Service Institute	INSTIPER Yogyakarta	
122	Sri Gunawan	Faculty of Agriculture	INSTIPER Yogyakarta	
123	Ida Bagus Banyuso P.	Faculty of Agricultural Engineering	INSTIPER Yogyakarta	
124	Nita Ratna Juwita A	Vice Rector I	INSTIPER Yogyakarta	
125	Purwadi	Rector	INSTIPER Yogyakarta	
126	Harjanto Prabowo	Rector	Universitas BINA NUSANTARA	
127	Iman H. Kartowisastro	Vice Rector I	Universitas BINA NUSANTARA	
128	Boto Simatupang	Vice Rector IV	Universitas BINA NUSANTARA	
129	Melly	Vice Rector II	Universitas BINA NUSANTARA	
130	Stephen G. Kurnia	Institute for Development of Collaboration	Universitas BINA NUSANTARA	
131	Lily Manoharan	International Collaboration Specialist	Universitas BINA NUSANTARA	

	Name	Title	Organization	
STUDY TRIP				
132	Jeong Guon Ih	Chair, Department of Mechanical Engineering	Korea Advanced Institute of Science and Technology (KAIST)	
133	J.M. Bae	Professor	Department of Mechanical Engineering	KAIST
134	Seung Bin Park	Dean	College of Engineering	KAIST
135	Lu Xiao Jun	Deputy Director, UICC	Tsinghua University	
136	Chen Hongbo	Vice President	TusPark	
137	Wei Zhang	Vice Chair, Department of Industrial Engineering	Tsinghua University	

Annex I: Paper prepared for the 10th Triple Helix Conference 2012

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University, Industry, and Government partnership: its present and future challenges in Indonesia[21]

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Abstract

This paper presents the current situation of the university – industry – government partnership in Indonesia, in the context of university readiness to contribute to the government strategy for economic development as outlined in the recent *MP3EI (Masterplan for Acceleration and Epansion of Indonesia Economic Development)* 2011-2025. Since the higher education system is highly diversified in term of its capacity to contribute to the *MP3EI*, the paper reviews the current status in terms of three different types of institutions: research oriented, production oriented, and human resources development oriented ones.

Initial finding shows that the government allocated very small budget for research (0.08% of GDP) and universities play a critical role in the national research capacity. Although research is still considered as very low in the government priority setting, the number of patents and international publications have significantly increased in the last few years. Collaborative activites have been carried out to date include, service and training, patenting, collaborative R&D, networking events, industrial collaboration for education, incubators, SME support, and science parks.

University and industry appear to be still in the state of *"institutional sphere"* instead of *"consesus space"* lacking understanding about each other. The uncertainty about institutional framework available for universities drives academics to develop partnership with industries individually instead of institutionally. Universities feel that there are only few domestic companies with interest and/or capacity to innovate, with the bulk of industry concentrated in assembly operations. Implementatio of *MP3EI* outside Jawa might require expertise and capacity that are only available in institutions in Jawa, that it is essential to develop mechanisms for building local institutional capacity.

We conclude that all three institutional spheres require further development before each can take purposeful action. Having said that, the study team found a number of cases whereby the three parties are willing, even eager, to develop partnerships. With an appropriate and comprehensive strategy, there is significant potential to create productive environment potentials could be developed into knowledge, consensus, and innovation space.

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1 Introduction

Today, it is widely accepted that higher education is critical for economic growth and national competitiveness. Excellence in scientific research and better linkages to industry and government are regarded as key policy priorities in practically all OECD countries, with more governments developing explicit innovation strategies with various support programs to encourage universities to take on greater economic roles. Emphasis on university-industry-government partnerships is a global trend not only in OECD countries, but also in emerging economies and increasingly in developing countries.

Indonesia is no exception in this respect. The government of Indonesia has just recently launched the *MP3EI (Masterplan for Acceleration and Expansion of Indonesia Economic Development)*, intended to drive the realization of high, balanced, fair and sustainable economic growth, through two key factors, i.e. acceleration and expansion [*MP3EI*]. Indonesia plans to accelerate its existing development programs, especially in boosting value adding of the prime economic sectors, increasing infrastructure development and energy supply, as well as the development of human resources as well as science and technology. Besides acceleration, the government also pushes for the expansion of economic development so that its positive effects can be felt not only at each and every region in Indonesia, but also by all components of the community across Indonesia. This economic development strategy requires a strong university, industry, and government (UIG) collaboration and partnership. The objective of this paper is to review the current status of universities[26] in Indonesia in terms of their capacity to contribute to this economic development strategy.

In this connection, we use the triple helix model as a framework for our analysis. Etzkowitz extended the triple helix model to describe the development of regional innovation systems (Etzkowitz 2002, Casas et al 2000). According to his model, the three separate institutional spheres, universities, industry and government, operate independently from each other initially. In the first stage of the development of regional innovation systems, the region develops a 'knowledge space', where knowledge institutions begin to concentrate certain R&D activities related to the region, with some networks emerging around them. In the second phase, the region develops a 'consensus space' where actors from three spheres begin work together to generate new strategies and ideas. In the third phase, the region develops a 'innovation space', in which new organizational mechanisms are developed or introduced to realize strategies developed in the previous stage.

The model has also been extended to describe the positioning of the UIG spheres with respect to each other. In a statist regime (Triple Helix I), government plays the lead role, driving academia and industry. In a laissez-faire regime (Triple Helix II), industry is the driving force, with the other two spheres as ancillary support structures [Etzkowitz and Marina, 2010]. In a knowledge-based society, university and other knowledge-producing institutions play an increasing role, acting in partnership with industry and government and even taking the leadership in joint initiatives, in a balanced model (Triple Helix III). In a university-led developmental model, the university takes the lead. The university is the gravitational center that intiates the partnership. In this case, the very first step to come to a productive partnership is to have a preliminary encounter with industry and the government.

The specific questions that we address in our endeavour to develop regional innovation systems across Indonesia in this paper are:

26 The term "universities" is used throughout this paper to represent all types of higher education institutions, i.e. university, institute, college (sekolah tinggi), academy, and polytechnics.

- What stage of development is Indonesia at in creating regional innovation systems?
- Can universities play a leading role in regional innovation systems as in triple helix III?

Our findings are based on a review of government documents, existing data within Directorate General of Higher Education (DGHE), and preliminary interviews with individuals and focus group representing key players from university, industry, as well as the government. When this paper was submitted, we have conducted in-depth interview sessions with 32 individuals and focus group meetings with 30 persons, and the number will keep growing throughout the study period.

Table-1: Number of interviewees in the study

Public universities	37
Private universities	3
Government officials	20
Industries	2

In order to explore the full scope of contributions of higher education institutions for *MP3EI*, the paper reviews the current status in terms of three different types of institutions: research oriented, production oriented, and human resources development oriented ones.

2 Indonesian higher education system: an overview

The higher education system in Indonesia does not have a long history, but today constitutes a very large and highly complex system, with more than 5.23 million students and gross enrolment ratio of 27.4% [DGHE, 2011]. There are 92 public institutions, more than 3,200 private institutions, dozens service institutions, 52 institutions under Ministry of Religious Affairs, and one Open University. The Masterplan for Acceleration and Expansion of Indonesia Economic Development (*MP3EI*) 2011-2025 sets 6 corridors for economic development, each with its own specific competitive and comparative advantages. The 6 economic corridors are 1) Sumatera, 2) Jawa, 3) Kalimantan, 4) Sulawesi and North Maluku 5) Bali, NTB, and NTT, and 6) Maluku and Papua [*MP3EI*, 2011]. The distribution of institutions and enrolment is not evenly distributed among the 6 economic corridors, as illustrated in table-2, that a different strategy is needed to foster the UIG partnership.

Table-2: Distribution of higher education institutions in the *MP3EI* corridors [Dikti, 2012]

	Public		Private	
Economic corridor	**Polytechnics**	**Higher education institutions**	**Polytechnics**	**Higher education institutions**
Sumatera	7	16	17	762
Jawa 9	23	68	1102	
Kalimantan	2	4	7	84
Sulawesi, North Maluku	4	8	6	336
Bali, NTB. NTT	5	6	11	151
Maluku, Papua	3	5	5	130
Total	**30**	**62**	**114**	**2565**

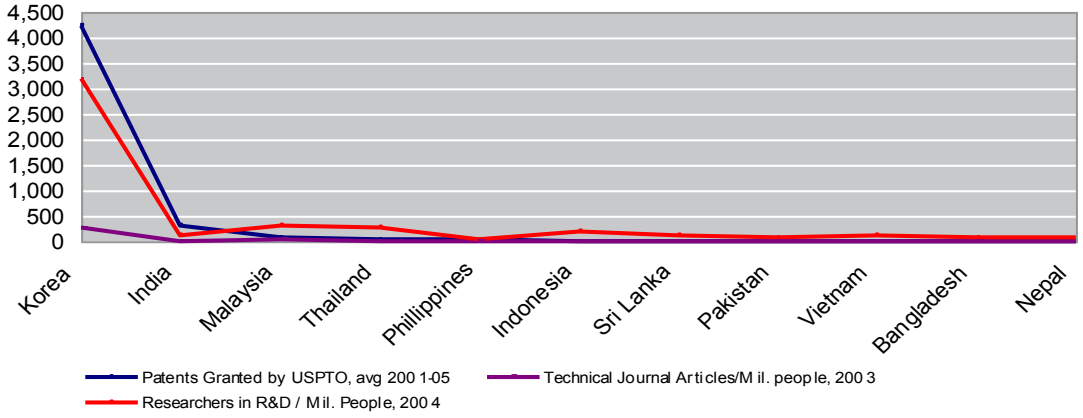
27 For private institutions: a) 2010 figure, and b) North Maluku is consolidated under corridor 6.

