Directorate General of Higher Education
Republic of Indonesia

Data Collection Survey on Higher Education Development in Indonesia

Final Report

June 2011

JAPAN INTERNATIONAL COOPERATION AGENCY

PADECO Co., Ltd.

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Abbreviations and Acronyms

ACDR	Asian Conference on Disaster Reduction
ACDP	Analytical and Capacity Development Partnership
ADB	Asian Development Bank
AGH	Agronomy and Horticulture
BAN-PT	Badan Akreditasi Nasional Perguruan Tinggi: The National Accreditation Agency for Higher Education
BAPPENAS	Badan Perencanaan dan Pembangunan Nasional: National Development Planning Agency
BHP	Badan Hukum Pendidikan: Education Legal Entities
BKPM	Badan Koordinasi Penanaman Modal: The Investment Coordinating Board Republic of Indonesia
BPOM	Badan Pengawasan Obat dan Makanan: Drug and Food Monitoring Agency
BRC	Biopharmaca Research Center
CDA	Career Development and Alumni Affairs
COE	Center of Excellence
COP10	The 10th meeting of the Conference of the Parties
CSD	Commission of Sustainable Development
DGHE	Directorate General of Higher Education
EPI	Eastern Part of Indonesia
FAHUTAN	Faculty of Forestry
FAPERTA	Faculty of Agriculture
FATETA	Faculty of Agricultural Engineering and Technology
FAPET	Faculty of Animal Science
FEM	Faculty of Economics and Management
FEMA	Faculty of Human Ecology
FKH	Faculty of Veterinary Medicines
FMIPA	Faculty of Mathematics and Natural Science
FPIK	Faculty of Fishery and Marine Sciences

FTIf	Faculty of Information Technology
FTK	Faculty of Marine Technology
FTSP	Faculty of Civil Engineering and Planning
FTI	Faculty of Industrial Technology
GACP	Good Agricultural Collection Practices
GAP	Good Agricultural Practices
GBO3	The 3rd edition of Global Biodiversity Outlook
GDP	Gross Domestic Product
GER	Gross Enrolment Rate
GOI	The Government of Indonesia
HELM	Higher Education Leadership, Management and Policy
IAARD	Indonesian Agency of Agriculture Research and Development
IBR	Indonesian Biopharmaca Center
ICCEED	International Cooperation Center for Engineering Education Development
ICT	Information and Communication Technology
IDB	Islamic Development Bank
IKIP	Institut Keguruan dan Pendidikan (Universitas Negeri): State university in Indonesia
IMF	International Monetary Fund
IMHERE	Indonesia Managing Higher Education for Relevance and Efficiency
IPB	Institut Pertanian Bogor: Bogor Agricultural University
IRR	Internal Rate of Return
ITB	Institut Teknology Bandung
ITS	Institut Teknologi Sepuluh Nopember: Surabaya Institute of Technology
JASSO	Japan Student Services Organization
JICA	Japan International Cooperation Agency
JISNAS	Japan Intellectual Support Network in Agricultural Science
JSPS	Japan Society of the Promotion of Science

KADIN	Kamar Dagang dan Industri Indonesia : Indonesia Chamber of Commerce
LCD	Liquid Crystal Display
LPPM	Lembaga Penelitian dan Pengabdian kepada Masyarakat: Institute for Research and Community Empowerment/Service
LIPI	Lembaga Ilmu Pengetahuan Indonesia: Indonesian Institute of Sciences
METI	Ministry of Economy, Trade and Industry, Japan
MONE	Ministry of National Education, Indonesia
MORA	Ministry of Religious Affairs
MoU	Memorandum of Understanding
MMT	Master of Engineering Management
PPTA	Project Preparation Technical Assistance
PREDICT	Project for Research and Education Development on ICT
RENSTRA	Rencana Strategis: strategic plan
R&D	Research and Development
RISTEK	Kementrian Negara Riset Dan Teknologi: Indonesia State Ministry of Research and Technology
SARD	Sustainable Agriculture and Rural Development
SNMPTN	Seleksi Nasional Mahasiswa Perguruan Tinggi Negeri: National entrance exam for state own university
STIP	Sekolah Tinggi Ilmu Pelayaran: Maritime Higher Education Institute
UB	Universitas Brawijaya
UGM	Universitas Gaja Mada
UMM	Universitas Muhammadiyah Malang
UMY	Universitas Muhammadiyah Yogyakarta
UNCEN	Universitas Cenderawasih
UNDANA	Universitas Nusa Cendana
UNHAS	Universitas Hasanuddin
UNILA	Universitas Lampung
UNIPA	Universitas Negeri Papua

UNLAM	Universitas Lambung Mangkurat
UNMUL	Universitas Mulawarman
UNPAR	Universitas Katolik Parahyangan
UNPATTI	Universitas Pattimura
UNRAM	Universitas Mataram
UNS	Universitas Sebelas Maret
UNSRAT	Universitas Sam Ratulangi
UNSRI	Universitas Sriwijaya
UNUD	Universitas Udayana
USU	Universitas Sumatera Utara
UNTAD	Universitas Tadulako
UP	University Partnership Program
VRRC	Vice Rector for Research and Collaboration
WSIS	World Summit on the Information Society

1. Introduction

1.1 Background of the Survey

The Republic of Indonesia has maintained around 5% economic growth since the year 2000, and is expected to transform into a newly industrialized economy in the near future. Within that process, it is now focusing efforts toward producing high value-added commodities by developing high and intermediate tech industries utilizing the country's affluent resources. The natural resources in Indonesia are abundant but not unlimited; therefore, it is crucial to develop capacities in value creation for sustainable development through sustainable utilization of natural resources.

The higher education sector plays an important role in developing the skills needed for value creation; however, some challenges can be seen in Indonesia. The higher education Gross Enrollment Rate (GER) is low at 18% in Indonesia compared to that of other neighboring countries such as 45% in Thailand, 29% in the Philippines, and 28% in Malaysia. Furthermore, there is room for improvement in terms of both education and research quality at higher education institutes in Indonesia. The research function does not hold sufficient capacity to absorb the needs of the society, nor do the higher education institutions provide sufficient practical education based on their research. This necessitates two approaches: nurturing human resources with value creation capacity, and strengthening the system to utilize the human resources in appropriate work appropriate to their academic backgrounds.

In short, Indonesia is expecting to establish a structure within higher education institutions for nurturing high quality human resources in fields such as science, engineering and agricultural technology in order to contribute to sustainable economic development for Indonesia, both regionally and locally.

The Japan International Cooperation Agency (JICA) has provided various technical cooperation and Yen loan projects for higher education in Indonesia. By comparison, JICA has implemented more higher education projects in Indonesia than any other country.

This survey aims to assess the current situation of higher education in Indonesia. It also focuses on examining possible approaches for strengthening universities to contribute to human resource development and economic development through Research and Development (R&D) activities, by collaborating with other higher education institutions and industry sectors in Indonesia.

1.2 Objectives of the Survey

The objectives of the survey include:

1. Collecting information to formulate an effective JICA cooperation approach for the higher education sector, including collaboration between target universities (Institut Pertanian Bogor: IPB) and Institut Teknologi Sepuluh Nopember: ITS) in Indonesia and Japanese universities, institutes, and/or companies;
2. Collecting information from target universities (IPB and ITS) to confirm the relevance, priorities, and the impact of the proposed development plans of IPB and ITS; and
3. Proposing the development scenarios for IPB and ITS by reviewing the proposed development plans of IPB and ITS, and also by collecting comments from companies and local governments for nurturing high-quality human resources capable of research in the high-tech industry, as well as promotion of local industries.

1.3 The Survey Area

The survey targets IPB and ITS.

1.4 Relevant Organizations

Ministry of National Education (MONE), Directorate General of Higher Education (DGHE), Badan Perencanaan dan Pembangunan Nasional (BAPPENAS), Kamar Dagang dan Industri Indonesia (KADIN), and local governments, and companies.

1.5 Survey Period and Team Members

The survey period is from 18 February 2011 to 20 June 2011, including three visits to Indonesia as shown in the following tables.

Table 1.1 The 1st Visit (Data Collection): 8–29 March 2011

Date	Place	Activities
8 March	–	Flight from Japan to Indonesia
9 March	Jakarta IPB, Bogor	• Team meeting • Introductory session for the mission
10 March	Jakarta	• Introductory session at JICA • Kick off meeting with DGHE, IPB, ITS members at BAPPENAS
11–16 March	ITS, Surabaya	• Introductory session for the mission at ITS • Data collection at ITS • Interview at ITS, local government, and semi-government company working with ITS
17–25 March	IPB, Bogor Jakarta	• Data collection at IPB • Interview at IPB, private companies working with IPB, NGO, government organization
22 March	Jakarta	• Interview to World Bank Jakarta office
26–28 March	Jakarta	• Interview to Jakarta Japan Club (chambers of commerce of Japan) • Report of the activity at JICA • Flight from Indonesia
29 March	–	Arrival in Japan
4 April	Jakarta	• Interview to Asian Development Bank Jakarta office

Table 1.2 The 2nd Visit (Data Collection): 10–28 April 2011

Date	Place	Activities
10 April	–	Flight from Japan to Indonesia
11 April	Jakarta	• Interview at DGHE, Kementrian Negara Riset Dan Teknologi (RISTEK), BPPT,
12 April	Jakarta	• Ministry of Agriculture • Interview to ADB Analytical and Capacity Development Partnership (ACDP) project (MONE) • Interview to JAC Recruitment Indonesia
12–16 April	IPB, Bogor	• Discussion on planned activities • Supplementary data collection
15 April	Jakarta	• Interview to USAID Jakarta • Interview at BAPPENAS
17–24 April	ITS, Surabaya	• Discussion on planned activities • Supplementary data collection

Date	Place	Activities
18 April	Jakarta	• Interview to Sharp Electronics Indonesia
25 April	Jakarta	• Interview to GMN (PT Gerbang Multindo Nusantara)
26 April	Jakarta	• Report to DGHE, MONE • Interview to JICA expert at The Investment Coordinating Board • Interview to Bank of Tokyo-Mitsubishi UFJ
27 April	Jakarta	• Interview to Islamic Development Bank • Meeting at JICA Jakarta Office • Flight from Indonesia
28 April	–	Arrival in Japan

Table 1.3 The 3rd Visit (Reporting): 22–28 May 2011

Date	Place	Activities
22 May	–	Flight from Japan to Indonesia
23-24 May	Bogor, Surabaya	• Discussion on study results with universities
25 May	Jakarta	• Discussion with all stakeholders
26 May	Jakarta	• Discussion with JICA
27 May	Jakarta	• Finalize report • Flight from Indonesia
28 May	–	Arrival in Japan

The interviewees during our survey term are listed in Appendix 10.

The team consists of 8 members in total, and the members participated in the field activities, to conduct data collection in Japan and in Indonesia.

Table 1.4 The JICA Survey Team Members

	Title	Name
1	Team Leader	Mr. Yuichiro Motomura
2	Deputy Team Leader / Economic Analyst 1	Ms. Hiromi Takagi
3	Higher Education Planner	Dr. Kyoko Nakano
4	Economic Analyst 2	Mr. Shinichiro Tanaka
5	Science and Technology Analyst	Dr. Hiroomi Homma
6	Educational Facility Planner	Mr. Tadayoshi Tsumoto
7	Educational Equipment Coordinator / Japanese University Collaboration Analyst	Ms. Midori Ozawa
8	Coordinator / Economic Analyst Assistant	Mr. Ryo Saito

1.6 Reports

The results of data collection are summarized, and the reports are submitted to JICA as per the terms in Table 1.5:

Table 1.5 The Reports to Submit

Term	Title of Report
Early March, 2011	Inception Report
Mid April, 2011	Progress Report
Mid May, 2011	Draft Final Report
By 20th of June, 2011	Final Report

2. Situation and Challenges of Higher Education in the Fields of Science, Engineering and Agriculture in Indonesia

2.1 Higher Education Plan and Conditions, Overviews from Policy, Budget, in the Fields of Science, Engineering, and Agriculture

2.1.1 Higher Education Policies and Plans in Indonesia

The government of Indonesia (GOI) is aiming to realize growth with equity. Thus, widening the access to higher education[1] is one of the most prioritized agendas alongside rapid economic growth in the National Development Plan for 2010–2014[2]. The second priority set in the National Development Plan is educational policy in connection with the ten challenging issues raised by the government through reviewing achievements during the previous five years. GOI targets to increase GER of higher education from its current 18% to 25% by 2014 in the National Development Plan. Meeting labor force demand is another concern addressed in the plan. The plan also focuses on food security, renewable energy, the living environment and some other specific fields to simultaneously achieve economic development and social welfare[3]. Additionally, the plan expects enhanced outputs of research through the networking of research activities.

Following such priorities and principles from the government as shown above, MONE is now making efforts to provide internationally competitive education services based on the specific development plan of higher education. The plan gives 28 key performance indicators, including the percentage of faculty members with doctoral degrees, the number of national and international publications and intellectual property rights and accreditation scores, as well as the GER and the number of recipients of scholarships[4]. According to Rencana Strategis (RENSTRA) of MONE, the GER is expected to reach 30% in 2014, giving a particular target ratio of 10% in the field of natural science and technology. This is more than twice the ratio in 2009, meaning that the percentage of graduates in science, engineering and agriculture should be increased from 20% to more than 30% within 5 years[5]. Special attention is paid to higher education in the fields of science, engineering and agriculture. MONE is pursuing not only a quantitative increase, but also an improvement of the quality of higher education. For example, they are aiming to become internationally competitive in science, which would be indicated by aiming at a ranking within the top 500 schools of the Times Higher Education (THES) World Ranking by 2014.

In this context, MONE presents five higher education programs in their RENSTRA, and the necessary budget for the period of 2010–2014. The share of the budget needs for the research

[1] Higher education in Indonesia consists of universities, institutes, schools of higher education, academies, and polytechnics.

[2] Presiden Republik Indonesia, 2010, *Lampiran, Peraturan Presiden Republik Indonesia Nomor 5 Tahun 2010 Tentang Rencana Pembangunan Jangka Menengah Nasional (RPJMN) Tahun 2010–2014*, Kementerian Perencanaan Pembangunan Nasional/Badan Perencanaan Pembangunan Nasional (BAPPENAS)

[3] Division of Higher Education, Directorate of Education and Religious Affairs of BAPPENAS expressed their concern with the enhancement of universities in the field of engineering and medical education (Source: Interviews with BAPPENAS on April 15).

[4] Menteri Pendidikan Nasional, *Rencana Strategis Kementerian Pendidikan National 2010-2014,* MONE

[5] The percentage of higher education graduates (not only universities) in Architecture and City Planning, Physical Science, Agriculture, Farming, Technic and Technology, and Transportation and Communication was 22% in 2008/2009 (Source: Departmen Pendidikan Nasional, Badan Penelitian dan Pengenbangan, Pusat Statistik Pendidikan, 2008a, *Statistik Perguruan Tinggi 2007/2008*). The ratio of students who obtained a bachelor in Architecture and City Planning and Technology from state universities in 2008 was 15.2% (Source: Departmen Pendidikan Nasional, Badan Penelitian dan Pengenbangan, Pusat Statistik Pendidikan, 2008a, *Statistik Perguruan Tinggi 2007/2008*).

and public services is the least, while supporting the managerial issues is predominant. As a whole, higher education claims about one third of the total budget, which consists of eight education programs at all levels from primary school to university[6]. Currently, the annual budget of DGHE is US$2.8 billion among which US$40 million is used for research funds. US$8.5 million is used for collaborative research by industries and universities[7]. Other budget allocation among universities is made based on the proposals by each university, and is not prioritized in a specific order.

2.1.2 Overviews of Higher Education in Indonesia

(1) Number of Institutions

According to the Law of National Education System (2003), 5 forms of institutions are deemed as higher education organizations in Indonesia:

- Academies (specific subjects of applied science, engineering, and/or art)
- Polytechnics (vocational applied/practical skills)
- Advanced schools (or professional education in a selected single subject)
- Institutes (consisting of several faculties/departments in one academic area)
- Universities (consisting of several faculties/departments in several academic areas)

Currently, higher education in Indonesia is characterized by rapid growth with the active involvement of the booming private sector. There were 76 state and 1,671 private institutions in 2000/01 and they have increased to 83 and 2,978 respectively in 2009/10; the state institution increment is 7, while more than a thousand private institutions have been opened in this decade.

Quality assurance of tertiary education, including those of emerging private institutions, is a growing concern. Areas of particular concern include the global competitiveness of the universities, and in this context, the learning system, academic atmosphere, quality assurance system, graduation standards, as well as the quality of publications[8]. MONE recently established the National Accreditation Agency for Higher Education (BAN-PT), and has started an university accreditation program. The ministry is now discussing how to ensure the quality of private tertiary institutions as well.

(2) Enrolment

During this decade both the private and state sectors have contributed to the increase in the number of students. In 2000/01, approximately 1.5 and 1.9 million students were enrolled in state and private institutions, out of a total of approximately 3.4 million enrolled students. Numbers continued to grow, and in 2009/10 there were 1.8 and 2.5 million students enrolled in the respective sectors, out of a total of 4.3 million enrolled students.

[6] DGHE provides 27 selected universities with a total of US$10 million as a discretionary budget for their development. The funding will be shifted to another group of 27 universities in a few years. (Source: Interviews with DGHE on April 11)

[7] Source: Interviews with DGHE on April 26

[8] Jardine, D (2010) INDONESIA: Cleaning Up Higher Education, University World News, Issue 107 (http://www.universityworldnews.com/article.php?story=20100114191152158&mode=print)

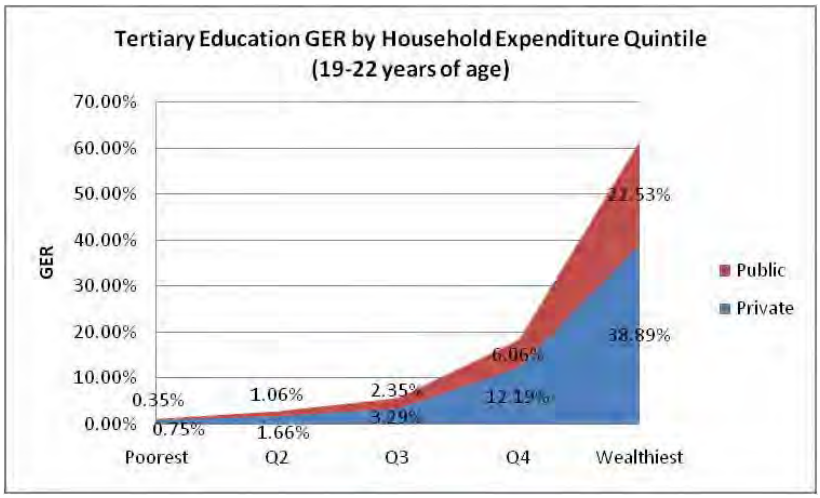
Table 2.1 Higher Education Institutions and Student Enrolment

	State		Private		Total	
	Number	**%**	**Number**	**%**	**Number**	**%**
1. Institution	**83**	**2.76**	**2,928**	**97.24**	**3,011**	**100**
University	48	10.43	412	89.57	460	100
Institute	6	11.32	47	88.68	53	100
School of Higher Learning	2	0.15	1,314	99.85	1,316	100
Academy	-	-	1,015	100.00	1,015	100
Polytechnic	27	16.17	140	83.83	167	100
Students	**1,804,761**	**41.61**	**2,532,278**	**58.39**	**4,337,039**	**100**
University	1,680,370	55.50	1,347,280	44.50	3,027,650	100
Institute	66,107	35.38	120,716	64.62	186,823	100
School of Higher Learning	1,688	0.22	752,731	99.78	754,419	100
Academy	–	–	252,488	100.00	252,488	100
Polytechnic	56,596	48.93	59,063	51.07	115,659	100

Source: MONE (2010) Education Statistics (http://www.psp.kemdiknas.go.id/uploads/Statistik%20 Pendidikan/0910/ index_pt(1)_0910.pdf)

Net Enrolment Rate (NER) and GER continue to grow, reflecting the recent growth in enrolment. GER for tertiary education was only 14.9% in 2000; it has then increased to its current level of 18%.

Tertiary education GER, however, is a limited phenomena in the wealthier quintile of Indonesian Society. An analysis of SUSENAS[9] data reveals that GER is dramatically higher in the top two wealthier quintiles. For example the tertiary education GER of the wealthiest quintile is 61.42% (state 22.53% and private 38.89%), while those of the poorest three quintile is very low – GER of the poorest quintile is almost negligible at 1.1% (0.35% and 0.75%).



Source: SUSENAS 2006 Education Module, provided by the World Bank Jakarta office

Figure 2.1 Tertiary Education GER by Household Expenditure Quintile

[9] Indonesia's National Socio-economic Survey by RAND

(3) BHP (Badan Hukum Pendidikan – Education Legal Entity)

Law No. 9/2009 on Education Legal Entities (BHP) was annulled by the Indonesian Constitutional Court in March 2010 as it was ruled unconstitutional[10]. MONE is now considering an alternative to BHP, and the new mechanism will be in place soon. Any proposed project/program should be aligned with the new mechanism.

(4) Budget

The Higher education budget has been increased from US$0.769 billion in 2005 to US$2.062 billion in 2009. Meanwhile, ODA funding is now counted as a part of the Ministry budget and if a Ministry receives any budget from ODA, an equivalent amount of the Ministry budget should be reduced and reallocated to another Ministry to be consistent with the ceiling provided. According to an interview with DGHE, the budget for 2011 is around US$2.8 billion.

Now MONE needs to prepare a project plan that is convincing to those stakeholders who are concerned that additional ODA funds will decrease the Ministry budget to meet the ceiling. Although the budget allocated to higher education sectors has been growing, indeed, there is still a need for foreign assistance to finance a big investment project that cannot be financed just by the Ministry budget, and there are many projects currently proposed in the government's blue book.

Table 2.2 MONE: Budget for Higher Education

FY	US$ billion
2005	0.769
2006	1.076
2007	1.456
2008	1.608
2009	2.062

Source: DGHE DIPA documents 2005–2009

2.2 Current University Conditions in Indonesia in the Fields of Science, Engineering and Agriculture

An Overview of the current conditions of Indonesian universities in science, engineering and agriculture from the viewpoints of relevance to national policies and the current situation could be summarized as follows:

- GOI plans to increase accesses to higher education especially in the field of science and technology as well as to provide internationally competitive higher education services.
- Contributions of universities in science, engineering and agriculture to socio-economic development are acknowledged by both industries and local governments. Subsequently, strengthening research capabilities and sharing the research outputs with industries and communities is anticipated by society.
- Networking among universities and researchers is a challenging agenda. This is also expected by DGHE from the viewpoint of elimination of disparities between central and

[10] Reasons for the revocation includes: (i) the BHP Law has many shortcomings in terms of juridical clarity, objective, and alignment with other existing laws; (ii) the BHP Law assumes that education institutions have the same management and financing capacities, which is not the case in Indonesia; (iii) granting autonomy to education institutions will lead to underfunding of many institutions, and negatively affect education; (iv) the BHP Law does not guarantee the achievement of national education goals, and it contravenes the commitment of the 1945 Constitution in this regard; and (v) the not-for-profit principle for education institutions can be applied in other legal forms, not necessarily in the form of BHP (http://us.detiknews.com).

peripheral areas. Considering the mission of universities in following the national development plan and their experiences in the past, coordination and operation systems should be carefully designed based on the conditions of participating universities and their social environments.

As described in the previous section, Indonesia pursues both quantitative and qualitative development of universities in the fields of science, engineering and agriculture. Therefore, there are dilemmas, for example that increased number of students or programs should increase the ratio of students per faculty member or the burden of each teaching staff. Since MONE is aware of the importance of accrediting the quality of higher education, degradation of these indices must be avoided.

It is also anticipated that universities, especially the resource universities in the fields of science, engineering and agriculture, will establish a network to provide societies with more benefit through research. In this connection, a facility sharing system was once introduced to some core universities; however it did not work well partly due to some coordination problems. Thus sharing knowledge, human resources and facilities in order to meet the needs of Indonesian societies should be seriously reconsidered.

Local governments, especially in the Eastern Part of Indonesia (EPI), have been utilizing universities' knowledge and research capabilities for solving complicated problems of the society. For instance, the Government of East Java Province has been actively cooperating in research with ITS in the field of human settlement, to secure the living environment of local communities, and making use of abundant natural resources to gain new energy, value added products and so forth[11]. Among these, geothermal technology is one of the priority areas of the joint research by the Energy and Mineral Resources Agency and ITS. However, the local government needs more advanced and wide ranging capacities of ITS in conducting research, and has been requesting ITS to establish a department in the field of earth science. Hence, ITS is now preparing a department that includes research in the fields of geophysics and geology so that the local government should not have to rely on the assistance of other universities such as Institut Teknology Bandung (ITB) and Universitas Gaja Mada (UGM). Another example was shown in the field of marine engineering, namely a potential request of designing a cheap but durable small fishing vessel from the Agency of Marine and Fishery. The Government of East Java Province also has experiences of cooperation with provinces in EPI. Assisting forest management and agricultural development in the East Kalimantan is among their joint research projects with ITS for EPI. The government intends to expand these activities to more provinces of EPI, and thus will need to utilize research capabilities of ITS more frequently.