The circumstances around higher education funding have changed significantly in the past several years. With the 4th amendment of the Constitution by the Supreme Consultative Assembly (MPR) in August 2000 requiring 20% of the government budget to be allocated to the education sector, the level of funding has increased dramatically. In 2012 the allocated budget for Directorate General of Higher Education (DGHE) has reached IDR 32.6 trillion, almost three folds compared to the 2007 figure of IDR 12.9 trillion, as illustrated in table-3. However, there is considerable concern being expressed within the sector about the effectiveness of such funding increase. For instance, the level of investment increased almost 4 folds between 2007-2012, while the operation and maintenance only doubled. While the four fold increase of self-generated revenues raises the possibility that universities can supplement the shortfall of operation and maintenance from their own resources, the regulatory environment does not make flexible management of financial resources easy in public universities.

Table-3: Allocated budget for DGHE 2007-2012, in IDR trillion [Dikti, 2012]

	2007	2008	2009	2010	2011	2012
Operation & maintenance	5.062	5.269	6.315	6.849	7.409	9.817
Investment	4.746	4.521	7.380	9.764	10.753	11.672
Self generated	3.150	4.268	5.317	6.627	10.712	11.116
Total	**12.958**	**14.058**	**19.012**	**23.240**	**28.874**	**32.605**

In spite of such a large scale increase in funding, the proportion allocated for the Directorate of Research and Community Services has been low and stagnant for some years at around IDR 436 billion or merely 1.34% of the current DGHE budget. A quick comparison with one leading Indonesian pharmaceutical company, PT Kalbe Farma[28], which spends IDR 200 billion annualy for its research and development [Setiawan, 2012], demonstrates the low level of government funding for research in higher education. Indeed, it is not just funding of research in higher education that is low; the overall government R&D budget is extremely low at 0.08% of GDP [Tradingeconomics, 2012], reflecting the higher to low government priority given to R&D. The low R&D investment has resulted in relatively low number of patents, journal, and researchers, compared to the neighboring countries, as presented in figure-1.



28 PT Kalbe Farma is the largest pharmaceutical company in Indonesia

Since research capacity is a key factor in the context of fostering UIG collaborations, it is important to take into account the disparity in research capacity among institutions in Indonesia. The first type of institutions is for those who possess a certain level of capacity to conduct research and innovation, and they are mostly located in Jawa. The second type of institutions is the polytechnics, which focus more on production oriented academic activities. An obvious example is the "production based education", currently implemented by the Polytechnics Manufacture Bandung (Polman). Therefore it is important to understand the distribution of polytechnics in the 6 corridors, as illustrated in table-2. The third and the last category is for institutions considered as the main supplier of competent and relevant graduates for the labor market, particularly the industries.

There has been recognition amongst policy makers that Indonesian higher education system is too large a system to manage in a centralized fashion. Therefore the Directorate General of Higher Education (DGHE) has begun to gradually decentralizing its authority and providing more autonomy to the institutions since the early 1990s by introducing the new paradigm concept. The first step was encouraging institutional planning and financial autonomy through competitive grants introduced in the mid-1990s.

Since the year of 2000 the government gradually converted the legal status of 7 public universities into a separate entity, called *BHMN (Badan Hukum Milik Negara)* through the Government Regulation 152/2000 for *UI*, 153/2000 for *UGM*, 154/2000 for *IPB*, 155/2000 for *ITB*, 56/2003 for *USU*, 6/2004 for *UPI*, and 30/2006 for *UNAIR*. The legal status provides these universities with autonomy and self governance through its Board of Trustees, including managing its own financial and human resource matters. The Higher Education Long Term Strategy 2003-2010 also consistently supported the development of autonomous institutions through its 3 pillars: namely, nation's competitiveness, decentralization and autonomy, and organizational health.

To provide a stronger legal basis for autonomy, the Law 9/2009 on Educational Legal Entity was passed by the Parliament in 2009. However, the Law was challenged at the Constitutional Court on the grounds that it introduced legal inconsistency and it was ultimately cancelled in 2010. The recent attempt to pass a new Higher Education bill at the Parliament has been unsuccessful yet, and a new revision of the bill is currently being debated in Parliament.

3 Government policies on UIG partnership

Traditionally, the main role of universities has been to provide education and to produce graduates to meet the needs for the workforce in industry and government generally. Rapid economic growth combined with structural change in industry today, call for greater emphasis on relevance of education, and new needs for research based collaborations. While a vast majority of universities remains focused on teaching, more universities are moving toward research-oriented institutions. To facilitate better interaction with industry and promote greater research orientation, DGHE has consistently launched a number of initiatives to support university research and community service.

Since early 1990s the DGHE has provided more than 20 different grant schemes, ranging from grants for fundamental research to applied and collaborative research. Initially, those programs aimed at improving the quality of higher education through the enhancement of university R&D capacity. Through years of implementation, the quality of university R&D is receiving higher appreciation by industries. And as the university research capacity is improving, the industry is also increasingly demanding for more applicable results from university research.

In recent years the DGHE has put considerable attention on establishing and fostering university - industry research collaborations. Amongst the 12 grants schemes currently administered by DGHE,

RAPID (Riset Andalan Perguruan tinggi dengan Industri) is the one specifically designed to foster synergy between the university and the industry R&D. Under such scheme the industry becomes the entry point for researchers to support and supply the technology needed by the industry. At a lesser degree, other grant scheme such as national strategic research *(STRANAS)* also requires the university to collaborate with the industry or government agencies in conducting research in one of twelve research themes [DP2M, 2012a]. In relation to *MP3EI* program, DGHE also launched Penprinas *MP3EI* which requires collaboration with local governments and/or other government agencies. Although remains relatively small, the government-research funding has increased almost four-fold in the last 6 years; from IDR 76 billion in 2006 to nearly IDR 290 billion in 2012 [DP2M, 2011]. Out of those figures, roughly 15% are allocated for various collaborative research activities.

A similar approach is implemented for university community service programs. Evolving from traditional community service program, DGHE initiates S&T-based service schemes for the universities to engage with small-medium enterprises and the community [DP2M, 2011]. Unlike traditional community service program, under this program the university is to collaborate with the community to establish new S&T-based entrepreneurs or to improve the S&T capacity of SMEs. In addition, Hi-Link is a program with the objective of building capacity of the university in applying S&T through collaborative works with industry and local government [DP2M, 2012b].

Universities are also actively engaged in research activities funded by other government agencies, such as the Ministry of Research and Technology (MoRT). Currently MoRT is administering the National Incentive Research Program, which is divided based on R&D stages (basic, applied, improvement of production system capacity, as well as diffusion and application of research) in 7 areas (food resilience, energy, ICT, transportation, defence & security, health & medical technology, advanced material) and two supporting factors (basic science and social science). The objective of this program is to strengthen the national innovation system in supporting *MP3EI*. The achievement in this program is indicated by the establishment of centre of excellence in research and the development of research consortium, facilitating improvement of research productivity and effectiveness, as well as increasing participation and investment of private sector. The development of research centres in excellence (CoE) opens to all R&D units, including university, government, and industries [*Ristek*, 2012]. This program highlights the importance of R&D unit's capacity in absorbing technology, developing demand driven technology, disseminating technology, and utilization of local resources.

Unlike those at DGHE, this incentive research program opens to ministerial R&D units, government research agencies, universities, local government as well as private entities [Ristek, 2011]. Although this program opens to wider applicants, the proportion of university researchers involved remains significant. In 2012, for instance, approximately 51% of incentive research grants were awarded to universities, amounting roughly to 47% of the IDR 90 billion budget [MoRT, 2012].

Aside from the two aforementioned major government-support programs, quite a number of research activities are also conducted by various organizations using various public and private funding. Again, university researchers are involved, either institutionally or individually, in various forms of these activities. Therefore, at least at this current stage, the university researchers are regarded as the most valuable asset for the national R&D.

There are many examples where government-led programs have successfully initiated and fostered UIG partnerships, while many others have yet to deliver satisfying results. Regardless of the outcome, such experiences and recent government attempt to increase R&D capacity should still be considered as important keys for the development of future strategy for UIG partnership. It is also important to acknowledge that the universities, especially individual researchers, are still the engine of research. Unfortunately, the strength of university research is not evenly distributed across the nation, where

domination of top universities on the national research programs is noticeable. Consistently, *UGM*, *ITB, UI*, and *IPB* post the highest number of research grants in DGHE program, followed by *UNAIR, UB*, *UNPAD, ITS, UNS* and *UNDIP*. These universities are responsible for about 43% of high profile research activities (*RAPID*, strategic research, etc.) in 2012. Similar concentration is also apparent on researchers under MoRT's incentive research program.

There have been at least 3 government's attempts to introduce incentives and facilitate industries to invest in R&D activities made to date, though none has been effective. The first is the Law 25/2007 on Investment, initiated by the Board of Investment, provides incentives and facilities for investment, i.e. land ownership, income tax, and import tax, in certain industrial sectors; the second is the Government Regulation 35/2007, initiated by the MoRT, provides tax incentives to drive industries to make investment in R&D; and the third is the Presidential Decree 38/2008, initiated by the MoI, aimed to encourage industries to invest in R&D. The main reason for their ineffectiveness appears to be the lack of detailed implementation planning. While these laws/regulations are presumably established with the best of intensions, claiming any support under them is practically impossible given that applications must take in to account conflicting or overlapping laws and regulations. In the current "reformation era", officials prefer not to take any risks when challenged with conflicting regulations.

4 Current status of UIG partnerships: initial findings

The last decade has seen a significant change in terms of how universities work with industry and government in Indonesia. Traditionally, in the absence of coherent government policies that allow institutions to take proactive roles in orchestrating UIG, many university-industry partnerships have been developed through individual professors largely privately. Since 2000, with the experimental introduction of institutional autonomy in seven top tier institutions, central university administrations became much more active in orchestrating institutional actions, particularly in promoting income generating activities. Sometimes, this was done through the establishment of foundations to facilitate legal and monetary transactions, as the legal basis for such activities were not fully in place. The national context has also been ripe in emphasizing the need for universities to work better with industry, as various government agencies, the Indonesian Academy of Science (*AIPI*), as well as business organizations hosted events and forums on innovation, entrepreneurship, and partnerships. The result is a diverse array of activities emerging as various types of institutions began to explore different options to pursue new relationships with industry.

Activities that are emerging include:

More service and training contracts: A number of universities have stepped up effort to procure service and training contracts with various government and industrial clients. The desire to generate income prompted by the move to autonomy has been the critical driver for this.

Patenting: More universities have begun the process of patent applications with government support. This is in contrast to the past when the normal practice was for individual academics to give away intellectual property rights to its industrrial partner.

Collaborative research and development: Many academics find difficulties in identifying industrial partners with interest and trust to engage in collaborative research or development, and there is a much greater recognition that institutional effort are needed in this respect. Gadjah Mada University is one example of an institution developing its institutional capacity to identify appropriate industrial partners and topics of mutual interest and is making progress in increasing cash support from industry in research.

Networking events: Lack of opportunities for university academics to meet industrialists is one salient issue. In response to this perceived need, higher education institutions are themselves beginning

to orchestrate events that bring together industry and government representatives with university academics. *ITS* is an example of an institution which has initiated a series of UIG forums in several thematic areas of regional interest. A few other universities has taken proactive steps in organizing its own networking events to forge meetings between industrialists and their own academics.

Industrial collaboration for education: Good practices to enhance relevance of education are emerging in some units within public institutions as well as private institutions. These include: surveying/obtaining feedback from employers systematically, getting industry staff to teach specific subjects of emerging importance, upgrading staff knowledge in new areas in collaboration with industry.

Incubation/entrepreneurship education: In the past, companies were occasionally formed by academic professors or graduates working closely with academics, though they remained largely invisible. Nowadays more universities are engaged in incubation efforts and provide entrepreneurship education to their students. However, most initiatives appear to be at an early stage of development, without a firm track record of success, and with the content of support such as mentoring of seed funding still evolving.

Small and Medium Enterprises (SME) support: Universities have traditionally seen community service as a legitimate part of their work, and as such working with local SME has been established activities in some universities. Working with SME, however, appear to be receiving renewed emphasis in some universities. Science Parks: Several universities are in the early process of establishing science parks close to their campus, though the direction or content of the venture are not yet clear.

5 Preliminary analysis

From our interviews and focus group discussions, several distinct issues emerged that could jeopardize the further development of UIG. The following section presents the result of our analysis.

5.1 Lack of mutual understanding and trust between university and industry

There appears to be a significant lack of mutual understanding and trust between university and industry communities. We found universities habitually developing their research strategies in isolation from industry. Some academics have little respect for industry as they see industrialists as far too money-oriented or too practical and lacking certain idealism. From the perspective of industry, higher education institutions often look like ivory towers, bureaucratic, too focussed on academic research and far too slow to be able to provide useful help. The lack of trust is confounded by the fact that many academics do not understand the problems faced by industry or their needs, and the fact that industrialists often cannot present their problems in a coherent manner. The analogous situation might be found between an inexperienced doctor and an inarticulate patient; only if the doctor has a solid understanding of the underlying problems related to symptoms that patients are able to convey would he/she be able diagnose properly. Both parties appear to be in the state of "institutional sphere" instead of "consesus space" lacking understanding about each other or mutual trust [Etzkowitz, 2002].

Nonetheless, the study team have come across a number of successful collaborations between individual university staff and industrial partners, where they developed understanding and mutual trust over time. The question is whether there are ways in which better understanding and trust can be developed more systematically.

5.2 Institutional framework

Institutional framework is a serious problem in developing partnership, particularly for public institutions. Most of the interviewees saw the uncertain future of institutional autonomy for higher education institutions as a serious threat for developing better UIG partnerships. At the minimum, universities must be able to engage in discussions and negotiations with industry as independent organizations that can hold discussions and negotiation with industry as equal partners; they must be able to work on legal contracts with industry as well as government as independent entities. They also must be able to deal with ownership of intellectual property rights or companies, to implement projects as needed in a timely manner, and to hire staff flexibly to undertake tasks as needed. According to the prevailing regulation, only the Government of Indonesia has the status of legal entity. Public universities are considered as merely the government's implementating units *(satuan kerja)*, and its authority is granted by the Minister of Education and Culture. The issue is particularly acute in financial management as cumbersome bureaucratic procedures must be adhered to for all financial transactions; and revenues from any collaboration have to be deposited to the state treasury, and can be used only after submitting a proposal for activities, according to a standardized tariff. Since the government sponsored research grant cannot be disbursed as a block grant, researchers must also pay considerable attention to detailed administrative rules and procedures. The current uncertainty about what kind of autonomy will be available to universities is casting serious doubt about the future of UIG partnerships particularly amongst academics who have been most actively engaged with industry.

Many of the government funding rules or norms are also not conducive to innovation and creativity, i.e. late disbursement (in some cases up to 6 month delay), the requirement that all the money must be spent within the financial year, government standard procurement procedures. There is also fear that the rigidity of government bureaucracy has strongly affected the staff mind set and mentality, and becomes a serious hindrance for developing a conducive environment for creativity and innovation to blossom.

The tendencies for individuals (or even institutional units) to avoid the bureaucracy, by conducting collaborations without involving the central administration can lead to other problems. Individuals may be exposed to unreasonable risks; reconciliating disputes may be much more difficult for individuals to handle. Academic staff may also become overloaded with non-campus work and become negligent of their campus obligations. Perhaps, the most significant problem is that fact that any lessons from collaborations will then stay with individuals, and not shared across the institution.

5.3 Uncertain industrial policy context

In an emerging economy such Indonesia, the industrialization process has just begun to enter the deepening process from labor intensive to skill intensive. Therefore it is not surprising that universities feel that there are not enough companies that they can collaborate with on reesarch. There are few domestic companies with technological sophistication and interest and/or capacity to innovate, with the bulk of industry concentrated in assembly operations or extraction of natural resources with little value added. And yet, without industries playing a more proactive role in the UIG partnership, the Triple Helix will just remain as an abstract concept. Worse, overreliance on government support could lead to further weakening of industrial competitiveness. The role of industry within UIG triple helix scenario has to be at least at par with university and government.

State owned enterprises seem to play a special role in this respect, as many university interviewees gave examples of more robust working relationships with them (e.g. BioFarma, Pertamina, Krakatau Steel), given their interest in domestic capacity building and relatively higher R&D orientation. The cases of the government intervention in PT Dirgantara Indonesia (debt restructuring) and PT PINDAD

(manufacturing armored personel carier for the army in partnership with *ITB*) are taken as examples of good practices by some [Kompas,2012]. In general, most stakeholders we interviewed called for far clearer government policies to selectively support the development of domestic industry. There has also been some suggestions to revitalize the state owned enterprises, particularly those with high added value to ensure that there are key knowledge-oriented industrial firms which could engage in productive partnerships with universities.

5.4 Regional disparity

The regional disparity in the level of economic development is very clear, and has been a source of concern for policy makers. The metropolitan Jakarta is far more advanced economically than other economic corridors outside Jawa; universities there are also more developed, well resourced, and diverse than in many other regions. As presented in section 2, universities with stronger research capacity are mostly loicated in Jawa, whilst 5 of the 6 economic corridors in *MP3EI* are located outside Jawa.

There is significant concern that the development of economic corridors outside Jawa requires expertise and capacity that are only available in institutions in Jawa. It may be possible to solve short term problems by mobilizing expertise from Jawa, but that could create other problems which may be social, cultural, or political. It seems essential to develop mechanisms for building local institutional capacity.

6 Concluding remarks

Our conclusion is that currently the government, universities, and industries are still in their respective institutional spheres in Indonesia, and a strong commitments as well as hard work are needed to develop the knowledge, consensus, and innovation space. Much progress has been made in the past decade, with a wider range of partnerships emerging, and with more institutions building capacity to play a more proactive role in fostering better relationships. A decade of exploration has seen some successes, but there is growing awareness amongst university community also that much more needs to be done, and that it is not easy to do so.