In terms of research and development to create new commercial values, both Indonesian and Japanese enterprises used to find difficulties in initiating cooperation with universities, or often had relatively weak motivation to work together. This is partly due to the lack of mutual reliance between universities and industries. Capabilities of match-making between technical needs of industries and intellectual resources of universities were also insufficient on both sides. Also, it is obviously unfavorable for both parties that only a small number of opportunities to do R&D activities were given to private companies located in Indonesia. Even still, collaboration between private companies and universities has been conducted in various ways, even though they have been more technical consultations than creative joint research activities, especially for manufacturing companies. In these cases, lack of fundamental technologies such as metallurgy, steel production, molding and so forth in Indonesia are one of the constraints[12]; thus strengthening fundamental technologies is still needed besides nurturing the soft skills of

[11] Source: Interviews with senior officials of the Government of East Java
[12] Source: An interview with a naval architecture company.

university graduates. Simultaneously, recruitment of masters degree holders is not much of a concern of industries, while graduates with bachelor degrees obtain jobs within 4 to 6 months after graduation[13]. Collaboration in biotechnology is more research based, as it usually pursues to add value to natural resources. Growing competitiveness in the cost and quality of manufacturing in all fields today is expected to encourage Japanese companies to move some parts of their R&D activities to Indonesia.

(1) Reviewing IPB from the Policy Level

IPB can be recognized as a core university that conducts research to foster the national food security among ten key areas of the national development plan, including biotechnology, natural sciences, energy, industrial materials, industrial architecture, ICT, meteorology, social sciences and so forth, and giving specific attention to food-related issues[14]. It is also anticipated that IPB, as one of the strongest universities in Indonesia, should become an "excellent" research university. Actually, IPB was mandated by the President of Indonesia in 2008 to take an important role in food and energy security and biodiversity as a "world class university" specializing in sustainable agriculture[15].This is in line with the role of IPB to contribute to economic growth through human resources and science and technology. The long term national development plan also acknowledges the sustainability of natural resources as one of the important target issues[16]. Thus, IPB's activities for sustaining local resources, empowering communities, and supporting small and medium size enterprises are considered to contribute to the natural resource-based industrial development.

(2) Reviewing ITS from the Policy Level

ITS is a higher education institution dedicated to engineering. It is strategically located in the eastern part of Indonesia (hereinafter referred to EPI) and was appointed as one of the resource universities in the field of Information and Communication Technologies (hereinafter referred to as ICT) in 2001, especially in terms of the higher human resources development for R&D[17]. In this context, DGHE and JICA agreed to implement a four-year technical cooperation project, namely the Project for Research and Education Development on ICT in ITS (hereinafter referred to as PREDICT-ITS) in 2006, and assisted ITS in transforming their masters programs from class-based to research-oriented, upgrading research capabilities, establishing substantial partnerships with universities in EPI, and strengthening university-industry linkages. Both the Indonesian and Japanese government have agreed to implement the second phase of the project. According to President's statement made in December 2010, ITS is expected to play a leading role in Indonesia, as MIT does in U.S.A.[18]. Not only in the field of ICT, ITS's contributions to the nation in the fields of marine, human settlement and energy are also anticipated.

[13] Waiting period in average is around 4 months at ITS (Source:Meeting at ITS), and less than 6 months at IPB, mainly obtaining jobs in the private sector except those from FAHUTAN (Source: Supply and demands of graduates:Questionnaires by the JICA Study Team in March 2011).

[14] *RPJMN Tahun 2010–2014* (See note 2)

[15] Source:" Orasi Ilmiah dalam Rangka Dies Natalis ke-45 IPB" prepared by IPB

[16] Presiden Republik Indonesia, 2007, *Rencana Pembangunan Jangka Panjang Nasional Tahun 2005–2025*, Sekretariat Negara Republik Indonesia

[17] M.T.Anggoro et al., 2001, *Higher Education Strategy on Information and Communication Technology,* Directorate General of Higher Education, Ministry of National Education

[18] Public Lecture by the President of Indonesia on the occasion of the inauguration of the Robotics Center of ITS on December 14, 2010 (http://www.depkominfo.go.id/berita/bipnewsroom/kuliah-umum-presiden-ri-dan-peresmian-gedung-pusat-robotika-dan-gedung-energi-its/)

2.3 Higher Education and Industry in the Fields of Science, Engineering and Agriculture

Like elsewhere, there are two types of activities for universities and industries to collaborate in the fields of science, engineering, and agriculture. Collaboration is done through: (i) Universities providing graduates to private firms and the public sector, and (ii) Universities engaging private firms and the public sector for research activities and consultancies.

2.3.1 Demand and Supply of University Graduates in Science, Engineering, and Agriculture

(1) Quantitative

As stated in the above section 2.1, widening the access to higher education is one of the most important agendas for GOI, and therefore it has been encouraging universities to accommodate more students. Reflecting these policies, the enrolment rate for universities in Indonesia is rapidly increasing; it has increased by 80% in the last decade.

Recognizing such macro policies and trends, the team has conducted a series of interview sessions to private firms and national/local government offices active in the fields of science, engineering, and agriculture. Despite the rapidly increased supply of university graduates, there has been no serious concern expressed regarding the over (and under) supply of graduates with such scientific and technological background in general, which in turn coincides with results from recent surveys on human resource development[19]. In general, it is recognized that Indonesian universities are supplying an appropriate number of graduates quantitatively. Several personnel pointed out that the number of graduate engineers would be too much if compared to the number of technicians with senior secondary schools certificates. Now the question is the quality of the graduates, rather than quantity. This suggests the following two hypotheses:

- Indonesian industry is growing sufficiently to absorb rapidly growing university graduates so that they don't observe the current situation as an oversupply of graduates
- On the other hand, the current level of industrial advancement and sophistication does not necessitate personnel with specialist skills/knowledge or tertiary-educated personnel, therefore the industry does not observe the current situation as an undersupply of graduates

(2) Qualitative

Though no serious concerns were heard regarding quantitative over/under supply of university graduates, many of the interviewees pointed out qualitative aspects, in other words basic generalist skills, behaviors, and attitudes of the university graduates need to be improved.

Keywords here are "soft skills (skills to respond to situations proactively in order to find feasible and flexible solutions, rather than doing things as they were told)", and entrepreneurship. The universities in the fields of engineering, science, technology, and agriculture, try to develop students' soft skills, such as adaptability and problem-solving skills,

[19] Some of the interviewed companies pointed out difficulties in recruiting personnel with very specific backgrounds. For example, Sharp electronics company Indonesia pointed out difficulty in recruiting technical personnel with skills and knowledge in (i) cooling machines (for air conditioner and refrigerator) and (ii) solar panels. According to the interviewee, however, recruitment of good sales personnel is more difficult and a serious issue, compared to the lack of science and technology personnel. In another example, PT GMN pointed out there is an undersupply of renewable energy (e.g., solar, micro hydro, biomass, etc). Generalization is impossible due to the limited number of interviewees though. These comments eventually suggest that proposed research areas by both IPB and ITS are consistent with the industrial demand for a very specific skill and knowledge set.

however those are not directly taught through lectures at universities. In addition, universities provide information seminars, and working opportunities at companies as a part of course work. At least two interviewed universities and government offices considered they should pay more effort to strengthen graduates' skills in these general competencies, rather than specialist competencies.

As mentioned in the previous section, companies are not complaining much about the specialist competencies, instead the leaders of business entities such as KADIN, or companies care about the new graduates' competencies. Expectations regarding human resource supply are high in their competent fields; the students majoring in engineering are expected to pursue work as engineers, and those who are in the agriculture major in agriculture. The majority of the students pursue work in their fields, whilst some portion of students take jobs in different fields, such as business, banking, finance, and so on. This situation is not ideal, but out of the control of universities.

The majority of the interviewees of the industry sector or local government prefer to recruit newly graduated students, rather than masters degree holders or Ph.D. holders. This is because the salary scale is different between bachelors and masters degree holders[20]. Some jobs require higher degrees, especially in the research section, but companies hire newly graduated or undergraduate students, and first train them for one or two years at their companies, and then the employees send the graduates back to university for further studies. According to universities, most master course students already have jobs. In the case of researchers or teachers working for masters or doctoral degrees, the purpose is for further academic study in their area. While, in the case of private companies' employees or government staff, it can be for receiving a promotion.

2.3.2 Demand and Supply for Research Activities by Universities

As for the research demands, generally, it seems there is a growing demand for organized research between universities and the industry sector[21]. In general, major companies in Indonesia would like to develop fully functioning R&D sections. However, under current conditions, most of them do not have many urgent research activities that they have to work on. It seems that they are in a vicious circle of: (i) low R&D function of the industries, (ii) low capacity of R&D function of university for creation of new industry, and (iii) low industry R&D demand toward universities.

However, some companies are already working with universities. Companies request universities to conduct some research, since the companies do not have enough facilities or human resources, through contracting them for research or consultancies. In addition, they are usually prestigious universities, such as IPB and ITS, that have strong reputations and the technical skills to work for companies.

In all the cases, the companies had some connections to the universities, such that the owners or staff of the companies are graduates of the universities. Therefore, the current research activities between university and industry are closely tied to the human resource connections they have.

[20] Interview with Arrbey Ltd., the salary is around 1–2 million per months for bachelor's, 2 million or more per months for masters degree holders.

[21] Only one Indonesian company applied for the RISTEK research fund in 2010, Appendix 1

2.3.3 Demands and Needs toward Collaboration between Universities and Companies

DGHE pointed out that it is necessary for universities to work with companies; generally speaking, there are still not enough collaborative activities in Indonesia. This is because: (i) in general, companies have not yet created many value added products, (ii) there is no channel to universities for assisting with the companies' requests, or (iii) people are not familiar with the knowledge and technology that universities have.

Regarding the research demands to higher education, some companies which have previously worked with universities expect further collaboration with universities in the future. However, it is not clearly seen whether the collaboration between university and industry is supported at the policy level in the industry sector. According to the Coordinating Ministry of Economic Affairs, it is clear that collaborations are necessary for all companies, even if it is not mentioned or clearly supported by policies. It is mentioned that all companies should have opportunities for university collaboration, because competitive product development requires R&D activities[22].

As for the academic side, there are supporting policies for working with the industry sector. Competitive research funds are based on application and proposal. As for the RISTEK research fund, the application score is marked higher with international collaboration or collaboration with industry. In the case of the DGHE research fund, 20% of the total research fund is allocated towards a collaboration activity.

By promoting university research activities, and by increasing value-added commodities in the market, the collaboration between universities and industry will increase more than it currently stands.

Some universities, at least IPB and ITS, have already started working with companies and are trying to respond to the demands of the industry sector, in human resource development as well as research activities as mentioned in previous sections.

For universities, collaboration activities with companies will bring benefits to universities such as producing the products for everyday use; connecting knowledge into practice. For the companies, there are benefits such as thorough research results with good facilities, equipment and the knowledge through the universities' national and international network. Companies expect universities to introduce new technology, material, and information, as well as examining products or technology.

The potential demands for research in each private company were not urgent or apparent. This is due to research being conducted internally, not to be noticed by other companies, especially in the case of a new invention. One of the approaches is that universities create a list of potential inventions and present them to individual companies. If the companies are interested in R&D, the companies will review and find one that has potential in the market.

The demands to create new industries are growing in Indonesia, which can be seen from the GOI policy which aims to increase the number of entrepreneurs from 0.18% of the total population to 2%. They are planning to bring up around 4 million entrepreneurs in 5 years. Universities are supporting this policy, by introducing entrepreneurship classes and seminars, some small funds, business incubation in schools, and sending professors to the committees in ministries[23]. Creating new ideas and running a business are different in nature. Running a

[22] JICA team, however, considers that starting collaboration is not easy for those without previous experience in collaboration activities. We will discuss more in section 5.

[23] IPB rector is a vice chair of the National Innovation Committee,

business is not the main role of the university. In the case of running new businesses, it is necessary to have a strong commitment from the industry sector and industrial policies.

From the interviews, it was observed that almost all companies and institutes expect universities to conduct some examination or testing for their technology or new products. Some institutes or research centers have special testing machines in Indonesia, but the companies need to wait for a long time or travel extensively to be examined with the special machines. It is convenient for them to conduct examinations or testing at universities. If the universities have special equipment, this function could be a part of contracted research activities.

Expectations for human resource development at universities are presumed to increase in Indonesia. Currently the common request is rather on discipline or working attitudes of new graduates, so basically the knowledge level for new graduates is relatively fine; however, some specific fields of human resources are requested by some institutions, such as workers at botanical gardens, or engineers at ship yards, energy fields, cooling machines, solar batteries, or LCD TVs. Most of them are newly developed sub-fields or are currently planned to expand the activities. We cannot specify the fields for human resource needs with a mid-long term vision, since this will differ based on the changing needs toward human resources created by technological inventions or R&D activities.

To meet the demands of industry about research activities with the human resources, it may be necessary that those business sectors related to agriculture and manufacturing are widely recognized as profitable and promising fields of work in Indonesia. Furthermore, the reputation and acknowledgement at the national and international levels can be factors to attract students, as well as salary standards for university graduates.

2.4 International Donors in Higher Education

World Bank, ADB and USAID have ongoing or projects in preparation at the higher education level as summarized below. The team did not have the opportunity to interview AUSAID, which is now undertaking a higher education sector review. AUSAID will be a major player in the higher education sector if they develop a support program based on the results of their review.

2.4.1 IMHERE (Managing Higher Education for Relevance and Efficiency, World Bank)

IMHERE (2006–12) which is in line with the Government's Higher Education Long Term Plan, supports the management and administration of the Directorate General for Higher Education in the Ministry of National Education, and assists with the development of the legal framework for higher education. It aims to help create an enabling environment for public universities to become more autonomous and more accountable, while also increasing the quality, relevance, efficiency and equity of education for students. Project components have been designed to (i) facilitate Higher Education system reform and oversight, (ii) provide grants to improve academic quality and institutional performance, and (iii) revitalize the national and open universities in the areas of governance, finance, outreach, content, and delivery. The total planned cost is US$142 million (World Bank US$107 million and GOI US$37 million). IMHERE offers 3 categories of competitive grants, and the grants are available for (i) Technical Assistance, (ii) non-degree training, (iii) IT infrastructure and software, (iv) policy studies, and (v) project management. Table 2.3 below shows the eligible institutions for each category.

Table 2.3 Eligible Institutions by Category for Competitive Grant at IMHERE

	Categories	Eligible Institutions
1	BHMN	University of Indonesia (UI), Gadjah Mada University (UGM), University of North Sumatra (USU), Indonesia University of Education (UPI), Airlangga University (UNAIR), Bogor Agricultural University (IPB), and Bandung Institute of Technology (ITB)
2	B2a	Jakarta Polytechnic (PNJ), Bali State Polytechnic (PN Bali), University of Bengkulu(UNIB), Hasanudin University (UNHAS), State University of Malang (UM), Jenderal Soedirman University (UNSOED), Lampung University (UNILA), Papua State University (UNIPA), Brawijaya University (UNIBRAW), Sebelas Maret University (UNS), and Sepuluh Nopember Institute of Technology (ITS)
3	B2b	All public higher education institutions

The World Bank is planning a "skills development project" which focuses on post junior-secondary level vocational training and education. The details are under discussion.

2.4.2 ADB

ADB is not currently implementing any project/program. However, there are three higher education programs in the pipeline which will be commenced soon: (i) ACDP (Analytical and Capacity Development Partnership), (ii) Polytechnic Development Program, and (iii) Higher education development, each of which are summarized below:

(1) ACDP (Analytical and Capacity Development Partnership)

- Australian-financed TA worth US$50 million. ADB is entrusted to manage the partnership.
- TA and training (capacity development) are the main components
- So far they have identified 14 areas of study of which 3–4 are related to higher education governance and policy framework (such as sector review, R&D and entrepreneurship, RENSTRA (strategic plan) improvement, etc.)
- Now ADB is finalizing the TOR for each area, and will begin implementation soon.

(2) Polytechnic Development Plan

Currently ADB is conducting the PPTA for the Polytechnic Development Project. The TA intends to design a project that will support the development of the polytechnic education system in Indonesia to respond better to the needs of the labor market and to support economic growth sectors. The PPTA consists of two phases: (i) assessment of the polytechnic sector, and (ii) development of the project design and monitoring framework. The study is scheduled to be completed in mid 2011. The followings is an outline of the project:

- Scheduled to start in 2012 (on ADB board by the end of December 2011)
- US$80 million
- Competitive grant for polytechnics
- Include SMKs (vocational high schools), in addition to polytechnics

(3) Higher Education Development

- Currently under consideration
- Implementation from 2012 or 13
- Budget range is US$100–200 million
- Competitive grant for both state and private universities
- Besides research activities, inclusion of equipment and facilities to be discussed

- Eastern Indonesia development - intend to promote higher education institutions in the area

2.4.3 IDB (Islamic Development Bank)

Fostering good Muslims is the philosophy of IDB, and in Indonesia, IDB has 7 on-going projects that support specific university development (building construction, facility, equipment, and TA), of which 2 will be completed soon. The amount of the financing ranges between US$10–40 million for each of the 7 on-going projects.

To be completed soon
- UIN Alauddin, Makasar (Teaching hospital) (US$8.87 million)
- Diponegoro University (US$33.0 million)

On-going
- Jakarta State University
- University of Indonesia (Teaching hospital and research center)
- IAIN Ar-Raniry, Banda Aceh (US$27.5 million)
- UIN Sunan Gunung Djati, Bandung (US$16.8 million)
- University of North Sumatra (Teaching hospital) (US$21.6 million)

L/A soon
- Padjajaran University
- IAIN Sunan Ampel, Surabaya
- Semarang State University

Furthermore, IDB plans to extend its support from 2012 for 7 universities under MONE and 5 tertiary education institution under Ministry of Religious Affairs (MORA), and appraisal will be conducted shortly. Target universities/institutions have not been disclosed yet, though it was confirmed that IPB and ITS are not included.

2.4.4 USAID

USAID is undertaking the Higher Education Leadership, Management and Policy (HELM) and University Partnership Program (UP).

(1) HELM

HELM is a TA project scheduled during 2011–2015, with an estimated expenditure of US$24 million. It has two components

- Component 1: DGHE capacity strengthening: to strengthen the leadership provided by DGHE for the implementation of key higher education reforms across the country, such as: financial management of universities; university administration and management; quality assurance; and collaboration with external stakeholders.
- Component 2: Institutional-level capacity enhancement: to perform more effectively in key management functions such as financial management of universities; university administration and management; quality assurance; and collaboration with external stakeholders (see terms below).

For component 2, the following have been identified as prioritized areas: (i) university administration and management, (ii) financial management, (iii) quality assurance, and (iv)

external collaboration. It will target approximately 25 universities, including 5 state universities (former IKIP), 10 universities from Java, and another 10 universities from non-Java area).

(2) UP

The primary objective of the UP project is to support the effective design and implementation of U.S.-Indonesian higher education partnerships. The secondary objective is to provide a means of increasing the capacity for a selected number of strategically targeted Indonesian institutions of higher education as effective partners to collaborate with various types of U.S. institutions of higher education.

The UP Project will support U.S.–Indonesian higher education partnerships as a means to strengthen human and institutional capacity at selected higher education institutions and thereby improve teaching, research and service in a manner that: (i) strengthens the quality of higher education; (ii) provides models and approaches that are employed by institutions throughout Indonesia; and (iii) enables the Indonesian higher education institutions to serve as more effective short, medium and long term assets to Indonesia's social and economic development. Through the UP, USAID intends to help promote innovation at the institutional, department and faculty levels that can inform the determination of appropriate management practices and policy priorities.

So far 4 collaboration proposals have been approved with the budget ceiling of US$650,000. In total, 25 collaboration projects would be implemented, which would amount to a total of US$16,250,000.

2.4.5 Issues in Conducting Activities in Indonesia

Based on the collection of project information by international donors, the following have been identified as issues commonly shared among international donors, and need to be addressed in the design of any future project:

1. Governance: MONE is now preparing an alternative structure for after the abolition of BHP (educational legal entity) as a part of the drafting work of higher education law. Project implementation organization at universities and any faculty development related work should be consistent with the new governance structure.
2. Community service function of universities: Community service function of universities is widely recognized and each of the projects tries to enhance the function through its activities. Benefitting the community has become mainstream. To be consistent with such trends, it is appropriate for the forthcoming JICA projects to include relevant activities such as industry collaboration and dissemination of the benefits preferably for socio-economically disadvantaged areas.
3. Sustainability: Sustainability is still a concern among all the international donors. Project design should accommodate mechanisms to ensure sustainability of the research activities, university-industry collaboration, dissemination activities, etc even after the support by the donor is terminated.
4. Eastern Part of Indonesia (EPI): Now it is becoming more common that higher education projects accommodate ways to include beneficiaries in the eastern part of Indonesia (EPI) or non-Java areas. To be consistent with ongoing activities by other donors and to address to the development needs of EPI, it is appropriate for forthcoming JICA projects to include some way to get EPI or non-Java areas involved in the activities to share the benefits of the project.

3. Bogor Agricultural University (IPB)

3.1 Current Condition of IPB

Bogor Agricultural University (IPB) was established in 1963 to be a center of excellence in agriculture and to promote scientific research, and now it is one of the national's foremost institutions of higher education in Indonesia. IPB became an autonomous university in 2000, and this status provides the university the opportunity to manage all assets for academic excellence as well as for entrepreneurial purposes. The city of Bogor, a site originally established for agricultural research stations by the Netherlands, is located approximately 60 km south of Jakarta.

IPB consists of nine faculties, (i) Agriculture, (ii) Veterinary Medicine, (iii) Fisheries and Marine Science, (iv) Animal Science, (v) Forestry, (vi) Agriculture Engineering Technology, Mathematics and (vii) Natural Sciences, (viii) Economics and Management, and (ix) Human Ecology and 37 departments. IPB offers 14 study programs of vocational study (Diploma), 35 undergraduate study programs, 79 masters study programs and 48 doctoral study programs. The study programs provide the competencies currently required in the development of agricultural industries, natural and marine resources for sustainable development. The organization structure of IPB is shown in Figure 3.1.

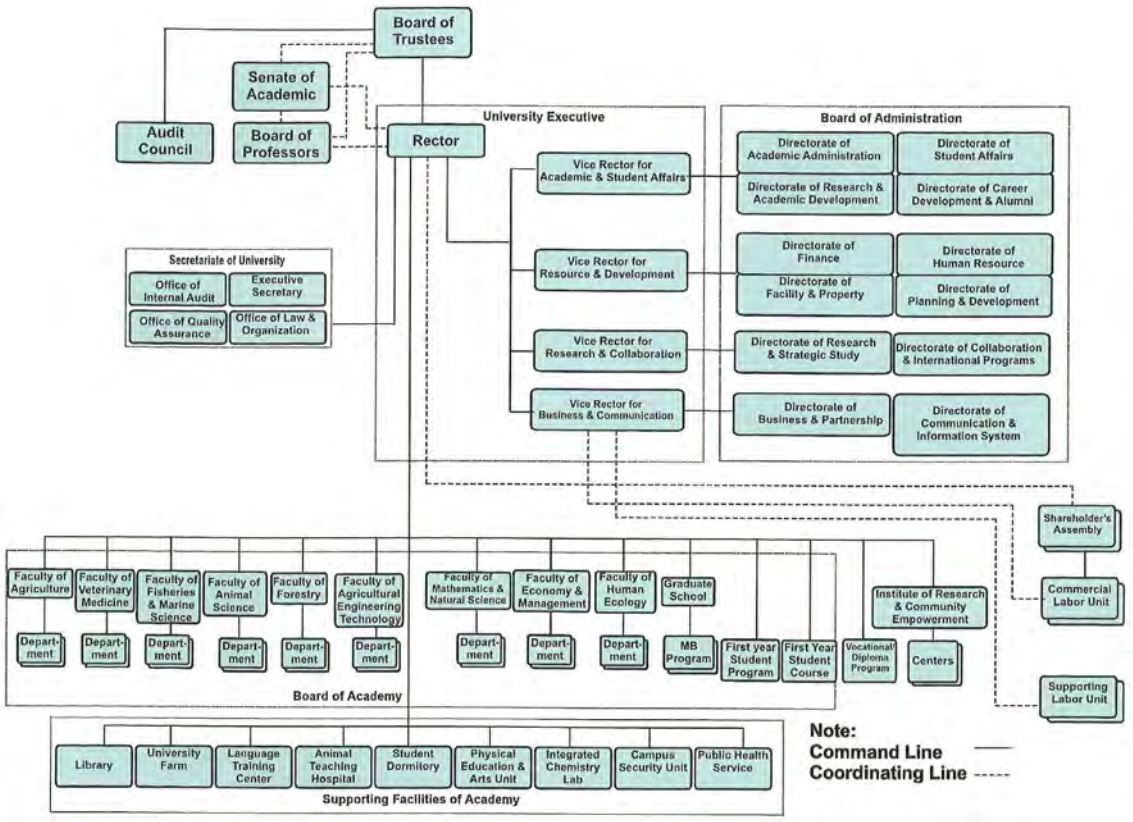


Figure 3.1 Organization Chart of IPB

The student body in IPB as of 2009 is 24,162, which consists of diploma vocational (5,793), undergraduates (14,338), masters (2,505), and doctoral students (1,526). Since its establishment in 1963, IPB has produced nearly 90,000 graduates.

Table 3.1 Total Number of Students per Faculty (as of 2009)

Faculty	Student body				Total
	Diploma	Undergraduate	Master	Doctor	
Diploma	5,793				5,793
Agriculture		1,888	318	167	2,373
Veterinary Medicine		677	79	53	809
Fisheries and Marine Science		1,673	414	273	2,360
Animal Science		975	51	68	1,094
Forestry		1,632	186	113	1,931
Agriculture Engineering Technology		1,756	247	190	2,193
Mathematics and Natural Sciences		2,864	505	91	3,460
Economics and Management		1,768	298	153	2,219
Human Ecology		1,141	184	120	1,445
Multidiscipline			223	185	408
Professional		0	0	113	113
Total	**5,793**	**14,338**	**2,505**	**1,526**	**24,162**

Source: IPB Profile 2010

As of 2009, IPB has 1,246 active teaching staff and the number of teaching staff with graduate education backgrounds was 697 and 56% of those held doctoral degrees. 409 academic staff (33%) are masters graduates, and bachelors holders are 140 people (11%). Considering the numbers mentioned, a rough ratio of students to academic staff throughout all the faculties is 1:19.

Table 3.2 The Number of Teaching Staff and Ratio of Teaching Staff to Students (as of 2009)

	Teaching Staff Background			Total
	Bachelor	Master	Doctor	
Number	140	409	697	1,246
Percentage	11%	33%	56%	100%

Source: IPB Profile 2010

Table 3.3 Average Length of Study of Undergraduate Students (Months) in 2010

Faculty	Length (month)
Agriculture	51.85
Veterinary Medicine	49.40
Marine and Fisheries	51.36
Animal Sciences	49.45
Forestry	52.80
Agriculture Engineering and Technology	50.67
Mathematics and Natural Science	51.00
Economy and Management	47.50
Human Ecology	49.46

Source: IPB fact and figures (interview)

Academic standards are very high and carefully reviewed in IPB. To enter the masters programs, a minimum GPA of 2.75 (4.0 scale) is required, while the doctorate programs require a masters with a minimum GPA of 3.5. Each student's progress is monitored and evaluated every semester. Students who receive a GPA below 3.0 for the masters program or 3.25 for doctorate program will not be permitted to continue their studies.

Currently the majority of faculties requires a little more than 48 months, or 4 years to complete graduation requirements. Among all faculties, the Faculty of Forestry needs the most time as 52.80 months are required to complete the requirements.

In order to sustain comprehensive research and out-reach programs, IPB continuously seeks to improve and develop its international programs. The collaborative program offers scholarships for advanced studies, and the enhancement of research skills for the doctorate level. Excellent students are registered in leading universities around the world, and IPB has sent its students to more than 20 countries including Australia, Japan, Germany, Malaysia, U.S.A., and so on.

IPB aspires to becoming a world class university. In order to fulfill its goal, improvement of research quality would be an issue for IPB. The quality of research is directly connected to human resources and capacity development. Setting research as a priority in its strategic plan and further collaborative research projects with universities and industries would also help to enhance the research quality of IPB.

3.2 Existing University Development Plan of IPB

3.2.1 Proposed Project and Its Context

IPB has a specific university development plan for the period of 2008–2013, besides its campus master plan launched in 1985, aiming at becoming a world class research university[24] equipped with strong competencies especially in tropical agriculture and entrepreneurship[25]. Eight strategic issues of the plan are raised based on national development plans. Therefore, target research fields, namely food, bioenergy, health, poverty reduction, natural resources and environmental management with a special emphasis on food security, upgraded quality of graduates, more competitive education systems, enhanced networks with other higher education institutions, and responsibilities to meet social needs are all in line with the plans.

(1) Organizational Development

IPB enjoys autonomy as a state-owned legal entity university (former Badan Hukum Milik Negara, BHMN)[26], possessing nine faculties and one graduate school as shown in Figure 3.1. Study programs are classified in three categories, i.e. undergraduate level (bachelors), graduate level (masters of science/Ph.D.), and vocational level (diploma). Each faculty offers graduate programs (MSc./Dr.) while there are more than ten graduate programs which are classified as multi disciplines, international programs and professional programs. As per their long-term development plan, IPB has a plan of establishing such units as National Biopharmaca Center,

[24] IPB is ranked 500th or under in THES (Times Higher Education Supplement) World University Ranking in 2008, and aims to be ranked around 400th in the THES-QS (Quacquarelli Symonds) Ranking by December 2012. (Source: presentation materials prepared by IPB) Currently IPB is ranked 119th by QS Asian University Rankings 2010–2011 (Source: HP of QS World University Rankings).

[25] Directorate of Planning and Development, Bogor Agricultural University, 2008, *Strategic Plan Bogor Agricultural University 2008–2013-Excellence in Organization, Transparency, Accountability, Accreditation, and performance*, Bogor Agricultural University

[26] The status of BHMN was stopped by the Constitutional Court recently. Current status of IPB allows to be financially autonomous while dependent on MONE for academic issues.

Seed Center, Veterinary and Biomedical Sciences, and National Zoonoses Center. The annual budget of IPB is Rp.966 billion in 2011, which is an increase by 17.5% from 2010.

Research centers are under Institute of Research and Community Empowerment (LPPM), which are on the same level as faculties and the graduate school. Manuals for faculty members to apply for patents are developed and distributed under IMHERE[27]. Career Development and Alumni Affairs (CDA) is established under the Vice Rector for Academic and Student Affairs. CDA works as a facilitator between private companies and students as well as supports entrepreneurship of students through offering pre-graduation entrepreneurial study programs and competitive seed money to establish venture companies.

From the viewpoint of research oriented educational arrangement, apart from the organizational arrangements, it should be pointed out that masters programs are not officially classified as course-based or research-based. However, masters students can participate in supervisor's research projects throughout the program or join from the third semester. In both cases, a supervisor is assigned to each student at the end of the first semester[28]. This arrangement has been in place at IPB since 2007[29]; the average proportion of students involved in research activities during 2006–2008 is 10.4% and 9.6% for masters and doctoral students respectively. 26.3% of the faculty staff received research grants through LPPM, and other faculty staff received the grants through Faculties and Research centers. The total percentage of staff participation in research was recorded at more than 60%.[30] A typical arrangement is a research group consisting of one researcher, i.e. the supervisor, one or two doctoral student(s), several masters students and senior undergraduate students. Doctoral programs are classified as course-based and research-based. In both cases, the first year is dedicated to course work[31]. The cost for their research activities, a concern at most universities in Indonesia, is partly borne by the students, but strategically supported by their supervisor's research fund[32].

(2) Progress of Strategic Plan IPB 2008–2013

The direction of the Strategic Plan IPB 2008–2013 (hereinafter referred to as the Strategic Plan) is based on the Development Plan IPB 2025, starting with the foundation of a research based university and entrepreneurship, good university governance, and social responsibilities. Now IPB is headed toward 2025 along the five pillars of the five year Strategic Plan, i.e. to widen the access while improving the quality of education, improve the quality of research and community services, update social welfare including salaries and fringe benefits, enhance the capacity of resources, and strengthen the management system. All pillars are furnished with specifically strategic programs, including facility development for wider access and fundraising for better welfare. The development policies of DGHE[33]have been translated into these pillars.

In this context, each faculty and research center has developed and is pursuing a roadmap in accordance to the Strategic Plan, as shown in Table 3.4, to fulfill the overall goal of IPB; to be a

[27] Managing Higher Education for Relevance and Efficient Project.
[28] Source: Interview with faculty members about discussion items. However, it is found, through direct interviews to the Dean and graduate students at Dep. Agriculture and Horticulture on March 22, that most of S2 students are not participating in research activities during the first year.
[29] Source: Interview with IPB faculty members.
[30] Source: Discussion items on March 17 and updated information by email on May 31 from IPB
[31] Source: Interview at Dep. Agriculture and Horticulture on March 22. Most of the interviewees are course-based students.
[32] For example, according to the members of BRC, students doing research at BRC should deposit around Rp.500,000 to use the laboratory facilities and equipment. Fee for using the equipment differs by user's status such as students, faculty members, outside companies and other conditions.
[33] Nation's competitiveness, Autonomy and decentralization, and Healthy organization (Source: DGHE, 2003, *Higher Education Long-term Strategies (HELTS) 2003–2010*). *Rencana Strategis 2010–2014 Direktorat Jenderal Pendidikan Tingg* was drafted in March 2010, but has not been published yet.

world class research based university. For instance, Biopharmaca Research Center (BRC) understands its vision as optimizing the added values of natural resources at national and international levels, and following the road to becoming a leading research institution. Steps are being taken to produce human health products, starting from exploration of natural resource, followed by standardization and production. To provide functional food, BRC is exploring indigenous functional food to produce optimized products. They have also been working on the database for "Jamu", Indonesian herbal medicine made from a mixture of several plants. Through these activities, BRC is to nurture human resources and their networking in the field of biopharmaceutical research. In this regard, BRC has been supported by three technical units (Biopharmaca Conservation and Cultivation Station, Biopharmaca Testing Laboratory, and Animal Testing Laboratory), Academic Business Unit, and PT. Biofarmaka Indonesia[34]. Twelve patents coming from the research at BRC have been registered during 2001–2010; some are used for the production based on the agreement among inventors, BRC and IPB. The large part of the research at BRC (Rp.2.8 billion in 2010) is currently funded by the government and industries.

Table 3.4 Development in Strategic Plan of IPB

Indicator	2006	2008	2010
Patent application*	–	18**	13
Publication through international journals	–	108	206
Publication documented by SCOPUS***	47	52	90

* Including patent, variety, industrial design. Patenting plant varieties is prohibited by the law No.29 of 2000 while Plant Variety Protection (PVP) rights are secured in Indonesia, which is not a member country of the International Union for the Protection of New Varieties of Plants (UPOV).
** Data in 2009 (n/s in 2008)
***SCOPUS is an abstract and citation database given by Elsevier Publishers
*** Documentation by SCOPUS of Elsevier
Source: Presentation by IPB "Facts and Figures of IPB" given on March 17

The Department of Agronomy and Horticulture (Dep.AGH), Faculty of Agriculture, has also been developing the seed teaching industry at Leuwikopo Campus since 1984[35], and initiated the Foundation Seed Production Program in 2011 to produce commercial seeds in accordance to the Strategic Plan. In fact, this activity is part of the development of Dep. AGH[36], based on the results of self-evaluation conducted in 2010, which suggested some challenges such as strengthening information systems and the database for education, introducing more research activities by students and teaching staff, and providing faculty staff with more opportunities to undertake research at institutions outside IPB[37].

(3) New Faculty Development/ Existing Faculty Development

In the future, IPB is planning to create the Faculty of Bio-medical science, to be included in the Faculty of Veterinary. The relationships between the current master plan and proposed project plan encompass the idea of improving health, or activities in biopharmaca. For example, those faculties will help conduct medical clinical tests.

[34] PT. Biofarmaka Indonesia (BIOFARINDO) is located in Taman Kencana Campus of IPB and sells various herbal products with the average price between Rp.38,000 and 50,000 per 60 capsules at this moment. (Source: Fryer of BIOFARINDO) According to the Head of the Center, initial investment was partly given by IPB.
[35] Laboratory of Seed Science and Technology in Leuwikopo Campus was built through Seed Project II funded by World Bank to develop educational programs in the field of seed science and technology. (Source: Department of Agronomy and Horticulture)
[36] Study programs in Seed Science and Technology, Agronomy, and Landscape Architecture are offered at Dep. AGH.
[37] Department of Agronomy and Horticulture, Faculty of Agriculture, IPB, 2010, *Self Evaluation*

(4) Proposed Project Plan

Having made progress as explained above, IPB has prepared two project plans to accelerate the Strategic Plan at this point of the roadmap. Summaries of the projects are as follows:

A. The development and Upgrading of Bogor Agricultural University (IPB): Toward a Research Based University

Goal: Enhanced human resources, technologies and international networking in the target areas

Target areas: Biodiversity, health, and food and energy security

Duration: three years

Outputs and programs/activities:

1. Strengthened food and energy security
   Sustainable seed supply research and development
   a) Enhancing Biodiversity Utilization through Plant Biotech and Breeding (Germplasm collection and preservation, plant breeding and biotechnology for new varieties)
   b) Developing Integrated Research Activities on Agriculture Production
   c) Developing Seed System and Technology
   d) Improving technology transfer
   e) Strengthening Human Resource Capacity
   f) Pilot plant for seed production
2. Enhanced utilization of herbal medicine (for community health improvement and poverty reduction)
   Biopharmaca research and development at Indonesian Biopharmaca Center (IBR)
   a) Biodiversity conservation and domestication of medicinal plants
   b) Study of Ethno-botanical and indigenous knowledge
   c) Developing Indonesian biopharmaca potency
   d) Development of good agricultural practices (GAP) and good agricultural Collection Practice (GACP) for medicinal plants
   e) Development of model of standardization
   f) Development of leading biopharmaca products for human, animals, and plants
   g) Developing biopharmaca education
   h) Study of socio-economic impact
   i) Utilization of biopharmaca product through herbal clinics
   j) Dissemination of biopharmaca achievement to stakeholders
   k) Strengthening networking

Budget for facilities and equipment needed to produce outputs: Loan US$43,330,000

Budget for human resources and network development: Grant

Target areas were selected based on interpretation of the priorities of national development plans. Activities for 1. and 2. mostly focus on Seed Center and IBR (current BRC) respectively. On the other hand, both centers include research groups consisting of researchers from related departments and faculties, and are able to take an interdisciplinary research approach. For example, Seed Center plans to develop a gene bank as part of program 1. to support the germplasm collection in Indonesia, while IBR is concerned with the preservation of biodiversity by protecting wild populations. Graduate students are also participating in the research projects at those centers.

In addition, IPB considers it indispensable to enhance existing collaborative networks with other universities in Indonesia such as Universitas Hasanuddin (UNHAS), Universitas Sam Ratulangi (UNSRAT) and so forth, since it would provide IPB with experience in precious research fields in terms of biodiversity along with the recognition of IPB as a core research university.

B. Development of Forest Resources Conservation and Ecotourism Department, Forestry Faculty, Bogor Agricultural University

Goal: Enhanced human resources and sustainable utilization of biodiversity resources

Target areas: Tropical biodiversity conservation

Duration: one year

Outputs:
1. National and international network for students and faculty members
2. Researchers deal with biodiversity conservation, conservation area management, ecotourism development and bio-medicinal products

Budget for facilities and equipment needed to produce outputs: Loan US$10,980,338

Budget for human resources and network development: n/a

The approach of this project is to promote sustainable utilization of local bio-resources in cooperation with BRC and contribute to poverty reduction and environmental preservation for local communities. For example, preservation of forests and biodiversity should be the major responsibility of the forestry group, while such processes as extraction, analysis and testing of active components of herbal plants could be undertaken by BRC.

It should be noted that procurement of equipment is not allowed under the budget of government research funds.

3.2.2 IPB Campus Master Plan

(1) The Current Condition of IPB Facilities

IPB owns land assets totaling 665.9 ha, including an Experimental Farm totaling 371.1 ha and campus grounds of 294.8 ha. IPB also has maintained an Education Forest of 140,300 ha since 1999.

IPB facilities are located in four campuses in Bogor Regency, namely Taman Kencana, Baranangsiang, Gunung Gede, and Darmaga. Some of the IPB experimental farms are located outside Bogor, i.e. Jakarta, Sukabumi, Cianjur and Pandeglang. The headquarters of IPB is located at Darmaga Campus with buildings for classrooms (total area 27.098 m^2), discussion/ meeting rooms, seminar rooms, auditoriums, administration rooms, faculty rooms, laboratories (total of 41.502 m^2), workshops, libraries, and supporting facilities like sports centers, dormitories, research and public services, staff housing, teaching/research animal hospital, and field station buildings.

In addition to the laboratories belonging to each faculty/department, common research centers among departments and faculties are established in IPB.

In Darmaga Campus, IPB has independent water purification plants and a drainage sanitation system.
However, it is reported that the capacity to clean water supply is occasionally unreliable.

The current Darmaga Campus site plan with the existing facilities is as shown in Figure 3.2.

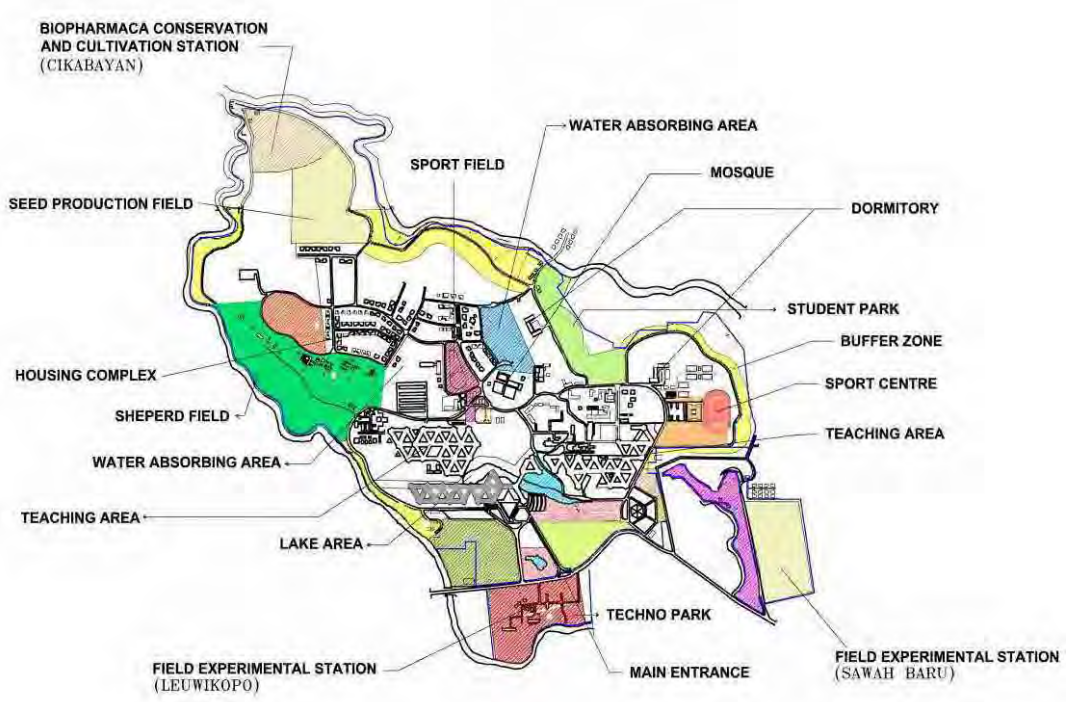


Figure 3.2 The Current Condition of IPB Darmaga Campus

It was identified that Darmaga Campus has enough space to develop more academic facilities though corresponding infrastructure developments are also needed.

(2) IPB Facility and Equipment Improvement in Proposed Project Plan

IPB prepared a master plan of Darmaga Campus up to 2030 that includes the following scopes:

- Expansion of the current academic buildings
- Upgrading of drainage system
- Improvement of internal access road and landscaping
- Reorganizing space allocations among faculties in the existing buildings
- Improvement of public traffic circulation around main entry of Darmaga campus

The latest master plan also includes development of a research center on biopharmaca and seed supply under the proposed project at Leuwikopo zone and the other proposed field facilities. An overall picture of Darmaga campus master plan is as shown in Figure 3.3.

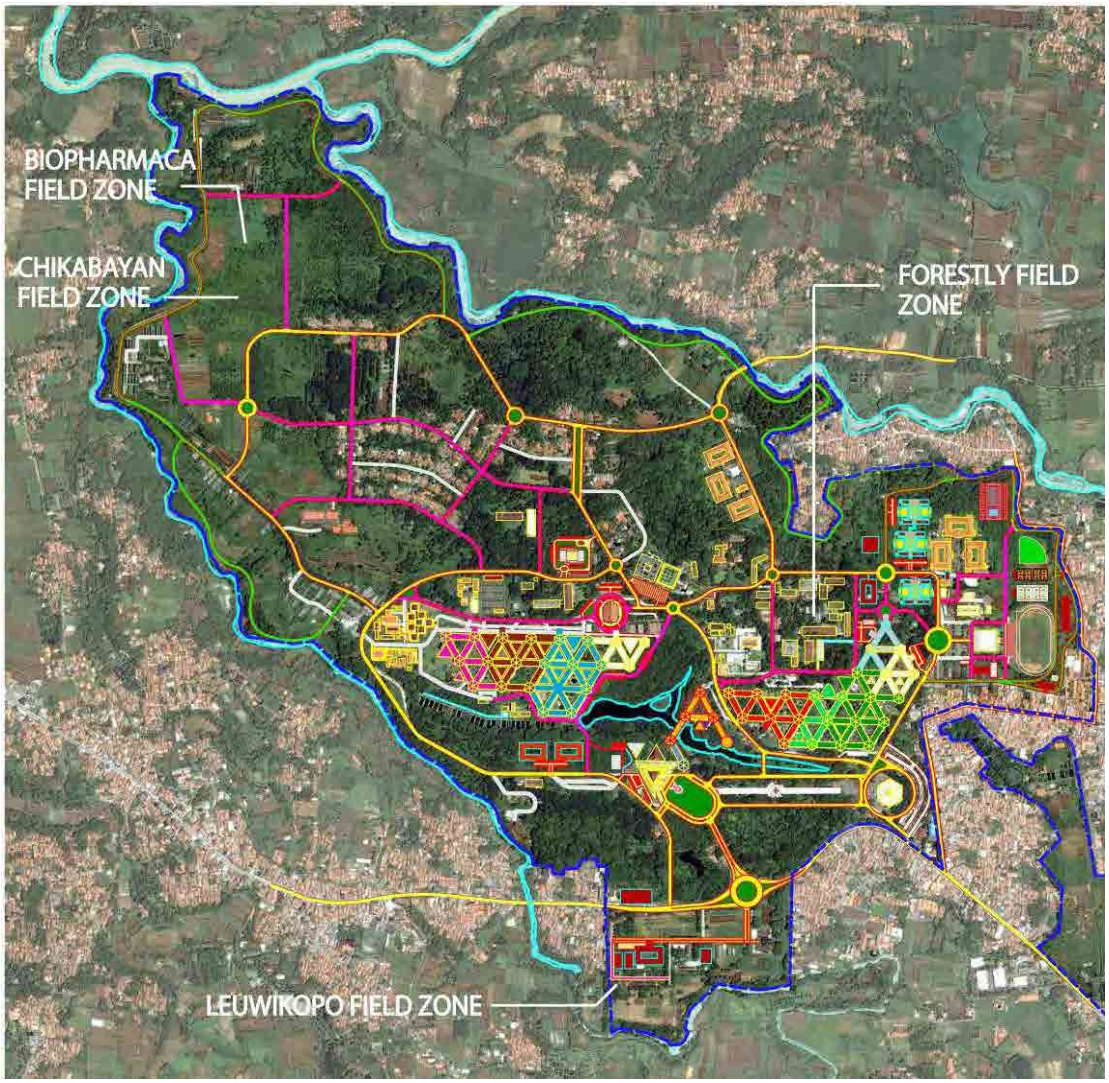


Figure 3.3 Darmaga Campus Master Plan

Both the Biopharmaca Research Center and Seed Center have compiled a list of equipment to be procured under the proposed project. At first, it was not clearly shown how the equipment listed would contribute to the objective of the proposed project; IPB's becoming a research based university. After the study team recommended to mainly list equipment that would contribute to the project objective, more specifically to enhancing each center's research capability, both centers revised the equipment plan. As a result, the revised equipment plan shows a clearer linkage with a more concrete research plan and the research topics (see Appendix 4 for details).

Upon the recommendation of the study team, in the process of revising IPB's equipment list, requirements or special considerations necessary for facilities to install the listed equipment are checked preliminarily and reflected in the facility planning. Unnecessary duplication of the same or similar equipment inside the center and among centers was also preliminarily checked.

Foreseeing the next steps of the proposal preparation, the study team recommended group equipment necessary to the specific research, common equipment necessary to almost all laboratories, ordinary equipment, in other words, consumable types of equipment, and furniture. Then, the equipment list was sorted out by IPB accordingly.

3.3 Relevance of Prioritized Fields of IPB

3.3.1 Worldwide Trends of Prioritized Fields

As mentioned at 3.2.1. (4), IPB targets the following fields in the development plan:

- Food security
- Biodiversity (Health)

Food security is now one of the highly discussed issues.

The Commission of Sustainable Development (CSD)[38] in the United Nations continues to review the conditions for sustainable agriculture and rural development (SARD) since its third session in 1995. In the 8th session of CSD, it was reaffirmed that the major objectives of SARD are to increase food production and enhance food security in an environmentally sound way, to contribute to sustainable natural resource management. It was also noted that food security remains an unfulfilled goal and that agriculture has a special and important place in society and helps to sustain rural life and land. In the 17th session of CSD[39], 2009, agriculture is included as one of the thematic areas to be discussed. The 17th session of CSD emphasized the urgent need to increase efforts at all levels to address the food security and the agricultural development in an economically, socially and environmentally sustainable manner. The session also concluded that achieving food security requires strengthening and revitalizing the agricultural sector in developing countries, including through enhanced international support, an enabling environment at all levels, the empowerment of small-scale farmers, especially women, technical assistance, access to and transfer of technologies, capacity-building and exchange of knowledge and experience.

Along to the lines of CSD activities, the Food and Agriculture Organization of the United Nations organized "World Summit for Food Security[40]", Rome, November 2009, bringing together over 4,700 delegates from 180 countries, including 60 Heads of State and Government as well as representatives of governments, the representatives of United Nations' agencies, the representatives of international and non-governmental organizations, private sectors, and media. Food security consists of the four pillars of availability, access, utilization, and stability.

Upholding the commitments of the 2009 World Summit for Food Security, the Global Conference on Agriculture, Food Security and Climate Change[41] was held in the Netherlands in November 2010. The final Roadmap for Action was presented. Climate-smart agriculture was proposed as one of the key actions for the roadmap, which is continuously changing and needs to be updated regularly. For climate-smart agriculture that sustainably increases productivity, and achieves national food security and development goals, reducing or removing greenhouse gases, preservation of local crops and seeds are emphasized.

Recently, the world seed market has rapidly grown, because high quality seeds play a crucial role, for high yield and food security. The commercial world seed market is assessed at approximately US$42 billion[42] in 2010. Several world seed conferences were organized by the International Seed Federation. Competition in high quality seed development will be increasingly intensified from now on.