Broadly, the directions that Indonesia needs to move appear reasonably clear. All three institutional spheres require further development before each can take purposeful action. The government needs to be able to develop effective policies that are implementable, and not at odds with the prevailing legal framework. The universities have to develop institutional capacity to opearate strategically. Indonesia must at least have a small critical mass of industrial firms that are ambitious enough to develop into knoweldge-based industry.

The gap between universities and industry continues to be wide – indeed, some would argue that it is getting wider as a result of changing industrial structure with increasing foreign investors and weakening of state owned enterprises, or because of the changing nature of academy. It is not clear whether universities develop their capacity taking into account industrial development objectives. Identifying opportunities in an ever more complex industrial environment requires much more than isolated efforts of individual academics. As more universities become research oriented, academic publications are becoming performance targets; it is not easy to promote academics to work on industrial collaboration, which requires much effort with little promise of reward.

There is much that institutions can do to close the gap; it could develop strategies, build support structures, and create incentives for academics. And yet, the current environment does not look promising in facilitating them to do so. Internally within universities, the appetite for more institutional initiatives may not be strong amongst the very academics who have been movers and shakers of UIG. To some of them, many institutional changes looked more like additional tax and bureaucracy without

producing benefits such as support, expertise or incentives. The process is complicated further by the broader decentralization process taking place, where relationships between the central administration, academic units and individual academics are being re-defined. To make the matters worse, the regulatory environment is actually becoming much tighter. In the absence of established autonomy law, institutions are thrown back to old rules which are being enforced more rigorously. There is precious little room for institutions for maneuver.

Our preliminary analysis would suggest that the principal lever for overcoming such difficulties would lie in the hands of government. It would be critically important to establish a firmer basis of institutional autonomy through the autonomy law. The subsequent autonomy process would also need to be set appropriately both through an appropriately defined regulatory environment as well as various funding arrangements. However, the details of how best to proceed needs to be explored through a more focused review of government side perspectives including key agencies such as DGHE, MoRT, MoI, MoA as well as MoF. This is particularly the case given that there are indications that different parts of governments think and react differently, and policy intentions as expressed by one part is not necessarily implemented by another.

We have also seen indications that the overall level of commitment to R&D may be low. Research-based UIG partnerships are potentially important, particularly in fields such as biological sciences, which could enable Indonesia both to extract appropriate value from its rich biological resources and to support appropriate conservation efforts. It would be important to examine the need for national research capacity building effort in key areas of strategic importance.

Indonesia has some government research capacity both under MoRT and other line ministries. In order to explore the future role of university research, it would be important to obtain an overview of governmental research, so that their roles, potential complementarity or collaboration potential can be explored.

Another area that requires further examination is the perspective of industry in Indonesia. Their view about the hopes and fears of the small number of companies that are known to be working with universities within Indonesia, and obstacles do they see in the way of industry developing working relationships with universities, are of importance for this study.

The findings of our paper have also been limited by the coverage of our interviews and focus groups, which so far were largely limited to participants from Java. Further investigation would be critical to illuminate the current status and issues unique to regions that are less developed economically, particularly to explore potential development paths for universities so that they can play the appropriate economic roles for developing economic corridors.

Having said that, the study team found a number of cases whereby the three parties are willing, even eager, to develop partnerships. With an appropriate and comprehensive strategy, there is significant potential to create productive environment potentials could be developed into knowledge, consensus, and innovation space.

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Annex II: Measuring Quality Of Undergraduate Education

a) Internal quality assurance

Many implement quality assurance in their institutions just because it is required by the law and regulations, i.e. accreditation and certification. However quality assurance should basically be an internally driven initiative, instead of merely to meet external requirements. It is deemed important to disseminate to all relevant parties within the institution, i.e. Rector, Dean, teachers, students, parents, and Trustees, that the primary beneficiary of quality improvement is the institution itself. Only by understanding this concept the continuous quality improvement can be sustained and becomes an important culture in the organization.

In order to impose a continuous process of internal review and evaluation, the DGHE requires that all institutions should establish a quality assurance (QA) unit. A training program was conducted for teaching staff who are assigned to conduct the process. In 2008 all institutions were requested to submit a document describing its internal QA operation, and a review team was assigned to assess the documents and conduct site visit. After the DGHE imposed the requirement to establish internal QA unit, in 2008 there were 24 public and 44 private universities considered as already had a good QA mechanism. Currently almost all universities have already the unit in place, though its effectiveness needs still to be assessed.

Internal QA mechanism implemented requires that the education process at each study program in compliance with the agreed upon standards. Examples of the standards applied are teacher attendance, time lag between student grade submission and the examination, employers' involvement in curriculum review, graduates' tracer study, etc. A few study programs, such as management and accountancy, are still having difficulties to comply with such regulation. However, most study programs in more established universities have been successful to meet the compliance with the regulations. Even the Faculty of Medicine, which was previously considered as difficult due to obligation to the clinical works in the hospital, has successfully implemented a very discipline and demanding competency based curriculum.

b) Accreditation

In addition to internal QA, one of the parameters used for defining quality is the result of accreditation, which basically represents external QA. In 2010 only 11,185 programs have been through the accreditation process or around 63% of 18,298 study programs, either due to their inability to meet the quality standard or the limitation of the National Accreditation Agency's (*BAN PT*) capacity to conduct assessment each year. In order to keep up with the ever increasing work load, *BAN PT* is in the process of shifting its strategy to evaluating institutions rather than study programs in the future.

The table 3.3 shows that the proportion of programs offered by public institutions is significantly better in term of accreditation result compared to private institutions. However the accreditation process only measures quality against the minimum standard that performance above that level is difficult to be rated against each other. Although the majority of programs in private institution is lower in quality and has small enrolment, some programs offered by larger private institutions are better than programs offered by the weakest public institutions. Due to time constraint, it not possible to extract from the *BAN-PT's* database the results for Institution in Jawa vs outer islands.

c) Competitive grants

One approach to assess quality is using the result of various competitive grants administered by the DGHE. The objectives of each competition vary between schemes, but the selection process is more or less similar. The process is conducted by involving independent reviewers, mostly a combination of subject specialists and experts in university management. Since the evaluation and selection process includes an in-depth thorough desk review and rigorous site visit, the result might better reflect quality. Grantees were evaluated every year to assure that the good practices had been well implemented. DGHE has a long experience in carrying out internationally reputable review process since 1995, and considered as objective, transparent, rigorous, and reliable process conducted by highly experienced reviewers. These experts provided assistance and played a leading role in designing similar funding scheme for the Government of Sri Lanka in 2003-2006.

In 2009 the DGHE funded 9 public, 17 private, and 5 *BHMN* universities, whilst in *PHKI*-2009 12 public, 31 private, and 1 *BHMN* universities were selected. In 2010 the I-MHERE World Bank assisted project funded 79 grants, comprises 37 study programs in Jawa and 42 study programs in outer islands. Unforunately in 2009 DGHE changed its strategy of providing competitive grants and shifted more toward direct allocation funding scheme. Until 2009 there were hundreds of study programs in public as well as private universities have received such grants and adopted the good practices into their management. In addition, there are thousands more study programs that have not received any grants but have changed to the betterment of their education process through the dissemination of good practices by their peers. Nevertheless competitions were mostly conducted in tiered system, that recipients from one tier cannot be compared with recipients from other tiers. The track record of a study program in acquiring various competitive grants indicates that the institutional commitment for continuous improvement; hence could become an important indicator that reflect quality.

d) Teaching staff

Although the education process is probably the most important aspect in the provision of quality education service, the qualification of teaching staff is a deemed important aspect. Its importance is reflected by the only input based parameter used in this report. Table 3.5 presents the qualification of teaching staff in public as well as private institutions. More than 2/3 of S3 holders are from universities in Jawa, an obvious illustration of disparity in the capacity to conduct research and innovatoon between between economic corridors in the *MP3EI*. The condition in private institutions located in outer islands is the worst in term of S2 and S3 holders.

According to the Law 14/2006 teaching staff in undergraduate program should have at least S-2 qualification. Table shows that more than 87,500 lecturers have to be upgraded into at least S-2 within the next few years. It also indicates that a lot of work has still to be done to improve qualification of teaching staff, particularly in private institutions.

e) International recognition

International reputation is represents among others by world ranking, though an endless worldwide debate on whether institutional ranking represents the quality of education offered is still going on. Table 3.4 presents the ranks according to the Times Higher Education Supplement or THES[29] and Quacquarelli Symonds or QS.

29 THES changed its criteria that the ranks for these universities are not available anymore after 2009.

DGHE continuously encourages institutions to improve their international reputation and recognition by providing grants for potential and prospective universities. New schemes have been introduced to provide incentives, among others supporting staff to publish their articles in refreed and reputable international journals and incentives for inventor of patents.

Some study programs in more established universities are preparing themselves for accreditation process by international professional agencies, such as American Board for Engineering and Technology (ABET) and World Federation of Medical Education (WFME). Some have successfully acquired the accreditation status, but we do not have the information yet on the number and the university's names that has acquired the acrreditation.

Annex III: National Committee on Innovation

The Council is assigned with the following specific mission:
- increase IPR from research activities and industries which directly relevant to economic growth;
- increase the number of niche products and industrial added value from many regions;
- improve science & technology infrastructure with international standard;
- achieve self-sufficiency in food, medicine, energy, and clean water which sustains;
- achieve self-sufficiency in defense, transportation, and ICT related product and industrial system;
- double export volume of creative industry products; and
- achieve continuous economic growth, prosperity with equity, and to strengthen Indonesia.