[38] http://www.un.org/esa/dsd/susdevtopics/sdt_agriculture.shtml
[39] http://daccess-dds-ny.un.org/doc/UNDOC/GEN/N09/355/72/PDF/N0935572.pdf?OpenElement
[40] http://www.fao.org/wsfs/world-summit/en/
[41] http://www.afcconference.com/final-roadmap-for-action
[42] http://www.worldseed.org/cms/medias/file/ResourceCenter/SeedStatistics/Domestic_Market_Value_2010.pdf

IPB plans to establish a seeds center in its campus. As explained above, the IPB plan is reasonably aligned with the United Nations' action plan and responding to international trends.

Biodiversity is another major issue in the world.

The last Conference of the Parties to Convention on Biological Diversity, COP10 was held in Nagoya, Japan, 2010. The conference launched five strategic goals[43]. Those are:

- Address the underlying causes of biodiversity loss by mainstreaming biodiversity across government and society
- Reduce the direct pressures on biodiversity and promote sustainable use
- Improve the status of biodiversity by safeguarding ecosystems species and genetic diversity
- Enhance the benefits to all from biodiversity and ecosystem services
- Enhance implementation through participatory planning, knowledge management and capacity-building

COP started in 1993 bringing together more than 150 states. In 2002, the sixth COP was held and 176 government representatives attended this convention and agreed with the 2010 biodiversity target to reduce the rate of biodiversity loss significantly by 2010.

The third Edition of the Global Biodiversity Outlook (GBO3) published in 2010 analyzed the biodiversity loss by 2010 and concluded that biodiversity is continuing to decline in all three of its main components - genes, species and ecosystems.

Eleven goals were set for the 2010 biodiversity target. Three of them have been achieved at a quite low level. The first is the sustainable use and consumption, the second is to maintain capacity of ecosystem to deliver goods and service and support livelihood, and the third is to maintain socio-cultural diversity of indigenous and local communities.

The biopharmaca center to be established by IPB aims at identifying medical plants to develop Indonesian traditional medicines, **Jamu**, analyzing medical functions of the plants from biological and chemical aspects, and collecting germplasms to address biodiversity promotion. Three hundred species are now identified and it is considered that more than 30,000 species may exist near forests in Indonesia. For Jamu development, indigenous knowledge on Jamu must be collected and systemized through exchange with indigenous and local communities. Therefore, the field selected by IPB is quite reasonable and in line with the international movement of biodiversity.

The seed center sustainably supplies high quality seeds to farmers, so high productivity of crops and other food can be realized. Then a sufficient amount of food and nutrition can be supplied to people. On the other hand, the **biopharmaca center** sustainably supplies medicines produced from natural materials such as herbs, which have no significant side effects like chemical medicines. Eventually, the seed center and the biopharmaca can provide a healthy lifestyle for people.

In association with the seed and biopharmaca centers' activities, IPB plans to develop a research and education field on **Forest and biodiversity conservation**. This aims to strengthen the capacity of research on forest conservation and community development near forests for assuring sustainable biodiversity utilization, such as for seed and biopharmaca storage, and exploration.

[43] http://www.cbd.int/decision/cop/?id=12268

3.3.2 Current Condition and Issues in Prioritized Fields in Indonesia

Food security, and health and pharmaceuticals are very important issues to Indonesia as well. RISTEK (Indonesia State Ministry of Research and Technology) set seven focus programs in its National Research Agenda 2010–2014[44]. Those are as follows:

- Food security
- Energy
- Information and communication technology
- Transportation technology and management
- Defense and security technology
- Health and medicine
- Advanced materials

Several research themes on food security are specified in the National Research Agenda. High quality **seed** production and management is of prime priority.

The seed market in Indonesia is not well developed yet. Only a few seeds, such as rice and corn, are produced in high quality in Indonesia[45]. Those seeds contributed to the steep increase of the yield for recent years.

Production of certified rice seeds in 2008 has reached around 50% of the country demand of around 360,000 tons per year. High quality seeds are essential to enhance the yield. Certified high quality conventional seeds of rice are mainly produced by two big state own companies. Hybrid rice and corn seeds are produced by 18 companies, which are almost all private. However, the supply of high quality conventional and hybrid rice seeds is only 5% of the total seed requirement. Many small-scale companies produce seeds, which are certified by the ministry of agriculture, but those are not of high quality. Charoen Pokphand (Thailand), DuPont, Bayer, and other international companies play a dominant role in production of hybrid seeds of rice, corn, and vegetable. Vegetable seeds are also produced in Indonesia by more than 100 seed companies. However, domestic production of the seeds cannot fulfill the country requirements of main vegetable seeds, except kangkong, cabbage, cucumber, and Chinese cabbage.[46] The Indonesian seeds market scale is estimated at around US$600 million in 2011[47]. As mentioned above, because the domestic production of certified seeds is in shortage, large-scale seed companies like Charoen Pokphand (Thailand), DuPont, Bayer, and other international companies import seeds from other countries. The value of total imported seeds was US$ 6 million in 2009[48]. On the other hand, many small farmers cannot buy certified seeds because of the expensive cost and they use cheap and uncertified seeds that are supplied through informal sources.

In summary, farmers in Indonesia are still facing difficulties in accessing cheap and high quality seeds. High quality seeds are still expensive to small farmers. As a solution to the seed problems, research and development of high quality and mass-produced seeds, which are sold at reasonable prices, must be carried out by research institutes[49].

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[44] http://ristek.go.id/?module=File&frame=Referensi/2010/ARN.pdf

[45] http://datacon.co.id/english/index.php?option=com_content&view=article&id=92%3adevelopment-of-food-crop-seed-industry-in-indonesia&catid=37%3Aicn-2009&Itemid=68&showall=1

[46] Sri Wijayanti Yusuf, Country Report Vegetable Seed Industry in Indonesia, DG of Horticulture, Ministry of Agriculture, Indonesia , Appendix11

[47] http://webcache.googleusercontent.com/search?q=cache:VVqpWAOJSSwJ:en.indonesiafinancetoday.com/read/2351/Increase-of-Commodities-Prices-Spurred-Seed-Producers-Expansion+Jakarta+post+domestic+seed+market+RP&cd=17&hl=ja&ct=clnk&gl=jp&source=www.google.co.jp

[48] http://www.worldseed.org/cms/medias/file/ResourceCenter/SeedStatistics/SeedImports/Seed_Imports_2009.pdf

[49] Subejo, "New challenges for agricultural development" The Jakarta Post, Thu. 13 Jan., 2011.

Many other crops and vegetable seeds should be developed for enhancing food security in Indonesia.

Health and medicine is divided into five sub themes in the National Research Agenda. The second sub theme is related to the utilization of **Jamu** as a preventive measure. The Indonesia Government positively supports the Jamu industry. There are more than 1,200 Jamu producers in Indonesia, of which 129 producers are large-scale companies. However, only 10 companies produce herbal medicines qualified with standards set by the Drug and Food Monitoring Agency (BPOM) [50]. The Indonesian pharmaceutical industry consists of chemical–pharmaceutical and non-chemical traditional medicine, Jamu manufacturers. The Indonesian pharmaceuticals market was around US$3 billion in 2008 and Jamu sales was US$550 million in 2008. In addition, the generics market is estimated up to 75% of the total pharmaceutical market. The quality of the generics is not enough to export[51].

Therefore, herbal medicine or Jamu, is the big potential area where Indonesia could create a competitive advantage in the global market.

3.3.3 Advantage of IPB in their Prioritized Fields

IPB is one of the most prestigious universities in Indonesia, especially, in the agriculture field. As mentioned in Table 3.2, the total number of academic staff is 1,246 as of 2009. There are 697 doctoral degree holders which make and 56% of all the academic staff. There are 409 masters degree holders. In total, there are 1,106 higher degree holders which make up 89% of all the academic staff. This ratio is very high compared with the faculties of agriculture in other Indonesian universities. Large potential human resources for research activities is also available from masters course and doctors course students. In the faculty of agriculture, more than 300 masters course students and more than 150 doctoral course students are participating in graduate programs. In addition, the faculty has several study programs closely related to the prioritized fields, seeds and biopharmaceutical. For example they are: (i) Science and seed technology, (ii) Plant breeding and biotechnology, (iii) Medical microbiology, (iv) Biochemistry (v) Chemistry (vi) Biology, (vii) Anatomy, Physiology, and Pharmacology, (viii) Seed technology, (ix) Food security management, and (x) Biotechnology.

The big advantage of IPB is its location; IPB is close to Jakarta where many ministries and government agencies associated with seeds and pharmaceuticals are located. Many academic staff of IPB serve as advisors to ministers, directors, and representatives of authority organizations, and committee members.

There are several similar research centers established by the Ministry of Agriculture, and LIPI in Indonesia. For instance, the research centers[52] related to the **seed center** are as follows:

- Indonesian Center for Food Crops Research and Development, Ministry of Agriculture
- Indonesian Center for Horticulture Research and Development, Ministry of Agriculture
- Indonesian Center for Estate Crops Research and Development, Ministry of Agriculture

[50] Aditya Suharmoko, "Herbal medicine expected to soar this year", The Jakarta Post, Monday, 10 March, 2008.
[51] J. Sudharta, and others, Position Paper, Sector working group on Medical & Pharmaceutical, EU–Indonesia Business Dialogue 2010, 28, Sept. 2010
[52] http://iaard.go.id/unker/

Research centers similar to the **biophermaca center** are as follows:

- Indonesia Medicinal and Aromatic Crops Research Institute[53], Bogor, Ministry of Agriculture
- Research Center for Biotechnology[54], LIPI

IPB **seed center** covers a rather comprehensive range of activities of germplasm collection, characterization of germs, improvement of variety based on germ properties, high quality seed development, and technology transfer to farmers and seed breeders, and education as well, while the above three centers concentrate on germ-plasm conservation and variety development.

IPB biophermaca center also covers a rather comprehensive range of activities from germplasm collection of medical plants, characterization of germs, extraction of medical efficacy components, and refining and compounding of medicines, systemizing of indigenous knowledge on medical plants, and local community development, while the above two centers' activities also include research on medical and aromatic crops, and not refining and compounding of medicines.

It should also be stated that researchers in the above research centers are almost all graduates from IPB. For instance, Indonesian Agency of Agriculture Research and Development (IAARD) has around 70 research professionals (Profesor Riset.), most of whom have doctoral degrees, and are working in 12 Research and Development Centers under Indonesian Agency of Agriculture Research and Development (IAARD). Twenty-three research professionals are alumni of IPB[55].

As described above, IPB has tremendous dominance in Indonesia's agriculture research field. Such a description is also found in the country report on Agricultural R&D Indonesia by the Agriculture Science and Technology Indicator[56].

On the other hand, based on the 2010 World University Rankings by Quacquarelli Symonds (QS-World University Rankings), as shown in Table 3.5, IPB was not ranked as high as the other prestigious universities in Indonesia UI, UGM and ITB. IPB was ranked between 501 and 550 while UI was ranked 236th, UGM, 321st, and ITB between 401 and 450 (Padjadjaran University, not available)[57]. Asian university ranking in natural science field[58] using criteria similar to those used for QS World University Rankings placed IPB at 65th, ITB at 35th, UI at 44th, UGM at 44th and Padjadjaran University at lower than 101st.

Table 3.5 University Ranking of IPB and Others

University	2010 QS-World University Rankings	2010 QS-Asian University Ranking (natural science)
IPB	501–550	65
UI	236	44
UGM	321	44
ITB	401–450	35
Padjadjaran University	Not available-	>101

[53] http://iaard.go.id/unker/one/461/
[54] http://biologi.lipi.go.id/bio_english/mTemplate.php?h=4
[55] http://www.litbang.deptan.go.id/peneliti/?j=100&p=1
[56] http://www.asti.cgiar.org/pdf/IndonesiaCR.pdf
[57] http://www.topuniversities.com/institution/bogor-agricultural-university/wur
[58] http://www.topuniversities.com/university-rankings/asian-university-rankings/2010/subject-rankings/natural-sciences

Nevertheless, the two IPB centers still have a big advantage in their research activities against other world ranking universities, because their research targets are Indonesian indigenous plants and herbal plants in a mega biodiverse country, and research on these targets automatically possesses originality (see Appendix 6 for details).

Concerning the biopharmacy and seed centers proposed by IPB, several items are selected and compared between IPB and other Indonesia universities to be considered as competitors. To do the comparison easily, the selected items are ones that the IPB centers are equipped with.

As mentioned at the tables below, IPB has apparent advantages against the other Indonesia universities.

Table 3.6 Biopharmacy Field Activities of IPB and Others

Items to be compared with	IPB	UNHAS	UNPAD	UGM	ITB
Research organization of biopharmacy	center	research program	new center	research program	research program
Handling of medical plant					
➢ Collection of new plants	**yes**	**yes**	partial	**yes**	no
➢ Cultivation	**yes**	**yes**	partial	**yes**	no
➢ Genetic analysis	**yes**	no	partial	**yes**	**yes**
➢ Biochemistry & microbiology	**yes**	partial	no	**yes**	**yes**
Utilization of biopharmacy product through herbal clinic	**yes**	partial	**yes**	**yes**	no
Development of good agricultural practices and good agricultural collection practices for medicinal-mapping of potential biopharmacy plant resources	**yes**	no	no	no	no
Ethno-botanical and integrated approach using indigenous knowledge/wisdom including community empowerment	**yes**	**yes**	partial	**yes**	no
Clear mission of medical plant conservation and biodiversity	**yes**	no	no	**yes**	no

Source: IPB Biopharmaca Center Collected the data from each university[59], UNPAD: university of Padjajaran

[59] Interviewees: UGM: Dr. Langkah Sembiring; ITB: Prof. Dr. Elin Yulinah Sukandar; UNPAD: Prof. Dr. Sidik, Faculty of Pharmacy, Lab. of Pharmacognosy; UNHAS: Prof. Dr. Dadang S.

Table 3.7 Seed Field Activities of IPB and Others (under Confirmation)

Items to be compared with	IPB	USU	UGM	UNHAS
Research organization of seed	center	laboratory	laboratory	laboratory
Handling of seed				
➢ Germ plasm collection and preservation	**yes**	no	**yes****	no
➢ Germ plasm exchange and distribution	**yes**	no	no	no
➢ Plant genetics	**yes**	no	**yes**	no
➢ Advanced breeding using tissue culture, molecular genetics, haploid technology, somatic embryo and so on	**yes**	no	**yes**	partial
Production of qualified mother seed	**yes**	no	no	no
Pilot plant for seed production	**yes**	no	**yes****	no
Research universities for oil palm seed	**yes**	**yes***	**yes*****	no

*Research at student level in cooperation with Pusat Penelitian Kelapa Sawit (Research Center for Oilpalm)
**Only for black soybean "Malika"
*** Research at student level
Source: IPB Seed Center collected the data from each university[60]

3.4 Examination of Current Condition toward University–Industry Collaboration, and Human Resource Development at IPB

3.4.1 Condition of Utilizing Internal Resource, Joint Research and Collaboration at IPB

There are two offices, VRRC and LPPM in IPB to facilitate and promote the research performance in regular and strategic research activities. The Vice Rector Office for Research and Collaboration (VRRC) formulates the research agendas for Research and Strategic Issue Studies of IPB to increase the number of research and collaborations, while LPPM focuses more on the research umbrella, research administration, quality monitoring, and evaluation of research. All the research activities and collaboration with industry sectors, government, and overseas research institutes are managed by these two offices. According to the LPPM evaluation on 2008 research activities, IPB earned Rp.17 billion through collaboration research. This amount is quite large, and obtained mostly from national competitive research grants from the Ministry of National Education, Ministry of Research and Technology, and Ministry of Agriculture.

However, the involvement of academic staff in research activities in 2008 was 26.3% and involvement of students was 8.6% from masters course students and 8.4% from doctoral course students. More than 70% of the academic staff did not participate in research and collaboration activities in 2008.

Besides the research activities supported by ministries, IPB also carries out collaboration research with the industry sector and overseas universities including Japanese universities. In these research activities, masters course students and doctoral course students also participate. There is not the same level of research equipment compared with a laboratory of a Japanese university, but students fully use the equipment for their research.

[60] Interviewees: USU: Dr Lollie Agustin, Ir Haryati, UGM: Ir Setyastuti, MP, UNHAS: Dr Riadi

According to an observation of laboratories to be involved with the two centers, graduate students and senior students used equipment more than 15 years old, donated by JBIC and other donors. The equipment is maintained quite well.

Utilization of internal resources in terms of academic staff and student human resources, instruments and laboratory facilities seems good, and the two centers have potential to enhance their research activities, if adequate research equipment is provided.

3.4.2 Current Condition and Examples of University–Industry Collaboration, and Human Resource Development at IPB

IPB collaborates with several companies and NGOs for their activities, mainly in the field of human resource development, joint research, and dissemination of the products. IPB is closely related to the government agencies such as the Ministry of Agriculture, Ministry of Forestry, Ministry of Health and Ministry of Fisheries. The current collaboration between private companies/ NGOs and IPB is listed in Appendix 8.

Based on the IPB tracer survey, around 50% of graduates are recruited within 3 months of graduation, which means almost all students who want to work can get a job. Another 30% of graduates find employment within 3–6 months of graduation. After getting a job, around 13% of the students were assigned to jobs in production, 13% in marketing, 12% in finance, 12% in administration, 10% in teaching, 5% in IT, 7% in R&D, and 3% in Quality control. However, around 63% of the students' applications go to the finance and banking sectors, which is the largest number of the sectors in 2010. The second is farming including off-farm jobs, such as office or factory work, and the third is the food and beverage sector, which is 13.8% of all the applications through IPB Career Development and Alumni Affairs (CDA). Around 8% of graduate students continue their studies and pursue a masters degree. Around 70% of the companies[61] which received students consider the level of education at IPB is relevant, so that the level of studies matches their work.

The two main reasons students apply to work in the financial sector are the salary standard and the living environment. The salaries in the agriculture fields are not very high in domestic companies. In the case of foreign agriculture companies, the salary is almost the same as those in the financial sector. According to the IPB tracer survey, the students' weakness pointed out most by companies is the language ability, most cases are English language, followed by adaptability. The working environment of agricultural fields, especially in field offices, their living environment changes a lot, especially in rural areas. Those environments are not easily acceptable for new graduates. The change of working fields to financial sector is an easier adjustment for new students than those working in rural areas. Another weakness of language is also related to students' selection of companies. Foreign companies with high salary standards require language skills, but the IPB graduates face difficulties in getting jobs due to their language skills.

IPB also promotes entrepreneurship by facilitating a program throughout the academic year in which a number of students develop their own businesses. Entrepreneurship education is incorporated in the curriculum for students as well.

Joint research is conducted with the industry sector as well as government agencies. The biopharmca center has started conducting research with several companies, and some products are sold in the market already. IPB is working with LIPI for forest conservation research, as well as receiving LIPI staff as masters degree and doctoral students.

[61] Source: *Statistik Pengembangan Karir dan hubungan alumni IPB-2010*:Tracer study of IPB

IPB has also dissemination activities, for example, to farmers in communities. The Ministry of Agriculture appoints IPB for examining new products to for dissemination. As for the bio fertilizer dissemination project, the product was created outside of IPB. The purpose of dissemination is the poverty alleviation of farmers, and introducing ecological farming.

IPB has a joint venture company on campus, which produces vaccinations for avian flu for poultry. The Japanese company assisted with the technology and equipment for vaccine production, and the IPB conducted testing and produced the products. The demand for their products, vaccines in Indonesia are more than their production now.

New collaboration activities, called ABCG (Academic, Business, Community, Government) collaborations, started with the four stakeholders from the government, community, and industry, PT.SOHO, a private company, and IPB. The private company was looking for a herbal planting place and asked IPB to introduce a site. IPB examined and select one community, and introduced herbal plants there for farmers' income generation. The local government promotes the plants and utilizes their organization for post harvest products. IPB conducts a quality check of the products for a marketable price for the farmers, and assists post harvest activities there.

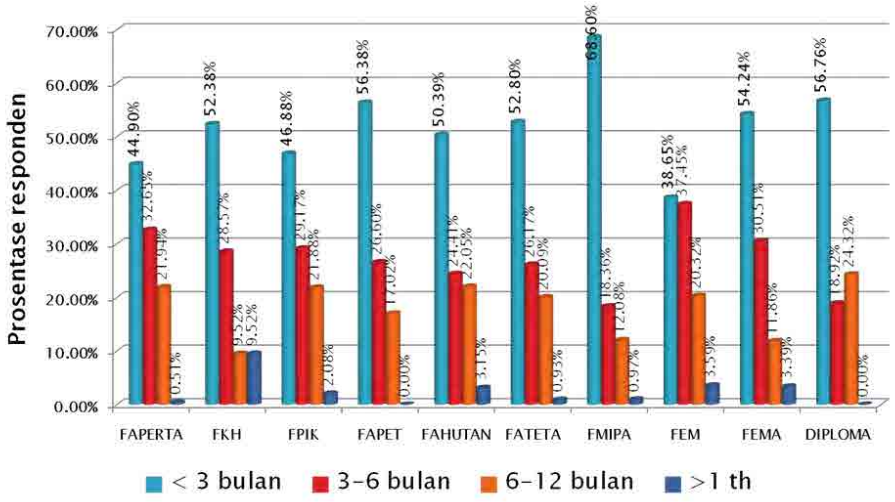
The success is that they started collaboration research activities with companies, which will be beneficial experiences for conducting biopharmaca center activities in the future. Also, IPB are involved in several dissemination activities and there are high expectations by the community. In addition, IPB fosters some entrepreneurs every year with their supporting activities. At the same time, those collaboration research activities have issues as well.

The issues IPB faces are in entrepreneurship development. The difficulties entrepreneurs face are in conducting their business for a long time, as starting the business is rather easier than sustaining the business. The support for the long term will also be necessary. At this moment, the entrepreneurs can consult at business incubation centers or CDA, and have advice if someone is available. It would be better if IPB can conduct periodical consultancies.

Another issue noticed by the JICA team was that the higher expectation of dissemination activities become, the more time the lecturers need to spend outside their academic work. That will be a further constraint for them to further become a research university. More time is needed for research activities than dissemination of technology or products. If the lab- based education system is established including masters or doctoral students, some activities can be conducted by the students, and the activities would still be considered as part of the university's activities.

IPB Graduates and Labor Market Demand

- IPB graduates are competitive in the labor market. It is recognized as such by both of IPB and employers.
- More than 90% of the graduates obtain their first jobs less than one year from their graduation. Proportion of the students that have to wait for more than 1 year is negligible at 5 faculties (out of 10), and in other faculties the figure is less than 5%, excpet for FKH (Veternary medicine)
- Around 30%–40% of the graduates have a job in non-agriculture area too. University consider they have sufficient capacity to accmodate students to respond to industry needs. Non-agricultural sectors (e.g. banking and commerce) are popular for students as they promise higher salary and benefits compared to agricultural sector.



Source: IPB Career Development and Alumni Affairs

Figure 3.4 IPB: Period from Graduation to Initial Employment (2010)

3.4.3 Current Condition of Collaboration with Japanese Universities and Companies at IPB

Approximately 200 or about 15% out of 1,300 faculty members graduated from Japanese Universities. The number of faculty members who graduated from Japanese universities is the largest among those who graduated from foreign universities.

Many types of collaboration with Japanese universities have been conducted, such as collaborative research, student exchange programs, faculty member exchange programs, research fund provisions, organization of international symposiums, and double degree programs (see Appendix 2 for details).

The trigger of starting these collaborations varies. The link between faculty members at IPB who studied at Japanese universities and Japanese professors who instructed them while they studied in Japan is just one of the cases. There are other occasions which foster collaboration also, for example, meeting at international conferences.

Collaborations with Japanese companies are scarce. One of the successful examples of collaboration with Japanese companies is mentioned in section 3.4.2. According to the interview with IPB faculty members, there are mainly two patterns of initiating collaboration with Japanese companies.

Pattern 1: Japanese companies firstly request some organizations in Indonesia, such as the Ministry of Agriculture, Indonesian companies or even a travel agent, to which it has a connection, to introduce an organization that can help achieving their business purpose. Then, these go-between organizations introduce IPB to the Japanese companies.

Pattern 2: The Japanese University, with which IPB has already had human resource connections, collaborates with Japanese companies. Then, Japanese companies can gain access to IPB via the Japanese University.

There seem to be no cases in which IPB has directly approached Japanese companies or vice versa.

Examples of Collaboration with Japanese Companies or Research Institutes

- A Japanese company in Nagoya was looking for some organization that can produce its product, a medicine called Pasak Bumi, in Indonesia. The Japanese company knew Fortune Star Company in Indonesia and the Fortune Star introduced IPB to the Japanese company. IPB passed the laboratory standard for small scale production of the medicine but failed to pass one for mass production.
- Sumitomo and Kyoto University have conducted a joint research on tropical forests. IPB has a connection with the main researcher of Kyoto University for this research and faculty members of IPB also participated in the research.
- NITE, National Institute of Technology and Evaluation of Japan, exchanged MoU with RISTEK about biodiversity conservation. Under this MoU framework, NITE had conducted collaborative research with LIPI, BPPT, IPB, UI and the Ministry of Agriculture.

3.4.4 Current Condition of Fellowships and Scholarships at IPB

IPB already has a high ratio of Ph.D. holders among lecturers; 56%. However, compared with the target ratio of 90% by 2014 given by MONE, it is still necessary for IPB to send faculty staff to overseas universities for higher degrees. To cope with the increasing educational tasks for lecturers, IPB implements several double degree sandwich programs with overseas universities, including a masters program with Ibaraki University and Chiba University. There are such cases where overseas host universities offer scholarships for degree and/or non-degree (internships, short-term student exchanges) programs; however, in many cases, scholarships by GOI are useful[62]. Thus, supporting human resources development through fellowships for higher degrees is a crucial demand from the viewpoint of strengthening the research capabilities of IPB as an established research university.

Furthermore, considering the very specific background of IPB faculties, namely a very high ratio of those who obtained Ph.D. degrees from Japanese universities, non-degree fellowships for young, active researchers to conduct research at Japanese universities should be extended. Ph.D. holders could maintain the quality of their research and their motivation through joint research with their overseas research colleagues, utilizing these fellowships. This is especially important when the sustainability of the project outputs is pursued.

[62] In 2009, five scholarships were obtained for doctoral studies in Japan, Germany and the Netherlands. (Source: DGHE website information in 2010)

4. Surabaya Institute of Technology (ITS)

4.1 Current Condition of ITS

ITS was established in 1960, in Surabaya, the capital of East Java province. It is known as one of the most prestigious and largest higher learning institutions in the eastern part of the county. Its vision is to become a university with an international reputation in science, technology and art, particularly supporting the environmental and marine industries. ITS aims to improve the current conditions through increasing the number of graduate-level students, graduate programs, qualification of teaching staff as well as facilities relevant to their targeted number of students.

At present ITS has five faculties: (i) Faculty of Mathematics and Natural Science, (ii) Faculty of Industrial Technology, (iii) Faculty of Civil Engineering and Planning, (iv) Faculty of Marine Technology, (v) Faculty of Information Technology, along with 2 states polytechnics: (i) Electronic State Polytechnics, (ii) Shipbuilding State Polytechnics, offering 76 study programs consisting of 11 doctorate study programs (S3), 18 master programs (S2)[63], 22 undergraduate programs (S1), 4 programs of four-year polytechnic diploma (D4), and 8 programs of three-year polytechnic diploma (D3). The organization structure of ITS is shown in Figure 4.1. The number of the students and faculty members are shown in Table 4.1 and Table 4.2 below:

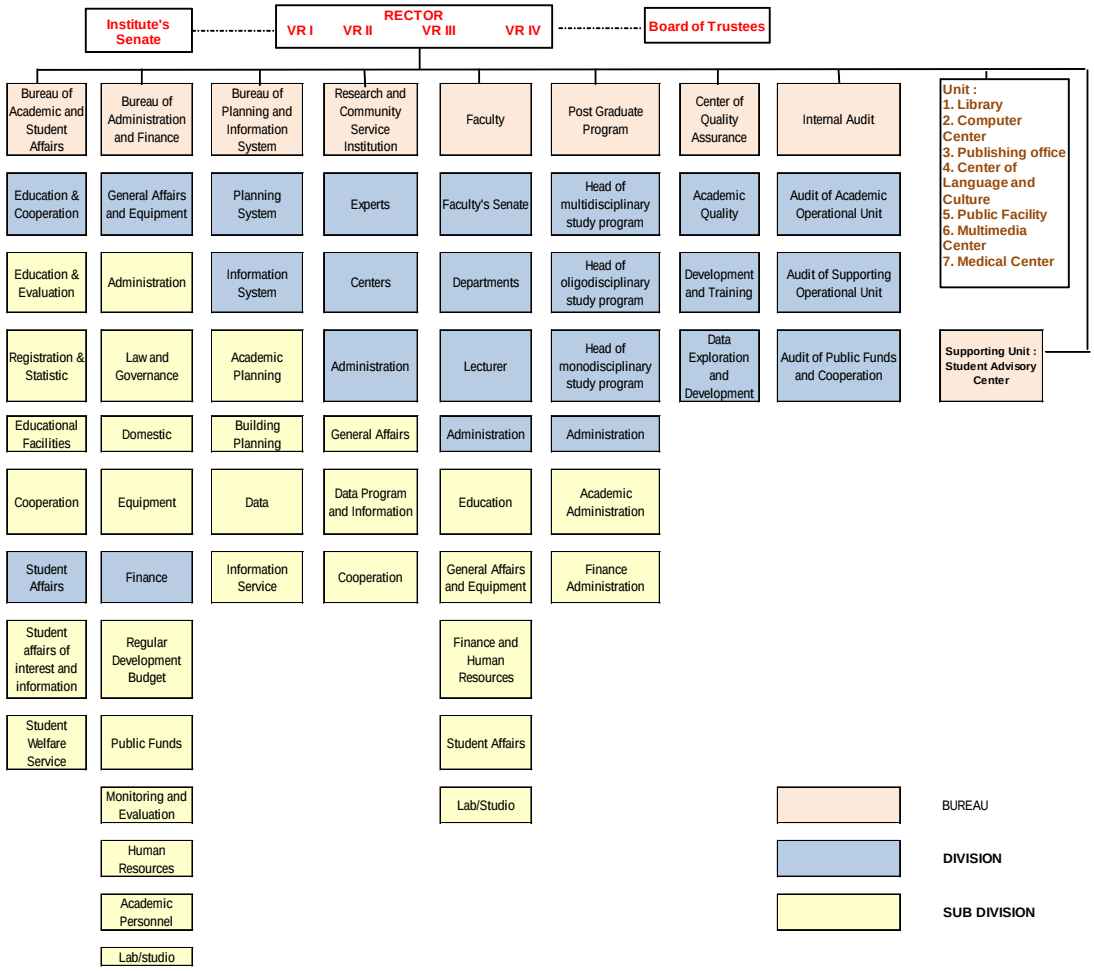


Figure 4.1 Organization Chart of ITS

[63] ITS offered 6 doctoral programs and 13 masters programs in 2009, now increased to 11 doctors and 18 masters programs.

Table 4.1 Total Student per Faculty (as of October 1, 2009)

Faculty	Doctor	Master	Bachelor	Diploma	Total
Mathematics and Natural Science	28	286	1,779	206	2,299
Industrial Technology	115	465	4,558	1,284	6,422
Civil Engineering and Planning	73	377	3,156	643	4,249
Marine Technology	39	100	1,515	-	1,654
Information Technology	-	128	1,433	-	1,561
Master of Engineering Management	-	328	-	-	328
Total	**255**	**1,684**	**12,441**	**2,133**	**16,513**

Source: ITS Profile 2010/2011

Table 4.2 Educational Background of Teaching Staff and Ratio of Teaching Staff to Students (as of October 1, 2009)

Faculty	Doctor	Master	Bachelor	Total number of staff	Ratio: teaching staff to student
Mathematics and Natural Science	47	127	41	215	1:11
Industrial Technology	87	163	66	316	1:20
Civil Engineering and Planning	44	130	83	257	1:17
Marine Technology	29	46	13	88	1:19
Information Technology	8	29	16	53	1:29
Total	**215**	**495**	**219**	**929**	**1:17**

Source: ITS Profile 2010/2011

Besides Diploma course students, around 80 percent of the students are enrolled in Bachelors degree programs, while only 2 percent are doctoral course students.

Around 70 percent of the students enter ITS by SNMPTN (Seleksi Nasional Mahasiswa Perguruan Tinggi Negeri: national entrance examination for state owned university), and around 30 percent of the students enter under the PMDK program (university examination). PMDK program takes more tuition than SNMPTN students.

Around 20 percent of the students enrolled are economically disadvantaged or handicapped students. The program, "BIDIK MISI[64]" is directed by DGHE.

The average Grade Point Average (GPA) and duration of study is as follows:

Table 4.3 GPA and Average Duration of Study in 2009

Program	GPA (maximum 4)	Average duration (semester)
Doctoral (S3)	3.76	8.33
Master (S2)	3.41	5.03
Bachelor (S1)	3.10	9.85
Diploma (D3)	3.10	6.43

Source: ITS Profile 2010/2011

[64] Its meaning is "Targeted mission", which indicates the scholarship for poor students.

Currently the majority of students take a longer time to graduate; S1 and S2 takes around 1 semester more than the original requirement. As for S3, they take 2 semesters more than the minimum requirement.

The annual budget of ITS is around Rp.450 billion[65], and out of this amount around Rp. 32–40 billion is for research funds, from national and local government, and companies.

Currently, there are 32 or more ongoing collaboration programs with overseas universities, mainly in Asia or in Europe, such as Germany and the Netherlands. It was noticed that ITS is even collaborating with institutions in Africa; they are currently working with three universities in Sudan universities.

The issues in ITS are the lack of human resources and the need to increase the capacity for quality research to become a research university. To be a research university, the quality of research is important. The quality of research depends on human resources, and facilities and equipment for research. ITS expects to increase the number of lecturers with doctorates as well as masters and doctoral students who can work on the research activities. In the case of increasing masters and doctoral students, the number of the undergraduates will also need to increase in order to provide a good selection of students. Furthermore, ITS needs more facilities and equipment for education as well.

4.2 Existing University Development Plan of ITS

4.2.1 Proposed Project and Its Context

ITS set a goal to be a world-class research university in 2010, its 50th anniversary. This is in line with ITS's strategic development plan for 2008–2017 that aims to attain three major achievements, namely international recognition such as ranking among the 90 best universities in Asia[66], national contributions, and transformation[67]. In this regard, ITS has selected Marine Technology, Human Settlement, and Energy as strategic target areas of development besides ICT, which is a major mission area for ITS under the government policy. These areas are relevant to the priority fields of the national development plan that include food, renewable energy, and the living environment. To reach the goal, ITS has been focusing on education, research, contributions to society, and management within the university. These four issues are also the focus of national development plans. Efforts to realize these three achievements include striving towards good university governance, quality assurance, intellectual outputs, effective networking, prosperity through driving values, leadership, innovation and creativity, ethics and integrity, synergy, value excellences in quality and service, and socio-responsibilities[68].

(1) Organizational Development

Currently, ITS is allowed to be financially autonomous but kept under the control of the Government as far as academic issues are concerned[69]. Under this condition and according with the direction of their own development plan, ITS is promoting organizational and cultural transformation to nurture competent human resources, especially in the fields of Marine Technology, Energy, ICT and Human settlement, through defining research clusters for each field. ITS has also developed substantial partnerships with universities in EPI. Consequently, one consortium has been established with UNCEN, UNDANA, UNRAM and UNSRAT; a

[65] Source: meeting at ITS
[66] ITS is ranked 201th in QS Asian University Ranking. (Source: HP of QS World University Ranking). "Universities in Indonesia by 2011 Web Ranking" ranks ITS 4th following ITB, UI and UGM. (Source: http://www.4icu.org/id/)
[67] Institut Sepuluh Nopember, 2008, *Rencana Strategis ITS tahun 2008–2017*
[68] ITS, 2010, *Laporan Tahuan Rektor 2010 dalam Rangka Dies Natalies ITE Ke 50*
[69] Badan Layanan Umum (BLU)

MoU with ITS on the Forum for Integrated Development of Eleven Universities on Energy, Marine and Human Settlement (FIND11) has been signed by 10 universities in EPI. Cooperation with UNHAS has also been promoted through receiving their lecturers in the engineering field as postgraduate students, partly under a JICA technical cooperation project implemented by UNHAS. In terms of research activities, LPPM at ITS manages eight research centers and fourteen supporting units attached to the centers.

From the viewpoint of research-oriented educational arrangement, same as IPB, the masters programs of ITS are not officially named as research-based or course-based; however, especially at the Faculty of Industrial Technology, faculty members are making efforts to organize a research team with younger researchers and graduate students and let masters students participate in the research project from the beginning of the program. This is the approach that ITS has been introducing to all faculties since 2006 in order to transform their education at the masters level so that it is substantially research-oriented, regardless of the official organizational arrangement.

(2) Progress of Strategic Plan of ITS 2008–2017

Although the number of obtained competitive research grants of RISTEK is third among all universities in 2011[70], ITS now recognizes that it is still a teaching university and the gap between the current situation and the goal of the strategic plan for 2008–2017 (hereinafter referred to as RENSRTA ITS) is not small as shown in Table 4.4. Thus, ITS aims at reaching the 80% level of key performance indicators by 2015. For example, in 2010, the expected number of increase in citations is 357 in the field of Marine Technology, 984 in Energy, 238 in ICT, and 691 in Human Settlement[71]; the ratio of teaching staff by degree is 229 (bachelors):580 (masters):126 (doctoral), meaning 24.5% of the faculty members should have doctoral degrees whilst it is suggested by DGHE that 90% of teaching staff of doctoral programs should possess a Ph.D. by 2014 ; the number of students per faculty staff is 1:17 in 2009 against 1:15 the target for 2007–2010. Thus, ITS identified six highlight programs to be a research university and set milestones for 2011–2015[72]. It starts from programs related to inputs, followed by those related to processes which would produce outputs that should enable ITS to receive international recognition and make significant contributions to the nation.

Table 4.4 Key Indicators' Development of ITS

Indicator	2006	2008	2009	Target (2017)
Patent application (Invention)	1	9	12*	Possess total 50
Publication through international journals	27**	95	121	50 in 2011
% of lecturers with Ph.D.	18.6%	23.1%	24.5%	35% in 2011
Ratio of students per faculty member	1:16	1:17**	1:15	1.15 in 2011

* Data in 2009
** Data in 2007
*** Data in 2009 (n/a in 2008)
Source: Presentation by ITS on March 11, RENSTRA ITS, and *Raporan Rektor Tahun 2010*

[70] The number of obtained research grants of RISTEK in 2011 is 34 by ITB, 18 by IPB, 16 by ITS and 14 by UI among 129 grants obtained by universities. 141 grants are obtained by national research institutions. (Source: "Recap penerima insentif tahun 2011" by RISTEK, Appendix 1)
[71] Source: Presentation by ITS on March 11 ("Strategic Development at ITS-A strategic empowerment of being a research university").
[72] Source: Presentation materials prepared by ITS

In this connection, ITS has nurtured research and education skills in the field of ICT and ICT applications and human network in EPI, through a JICA technical cooperation project during 2006–2010, aiming to contribute to the development of EPI and industries. The vehicle to carry out the outputs was joint research with Japanese partner laboratories. One of the outputs from these activities was the increased number of patent applications, compared to the total number of 23 up to 2007. To expand this process to other fields and more partners in EPI, ITS prepared a continuation of the project in 2009, which was agreed between the GOI and Japan in early 2010. At the same time, ITS and 10 universities in EPI established a consortium named FIND-11 (Forum for Integrated Development of 11 universities) in 2009 for further collaboration.

Qualified human resources and processes of capacity building including research-oriented education at graduate levels are included in RENSTRA ITS as part of inputs and processes respectively. Likewise, ITS has developed infrastructure such as the National Ship Design Center, Center for Robotics and Energy, and a common-use laboratory building as infrastructural inputs using funds from ministries.

(3) New Faculty Development/ Existing Faculty Development

In the near future, ITS is planning to establish the Faculty of Design and Creative Industry, which is connected to the arts and industry sector. Also, the Department of Earth Science is requested to provide further studies related to Geology.

(4) Proposed Project Plan

In this context, ITS prepared a proposal "Development of ITS Surabaya: A Strategic Empowerment of Being a Research University".

Goal: Strong competency in the target areas to be used for national development especially in EPI

Target areas: Marine Technology (Faculty of Marine Technology), Energy (Faculty of Industrial Technology), ICT (Faculty of Industrial Technology and Faculty of Information Technology), and Housing, Human Settlement, Environment and Disaster Management (Faculty of Civil Engineering)

Duration: five year

Outputs and programs/activities:

1. Marine technologies and ICT support for safe ship operation and coastal environment
   a) Deep water technology
   b) Ship building development
   c) Coastal technology
   d) Ship safety operation
2. Strengthened research and development of alternative energy in EPI
   a) Renewable energy
   b) Energy conversion
   c) Alternative energy
3. Housing, Human Settlement, Environment and Disaster Management
   a) Housing and human settlement (Solve housing problems of the urban poor)
   b) Environment
   c) Disaster management
4. Basic research and development on ICT
   a) Development and applications and interface of health check through ICT
   b) E-Learning development for communities in poor Internet environment

Budget for facilities and equipment: Loan US$60,726,086

Budget for fellowship for degree and non-degree programs: US$11,517,857

Budget for technical expert: US$1,535,714

Budget for project management: US$3,839, 286

The project's overall goal is to carry out the mission to become a resource university in EPI, which would contribute to the safety of local communities. ITS has some research plans to address this; for example, city planning with environmental consideration, development and applications for health checks through ICT for rural people, and e-learning development for communities with poor Internet connectivity.

4.2.2 ITS Campus Master Plan

(1) The Current Condition of ITS Facilities

Most of the facilities of ITS have been integrated in the Sukolilo Campus as a comprehensive institute of technology with five faculties and two polytechnics in accordance with the overall master plan of functional zoning and circulation. The facility development of Sukolilo Campus with a total site area of 180 hectares started in 1977 with a loan from ADB for the development of its four faculties: Faculty of Civil Engineering, Faculty of Mechanical Engineering, Faculty of Electrical Engineering, and Faculty of Chemical Engineering. ITS received another ADB loan in 1994 for the development of all of the faculties within the Institute, focusing on marine technology. In addition to these loans, a grant from the German Government/GTZ was also received (1978–1986) for the development of the Faculty of Naval Architecture. Meanwhile, the Government of Japan/JICA has also been providing financing to develop facilities of polytechnics under ITS. In principle, all the faculty buildings in Sukolilo Campus are designed in accordance with a uniform design code, such as pitched roof with clay tile or white wall color. In the academic zone in the campus, the faculty buildings are around four stories high and isolated from other buildings.

Recently, Techno Park, an area in the north-east zone of Sukolilo Campus has been developed for research oriented facilities for collaborations. The university staff in charge of facilities said the design code is not imposed on buildings in Techno Park. At present, two buildings of Techno Park were already constructed with a contemporary design which was not in line with the design code.

The majority of undeveloped ground within Sukolilo campus is swampy because the ground level is very low and flooding during the rainy season. Careful attention for drainage and building structure are required for development here. The current Sukolilo Campus site plan with the existing facilities are as shown is in Figure 4.2.

Figure 4.2 Current Condition of ITS Sukolilo Campus

(2) ITS Facility and Equipment Improvement in Proposed Project Plan

In accordance with the ongoing master plan by "Pusat Implementasi Master Plan ITS", academic and student buildings expansion, overall Techno Park development and major landscape upgrading within the campus are planned together with infrastructure improvement. At present, common laboratory buildings are under construction with financing from GOI.

The latest ITS Sukolilo campus development master plan is as shown in Figure 4.3 .

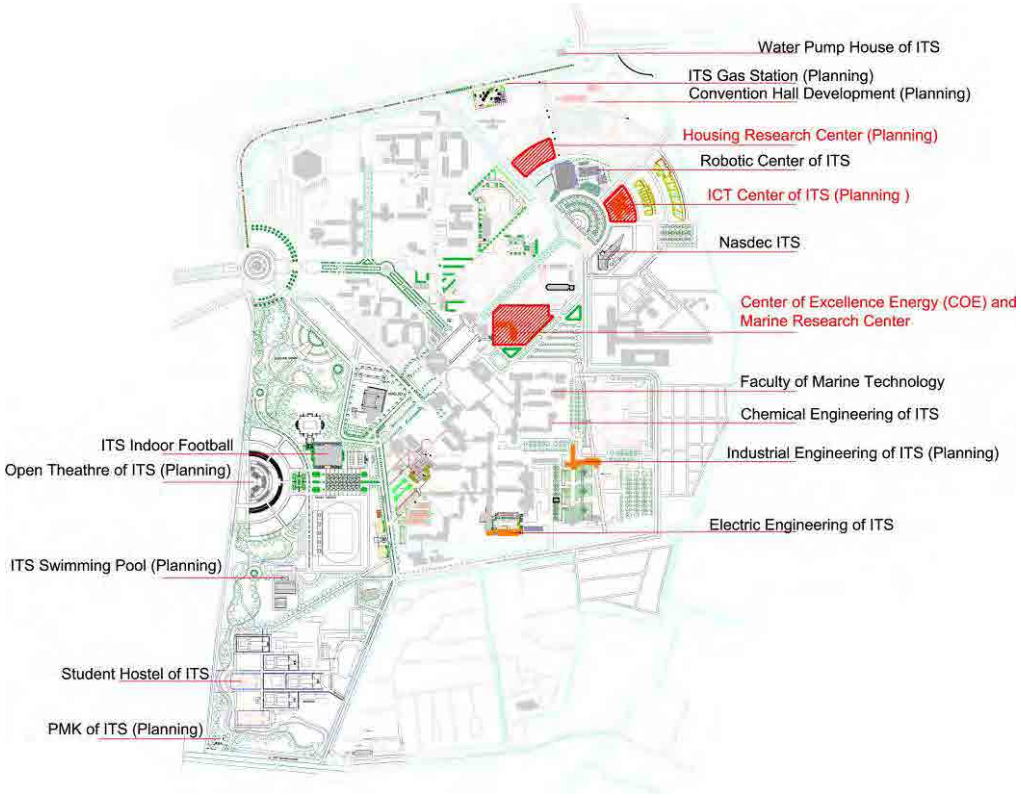


Figure 4.3 ITS Sukolilo Campus Master Plan

It is confirmed that the locations of buildings under the proposed project are planned in accordance with this master plan.

As for equipment procurement, first of all, ITS proposal writing committee asked each of the concerned departments related to the proposed four fields to make a list of equipment for procurement. Then, the committee compiled a list of equipment that was within the hypothetical budget ceiling. Therefore, there was a weak connection between the objectives of the university development plan and the proposed project. After the study team recommended to list equipment that would mainly contribute to the project objective, ITS revised the equipment plan so that it showed clearer linkage with more concrete research plans and topics (see Appendix 5 for details).

Upon the recommendation from the study team, in the process of ITS's revising the equipment list, requirements or special considerations necessary for the facility to install the listed equipment were checked preliminarily and reflected in the facility planning. Unnecessary duplication of the same or similar equipment inside each field was also preliminarily checked.

4.3 Relevance of Prioritized Fields of ITS

4.3.1 Worldwide Trends of Prioritized Fields

The fields to be developed in ITS are:

- Marine technology,
- Energy,
- Information and communication technology,
- Housing, human settlement, environment, and disaster management

Marine technology or ocean engineering is an important field. Academic societies, for instance, the Marine Technology Society[73], and the Oceanic Engineering Society[74] are famous societies in the world. These societies periodically organize international conferences. In the societies, ocean pollution is one common issue among members. However, specific major issues to be urgently solved are not recognized by these societies. Each country has its own strategic development plan concerning marine technology and oceanic engineering. The development plan in Indonesia is discussed in the next section.

Energy is a major global issue because of several reasons; namely (i) exhaustion of fossil fuels; (ii) climate change due to green house gas emissions; and (iii) environmental degradation by exhaust fumes from boilers and engines. Energy is closely related to global environmental issues. The Kyoto Protocol treaty was negotiated in December 1997 in the city of Kyoto, Japan and it came into force February 16, 2005 [75]. This is an international agreement to reduce collective greenhouse gas emissions by a certain percentage in developed countries. U.S.A., Japan, European countries and other developing countries have started developing alternative, or renewable energy. The World Energy Congress has been held every three years by the World Energy Council[76] to discuss problems on all types of energy, including coal, oil, natural gas, nuclear, hydro, and renewable energy. The World Energy Council is organized by 91 country member committees including Japan. As mentioned above, energy is now an international issue.

Information and communication technology (ICT) is now an inevitable tool for science, engineering, technology development, and social development as well. However, utilization of ICT is not fully realized in developing countries and even developed countries.

The International Telecommunication Union monitors global progress in telecommunications and ICT development and publishes "World Telecommunication/ICT Development Report". This is to follow implementation of action plans agreed by the two world summits, Geneva and Tunis, on the information society (**WSIS**) endorsed by the United Nations' Assembly. Nearly 50 Heads of state/government and Vice-Presidents and 197 Ministers, Vice Ministers and Deputy Ministers from 174 countries as well as high-level representatives from international organizations, the private sector, and civil society attended the Tunis Phase of WSIS and gave political support to the Tunis Commitment and Tunis Agenda for the Information Society that were adopted on 18 November 2005. The World Telecommunication /ICT Development Reports 2006 and 2010 were the direct response to the WSIS request to track global progress in the use of ICTs to achieve internationally agreed development goals and objectives, including the Millennium Development Goals.

ITS's ICT development is in line with WSIS development goals.

Housing, human settlement, environment, and disaster management have become the focus of global attention after the huge earthquake at Hanshin-Awaji Japan 1995, and huge earthquake and tsunami at Aceh Indonesia 2004, because a wide area in Hyogo and coastal areas over several countries, Thailand, Sri Lanka, and of course Indonesia, sustained serious damage. United Nations convened the World Conference on Disaster Reduction 2005[77] and adopted the Hyogo Framework for Disaster Reduction. In 2003, the Asian Conference on Disaster Reduction (ACDR) was established in Bali Indonesia, and every year, a conference is held in a different Asian country to follow up the progress made towards the implementation of the

[73] https://www.mtsociety.org/
[74] http://www.ieee.org/organizations/pubs/newsletters/oes/html/fall10/index.html
[75] http://unfccc.int/kyoto_protocol/items/2830.php
[76] http://www.worldenergy.org/
[77] http://www.unisdr.org/wcdr/preparatory-process/why-wcdr.htm

Hyogo Framework for Action and identify the gaps and challenges in the Asian region. Now, many international conferences on disaster are held throughout the world.

Ensuring environmental sustainability is one of the main goals in the United Nations Millennium Development Goals. To achieve this goal, four tasks must be implemented. One of them is to achieve a significant improvement in the life circumstances of at least 100 million slum dwellers by 2020. Housing, human settlement and the environment are closely related to this task[78].

4.3.2 Current Condition and Issues in Prioritized Fields in Indonesia

GOI has launched a long-term development plan 2005–2025 [79] and a medium-term development plan 2010–2014[80] as well. In those development plans, national priorities are put on the following fields and areas for enhancement of people's welfare:

- Economics
- Education
- Health
- Food
- Energy
- Infrastructure

Concerning energy, enhancement of crude oil production and geothermal power generation are highlighted, and concerning infrastructure, inter-island transportation infrastructure system network, housing of simple and health home units for the general public, and optical fiber network in eastern part of Indonesia are highlighted.