The 30 *KIN* members are grouped into 5 divisions, namely Government-led Innovation Program; Business and Industry Innovations, Innovation; Incentive and Regulation Policy for Innovation; and Economy, Social, and Culture Innovation. The Council has submitted the recommendations of empowering all ministries, government agencies, state enterprises, and public universities. The recommendations cover the following strategies:

a) Top down model recommendation for development of innovation in human basic needs, including food innovation and Innovation in medicine;
b) Recommendation for development of innovative industrial zone based on national and local excellence (combined top down and bottom up model), including revitalization of Puspitek (quick win), establishment of Bandung Raya Invation Valley (quick win), and establishment of East Java Agrotech Innovative Industrial Zone (quick win);
c) Recommendation to increase the innovative R&D fund;
d) Recommendation to create innovative culture; and
e) Recommendation to plan road map towards national innovation system.

Annex IV: Capacity development grant for UIG partnership Detailed description

1. Background

The government of Indonesia has recently launched the *MP3EI* (Master Plan for Acceleration and Expansion of Indonesia Economic Development), intended to drive the realization of high, balanced, fair and sustainable economic growth, through two key factors, i.e. acceleration and expansion [*MP3EI*, 2011]. *MP3EI* envisions national development based on seven economic corridors, with aspirations to promote geographically balanced growth. Universities are expected to play critical roles not only in providing key human resources to meet the national and regional development needs, but also in becoming key 'knowledge base' for the regions so that regions can develop appropriate economic activities with increasingly higher value added. Given the status of economic development in Indonesia, the roles expected of universities are different in different locales, but can be categorized into the following three levels:

Level 1: Working with local (or potentially local) industry and government to provide relevant undergraduate and diploma level education

Level 2: Working with local (or potentially local) industry and government to develop strategic R&D capacity to address emerging or future industrial needs of regions

Level 3: Working with national and international industry and government to develop S2 and S3 programmes of relevance to industry so that they can contribute to R&D capacity development of industry

Today, none of Indonesian universities are equipped to perform such roles adequately. Inadequacies to deal with level 1 needs are demonstrated by the fact that there are many locales particularly outside Jawa, where industry is hard pressed to recruit relevant undergraduates or diploma holders. There are hardly any established R&D centres known for their collaborative work with industry in themes relevant to regional economic needs – to meet level 2 needs. As far as level 3 is concerned, most research programmes in established institutions are still academically oriented, with research degrees such as S3 designed for academic jobs with little attention given to emerging or future industrial requirements.

Currently such roles have not been actively played by universities, mainly because their capacity to engage with industry has been limited. It is essential that this tradition of isolated institutional development for universities is broken so that universities begin to develop along with the needs of the society. It is critically important that universities in outer islands plan new S1 programmes in consultation with local emerging and future needs. It is essential that applied research centres are developed in key locales to meet regional needs. As R&D interests emerges in some segments of industry (e.g. as found in pharmaceutical companies in Indonesia today), it is the right moment for research oriented institutions to engage with them to plan research-oriented degrees at S2 and S3 so that university research capacity develops in conjunction with R&D capacity in industry.

This capacity development program proposes to provide significant grant assistance to universities, so that they can build better institutional capacity to deliver more relevant education and research on the basis of close dialogue with industrial and government stakeholders.

2. Objectives

The objectives of this funding program are to:

a) Improve university ability to work with local stakeholders such as industry and government in planning its capacity development,

b) Improve university capacity to deliver (i) undergraduate and diploma programmes, (ii) applied research and development services to assist industry to move up to higher value added production and services; and (iii) research-based post graduate education to meet the needs of emerging R&D activities in industry.

3. Scope of the program

It is critical for universities to acquire the commitment of relevant stakeholders from industry and government, in order to participate in this program. The program will include support for graduate fellowship, start-up R&D grants, domestic and international technical assistance, travel, laboratory equipment, industrial exchange program, and twinning arrangement with national as well as international institution.

Depending on the strength of the proposal, the fund provided by this program is in the range of IDR 15 to 20 billion over 3-5 years period, excluding the contribution from the local industries and government partners. A twinning arrangement with more established national or international universities would be strongly encouraged, and may be 'required' when proposing institutions are deemed to have in adequate expert capacity in the domains envisaged.

4. Eligible proponents

Eligibility will be different for different level proposals:

Group 1: only universities located in the economic corridor of Sulawesi – North Maluku, Maluku – Papua, and Kalimantan are eligible to submit proposal. The proposal must be developed in partnership with the local industries and government.

Group 2: only universities located in the economic corridor of Sumatera, and Bali – Nusa Tenggara

Group 3: only universities with a good track record in research, as demonstrated by the research training and track records of academic staff, credibility of establishing *S3* programmes

Since the heart of capacity building lies in successful collaboration between universities, industry and local government in the planning process, the program could start with seed grants to fund planning and proposal development in collaboration with industry and government, which will be selectively provided based on pre-proposals submitted by institutions. The capacity development grants to support the actual implementation will be awarded based on full proposals thus developed and evaluated.

The up to IDR 200 million seed grant can provide support for time-relief for university staff, national technical assistance, workshops, and travel to the local industries, e.g. plantation, mining, hatcheries, or breeding sites. For some pre-proposals, where aspirations make sense, but where institutional capacity to develop full proposals seems inadequate, the funding agency may assign technical assistance to help develop the full proposals.

The full proposals should outline what kind of education/research capacity would be developed and how, and should include some matched funding from local government and industry.

5. Institutional framework

The program requires institutional capacity building of the kind that has never taken place before. It will be necessary to explore new implementation arrangements at local as well as national levels, with flexibility to involve industry as well as government partners. It is also likely that capacity building will require international collaboration on specific topics. For this reason, we strongly recommend an involvement of an international donor agency, to provide a better framework for experimentation,

involving international expertise. The actual capacity building would be funded mainly by the government fund, but with contributions from local industries as well as local government.

In order to ensure smooth planning and operation, with expected interdiscipolinary capacity, it is likely that the program requires universities to establish new units/organizations that are legally separate and can be accountable along with the universities, rather like Fraunhoffer in Germany. With or without such a new structure, it is anticipated that a special tri-partite board shall be established to oversee the implementation of this program at the institutional level. The institutional arrangement shall be in such a way that the financial management comply with the prevailing regulation, whilst at the same time able to provide sufficient felxibility for the industrial collaboratiive activities.

An oversight committee should be established to regularly monitor the implementation. The committee comprises representatives from local universities, industries, local as well as central government.

Annex V: UIG support facilities grants
Detailed description

1. Background

The government of Indonesia has recently launched the *MP3EI* (Master Plan for Acceleration and Expansion of Indonesia Economic Development), intended to drive the realization of high, balanced, fair and sustainable economic growth, through two key factors, i.e. acceleration and expansion [*MP3EI*, 2011]. *MP3EI* envisions national development based on seven economic corridors, with aspirations to promote geographically balanced growth. Universities are expected to play critical roles not only by providing key human resources to meet the national and regional development needs, but also by becoming key 'knowledge players' in working much more productively in partnership with industry and government, and in embracing spinoffs and other commercialization efforts.

If universities are to play such proactive roles, it is essential that they explore new ways of connecting with industry and working with them. A number of Indonesian universities have already began such a process of exploration, by establishing industry facing activities in a range of areas covering networking, corporate relations, technology transfer, to science parks or incubation. However, most of such efforts are still at an early stage of development, and they require significant further work in clarifying strategic objectives, refining operational processes, and in professional development of staff. Indonesia does not yet have 'best practices' in most of such support functions, and most initiatives have the appearance of self-made plans with little learning from international best practices.

There is also a tendency all types of institutions to try to develop the same set of functions, irrespective of their institutional mission and capacity. While this is not surprising given the early stage of thinking about UIG partnerships, international experience shows that not all institutions are fit to engage with industry in similar ways. It is important that institutions are pushed to engage in increasingly sophisticated experimentation, taking into account their institutional capacity as well as orientation.

2. Objectives

The objectives of this funding program are to:

a) Promote excellence in developing new ways for engaging and working with industry
b) Improve university ability to develop realistic strategies for working with and for industry, given institutional mission, orientation and capacity
c) Promote the development of 'best practices' in a range of support facilities based on well informed strategies and learning from international experience

3. Scope of the program

The program will provide highly selective support to a small number of initiatives in each category of support facilities. Funding support could be given for expenditures such as, professional staff recruitment/training, short-term experts, equipment and facilities, studies.

The size of the grant should not exceed IDR 200 million and should last for 2-3 years.

4. Eligibility and selection criteria

There is no formal requirement for eligibility, but proposals are expected to provide strong rationale why a given institution is fit / suitable to develop a particular type of support facilities.

Since the key objective is to promote better strategy development and planning for such support functions, the program will start with seed grants to fund planning and proposal development, providing small seed grants to a small number of best pre-proposals in each category. The up to IDR 100 million seed grant can provide support for time-relief for university staff, national and international technical assistance, domestic and limited international travel.

The selection criteria will include: (a) appropriateness of the choice of support facilities given institutional character/development plans; (b) track record in preparing for such a function; (c) evidence of clarity in planning

The full proposals should outline what kind of support function capacity would be developed, clarifying expected roles, organization, and operations, and proposing an investment program to develop such a function over a period of 2-3 years, beyond which, all running costs are to be funded by universities themselves.

5. Selection process and program level technical assistance

The selection of pre-proposals will be undertaken by a small group of international experts with a range of support function expertise. They will provide a workshop for selected grantees for seed grants, to assist in their proposal development process.

Annex VI: REPORT ON STUDY TRIPS

OBJECTIVES:

1. To gather information from experts and researchers from the international perspectives on the experiences and practices in conducting university-industry R&D partnership
2. To study and explore good practices of the universities in developing policies, strategies for creating and fostering effective university-industry collaboration.
3. To study the role and the policy that the government have set supporting university-industry collaborations.

COUNTRIES VISITED:

Republic of Korea:
- Korea Advanced Institute of Science and Technology (KAIST)
- Daedeok Innopolis

Korea is well known for its early industrial success, most notably in developing domestic conglomerates (Chaebols) with significant technological capabilities. In spite of such a success, Korean higher education institutions are not known to have developed good U-I relationships, or to have become key players in national or regional innovation systems. This is not because of the lack of effort. For instance, Korea has been making significant investments to develop a scientific hub, Daedeok Science City, by collocating government laboratories as well as key higher education institutions such as KAIST and industrial R&D laboratories for the past 30 years.

Since 2008, the Korean Government has made another round of concerted effort, most notably by concentrating resources for specific themes of research, and to strengthen further key eco-system features which had been hitherto missing.

People's Republic of China:
- Tsinghua University
- TusPark – Tsinghua University Science Park

The experience of China was proved to be illuminating as it successfully re-built its higher education system in the last thirty years, with universities given responsibilities to contribute to national economic development. Some of their elite universities have been particularly successful in their contribution. They created new companies with better technological capabilities, when their domestic industry was weak. Some are developing ties with multinational companies to help in the industrial catch up process. Zhongguancun is a large industrial district within Beijing which is particularly well known for its success based on contributions from academic institutions such as Tsinghua University, Peking University, and the Chinese Academy of Sciences. New companies such as Founder emerging from Peking University, or Tongfang and Ziguang from Tsinghua University, have been national success, and created the core of Zhongguancun. Over the years, Zhongguancun has become a nationally recognized model of China's Science Parks.

Korea Advanced Institute of Science and Technology (KAIST)

Visit to KAIST includes discussion with head and academic staffs (professors) from Department of Mechanical Engineering, visit to laboratory facilities, discussion with research students (masters and doctoral students), discussion with professors/researchers at laboratory; discussion with Dean of College of Engineering; and visit and discussion with officers at KAITS Office of University – Industry Cooperation

Some specific notes on KAIST ME:

- ME department has 56 faculty members, including 9 emeritus professors, 2 assistant professors and

10 associate professors, serving 886 undergraduate and graduate students (all under scholarships). Faculty members are active participants in Korea and International Engineering Societies.

- ME department currently has 6 strategic research areas that are highly relevant with the industry. Each professor is researching in those 6 areas as their major and minor fields of research. The department keeps track of the research conducted in research centres and/or research group using matrix system. Each research centre and research group is headed by a director (professor).
- Number of master students: 205 (119 government scholarships, 28 department scholarships, 41 industry scholarships, 17 scholarships for foreign students). Numbers of PhD students: 327 (238e government scholarships, 31 department scholarships, 47 industry scholarships, 11 scholarship for foreign students).
- Large number of graduate students is the backbone for research, which in 2011 generated over US$ 20.3 million (US$ 5.3 million from Industry research grants and US$ 14.9 million from Government research grants). Research output includes: 472 IF in scientific publications (9.84 IF per professor), and 108 domestic and 13 international patent registered.
- To promote and maintain industrial relevant, KAIST ME established Industrial Cooperation System in the form of Industrial-Academia Consortium (IAC) This consortium focuses on 2 things: 1) to survey difficult technical problems of the industry, and 2) to create research strategies for industry, which is implemented in industry sponsored research programs.
- KAiST ME also established Industrial Advisory Board (IAB) that advices and evaluates the education and research activities at KAIST ME. IAB systemizes the industry-academia cooperation and providing the industry with on-demand high-quality human resources and industrial training (non-degree short courses)
- Professors at ME have start-up companies. As the founder, KAIST allows professor to become the CEO of Start-up Company up to two years, which after that will be taken over by non-professor. KAIST retains share of ownership of the companies.
- ME alumni's spin-off companies totalling 56 companies, is a proven success of diffusion entrepreneurial spirit within ME department.

Some specific notes on KAIST Office of University Industry Cooperation (OUIC):

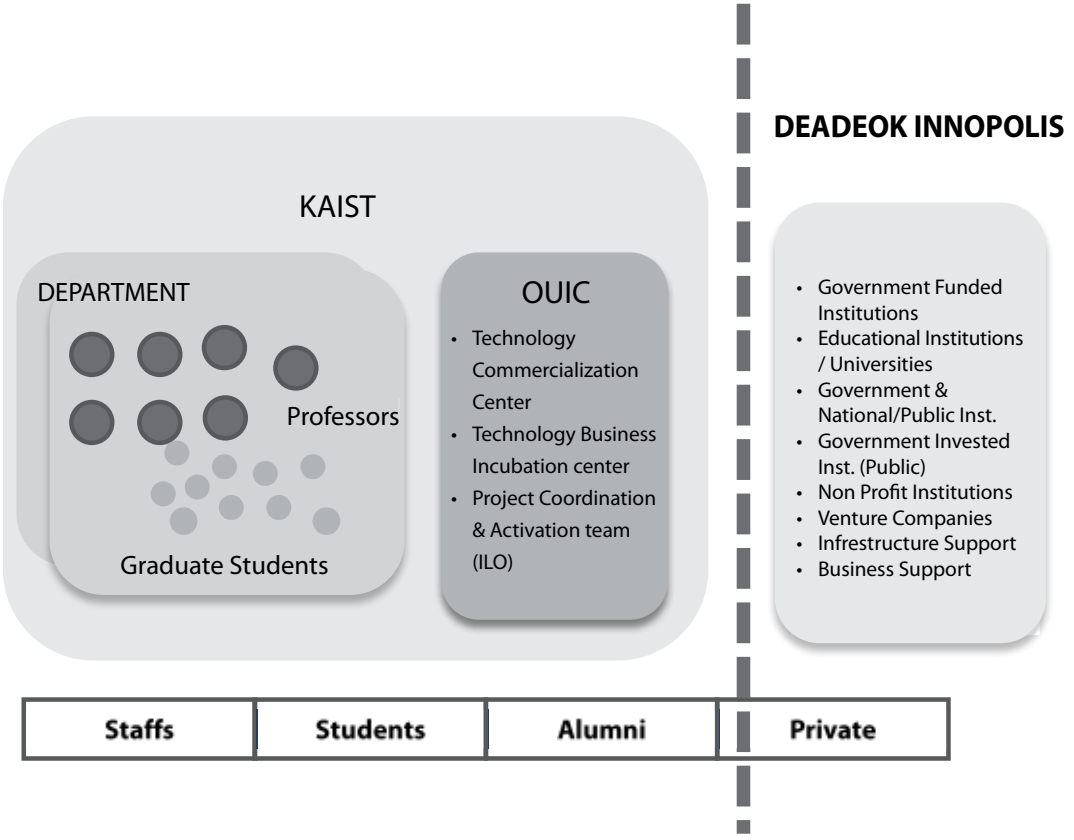
- This unit is headed by Dean of the Office of University and Cooperation, under the Vice President of Research. This unit functions to support KAIST in transferring research achievement and technology to the industry, which is implemented in three units or groups:
- Technology Commercialization team that promotes technological transfer and commercialization through creation patent portfolio, construction of patent information system, and intensification of technology licensing. Total Patent registration is 4.481, including 909 overseas patent registrations. Number of technology transfer in 2010 is 40 cases resulting in US$ 1.8 million licensing fee.
- Project Coordination and Activation Team that helps create collaborative relationship among industry, industry and KAIST institutes of research. This unit is responsible for operation of Industry Liaison Program (ILP) membership, the foundation and operation of KAIST Technology holding company, management and operation of KAIST trademarks, and constitution of Incubation Complex.
- Technology Business Incubation Centre that is responsible for incubation of venture companies. OUIC allows incubator tenants to remain in the incubation complex up 5 years. Capitals for new venture companies can come from government support or university support (loans). Average number of tenants is 100 tenants per year, with success rate of less than 40%. More than 90% of incubator tenants are from outside KAIST.

- OUIC is operating professionally with support from 25 competent full-time administrative staffs. When needed OUIC will invite external professional (outsourcing) to assists tenants and or member from industry, such as for market research, banking & investment, etc.
- OUIC serves academia, students, alumni and external parties (industry and individual investors).
- Revenue sharing policy: 50% for inventor, 30% for KAIST; 10% for Department; 10% for OUIC.

DAEDEOK INNOPOLIS

- This government-support facility complex is one of three Innovation Metropolis; the others are in Deagu and Gwangju. This Techno Park facilitates R&D and support S&T commercialization for universities, government R&D agencies, as well as industry sector. Daedeok Innopolis currently houses 1,266 resident institutions (public institutions, government-funded institutions, national/public institutions, education institutions, other non-profit organizations, and enterprises. The total number of personnel at Daedeok Innopolis is 55.615 persons, including 9,005 PhDs and 9.736 Master's degree holders.
- Daedeok Innopolis provides benefits to resident enterprises: tax deduction (national and local) for high-tech enterprises, utilities discount for R&D institutes and enterprises, institutionalized supports, and specialized funds.