Energy, especially electricity generation, in Indonesia was 151 TWh in 2010. It is estimated that in 2020, electricity demand in Indonesia will increase up to 231 TWh for 8% economic growth[81]. Therefore, new power generation plants must be constructed.

Regional development is also an important policy for the GOI. The government intends to accelerate the development of the eastern part of Indonesia, Kalimantan, Sulawesi, and Papua maintaining the development momentum in Java, Bali, and Sumatra regions. To this end, ICT and inter-island transportation development in the eastern region of Indonesia will play a key role.

4.3.3 Advantage of ITS in Their Prioritized Fields

ITS is one of the few universities with a faculty or department related to marine technology in Indonesia, IPB, UNHAS, UI, ITB, and STIP (Sekolah Tinggi Ilmu Pelayaran: Maritime Higher Education Institute). Among them, the faculty of marine technology, ITS has departments in all aspects of marine technology, consisting of the department of naval architecture, department of marine engineering, and department of offshore engineering. In Surabaya where ITS is located, there are several ship building companies and they have collaborated with ITS. In addition, a National Ship Design and Engineering Center was established for a joint project with the Ministry of Industry, GOI in the ITS campus. Therefore, ITS is at a central position of promoting **marine technology** in Indonesia (see Appendix 7 for details).

[78] http://www.undp.org/mdg/goal7.shtml
[79] RPJPN 2005–2025
[80] RPJPN 2010–2014
[81] APEC Energy Demand and Supply Outlook 2006.

As mentioned above, GOI must reinforce its electricity supply by building new power plants to materialize sustainable economic development in the future. However, because of the global issue of climate change, electricity should be generated by the use of clean energy or renewable energy. GOI decided to utilize geothermal energy in its long-term national development plan 2005–2025. The East Java provincial government has identified eleven geothermal sites in the province. ITS has already many collaboration activities with the provincial government to develop geothermal energy. The eastern region of Indonesia must have many geothermal deposits and other renewable energy resources such as biomass in the region. As a core university to support the development in the eastern part of Indonesia, ITS can play a main role to develop geothermal and renewable energy. Therefore, ITS should possess strong initiative in **geothermal and renewable energy** development, and ITS can sublimate their strong initiative to their advantage (see Appendix 7 for details).

JICA PREDICT project was implemented from 2006 to 2010. The project objectives are:

- Research skills in ICT field at ITS are enhanced
- Human resources with advanced ICT knowledge and skill are developed through research activities.
- Human resources developed by this project are supplied to industry sector, university, and research institutes in eastern part of Indonesia.

ITS has rich experience in ICT development and basic research equipment through PREDICT.

Therefore, ITS possesses an advantage in **ICT development** in Indonesia, especially for the eastern region of Indonesia (see Appendix 7 for details).

The Department of Civil Engineering and Planning has close relationships with the central government and the East Java province government concerning human settlement in East Java province and disaster rehabilitation of Aceh after the 2004 earthquake and tsunami damage. ITS has already developed low cost simple and strong housing for human settlement according to request of the East Java provincial government (see Appendix 7 for details).

Therefore, ITS possesses an advantage in **human settlement, environment, and disaster management** in Indonesia.

ITS ranked lower than 601st in the 2010 QS-world university ranking[82]. In the 2010 Asia university ranking in engineering[83], ITS is lower than 101st, while ITB ranked 30th, UI ranked 50th, UGM ranked 58th, and Diponegoro University ranked 100th among Indonesian universities. Thus, ITS's ranking in 2010 was rather low among Asian universities. However the 2011 Asia university ranking of ITS is tremendously improved at 65th while other Indonesia universities keep similar positions.

[82] http://www.topuniversities.com/institution/sepuluh-nopember-institute-technology/wur
[83] http://www.topuniversities.com/university-rankings/asian-university-rankings/2010/subject-rankings/technology?page=2

Table 4.5 University Ranking of ITS and Others

University	2010 QS-World University Rankings	2010 QS-Asian University Ranking (engineering & IT)
ITS	601+	>101
UI	236	50
UGM	321	58
ITB	401–450	30
IPB	501–550	93
Diponegoro University	601+	100

ITS's research plan focuses on support of economic development in the eastern part of Indonesia. Since JICA PREDICT project started in 2006, ITS has played an important role to support the development in the eastern part of Indonesia through strengthening local universities in this region. Using this university network, ITS should carry out research for technology development in this region. UNHAS is also positioned as a core university for the development of eastern Indonesia. As mentioned above, the university ranking of UNHAS is much lower than ITS. In fact, research activities in UNHAS are quite low as compared with ITS[84]. In addition, ITS is one of most active Indonesian universities in research funding recipience. In 2011, ITS received 16 funds from RISTEK incentive program, next to ITB, which had 34 funds and IPB, which had 18 funds[85]. Therefore, ITS has an apparent advantage in terms of technical support to the development of eastern part of Indonesia against UNHAS and other Indonesia universities.

In order to provide comprehensive support for effective and efficient overall development in eastern part of Indonesia, the four fields proposed by ITS should collaborate with each other. For instance, energy and marine groups will develop an efficient and safe ship for inter-island transportation, in which the energy group will develop a 100% biodiesel engine and the marine group will develop safe ship design. ICT group can collaborate with all the other groups. Therefore, the four fields must be equally prioritized.

Four research fields are proposed by ITS. Because the ITS strategic development plan aims to enhance the research capability in those fields, to support academic activities and human resource development of local universities in the eastern part of Indonesia (EPI) and eventually to support economic development in EPI as a core university. ITS can put emphasis on their contribution to the nation in terms of the support of EPI economic development whilst working as one of the resource universities in Indonesia. Therefore, using BAN-PT accreditation results for main related departments involved with four fields and graduate education program as well, the advantage of ITS is analyzed against UNHAS. BAN-PT accreditation is based on several criteria including research activities. In addition, almost all engineering departments of ITS have graduate programs up to the doctoral level, while departments of UNHAS have graduate program only up to the masters level.

Table 4.6 to Table 4.9 clearly show that ITS quality is superior to UNHAS over almost all engineering departments.

[84] JICA expert report on Project for the Development of the Engineering Faculty of UNHAS, Sept. 2009
[85] RISTEK, incentive program funding data in 2011, Appendix 1

Table 4.6 Accreditation and Education Program in the Energy Field

Main departments in cluster	PT BAN Accreditation(S1)		Education Program	
	ITS	UNHAS	ITS	UNHAS
Mechanical Engineering	A	B	S1, S2, S3	S1, S2
Chemical Engineering	A	-	S1, S2, S3	-
Electrical Engineering	A	B	S1, S2, S3	S1, S2

Source: BAN-PT http://banpt.blogspot.com/2010/04/its.html, http://banpt.blogspot.com/2010/04/unhas-akreditasi-universitas-hasanuddin.htmlWebsite, Information revised by ITS staff

Table 4.7 Accreditation and Education Program in the Marine Field

Main departments in cluster	PT BAN Accreditation(S1)		Education Program	
	ITS	UNHAS	ITS	UNHAS
Naval Architecture and Shipbuilding Engineering	A	B	S1, S2,S3	S1, S2
Marine Engineering	A	-	S1, S2, S3	-
Ocean Engineering	A	-	S1, S2, S3	-

Source: BAN-PT http://banpt.blogspot.com/2010/04/its.html, http://banpt.blogspot.com/2010/04/unhas-akreditasi-universitas-hasanuddin.htmlWebsite, Information revised by ITS staff

Table 4.8 Accreditation and Education Program in Housing, Human Settlement and Disaster Management

Main departments in cluster	PT BAN Accreditation(S1)		Education Program	
	ITS	UNHAS	ITS	UNHAS
Civil Engineering	A	A	S1, S2, S3	S1, S2
Architecture Engineering	A	A	S1, S2, S3	S1, S2
Environmental Engineering	A	-	S1, S2,S3	—

Source: BAN-PT http://banpt.blogspot.com/2010/04/its.html, http://banpt.blogspot.com/2010/04/unhas-akreditasi-universitas-hasanuddin.htmlWebsite, Information revised by ITS staff

Table 4.9 Accreditation and Education Program in ICT Field

Main departments in cluster	PT BAN Accreditation(S1)		Education Program	
	ITS	UNHAS	ITS	UNHAS
Electrical Engineering	A	B	S1, S2, S3	S1
Informatics	A	-	S1, S2	-
System Information	A	-	S1	-

Source: BAN-PT http://banpt.blogspot.com/2010/04/its.html, http://banpt.blogspot.com/2010/04/unhas-akreditasi-universitas-hasanuddin.htmlWebsite

4.4 Examination of Current Condition toward University–Industry Collaboration, and Human Resource Development at ITS

4.4.1 Condition of Utilizing Internal Resource, Joint Research and Collaboration at ITS

ITS is rather active in pursuing research funding from outside. For instance, in 2009, ITS submitted 256 proposals to DGHE funding programs and 143 proposals were funded. As a result, in total, 399 academic staff (around 43% of all staff) were involved in research activities. ITS also submitted proposals to funding programs other than DGHE and 209 research projects

were approved. 309 academic staff were involved with those projects. As seen from these facts, ITS utilizes human resources of academic staff as an internal resource for joint research and collaboration research.

Through JICA PREDICT project, laboratory based education was widely spread to other departments and faculties. Therefore, student human resources are also fully utilized for joint research and collaboration activities.

LPPM is functioning as a management office for collaboration with outside partners. So many collaboration activities were carried out in the past years as mentioned above.

Concerning facility utilization as an internal resource, full utilization of facilities cannot be observed. ITS receives equipment and instruments from GOI, and buildings as well. New equipment and instruments were installed in centers located in Techno Park. That equipment and instruments are commonly used by academic staff and students on an application basis. Newly installed equipment and instruments are not ready for full utilization.

4.4.2 Current Condition and Examples of University–Industry Collaboration, and Human Resource Development at ITS

ITS has collaborated with industries and local governments in the fields of human resource development, joint research, and dissemination activities. The information of the current collaboration partners are listed in Appendix 9. Based on the study of ITS, around 65% of the students found jobs within 3 months of graduation in 2010, as for the Marine Technology Department, the students were employed within 1 month, since due to the uniqueness of the study field there were no other competitors. However, around 10% of the graduates cannot find jobs within 6 months, which includes those who do not want to work for some reason. The average first salary is Rp.2,670,000 (US$267) which is around three times as much as the minimum salary standard.

Human resource development is expected by the industry sector and local government. Local government staff continue their studies for masters or doctoral degrees after working several years, since ITS is strong in the engineering fields. The East Java province expects ITS to establish an Earth Science Department due to the high potential of geothermal energy in East Java province.

Research activities are also conducted with local government and companies. PT DOK, GMN, PT Hamdala and East Java provincial government depend highly on ITS in research. They have some engineers at their places, but not enough to conduct R&D activities by themselves They need further study and human resources for conducting research, so that they ask ITS for help with their activities. They do not intend to establish or strengthen their R&D sections.

As for the dissemination of the research activities, ITS contributes to designing low-cost housing for the poor in assistance with East Java province for their “One Million House Project”. That project is also supported by PT Hamdala. In the case of renewal energy, production has been supported by the government since 2002.

ITS graduates support government activities, even when they are working in the private sector. The private companies along with local government also tend to support the regional development of EPI. That is one of the characteristics of companies in Surabaya. The owner of PT Hamdala says that he was familiar with government activities during his ITS student days since there were many activities going on in their faculty, so that he also would like to contribute to those activities after graduating. In his group association, 6 out of 8 members in

his group are graduates of ITS, and so they have similar ways of thinking. The owner of GMN working for energy in the off-grid market or rural areas or islands says that his thesis at ITS around 35 years ago was about solar energy, and he decided that would be the topic for his life work.

The success is that the graduates ask ITS to work in their research activities. The companies do not have a full R&D section, so they need ITS when they develop technology. Since they are graduates, there is a channel to universities as well as information available that ITS will support.

The challenges are that there are not many big companies operating in Surabaya. There are small-medium size companies there, so that most of the companies do not have enough R&D funds and staff which can be potential partners to create innovations in specific fields. ITS, however, cannot stop working for small application support as well, since the companies are highly dependent on ITS. University research is not only for companies, but also for the academic perspective. ITS also needs to conduct research for academic purposes with international standards. Academic and fundamental research generally takes a longer time than applications for market use.

ITS Graduates and Labor Market Demand

ITS graduates have a strong competitiveness in the labor market. For example, a total of 138 firms joined job fairs at ITS for recruiting students. They would like to identify students to recruit even before graduation.

More than 90% of the graduates obtain their first job in less than one year from their graduation. Only 6.4% of the students had to wait for their first job opportunities.

Table 4.10 ITS: The Period from Graduation to Initial Employment (2010)

Achievements	Percentage (%)
Waiting Time of Work:	
0–3 months	61.1
4–6 months	20.7
7–12 months	11.3
> 1 year	6.4
Average waiting time: 3.82 months	

4.4.3 Current Condition of Collaboration with Japanese Universities and Companies at ITS

Among senior faculty members at ITS who are over the age of 40, the popular destination for studying abroad to obtain their masters degree or Ph.D. was Europe and the U.S.A. However, among junior faculty members, the number of them who have studied or are currently studying in Japan is increasing.

Compared to IPB, there has been less collaboration with Japanese universities. One of the reasons behind this might be that fewer of their faculty members have graduated from Japanese Universities than those at ITS (see Appendix 3 for details). However, ITS has effectively utilized its human resource network established through the JSPS (Japan Society for the Promotion of Science), more than 10 years ago to search collaborative research partners or professors who can accept ITS faculty members for fellowships or degree programs.

There have been several collaboration programs with Japanese companies. According to the interview with ITS faculty members, there are mainly three patterns of initiation of collaboration with the Japanese companies as follows:

Pattern 1: Japanese companies firstly request some organizations in Indonesia, such as BPMIGAS, an Indonesian governmental body which manages oil and gas, or Indonesian companies with which it has a connection, to introduce an organization that can help achieving their business purpose. Then, these go-between organizations introduce ITS to the Japanese companies.

Pattern 2: A Japanese University, with which ITS has human resource connections, collaborates with a Japanese company. Then, Japanese companies can access ITS via the Japanese University.

Pattern 3: ITS directly approaches the branch office or factory of a Japanese company in Indonesia.

Examples of Collaboration with Japanese Companies or Research Institutes

- INPEX Corporation has established a long-term business partnership with BPMIGAS. BPMIGAS introduced ITS for collaborative research on gas conversion into liquid on Floating LNG with INPEX Corporation.
- RIKEN initiated to have a MoU among ITS, ITB, and Universitas Padjadjaran about collaborative research on advanced materials mediated by DGHE. An annual international joint seminar and researcher exchanges have been taking place with some financial support from DGHE.
- ITS directly contacted HONDA Indonesia to request developing an engine system and fuel injection system to be used for an eco-vehicle to participate in an Eco-Marathon competition organized by Shell (private company).

4.4.4 Current Condition of Fellowships and Scholarships at ITS

ITS aims at increasing the percentage of faculty members with a Ph.D. up to 35% or more in line with the development plan of MONE. It is obvious that ITS needs fellowships to finance studies abroad; thus, ITS obtained scholarships from DGHE in 2009, three for doctoral programs and three for masters programs[86]. It was eleven for doctoral programs and eight for masters programs in 2008. Other than those from the GOI, ITS has such resources as Japanese Government (Monbukagakusho) scholarships, JASSO, Hitachi, Asian Development Bank, Irlandia Government scholarship, AD Australia, NESO, Aminef, Korean Government Scholarships, Erasmus and Mundus.

These are far from enough to meet the needs of ITS, considering the current percentage of Ph.D. holders among lecturers, i.e. 24.5% or 229 people. Therefore, ITS includes fellowships in the project implementation plan that would complement MONE's scholarships and help ITS to push forward RENSTRA ITS.

At the same time, in order to strengthen the existing partnerships with Japanese universities in preparation for the future joint research projects, non-degree fellowships would be much appreciated by young and motivated researchers. It should be emphasized that complementary scholarships for young lecturers to obtain higher degrees at Japanese partner universities, based on each research project, would underlie the sustainable research and industrial cooperation.

[86] Source: DGHE website information in 2010

5. Suggested Development Scenarios for Universities in Indonesia, Especially IPB and ITS

5.1 General Issues in Indonesia

(1) Background Issues in Indonesia

The current government led by Dr. Susilo Bambang Yudhoyono set up the policy of national prosperity by economic growth. The target economic growth average is between 6.5% and 6.8% in year 2010–2014, and over 7% in 2014. Indonesian policies also put a focus on poverty alleviation. The current national issue is to lead the economic growth to alleviate poverty and unemployment[87].The national research priority of DGHE includes poverty reduction. The long term national development plan 2005–2025 also states poverty and unemployment as one of the key issues, as well as income per capita. Now economic growth means not only an increase in the national income, but also poverty alleviation in Indonesia.

Continuing activities to create new values are indispensable if a nation aims to grow through industrial development. A well-known economic theory tells us that sustainable economic growth is observed when continuous technological progress occurs; selling newly added values in international markets is a resource for economic growth.

Therefore, it is necessary for industries with advanced knowledge and technologies to create new values from natural resources; inventions produced through research activities must be utilized to push up the capacities of industries to pursue technological progress.

A research university or a resource university of the nation must strongly recognize this issue as one of the potential collaborators for industries. Responding appropriately to the necessities, DGHE and RISTEK have started supporting R&D activities for universities to collaborate with industries by providing a portion or higher mark for collaboration research funds between universities and companies.

Industries must also be aware that new ideas should be the source of continuous profits in a competitive business environment. Encouraging industries to see this part of business activities, namely R&D, is therefore very important to promote industrial development in Indonesia. Consistent policies and incentives for industries to add new values on their products should be given by the relevant authorities. However, supporting policies for industries to conduct R&D activities are not much visible. Indonesian policies should promote the environment for conducting R&D in the industrial sector.

Another aspect of the R&D contribution is related to local communities. By the same token from the above mentioned standpoint, it is also an important agenda for local or small enterprises to continuously add values to their products. Strengthened local industries may enhance employment and per capita income of the region. Thus, outcomes of the R&D can be the resources for socio-economic development of remote areas such as EPI, sometimes through core local university networking, once local industries are motivated. We can see the trend that university research activities are also moving toward poverty alleviation, such as introducing new commodities for the poor, or regional equity.

In any case, introducing successful value creations in Indonesia is a critical issue. As described in 2.2, the current social environment is not favorable in Indonesia in this regard while many

[87] Unemployment rate in 2009: Thailand 1.5%, Malaysia 3.7%, Philippine 7.5%, GDP: Indonesia US$2,590, Thailand US$4,154, Malaysia US$6,763, Philippine US$1,747 (Source: MUFJ material).

joint activities are conducted in such styles as internships, scholarships from private companies, consultations and so forth.

As mentioned above, private companies are not yet working with universities for R&D activities. Industries should also consider more about R&D with universities. It is proposed that universities' knowledge and resources for R&D should be utilized through industry-university linkages.

The diagram of Figure 5.1 following shows the concept of suggested approaches to the higher education sector and its linkage with other sectors. The diagram shows what is involved in developing technologies through research at universities in collaboration with industries, and where Japanese assistance can be applied. The orange-colored parts indicate the contents of possible support from Japan. The Japanese side can assist in hard components including development of infrastructure to support research, general soft components such as institutional development, and other support for individual research projects that may include financial assistance.

Core research universities, such as IPB and ITS, are expected to lead a network of universities in Indonesia. The network should link Indonesian academic sector with Japanese universities and industries, and it could underlie the future collaboration between Indonesian and Japanese industries through universities. All stakeholders should make efforts to nurture partnerships for R&D by various means including exchanges of personnel.

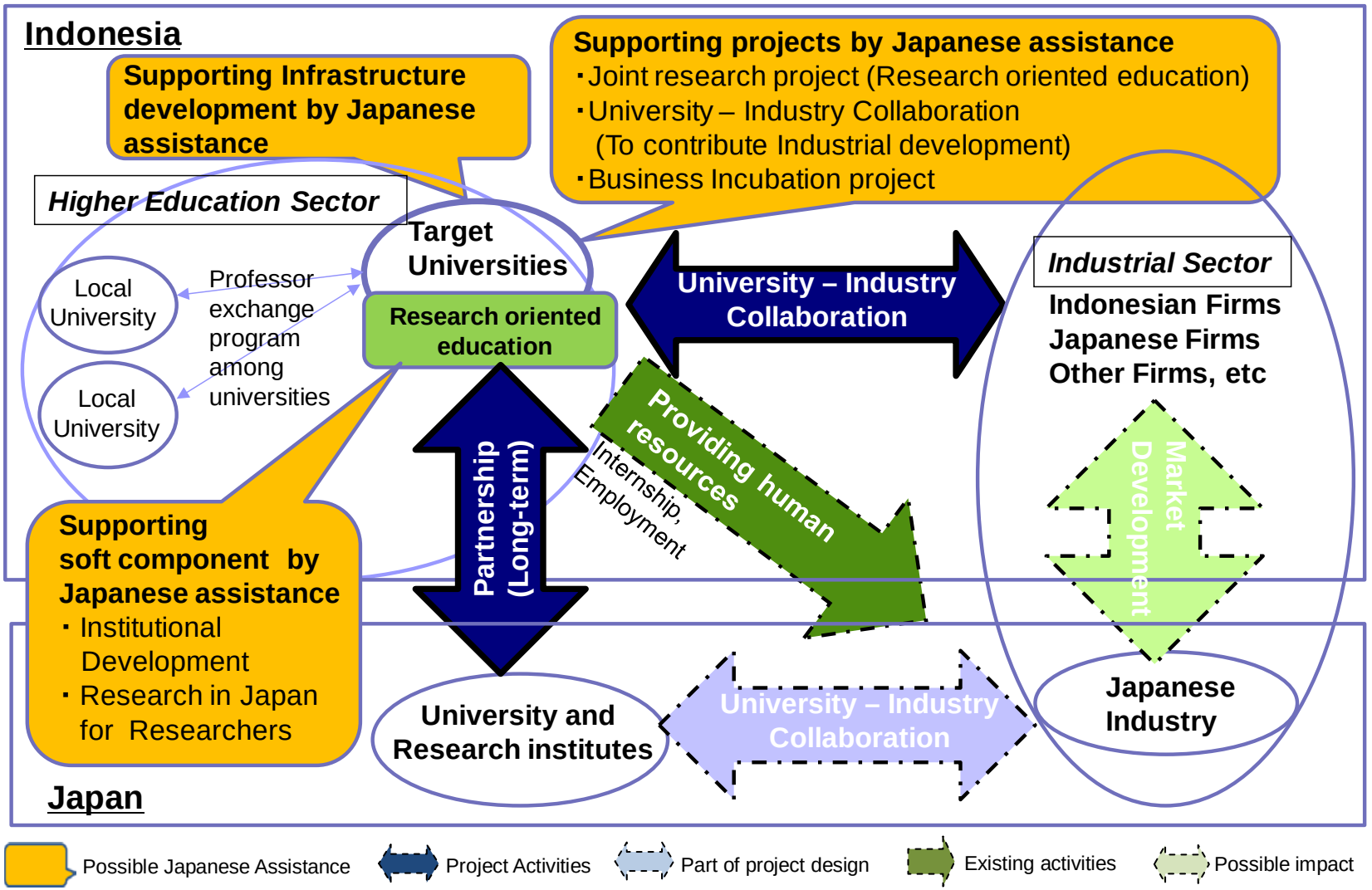


Figure 5.1 Concept of Approaches to Higher Education Sector and Linkage to Others

(2) Assistances for Industry-University Linkages

From the viewpoint of technical assistance from Japan, especially in terms of enhancing effective industry-university linkages, there may be several frameworks such as: (i) opportunities and information, (ii) technologies, (iii) human resources development, and (iv) policy and financial resources. When learning from experiences of cooperation between Japanese industries and universities (see boxes A-D for details), we can see several key issues as follows[88]:

- The target technology must meet the needs of customers. (B)
- Different business models are required for different technologies, business environments and business sizes. (B)
- Diversified methods and opportunities of matching technical needs and research seeds are appreciated. (A, C, D)
- University-based venture companies should follow several phases, from basic research until industrialization by large-scale enterprises[89]. (A, B)
- Intellectual property management from the early stage enhances competitiveness. (A, B)

Some of the experiences of Japan related to possible frameworks of the assistance are shown in the boxes below, though they do not cover all aspects of industry-university linkages.

Experiences of collaborative research and development by a private company and a university are usually confidential, while those who receive official financial assistance are requested to disclose the processes and results. From the interviews to local and Japanese companies, official assistance to universities could mitigate the risk that might be taken by private companies when starting collaborative research and development.

A. Cases of Opportunities and Information

A university in a western prefecture possessed a useful measuring technology. The industry-university coordinator of the university approached a group of local companies who would potentially be interested in this technology, and encouraged them to conduct joint research as a local consortium. The consortium furthered the research and development obtaining financial support by the Ministry of Economy, Trade and Industry (METI) of Japan, pooled patents and promoted the products to customers in various fields. The coordinator, who had good knowledge of technologies and was assigned as the dedicated personnel for industrial cooperation, played a critical role in this case.

Another successful example could be seen in the case of a private engineering university in Tokyo and a city bank[90] where the bank had been long sharing the ideas of sustainable

[88] References: http://sangakukan.jp/journal/ (Japanese), http://www.univinfo.jp/sangaku/ (Japanese), http://dndi.jp/index.php (Japanese), Yuko Harayama. Yutaka Ujiie, Toru Degawa, 2009, *Driver of Industrial Innovation: Technology Ventures Fuelling Innovation Ecosystem*, Hakutou-shobo (in Japanese: *Sangyo kakushin no gensen*), Yukio Nakamura, 2003, *Industry University*, Nikkei BP (in Japanese: *Sangaku renkei: Chuo-kenkyuujo no jidai wo koete*), and others

[89] University-based venture companies in Japan including the one who received an award from the government in 2003 are suffering from balance deficits. (Source: http://dndi.jp/main/shiryou.pdf, http://www.anges-mg.com/ir/pdf/2010_12_chukan.pdf, and others). The Ministry of Economy, Trade and Industry (METI) of Japan started a program in 2001 to establish 1000 university-based venture companies by 2004, resulting in 1009 venture companies in 2004. Japan Science and Technology Agency (JST) has also been supporting universities in creating venture companies. Evaluation of individual venture project suggests the importance of technological excellence and elaboration of business plans.

[90] The branch office of this bank in Indonesia provided ITS with information on the technical needs of Japanese companies near Surabaya. This information was a trigger of the industry-university cooperation between a research group of ITS in the field of ICT and a Japanese food processing company.

industry-university cooperation with the rector of the university. First they tried to make a model case through joint development of e-learning materials for the kids academy run by the bank. They recognized that being known to industries should be the starting point for the university to initiate industry-university cooperation. Then, the bank continuously provided the university with opportunities to introduce their technologies. Technical solutions offered by the university are appreciated by the customers of the bank; thus the cooperation has been win-win for both sides[91].

B. Cases of Technologies

Mulberry leaves have been used as an indigenous medicine for preventing diabetes in Japan; however the mechanism of the medical effect was not known. An established research university of Japan has identified and purified the effective component as well as proved its safety. The researcher and the partner company are now trying to obtain a certificate to sell the compound as a special health food. In this case, the technology itself is the agenda, apart from the know-how to make it into business.

Producing hydrogen for fuel cells from biomass is a challenge for research and development. A university has the technology to use a specific microbe for this purpose and launched a venture company to apply it to large scale plants. In this case, researchers are continuously required to upgrade the technology and design processes in order to make it into business-scale.

An idea of supporting industrial zones in Indonesia through research on environmental impacts has been raised by an Indonesian university. Learning from Japanese experiences, excellence and advancement of technologies must be pursued. This university has been invited as an educational institution to participate in an industrial city development project by a Japanese company, which may physically decrease the distance between universities and industries.

C. A Case of Human Resources Development

A large-scale company in the field of electrical engineering has been conducting “Research Internship” programs since 2005 in cooperation with four established research universities. The electrical company utilizes this program for exchanging information with researchers of universities, equipping graduate students with soft skills, and creating innovative research seeds. Essentials listed by the electrical company are the leadership and deep involvement of researchers (supervisors of the students), efforts to make very close communications with students, implementation of a plan-do-see cycle, and motivation to fully utilize this human exchange opportunity for further innovation.

D. A Case of Policy and Financial Resources

Some local governments consider that supporting small and medium enterprises should enhance local business development, and in this regard local banks may play important roles in promoting industry-university linkages. There are several kinds of services including funding, needs-supply matching promotion, and consultations. Opportunities, business plans and skills, technologies for high value products and close communications are assisted by local banks as well as financing schemes are proposed .

[91] Source: Home Page of Mitsubishi Research Institute

5.2 Development Scenarios for Universities in Indonesia

Development scenarios for universities in Indonesia, taking into consideration the national development strategies and current situation, are suggested here. The belief is that human resources will not decline in the long run but keep being reproduced. Facilities and equipment will pay for themselves when they are used for research activities in line with this belief.

(1) Basic Concepts—for Equity, Quality and Contributions of Universities in the Fields of Science, Engineering and Agriculture

A. Resource Universities and Networking

Indonesia aims to be a self-sustaining nation with progress, equity and prosperity as stated in the national development plan. Sustainability of economic growth needs continuous technological progress; thus perpetual R&D in all fields of industries is the key for sustainable growth. In this direction, higher education, especially of the graduate level, in the field of science, engineering and agriculture is required to provide qualified human resources equipped with capabilities to create values whilst an equal opportunity for all citizens to enjoy higher education is also pursued. Poverty elimination in rural areas is also an agenda.

Accordingly, enhancing capacities of resource universities in science, engineering and agriculture should be a must; and simultaneous nurturing of substantial and collaborative networking among universities may lead to two separate tasks being accomplished together, meaning that nationwide access to standardized higher education and advanced technological inputs for industrial value creations could be inclusively realized.

From the viewpoint of technical and financial support from Japan, upgrading the research and education of resource universities will improve the education at local universities as well. Local communities will also benefit from the outputs of local universities. This is under the condition that resource universities conduct research, apply for patents in Indonesia, and publish academic papers in international journals in collaboration with partner universities/researchers in Japan.

Currently, informal networks among universities are being nurtured in Indonesia. A comprehensive and intentional development plan of networking based on regional needs and capabilities of resource universities should be given, targeting selected model fields and universities.

B. Research Oriented Education at Graduate Levels of Resource Universities

Quality of education provided by a research university is evaluated by the capacity of graduates to solve problems and create values through research and development. Education provided by research universities in science, engineering and agriculture is the most important part of higher human resources development that should increase value creations by industries. Therefore, if the quality should be world-class, graduate programs in science, engineering and agriculture could not be lecture based but must be research oriented.

At universities in Indonesia including potential resource universities, generally, masters programs or even doctoral programs require a number of credits to be earned by classroom lectures, and thus have not been very successful in providing graduates with sufficient skills in research and development. Research oriented education could be introduced by involving graduate students in supervisor's research projects regardless of the official crediting systems. Research oriented education would thus force supervisors, namely faculty members of research universities, to participate in qualified research projects.

C. Sharing Facilities and Equipment Based on Joint Research Activities

As stated above, networks among universities in Indonesia are crucial for more equity and a higher quality of higher education. It is also anticipated, in terms of efficiency of resource sharing, that facilities and equipment are shared by researchers who are jointly implementing research projects or those who need them to carry out his/her research plan. A national common research facility is operated based on research activities; it is not just a building with equipment. Researchers of a certain research facility equipped with advanced devices can participate in research projects proposed by those who do not have access to certain devices.

Researchers of facility centers are not there to manage the usage of equipment but to use the equipment with graduate students and contribute to the research outputs. This is a transformation of research facilities from a building into a research and/or project based activity center.

D. Intellectual Property Management and Income Generation

Patent mapping is a process that must be done when making research plans; otherwise researchers may waste time in finding what has already been found by others. Patent applications should be done before publicizing the research outcomes; however, publications by graduate students are more concerned with emphasizing the viewpoint of human resource development.

Licensing is one of the methods of income generation. Since universities are not manufacturing companies, but are expected to transfer the technologies to industries, disclosing their invention to the public by patenting and making them available for industries is an important task.

Thus, the number of publications in international journals and patent applications could be indicators for the impacts on university development. It should be noted that registration of applied patents, i.e. requests of examinations, should be made once universities know it is worth doing. It should also be taken into consideration that patenting plant varieties is prohibited by the law in Indonesia but can be protected by the application of Plant Variety Protection[92].

E. Demands and Supply Match between Universities and Industries—Based on Mutual Reliance Nurtured by Universities and Industries, in Various Occasions and in Compliance with Business Principles

Without mutual reliance, industry-university cooperation would not be initiated, even though there is demand and supply. Researchers, namely inventors, and private companies become convinced to work together for profits using the invention; then activities start between them. Therefore, opportunities to nurture mutual understanding should be created as much as possible, including technology fairs by universities, academic conferences, and internships. It must also be understood that access to Japanese companies through Japanese universities is much more realistic than making random and direct access from Indonesia.

Another point is that private companies are pursuing profits. Universities are not profit making entities; thus pairing should focus on the profit making if industrial cooperation is concerned. However, universities must not forget that they are resources for value creations and human resource development. Balancing the two is important for educational institutions.

[92] **The Plant Variety Protection and Agriculture Licensing Office** is an Institution under The Ministry of Agriculture, Republic of Indonesia which has authority on the implementation of the protection of new varieties of plants. (http://ppvt.setjen.deptan.go.id/ppvtnew/indexing.php)

In this regard, we also recognize that one of the major purposes of human resources development in science, engineering and agriculture is to further the industrial development of Indonesia. Manpower produced by universities must become the entities of industrial activities which are relevant to their capacities nurtured through education programs.

It is well known that technology transfer is feasible when the capacity to localize the advanced technology is well prepared. More importantly, continuation of technological progress is supported by a series of inventions. If human resources developed through world-class research based education are not utilized by the industries, sustainable growth based on the technological progress may not be achieved.

Supporting incubation activities to establish venture companies rooted in research and development is also recommended. Many programs are currently conducted in this direction, since weak motivation of existing private enterprises to do research and development often hinder the industry-university linkages based on research and development. However, active and intentional input may bring out profits for both industries and universities, if such companies that need localized research and development in Indonesia are involved.

(2) A Model Scenario for Resource Universities—a Set of Research, Education and R&D with Industries "from Planning to Applications"

A feasible scenario of substantializing the basic concepts is to execute a set of several activities. The goal is enhanced contributions to the industries by resource universities and simultaneous standardization of local universities to support more access to higher education. In this context, activities should be consolidated and tailored toward the goal. A model set includes: (i) research projects with industries and Japanese and Indonesian partners accompanied by research oriented education for masters students as research members, (ii) collaborative fellowships for degree and non-degree within the scope of the sustainable industry-university cooperation, and (iii) procurement of related facilities and equipment.

A. Research Projects with Industries and Japanese Partners Accompanied by Research Oriented Education

Following activities should be implemented in sequence and thoroughly coordinated until the outcomes are achieved.

Patent mapping: this is to clarify the goal and the technological advantages

Research planning: this is conducted in cooperation with a potential private company in Indonesia and a Japanese partner who has close communication with Japanese companies, preferably those who have production sites in Indonesia. Information on technical needs in the relevant field should be given by the partner company. Research leaders must be aware that universities are responsible for the value creation and technological progress of the nation.

A research group must consist of a leader, senior researchers/lecturers/Ph.D. candidate(s), and masters student(s). Undergraduate students who are to develop a graduation thesis may join. Partner universities in Indonesia must be invited as a senior researcher or as masters student(s)/Ph.D. candidate(s).

Patent applications: A patent must be applied for at the beginning of the research project, or at latest before publication. Examination of the patent could be done when it is thought to be worth doing. In the case where patent applications were not done before publication, patents should be applied for within six months of the publication, making exactly the same technical claims as those described in the paper. Registered patents or the filing date of the patent can be sold to

national and/or international companies; commercialization of the technology should be pursued by private companies.

Publications in international journals: Masters students must publish one paper through an international conference or a journal. Supervisors should assist them in preparing a qualifying paper and finish patent applications before their publications.

R&D with the Indonesian partner company: Competitive follow-up research funds are offered so that the technical seeds nurtured during the project could be developed by Indonesian stakeholders through continuing the research activities with the university.

B. Collaborative Fellowship Program at Partner Universities

Experiences of research at Japanese partner universities strongly support those who lead and/or conduct research projects, equipping them with practical understanding of research-oriented education and research culture of Japanese universities along with the knowledge and information needed to update their research in Indonesia. Nurturing human network with Japanese scholars and industries should be another aspect of anticipation.

Fellows must also experience research activities at partner companies in Japan during their study at a Japanese university. Japanese research partners are responsible for preparing this industrial program. Technology transfer to Indonesian companies and an initiation of new R&D is required based on this activity.

Collaborative fellows are required to publish at least one paper in an international journal.

This component is very important not only for securing the quality of research but also for establishing sustainable partnerships with Japanese universities and industries. Agents are human beings, after all; thus human relationships are indispensable for any kind of collaboration. At the same time, nurturing human resources with higher degrees is also anticipated. This part might be borne by scholarships by GOI and/or those offered by joint programs with overseas universities including sandwich programs, when considering the current situation of scholarships and lecturers duties in Indonesia.

Therefore, collaborative fellowship programs that complement those given by MONE could strongly support the effective implementation of research projects and make its social impacts sustainable.

C. Procurement of Related Facilities and Equipment

Facilities and equipment should be ready by the time when degree/non-degree fellows come back from Japan.

D. Utilization of Scholarships for Substantial Industry-University Linkages

There may be opportunities for universities in Indonesia to send their young lecturers to Japanese universities for higher degrees in general.

In this regard, it is strongly recommended to utilize the partnerships developed and nurtured through the project activities. Research funds can be jointly sought by their supervisors in Japan and Indonesia and from international foundations.

One of the options is to ask Japanese supervisors to send them to their partner companies for a few months. In this case, the following might be requested by the company:

- Student(s) sent to the Japanese company must be excellent.
- Student(s) are motivated to work for the Japanese company after obtaining the degree, and expect the support of their supervisor's coordination.

The key roles of human resources development for R&D in Indonesia is shown in Fig.5.2. A model case illustrates how such research projects as described in A should enhance the capacity of research and industrial cooperation of resource universities. It indicates the essentiality of actions taken by researchers and graduate students at each university throughout the scenario including B, C, and D.

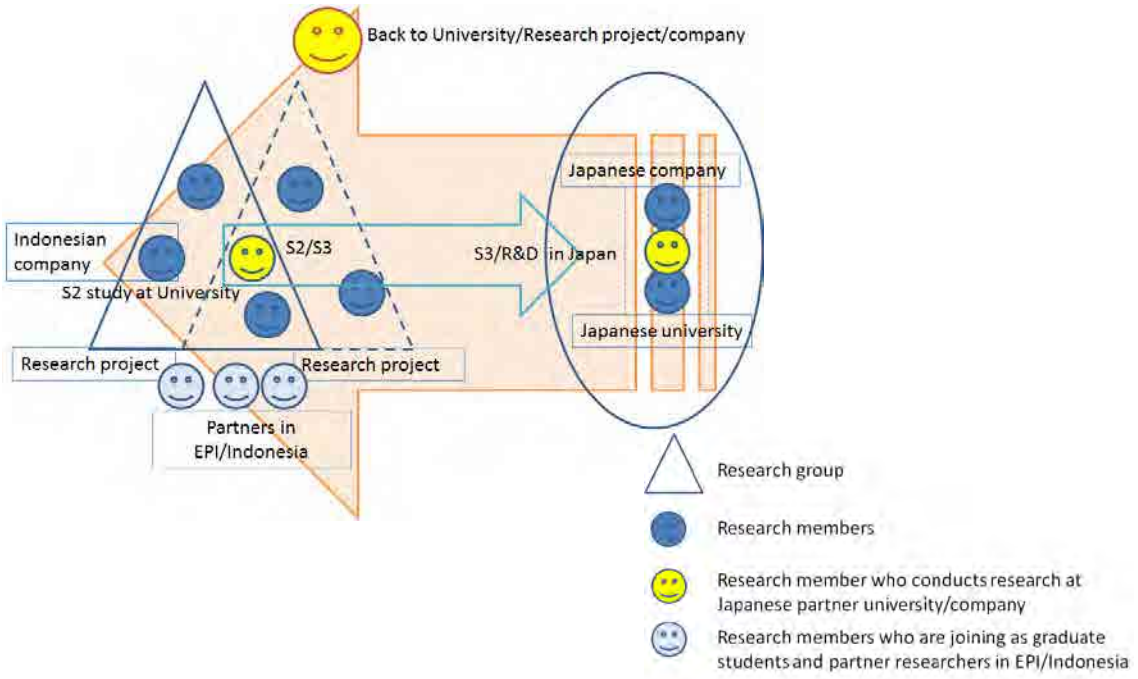


Figure 5.2 Key Roles of Human Resources for R&D in Indonesia: A Model Case

5.3 Suggestions for Development Approaches at IPB

(1) University Human Resource Development

A development approach at IPB is suggested here. This is to offer ideas for IPB to further elaborate their development plan.

From the viewpoint of contributions to the Indonesian economy, finding and preserving "Indonesia specific" medicinal plants that have "precious functions" should be strongly emphasized in order to attract international customers. In terms of international quality standard and required traceability, quality assurance from the seed to the product, meaning pure genetic strains with no pesticides, chemical fertilizers and genetic transformation, must be pursued.

In this regard, it is rather practical for BRC to put emphasis on identification of effective components, clarification of functional mechanisms and development of horticultural technologies along with conservation and cultivation, ethnological study, standardization, socio-economic impact, community empowerment. Meanwhile the seed center should improve the varieties of qualified seeds and prepare a seed bank in order to sustain biodiversity in Indonesia. Commercialization of the products should be managed by private companies in cooperation with the research groups.

Project title: The development and upgrading of Bogor Agricultural University (IPB): Toward research based university

Goal: Sustainable biodiversity and poverty reduction in Indonesia through improved seed varieties for food security and enhanced utilization of herbal medicine

Purpose: (1) To improve varieties of important crops and produce high quality seeds of the improved varieties

(2) To obtain and improve valuable biopharmaca materials from safe indigenous resources while conserving biodiversity

Target areas: (1) Seed development and production
(2) Biodiversity conservation and Biopharmaceutical studies of indigenous herbal plants

Research projects:

A. Seed Center
Outputs:
1. Indonesian indigenous germplasms collection
2. Improved breeding methods for producing improved varieties
3. Improved varieties through utilizing collected germplasm
4. Production and conservation of high quality seeds of improved varieties

B. BRC
Outputs:
1. Conserved selected indigenous biopharmaca resources
2. Ethnobotanical information on biopharmaca resources
3. Standardized raw materials and extracts
4. Identified medical effects of selected biopharmaca resources
5. Purified active components
6. Elucidated functional mechanism
7. Socio-economic impacts of biopharmaca development
8. Empowered communities

Networking with universities in Indonesia: UNHAS, UNSRAT, USU, UNSRI, UNILA, UNMUL, UNLAM, UNPAR, UNTAD, UNUD, UNRAM, UNDANA, UB, UMM, UMY, UNS, UNPATTI, UNIPA

Japanese partners:

A. e.g. Nagoya University
Kagawa University
Ehime University
National Institute of Agrobiological Sciences
(NIAS, http://www.nias.affrc.go.jp/index_e.html)

B. e.g. Toyama University (http://www.inm.u-toyama.ac.jp/pharmacognosy/index-j.html)
Kyoto University
Gifu University
Hokkaido University
Nara Institute of Science and Technology(N AIST)
National Institute of Technology and Evaluation of Japan (NITE)
Hokkaido University (http://www.pharm.hokudai.ac.jp/garden/garden01.html)
The University of Tokyo (Botanical Garden)

Collaborative fellowship programs at partner universities and their partner companies

Industries in Indonesia and Japan:
A. e.g. PT Bis International Tbk (PERUSAHAAN) / S Corporation (seed development)
B. e.g. PT Bintang Toeju in Indonesia/Company T(herbal medicine)
Government of East Java/Ministry of Environment (Forestry and rangers)

(2) Target Scientific Fields of Activities

The seed center and biopharmaca center are rebuilt as a common use center in IPB. The biophamaca center is already managed as a common center. The seed center has established a center in the department of agronomy and horticulture and it should be upgraded into a common center by IPB development plan. One big issue for a common center is to sustain activities of the center at a high level for the long term. To sustain vital activities, several new projects should always be carried out in the center. To this end, the center should be a common center for all the universities and research institutes in Indonesia. The following management methods can be considered:

- The center should solicit proposals of research projects from not only IPB academic staff, but also other universities, or research institute researchers.
- When other universities or research institute researchers use the center, they can obtain travel expense support from DGHE.
- The center must disseminate the activities by publishing an annual report compiling project activities accepted by the center, new equipment specifications, and other center activities.

Both centers should concentrate on more academic activities rather than business. For instance, production of commercialized goods is handed over to the private sector. The center should search for academic solutions for seed quality enhancement, gene database, extraction and refinement of medical compositions from medical plants, and cultivation methods of medicinal plants.

IPB wants to become a research-based university. The roadmap to the research based university has been formulated but still needs to be revised. To this end, each teaching staff must publish at least two papers in an international journal every year. To do so, student manpower must be fully utilized in research activities. In IPB, if a student continues their studies from undergraduate course to masters course, they start a research activity through a final project during their senior year. They then continue on to the masters course program in the same laboratory or under the same supervisor, but they stop their research activity for the first year of the masters program due to IPB regulation. Therefore, the student can carry out research continuously for two years during their undergraduate and masters program. For the student, this is very inefficient to enhance their research performance. Namely, IPB does not fully utilize the student's manpower for research activities.

Therefore, flexible management of IPB regulations must be considered so that students could carry out research on one theme for three years during their undergraduate and masters course programs.

(3) Relationship with Community and Industry

Indonesia is rich in natural resources and provides an attractive field for research work not only for IPB but also for those universities located in the regions. As the only agricultural university in Indonesia, IPB is able to become a trend setter, as declared in its strategy document, to lead,

guide, and facilitate these through research and other university activities. To become the trend setter, proposed activities can be reviewed and restructured in this regard.

In this regard, suggestion for IPB includes:

- Mobilize university contact/networks in Indonesia
- Reorganize activities involving other universities, industry-university collaboration, entrepreneurship development, utilization of locally available natural resources, etc.,
- Proposed output of the activity should emphasize benefit to local, socio-economically disadvantaged people, such as farmers or those who are living in poor conditions in farming areas in Indonesia.

(4) University Facility Development

To implement the aforementioned proposed research activities, it is considered that the current capacity of laboratory buildings and equipment is very limited and upgrading to up-to-date facilities is desirable.

In accordance with the research plans, the following facility developments are proposed by IPB:

A. Seed Center and Biopharmaca Center

- Establishment of laboratories and incidental research facilities for Seed and Biopharmaca Center
- Development of gene bank and seed collection storage
- Development of Database and Information System
- Upgrading farm facilities and conservation unit
- Pilot Plant For Product Development
- Herbal Clinic and Museum

B. Forest Resource Conservation Facility

- Establishment of Laboratories and incidental research facilities for Forest Resource Conservation Center

C. Common Facilities

- Administration facilities
- Teaching facilities such as classroom
- Infrastructure Development

According to the proposal, all the major facilities are proposed to be developed at Leuwikopo zone in Darmaga Campus. The research facilities at Leuwikopo zone are related to seed science & technology. The existing facilities were developed in 1984 financed by the World Bank. The majority of facilities have not been updated since then. Accordingly, a lot of pieces of the equipment and buildings are already deteriorating or not adequately functioning.

A detailed summary of proposed facility development plan is as shown in Table 5.1.

Table 5.1 Proposed Facility Components of IPB

Leuwikopo Area
Main Research Center Building
- Seed Center Office
- Seed Center Laboratory
- Gene Bank and Seed Storage
- Seed Processing Unit
- Gallery for seed product and technology
- Herbal Clinic
- Herbal Museum
- Biopharmaca Standardization Laboratory
- Biopharmaca Product Development Laboratory
- Lecture Room
- Biopharmaca Center Office

Researcher Guesthouse
Biopharmaca Industrial Pilot Plant
Animal Laboratory
Seed Workshop building
Seed Drying Floor
Field Facilities (Green House and Experimental Firm facilities, etc)

Cikabayan Area (Darmaga Campus)
Collection and Cultivation Field Laboratory
Stock room and Green House

Fahutan Area (Darmaga Campus)
Biodiversity Conservation and Domestication of Medicinal Plant Laboratory
Arboretum and Field Laboratory

Sindang Barang Area
Lecture room, Warehouse and Management office
Field Facilities (Green House and Experimental Firm facilities, etc)

Pasir Sarongge Area
Lecture room, Warehouse and Management office
Dormitory / Guest House
Field Facilities (Green House and Experimental Firm facilities, etc)

Sawah Baru Area
Lecture room, Warehouse and Management office
Field Facilities (Breeding House and Experimental Firm facilities, etc)

(5) Measures to Find Collaborative Partners in Japan

A. Japanese Universities and Research Institutes

One of the recommended ways to find potential partners is to contact JISNAS(Japan Intellectual Support Network in Agricultural Sciences). JISNAS[93] was established at the end of 2009 aiming to establish an intellectual resource network in the field of agriculture. Since then more than 20 Japanese universities, research institutes, and international development organizations have joined. Its secretariat is located in the International Cooperation Center for Agriculture Education at Nagoya University. JISNAS manages a database registering Japanese universities' intellectual resources and the collaborative needs from developing countries and it is planning to provide matching services among them for the future.

[93] Details can be found at http://jisnas.com/en/index.html

According to the interview with faculty members of several Japanese universities and the results of questionnaires distributed in 2009 to Japanese universities which have collaboration agreement with JICA, Japanese universities expect to recruit foreign students through collaboration with universities in the countries like Indonesia. The needs of collaborative research are less than those of recruiting foreign students. However, for research requiring a special environment or conditions that only exist in Indonesia, needs of collaboration do exist. Moreover, as social responsibility has become one of the key evaluation factors of Japanese universities, in this regards, the needs of collaboration with Indonesian universities have also become apparent.

B. Japanese Companies

It seems that it is not easy to establish a partnership between Indonesian universities and Japanese companies directly. One of the recommended ways to do so is to utilize Japanese universities that already have some activities with Japanese companies as a facilitator. In addition, according to the interview with an agri-business advisor for Japanese companies wishing to enter a foreign market, currently small scale companies in Kyushu area, in the southern part of Japan, are actively searching for the opportunity to collaborate with foreign partners. Thus, it might be a good idea to contact Japanese universities in the Kyusyu area.