In summary, UIG partnership in Korea (KAIST and Daedeok Innopolis) can be illustrated as follows:



University staffs (professors) and graduate students are the main engine for R&D at the university. Scholarship for graduate students enables the department to recruit talented students to work on research. The availability of research groups and/or research centres, as well as IAC and IAB allows professors and graduate students to execute researches that are highly relevant to the industry.

Professors will have access to research grants provided by the government, industry and university, and are also free to choose to work within the department, faculty or college, KAIST OUIC or even with the industry sector at Daedeok Innopolis, as long as the contract is formal (institutionalized) and they have fulfilled all their academic obligation (teaching, etc.) the university.

A clear and consistent policy and regulations concerning R&D activities at university will be very important for researchers (professors), which include regulation on ownership of IPR, share of ownership of start-up companies etc.

In particular, the success of University-Industry collaboration depends strongly on the quality of organization and professionals that run the university-industry collaboration offices. This organization must not only play active role in promoting S&T advances at university but should also know how to commercialize it to the industry. Professionals that that fully function as business liaison is definitely needed to bridge the gap between the university research and the industry. Such professional role cannot be double-played by academic staffs.

Business incubator must be run by professionals who know business, business network and sense of entrepreneurships; although outsourcing for experts in various area of expertise can also be done.

DETAILED PROGRAMMES

LOCATION 1: DAEJEON - SOUTH KOREA

Date: 15-16 November 2012

Delegation:
1. Prof. Dr. Agus Subekti, Director of Research & Community Service – DGHE
2. Dr. Amich Alhumammi, Directorate Education and Religion – *BAPPENAS*
3. Prof. Dr. Mulyadi Bur, Andalas University
4. Dr. Alfa Edi Tontowi, Gadjah Mada University
5. Dr. Junaedi Muhidong, Hasanuddin University
6. Dr. Andi Isra Mahyudin, Institute Technology of Bandung
7. Dr. Biemo W. Soemardi, Study team member, Head of delegation

No	Date - Time	Location	Program	Remarks
	16 November			
1	11:00 – 12:30	Department of Mechanical Engineering Korea Advanced Institute of Science and Technology - KAIST	Welcome by head of ME department, Prof. Jeong-Guon Ih Introduction to ME department Presentation from visiting team by head of delegation Discussion with head and professor from ME department	Historical development of ME department followed the progress on KAIST in the early development of KAIST Department-Industry research collaboration has become routine program because the industry recognizes the capacity and competency of the university research. Laboratories are equipped with state of the art equipment Number of doctoral and master students are substantial, providing ample resources for research Many doctoral students are under the scholarship from university or industry Most doctoral students will to industry as researchers 53.4% research funding are from industry, the rest are from university and government competitive grants No rigid and comprehensive research plan, but follows the industry needs
2	13:00 – 15:30	Laboratory and research facilities in ME department	Meeting PhD and master students Visit laboratories: ● Precision Eng. And Metrology ● NOVIC (sound and vibration) ● New energy conversion ● HUBO Meeting with Professor	Prof. J M Bae, (energy conversion system lab.), is working on invention of new energy conversion devices. Established startup company H2-Energy, and KAIST allows the position of CEO for two years After two years, leadership (CEO) is handed over to professional engineer (PhD) KAIST holds part-ownership of the company with a certain arrangement of profit sharing.
3	15:40 – 17:40	International Center	Meeting with Indonesian students	Satisfy with facility at KAIST Opportunity to get scholarship

4	10:00 – 11:30	Office of University – Industry Collaboration	Introduction to KAIST OUIC	KAIST OUIC is located at ICC campus (old campus). OUIC is and independent unit of KAIST, headed by vice Rector Fully managed by 25 professionals; other duties are outsourced Facilitates U-I partnerships: - Technology commercialization - Technology Transfer / Licensing - Business incubator Total tenants 500 companies, with more than 90% came from outside KAIST Share KAIST in every new venture is 5% Share of royalty: 50% inventor, 30% KAIST, 10% OUIC, 10% department Student's start up business can get financial support from the government grant. Term of incubator tenant up to 5 years; with average failure rate of incubators is 60%
	11:30-12:00		Visit to tenant of business incubator	i-KAIST became the first business venture (incubator tenant) that allow to use KAIST as its identity ownership by ex-KAIST design student, and now employing PhDs
	12:00-13:30	KAIST faculty club	Lunch hosted by Dean of College of Engineering, Prof. Seung bin Park	Information on the historical background on Korea R&D and general affairs
	14:00-15:30	Engineering Building E2	Meeting with young professor with experience in US industry	Information how young professor works and role in the department. Previous experience and expertise working with industry in USA is important capital. Inter-departmental works can run smoothly
	16:00-17:300	Daedeok Innopolis	Presentation of Deadeok Innopolis S&T park Discussion	Deadeok Innopolis was a government initiative to house all R&D facilities in one place, where university, government and industry can work together. All government R&D units, including defense, will be moved to this facility. Become the model for other S&T park across Korea. Currently host annual conference of World TechnoPark Association – UNESCO. Provide office space and business assistantship for tenants Provide assistantship to other S&T Park

TSINGHUA UNIVERSITY

Visit to Tsinghua University includes discussion with Deputy Director of Overseas R&D Management Office – University Industry Cooperation Committee and a discussion with Prof Zhang Wei for Industrial Engineering department, as a sample of individual professor/researcher at university.

Some specific notes on Tsinghua UICC:

- Tsinghua UICC was founded in 1995, which functions somewhat like enterprise club. Current membership is more than 160, including well-known international companies such as IB, GM, P&G, Motorola, Toshiba, Hitachi, Samsung, EDF, and France Telecom. These enterprise members are membership fee, and in return UICC provides office support for the industry in terms of:
  - Strengthen cooperation between university and industry
  - Study trends of technology development
  - Helping companies solving technical problems arising from production, strengthening competitiveness
  - To assist companies in creating joint laboratory and/or research centres, between Tsinghua academic department and domestic industry
  - Serving the bridge between domestic and overseas companies
  - Set up in-house engineering master training station (non-degree) for domestic companies
  - Established more than 100 distance learning stations in 30 provinces
  - Organizes workshops, conferences, seminar between academia and the industry; creating communication platform for exploring potential cooperation.
  - Promoting Tsinghua technology to the members
  - Assisting member for special events, such as recruitment, setting up scholarship, etc.

- The role and position of UICC at Tsinghua University is as a broad platform for accelerating Tsinghua's technology transfer and specific instrument for strengthening university-industry collaboration. In a sense Tsinghua UICC is operating as the window for the industry to engage with Tsinghua University for R&D and technology transfers.

- UICC is run by executive operation office, with two divisions, domestic and overseas; and coordinates the following units:
  - Business Intelligence Centre
  - Development Strategy Research Centre
  - Technology Diagnosis
  - Consulting on Finance & Investment
  - Talent Training
  - Information Services

- UICC also coordinate several centres, such as Business Intelligence Centre – BIC and Development Strategy Research Centre - DSRC. BIC provides intelligence consulting to companies and organization. This centre also provides information to client companies to support their product development, technological innovation and market expansion. Whereas SRC provides analysis and consultation for companies and government administrations.

- At the department level, before 2008 professors engaged (in R&D) with the industry on individual contract basis, and not regulated by the university. After 2008, with the promotion of high technology by the government, research in that area become important and the university began institutionalization of university R&D. At that time China understand the importance of having its strength on own technical capability, as most of the technology is still imported by the companies. Since then all R&Ds by the professors are obligated to be contracted by the university, either at university level, faculty level or department level.

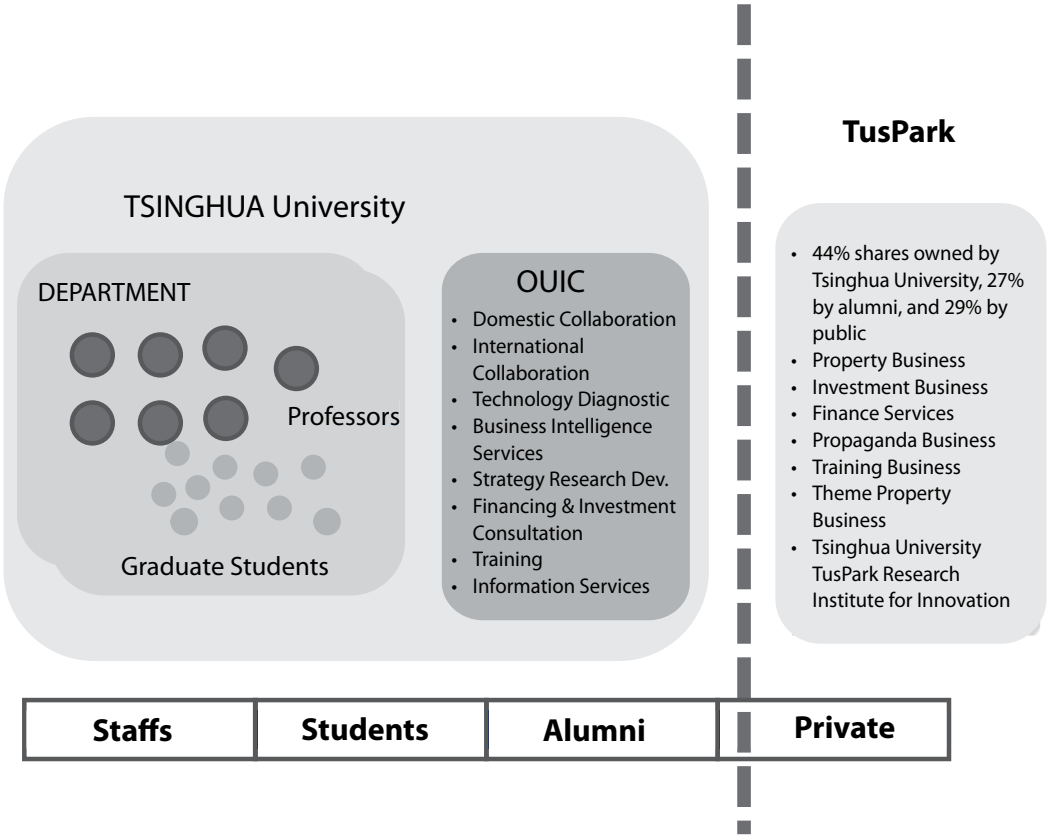
- Accompanying that policy, the university set up regulation concerning the share of revenue or overhead charge to R&D contract: 5.5% for government tax, 5% for university overhead charges, 5%-10% for department overhead charges, and the remaining for the professor's research account. This policy and regulation are implemented with support of strong system and professional administrative staffs.
- Professors are free to engage to as many research project (including consultation works), as long as they fulfil their obligations to the university (e.g., teaching, student advising, etc.). To maintain academic staff performance, the university imposes professor evaluation base on the criteria on teaching, production of research/academic papers, number of research fund (especially government funding), and professional impact at national and international level.

TUSPARK:

Visit to TusPark includes discussion vice President of TusPark, Dr Chen Hongbo. Dr Chen's motto is to change from "made in China to "created in China".
Some specific notes on TusPark:

- TusPark is an independent company solely functions to facilitate the university science and technology park. TusPark Co Ltd was established in July 2004, as the realization of university leaders to have a place where Tsinghua University strive its advances in science and technology. Tuspark Co. Ltd was formerly established as the Development Centre of Tuspark in August 1994. TusPark concept was formally proposed and approved by Beijing Government in 1993.
- Currently TusPark ownerships consists of:
  - 44% shares belongs to Tsinghua University
  - 27% shares belong individual shareholders (alumni)
  - 49% shares belong public
- According to Dr. Chen, to succeed an STP needs 4 elements (space, resources, services, and tenants) that must be managed in an integrated manner. In this context Tuspark is responsible for the development, construction, operation and administration of Tsinghua University Science Park (TusPark).
- TusPark core product is Science and Technology service platform centering on the Innovation service system, and is implemented in the following services:
- Incubator base for innovative enterprises
- Cultivation base for innovative talents
  - Transformation base for technological result
  - Human resource services
  - Capital services
  - Information exchange
- TusPark business includes:
  - Property business
  - Investment business
  - Finance Service
  - Promotion business
  - Training business
  - Theme property business
- Tsinghua University TusPark Research Institute for Innovation is TusPark organization unit, an institution jointly founded by Tsinghua University and Central and local government agencies. This is considered as the think factory for regional innovation, corporate innovation and technological innovation.

In summary, UIG partnership in Tsinghua can be illustrated as follows, where R&D can be implemented fully at university (at department level or through the office of University-Industry Cooperation Committee) or through TusPark:



Unlike KAIST, S&T Park at Tsinghua relies on university brands. Although the alternatives are always open, most R&D and university-industry collaboration at this park is related to Tsinghua University.

Similar to the KAIST case, the success of Tsinghua U-I collaborations depends strongly on the strength of organization and the people who ties the knots between university R&D and the industry. Independency of the organization from academic function should be very clear so that the organization can be functioning fully as professional unit that has the responsibility, authority and capability as business entity. Staffing for such organization requires professional support units, such as industrial/business liaison, technology transfer and technology commercialization, etc., that should also understand the university R&D capability.

DETAILED PROGRAMMES

LOCATION 2: BEIJING - CHINA

Date: 15-16 November 2012

Delegation:
1. Mr. Noor Arifin Muhammad, Directorate of S&T, BUMN - *BAPPENAS*
2. Prof. Dr. Ali Agus, Gadjah Mada University
3. Prof. Dr. Lilis Nuraida, Bogor Agricultural University
4. Dr. Armein Z. Langi, Bandung Institute of Technology
5. Mr. Purwanto Somali, PT Indofood Sukses Makmur
6. Dr. Biemo W. Soemardi, Study team member, Head of delegation

No	Date - Time	Location	Program	Remarks
	19 November			
1	14:00 – 15:30	Office of University-Industry Cooperation Committee, Tsinghua University	Welcome and introduction to Tsinghua UICC by Dr. Lu Xiao Jun, Deputy Director of Overseas R&D Management Office	The role and position of UICC at Tsinghua University as a broad platform for accelerating Tsinghua's technology transfer and specific instrument for strengthening university-industry collaboration. UICC is run by executive operation office, with two divisions, domestic and overseas. UICC coordinates the following units: - Business Intelligence Center - Development Strategy Research Center - Technology Diagnosis - Consulting on Finance & Investment - Talent Training Information Services Tsinghua UICC was founded in 1995, and also functions somewhat like enterprise club. Current membership is more than 160, including well-known international companies such as IB, GM, P&G, Motorola, Toshiba, Hitachi, Samsung, EDF, and France Telecom. Members are paying membership fee. UICC provides office support for the industry for: - Strengthen cooperation between university and industry - Study trends of technology development - Helping companies solving technical problems arising from production, strengthening competitiveness - To assist companies in creating joint laboratory

				and/or research centers, between Tsinghua academic department and domestic industry - Serving the bridge between domestic and overseas companies - Set up in-house engineering master training station (non-degree) for domestic companies - Established more than 100 distance learning stations in 30 provinces - Organizes workshops, conferences, seminar between academia and the industry; creating communication platform for exploring potential cooperation. - Promoting Tsinghua technology to the members - Assisting member for special events, such as recruitment, setting up scholarship, ect. UICC also coordinate several centers, such as Business Intelligence Center – BIC and Development Strategy Research Center - DSRC. BIC provides intelligence consulting to companies and organization. This center also provides information to client companies to support their product development, technological innovation and market expansion SRC provides analysis and consultation for companies and government administrations. In a sense, Tsinghua UICC operates similarly with university *LPPM* in Indonesia, in terms of linking client form industry to academia at

				at the university campus, but with more independent for the administration and more professional
2	15:40 – 17:00	Office of TusPark	Introduction and discussion on the role and function of TusPark by vice President of TusPark, Dr Chen Hongbo	TusPark is an independent company solely functions to facilitate the university science and technology park. Dr Chen motto is to change from made in Chine to created in China TusPark Co Ltd was established in July 2004, as the realization of university leaders to have a place where Tsinghua University can strive its advances in science and technology. Tuspark Co. Ltd was formerly the Development Center of Tuspark set up in August 1994. TusPark concept was formarly proposed and approved by Beijing Government in 1993. TusPark ownership: - 44% shares belongs to Tsinghua University - 27% shares belong individual share holders (alumni) - 49% shares belong public 4 elements of STP: Space, resources, services, tenants TusPark is responsible for the development, construction, operation and administration of Tsinghua University Science Park (TusPark) TusPark core product is Science and Technology service platform centering on the Innovation service system. TusPark services: - Incubator base for innovative enterprises - Cultivation base for innovative talents - Transformation base for technological result - Human resource services - Capital services - Information exchange

				TusPark has network in every region of the country where the economy and industry are booming. TusPark business includes: - Property business - Investment business - Finance Service - Promotion business - Training business - Theme property business Tsinghua University TusPark Research Institute for Innovation is TusPark organization unit, an institution jointly founded by Tsinghua university and Central and local government agencies. This is considered as the think factory for regional innovation, corporate innovation and technological innovation.
	20 November			
3	09:00-11:30	Department of Industrial Engineering, Tsinghua University	Discussion with Prof. Wei Zhang, Vice Chair of Industrial Engineering Department	Discussion on various aspect of academic and professional engagements with the industry. The last 10 years Tsinghua has been focusing more on academic (theoretical) research than on applied research. This is the consequences of being a world class university. On the other hand, industry has its own R&D capacity. Before 2008, professor engaged individually with the industry, but since2008 Tsinghua tried to bring academic engagement as institutional basis at department level. 2000 was the best time to start engagement with the industry because at that time companies are importing technology, and professor has the opportunity to help industry to create their own competitive strength.

				To promote the creation of innovative SME, the government provides incentive of 3 years tax free and additional 3 years of tax deduction. The university provides freedom and flexibility for professor for doing research with the industry, and providing conducive environment to do so. Professor are charged US$ 1.000/ year for their 18m^2 office, such a policy that drive professor being competitite to get as much research project as possible. Overhead charges to research projects: 5.5% for government tax, 5% for university charge, 5%-10% for department charges. Academic excellence is a group responsibility; one does academic research the other does applied research and other does the teaching

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