5.4 Reviewing the Expected Impacts of IPB on Other Universities and Industries around the Target Universities

5.4.1 Analysis of Expected Impacts of Improvement Plan to IPB Internally

Expected impacts are classified in the following four categories:

1. Research oriented education: Making masters students do research throughout the program means that supervisors/lecturers must improve their research skills at all times. Publications in international journals by graduate students and supervisors are the fundamentals for any universities to be a world-class research university.
2. Culture of research activities and sharing equipment at research centers: A research center is transformed from a building to a place of research activities through the research projects. This is also an international standard for research universities.
3. Establishment of organizational industry-university development and identification of the role of universities as the resource for new value creations: Industrial cooperation has been done at IPB; however new values created by IPB have not often been well transferred to industries, rather IPB tended to be a commercialized entity. It is also an international standard that universities should concentrate on value creations and hand them over to industries by licensing or other business methods.
4. Updated research topics and outcomes: IPB is a core university in agricultural education and research. In this regard, selecting strategic research topics, and obtaining international competitiveness in terms of adding values to precious natural resources or biodiversity as export goods should have a strong impact inside and outside IPB.

Further spill-over impacts to partner universities are also expected through conducting research projects. Members of the research project, either as masters students of IPB or senior researchers of partner universities, will transfer the technologies and the research culture.

These internal and spill-over impacts should affect the research culture of Indonesian universities, because projects which are implemented comprehensively through soft and infrastructural components should create more patents and international publications. Therefore,

the impacts are nationwide especially in terms of enhanced motivation to create value added products through R&D to be used by industries, no matter how small they might seem at the beginning.

Policies to enhance research oriented education at graduate levels and research activities at international levels should be also affected by the outputs of the projects. Furthermore, as already pointed out in section 5.1, policies that provide industries with incentives to do R&D, namely to add values to their products continuously, are not effective enough in Indonesia. Such impacts as the above are strongly anticipated to aspire policy arrangements for more R&D activities by industries.

5.4.2 Analysis of Expected Impacts of Improvement Plan of IPB to Industry and Community

The expected impacts of the proposed IPB improvement project are significant to bring benefits to related industries (e.g. seed industry, herbal medicine, supplement foods, agriculture etc), considering the current situation described in 3.3.2. These industry sectors have now started to grow and necessitate their products for further quality improvement. For example, food security is not only on the government agenda but also consumer concern in general, and organic products are gaining popularity as value added products; therefore, realization of value creations by IPB and commercialization of these inventions by industries should have enormous impacts in terms of industrial development based on the utilization of natural resources in Indonesia.

On the other hand, Indonesian traditional herbal medicine is well integrated into Indonesian daily life and there is a constant demand for better products by the Indonesian consumer at large including the poorest quintile of population. These markets are emerging and farmers and firms are competing for better, qualified products, using the local vegetation.

In the area covered by the Seed Center, newly developed or specifically conserved varieties could offer rich resources for seed industries to produce improved high-value seeds for farmers, though IPB itself would not be a seed producing company but a fountain of technologies. In the biopharmaceutical area, it is not necessary to mention the value that IPB could provide. Quality assurance including the traceability is the key for industries to be competitive in international markets. No one would invest in any pharmaceutical company that produces “Jamu” products unless their products meet the requirement and standard of their customers. Research on the mechanism of herbal plants should be thus very important.

This is not only for enterprises in the geographically remote areas but also for those who are financially peripheral, mainly small and medium enterprises. It again suggests the importance of enhancing networking among Indonesian universities and between each university and a private enterprise, if what makes the economic development possible is recognized by industries and GOI.

The indirect impact on poverty reduction can be expected through the activities between IPB and local government. IPB already conducts research activity involving local farmers in a way to benefit them through income generation with direct research outcomes (e.g. utilization of new technologies) and in-direct research outcomes (research activity includes support for local farmer on better productivity of agricultural products that is not a research topic of).

Proposed IPB improvement will strengthen a foundation for IPB and industry to collaborate. The seed center will store more varieties of seeds in a stable and organized manner. Enhanced collection of seeds will be made available not only for academic research but also for collaboration of IPB and industry. Biopharmaca centers would facilitate a wider and deeper

collaboration with industry with specific demands for such as R&D of new products and verification of prototype products.

5.5 Necessary Process and Schedule to Development Approaches based on the Survey Results at IPB

5.5.1 Financial and Economic Feasibility of the Approaches at IPB

As discussed, proposed IPB activities are well justified by its consistency with the national development plan, and by their focus and intention of benefitting the local society at large (including socio-economically disadvantage group) utilizing natural resources uniquely available in Indonesia.

Meanwhile, the nature of proposed IPB activities seems not to be the subject of economic or financial analysis (IRR calculation) in an education project. In an ordinary economic/financial appraisal with IRR estimation of educational programs, the number of additional student cohort is counted as a source of economic and financial benefit (salary gain of newly accommodated and graduated student is normally counted as benefit); however, proposed IPB activities do not primarily intend to increase the number of students. Proposed activities are more quality oriented, to improve and enhance current research and non-research university activity, which in turn is reasonable considering the expectation of the labor market toward the quality of the graduates.

Even so, it is important for IPB to have a mid-term financial plan, to ensure a broad view on how the Biopharaca center and Seed center should be properly managed with good sustainability. The financial plan of the facilities needs to be reviewed during the preparatory survey period.

5.5.2 Order and Timeframe of Components of the Project for IPB

(1) Components of the Project

The study team considered the project components by integrating the proposed project plan submitted by IPB and the study team's suggestions written in section 5.3. The project might consist of the following components.

A. Facility Construction

The proposed facility components to be constructed are written in Table 5.1 in section 5.3.

B. Equipment Procurement

It is recommended to divide equipment into two groups. One is equipment commonly used by many researchers of both Centers. The other is equipment that is used by the limited number of researchers for a very specific research topic. The latter can be procured through research fund provision. Equipment procurement through research funds enables more rapid procurement and flexible selection of the equipment suitable for the specific research topics.

C. Collaborative Fellowship Program

At the early stage of the project, a number of the Centers' faculty members who will be key members to utilize the Centers' facility and equipment for their research will be sent to a Japanese university for degree/non-degree fellowship up to one year. This fellowship might contribute to: 1) enhancing Centers' faculty members' research capacity; 2) establishing and consolidating researchers' human and intellectual network through which collaborative research might be performed even after IPB's faculty members return to IPB; 3) ensuring facility and

equipment invested through components in the previous paragraphs A and B will be fully utilized. Details of this component can be found in section 5.2 (2) B. This fellowship is complementary with existing scholarships from GOI.

D. Research Fund Provision

This component supports actual research activities that might contribute to enhancing research capabilities of faculty members as well as graduate students, which might ultimately contribute to IPB becoming a research-based university. In order to maximize this investment, this component could be implemented on a competitive basis.

As mentioned in paragraph B: equipment procurement, it is recommended to have room to procure some research specific equipment. Research should involve graduate students and parties outside of IPB, for example, other universities in Indonesia, Japanese universities, industries in Indonesia, Japan or other nations, or local governments. This might contribute to strengthening and expanding IPB's network and at the same time expanding the impact of the project. Costs to be covered by research funds could include: cost of research activities, equipment procurement, travel expense of IPB faculty members or partner researchers to physically research together for a while (for example, three months per year for one research fund), patent application, and attendance in international conferences etc.

E. Academic and Industry Coordination with Japanese Partners

This component has a key role to effectively implement the soft component of the project, especially C. Collaborative fellowship program and D. Research fund provision. This component includes technical assistance to be provided by experts. They will coordinate: (i) research fellowship programs by finding and arranging suitable Japanese fellowship destinations that fit with the fellows' research topics as well as the project direction; and (ii) university-industry collaboration especially with Japanese partners to be implemented through research fund provision. As it is written in 5.3 (5): "Measures to find collaborative partners of Japan", university-industry collaborations with Japanese partners better start from collaboration with Japanese universities that already have joint research with Japanese Industries.

In addition to strengthening the sustainability of university-industry collaboration even after finishing the project, this component should also include: (i) training for the head of LPPM and key persons of the proposed fields to learn about tips, mechanisms, good and bad practices of university-industry collaborations in Japan and (ii) practice in searching for potential collaboration needs with Japanese partners in order to establish human resource networks with Japanese partners.

This component targets academic and industry coordination mainly with Japanese partners and assistance to establish long lasting partnerships that could benefit both Indonesia and Japan.
In this regard, this component is recommended to be provided by a grant.

When getting further into the proposal preparation stage including cost estimation and implementation arrangements, like other Yen Loan Projects, the consulting service component, for example, project management services and engineering services will be considered.

(2) Order and Timeframe of Components

In the case of a Yen Loan, after concluding a loan agreement, it usually takes more than one and a half years to select the consultant, design buildings and complete tenders for construction and equipment.

After tenders are completed, facility construction and equipment procurement start. Equipment procurement should consider the timing that ensures equipment to have proper space to be installed. This process may take about two years to complete. While facility construction and equipment procurement are taken place, it is recommended to have a collaborative fellowship program as well. It is ideal that when fellows come back to IPB, facility and equipment are ready for them to utilize for their research. The collaborative fellowship program can be implemented through two batches in order to prevent quite a number of key faculty members from being absent from IPB at the same time and imposing a higher work load on the remaining faculty members.

Research fund provision can be started after the completion of facility construction and equipment procurement. Research activities that can produce results will take quite a long time. Therefore, it is recommended to have a longer timeframe for this component, for example, three to four years. However, the length of supporting period for one research topic could be flexible depending on the nature of the research and the scope of the activities to be covered by the fund. Research fund provision can be implemented through two batches, for example, in order to provide some rooms for research that is very important for the project but not ready at the first batch selection or simply give runners-up the second chance. An annual review should be conducted in any research activity, to find out if the funding should be continuously provided or not.

Academic and Industry Coordination with Japanese partners is necessary at least before starting each batch of the collaborative fellowship program to find and arrange suitable fellowship destinations. However, it is ideal that this technical assistance can be provided throughout the project upon necessity to effectively implement not only fellowship programs but also research fund provision that could initiate university-industry collaboration with Japanese partners.

Figure 5.3 indicates the order and time frame of the project components.

Year / Component		Year 0	Year 1	Year 2	Year 3	Year 4	Year 5	Year 6
Tender		■						
Facility Construction			■	■				
Equipment Procurement			■	■				
Collaborative fellowship program	Batch1		■					
	Batch2			■				
Research fund provision	Batch1			■	■	■	■	
	Batch2				■	■	■	■
Academic and Industry Coordination with Japanese partners		■ ■	■ ■	■ ■	■ ■	■ ■	■ ■ ▮	

Figure 5.3 Order and Time Frame of Each Component for IPB

5.5.3 Environmental Social Consideration at IPB

Proposed project buildings are located in the Leuwikopo area adjacent to Darmaga Campus and other research farm sites belonging to IPB and separated from residential areas. It is also confirmed that the proposed new experimental farms are also located in the existing farming area of IPB.

Accordingly, it is judged that new land acquisition and resettlement will not be necessary, and any adverse impact on the natural environment will be minimal.

However, a part of proposed buildings may be directly connected to the existing education building. Therefore, mitigation or reduction of impact shall be considered during the project implementation process. Especially the impacts of the necessary measures shall be taken out by the contractor, against noise, vibration and other possible negative impacts which might occur during construction.

Regarding experimental farms, it is also considered that special attention to the safety of agricultural chemicals and wastewater from farms shall be required.

Wastewater from laboratories will be sanitized with a treatment tank in a manner that conforms to local standards and will be discharged into the river along the site boundary of campus using the same method as the existing laboratory wastewater treatment in Darmaga campus. It is not expected that discharge of this treated water will cause any significant impact on environment.

Since environmental impact from the implementation of the proposed project is limited, it is considered that the environmental impact assessment process, such as AMDAL (Analisis Mengenai Dampak Lingkungan Hidup), is not required in advance. However, conventional environmental management and monitoring process are possibly required as the obligations of IPB during the project implementation phase.

In accordance with the information up until the second survey, this proposed project is classified as Category B under "GUIDELINES FOR ENVIRONMENTAL AND SOCIAL CONSIDERATIONS" (published April 2010) of Japan International Cooperation Agency (JICA), since it is considered that any adverse effects on the environment would not be serious in consideration of the project sector, the project location and the project scale.

5.6 Suggestions for Development Approaches at ITS

(1) University Human Resource Development

A development approach at ITS is suggested here. This is to offer ideas for ITS to further elaborate their development plan.

It is strongly suggested that four research clusters should be comprehensively planned and executed in order to reach the goal, namely elimination of disparities between the central and eastern parts of Indonesia. Contributions by ITS to the industries and communities are strongly anticipated by the society as well as by other local universities who are expected to develop their education programs quantitatively and qualitatively.

Project title: Development of ITS Surabaya: A strategic empowerment of being a research university

Goal: Sustainable development in EPI supported by enhanced ITS as a research university

Purpose: ITS to obtain a set of technologies, facilities and capacity to become a research university that leads sustainable development of EPI

Target areas: Marine/Maritime cluster, Energy cluster, Human Settlement cluster and ICT applications for all clusters

Research projects:

A. Marine: Research and development for efficient and safe maritime transport and sustainable exploration of marine resources and environment
   Outputs: 1. Efficient inter-island marine transportation and logistics
   2. Better standard of safety ship operation in EPI

3. Efficient method in distribution of energy resources in EPI
4. Efficient and sustainable utilization of marine resources in EPI
5. Better marine and coastal environment management in EPI

B. Energy: Research and development of suitable renewable energy in EPI
Outputs: 1. Distributed renewable energy generation in EPI
2. Steam power generation from low rank coal and geothermal resources
3. Biofuel from local resources and engines to be run by 100% biofuel including A (Marine).

C. Human settlement: Research and development of technologies for safe living environment from the viewpoint disaster management
Outputs: 1. Safe and appropriate housing in EPI
2. Wastewater treatment technologies for small households in EPI
3. Disaster management sensitive community development plans

D. ICT: Research and development for communications and e-services in EPI
Outputs: 1. Communication systems for fisheries, safety information and education including those for A (Marine).
2. Applications for e-learning, e-health services and integrated communication systems in EPI.
3. Comprehensive supporting infrastructures for local communities

Networking with universities in Indonesia: UNCEN, UNDANA, UNRAM, UNSRAT, UNUD, UNPATTI,UNHAS

Japanese partners
A. e.g. Kobe University (International Maritime Research Center)
Hiroshima University
B. e.g. Hiroshima University, RIKEN
C. e.g. Keio University SFC
D. e.g. Kumamoto University, JAXA (Japan Aerospace Exploration Agency)

Collaborative fellowship programs at partner universities and their partner companies

Industries in Indonesia and Japan
A. e.g. PT PAL, PT DOC/ M ship building company
B. e.g. PLN/K Electric Power Company, Asahi Glass Co.Ltd.
C. e.g. East Java Provincial Government, K water pumping company
D. e.g. Provincial Government/ F electrical com

(2) Target Scientific Fields of Activities

ITS selected four fields in its development plan. However, research objectives of all the selected fields are not clearly described in accordance with the national development plan. The following points should be taken into account:

- Marine technology: research activity should include development of inter-island transportation infrastructure network.
- Energy: Geothermal energy development should be emphasized more.
- ICT: ICT development plan in the eastern region of Indonesia should be elaborated focusing on utilization by industry sector, local government, school and local community.
- Housing, human settlement, environment and disaster management: Research plan should be clearly elaborated.

Because the ITS proposal is not finalized yet, suggestions to ITS development plan cannot be made in detail.

Student involvement with research activity must be actively attempted.

(3) Relationship to Local Community and Industry

ITS is strategically located in the City of Surabaya, East Java province which is the closest to EPI. It has an organized university network consisting of 11 universities in EPI (FIND 11), each of which has the potential to function as a hub to reach local small and medium-sized enterprises, local government, and non-governmental organizations. Benefits of ITS activities can be channelled through the network and its hubs for the welfare betterment of EPI.

In this regard, suggestion for ITS include:

- Prioritize research activities that mobilize FIND-11
- Mobilize bilateral university relationship as well, especially within Eastern Indonesian region.
- Proposed activity should identify and emphasize benefit to the local, socio-economically disadvantaged people in eastern Indonesia and/or non-Java area, which in turn will make the proposed activity more attractive.
- In this regard, research topics not only the advanced technologies but also the intermediate ones of which benefit can be channeled through FIND-11, bilateral university relationship, industry collaboration, and entrepreneurship program should be prioritized.
- Collaborate not only with big companies from Java, but also with small-medium sized enterprises running businesses in EPI.
- Entrepreneurship program could mobilize/involve students/graduates of the EPI universities hence it would contribute to generating employment in EPI.

(4) University Facility Development

The current facilities of ITS are basically planned for requirements of the undergraduate program (S1) and not suitable for the research activities of postgraduate programs (S2 and S3). In addition, the number of postgraduate students is increasing from 800 to 3,000 according to the ITS Strategic Plan. Consequently, it is considered that the current capacity of laboratory equipment and buildings are very limited to implement the aforementioned proposed research activities.

In accordance with the activity plans and growing post graduate programs, the following physical facility developments are proposed to each strategic field and common facilities:

A. Faculty Buildings including Following Components:

- Lecture rooms
- Laboratories that cover the strategic research field of Marine Technology, Energy, ICT and Housing and human settlements, Environment and Disaster Management
- Library
- Administration Office

B. Techno Park

- Conference halls and laboratories for the research program for Housing and human settlements, Environment and Disaster Management

C. IT support Facilities

- IT laboratories for utilization among departments

D. Utilities and Infrastructures

- Upgrading of campus utilities including drainage system
- Improvement of exterior facilities including access road

The proposed new building development sites are within the existing academic zones and Techno Park zone of ITS Sukolilo Campus.

The procurement and installation of equipment is also proposed to the existing laboratories. Accordingly, the upgrading of the existing building facilities corresponding to such equipment will be required.

Detailed summary of proposed facility development plan is as shown in Table 5.2.

Table 5.2 Proposed Facility Components of ITS

Marine Technology
Deep Water Laboratory
Coastal and Small Island Laboratory
Marine Ecology Laboratory
Marine Microbiology Laboratory
Biotechnology Laboratory
Marine Design Laboratory
CNC Laboratory
Energy
Workshop type laboratory
Operator room
Storage room
Classroom
Meeting room
Library
Theater/lecture room
Utilities and workshop
Researcher's room
Postgraduate Student's Room
ICT (Information and Communication Technology)
Photonics Laboratory
Requirements Engineering Laboratory
Integrated Information System Laboratory
Security & Reliability Laboratory
Digital Studio Laboratory
E-Learning Laboratory
Medical Appliance Laboratory
Embedded & Intelligent system Laboratory
Radio communications & satellite Laboratory
Antenna Laboratory
WSN Laboratory
Administrative support
Conference rooms
Data Center
Incubators
Network Operation Center

Housing, Human Settlement, Environment and Disaster Management
- Seminar Room
- Training/Lecture Room
- Lecturer Room
- Meeting Room
- Postgraduate student office
- Administration room
- Library
- Design Gallery and exhibition
- Laboratory. Regional Development
- Laboratory. Geospatial
- Laboratory. Transportation
- Laboratory. Sanitation
- Laboratory. Housing Studies
- Laboratory/workshop Building Studies
- Laboratory/ Disaster Mitigation & Project Management

Regarding equipment, it is recommended to refine an equipment list by checking unnecessary duplication of the same or similar equipment across the four fields. In addition, unified coordination is necessary to verify equipment to be included across the proposed four fields.

(5) Measures to Find Collaborative Partners of Japan

A. Japanese Universities and Research Institutes

One of the recommended ways to find potential partners is to contact ICCEED, an International Cooperation Center for Engineering Education Development at Toyohashi University of Technology. ICCEED has a database registering approximately 850 faculty members in engineering field of Japanese universities who are interested in international cooperation activities.

According to the interview with faculty members of several Japanese universities and the results of questionnaires distributed in 2009 to Japanese universities which have collaboration agreement with JICA, Japanese universities expect to recruit foreign students through collaboration with universities in a country like Indonesia. The needs of collaborative research are less than those of recruiting foreign students. However, for research requiring a special environment or conditions that only exist in Indonesia, the needs of collaboration do exist. Moreover, as social responsibility has become one of the key evaluation factors of Japanese universities, in this regards, the needs of collaboration with Indonesian universities have also become apparent.

B. Japanese Companies

It seems that it is not easy to establish a partnership between Indonesian universities and Japanese companies directly. One of the recommended ways to do so is to utilize Japanese universities that already have some R&D activities with Japanese companies as a facilitator. According to the interview with the staff of a big Japanese trading company, who is in charge of creating new businesses in foreign markets, the energy field has the highest potential among the proposed four fields for collaboration with Japanese companies.

5.7 Reviewing the Expected Impacts of ITS on Other Universities and Industries around the Target Universities

5.7.1 Analysis of Expected Impacts of Improvement Plan to ITS Internally

Internal Impacts of improvement plans at ITS should be as follows:

1. Recognition as the resource university in EPI: ITS is recognized as a resource university in EPI, especially in the field of ICT based on the government policy and activities conducted so far. In this regard, integrated research activities and partnerships in four clusters should enhance ITS as a comprehensive resource university to support sustainable development in EPI.
2. Research oriented education in the field of engineering: Trials to improve engineering education at the masters level have been introduced. Then, expanding research oriented masters programs to the four research clusters should strengthen ITS's contributions for EPI from the viewpoint of both human resource development and value creation.
3. Stronger partnerships with Japanese universities and industries: research projects including collaborative fellowship programs should nurture close partnerships with Japanese universities and industries. Follow-up competitive research funds should support them to keep joint research, and then will lead to substantial industrial cooperation and international joint research projects in the long run.
4. Strategic research activities for communities, industries and local governments in EPI: integrated research outcomes in four clusters should be a model for ITS in planning their contributions in EPI. Especially safety in EPI must be realized through research and development by universities.

Networking among ITS and local universities should become more sustainable through these activities, and is further anticipated by all stake holders in EPI.

Eventually, an increased number of patents and international publications at ITS and partner universities in EPI should enhance the motivation of other research institutions and even industries to create value-added products through R&D. It is also the case where these impacts may increase industrial policies for motivating continuous value creation.

5.7.2 Analysis of Expected Impacts of Improvement Plan of ITS to Industry and Community

The proposed three fields (including IT, four areas) are equally important to Indonesia; therefore it would not be appropriate to prioritize the academic field. If prioritization is required to meet financial and other limitations, it is recommended to prioritize by the nature of the research; by looking at the potential impact of each research to the EPI.

(1) Marine Technology: Shipbuilding

Indonesia is an archipelagic state consisting of more than 18,110 islands and GOI is promoting shipbuilding and related industries. Presidential decree No. 5 (2005) indicates GOI's determination to strengthen shipbuilding and related industries of Indonesia. It also encourages commercial banks to support the industry.

Expected impacts on the industry from the proposed ITS project to Marine Technology area are significantly high. Being an archipelagic state, Indonesia needs vessels to travel between the

main islands and now approximately 8,600 vessels are in operation[94]. Also there are numerous numbers of boat builders using local boat building technologies and techniques across the nation, mainly providing small-sized vessels for transportation to small islands and fishery. There is a constant demand for safer, more energy-efficient (at a less expensive running cost) and more environmentally friendly vessels by users of the boat and ship builders. Furthermore, Indonesia has a number of unexploited oil and gas reserves, and the industry is looking for reliable off-shore structure drilling facilities.

Enhanced R&D capacity of ITS marine engineering will cater to demand from the ship/boat building and energy sectors through ITS – industry collaboration to apply the advanced and intermediate technology for a safer, more comfortable, and energy saving means of marine transport and off-shore facilities.

(2) Energy: Geothermal and Renewable Energy

GOI has set a so called "25/25 target" which aims to increase the share of geothermal and renewable energy to 25% in 2025, from its current 7%. Geothermal and renewal energy (biomass, solar, micro hydro, etc.) markets have started to be developed, however utilization has not been optimized yet[95].

There are off-grid areas where electricity is not available, especially in remote mountainous and island locations. Renewable energy is considered as an alternative way to provide electricity in such disadvantaged areas. There are a number of regional governments working in collaboration with mainly local firms who are attempting to provide electricity to such remote areas.

According to the 25/25 target, the market would be tripled, and there will be constant industry demand for a more feasible (less expensive, stable, maintenance-free) method of energy provision. Enhanced R&D capacity of ITS energy will impact these through ITS-industry collaboration. This is good not only for the industry to prosper, but also for remote, unelectrified, disadvantaged areas of Indonesia to be electrified.

(3) Housing and Human Settlement

Indonesia is a disaster-prone country and is experiencing a variety of natural disasters such as earthquakes, landslides, floods, high tides, volcano eruptions, etc., nationwide. On the other hand, there is an emerging demand for affordable and comfortable houses by the growing middle class in Indonesia. Housing and human settlement therefore is an indispensable academic area to generate knowledge and technologies applicable for affordable and comfortable housing and human settlement, with special attention paid to disaster mitigation/prevention. This shall include the design of post-disaster temporary shelter, disaster-proof design of houses, besides affordable house design for a better quality of life. Disaster prevention strategy and planning integrated to urban/regional planning is also an important area.

An enhanced research capacity of ITS will benefit the Indonesian population at large by providing solutions for the issues above. Also there is a range of relevant industries that can be

[94] Indonesia has four main shipbuilding firms: PT Kodja Bahari, PT Dok dan Perkapalan Surabaya, PT Industri Kapal Indonesia (IKI) and PT Pal Indonesia.

[95] For example, Indonesia holds 40% of the world's geothermal power resources, as it is perched on top of the Pacific ring of fire. However of the estimated 27,000 MW potential annual capacity, only 1198 MW have so far been exploited according to Energy Ministry data. (quoted in U.S. Department of Commerce International Trade Administration (2010) Renewable Energy Market Assessment Report: Indonesia)

impacted: architect, construction, house building, housing material/equipment, land development, urban/city planner, etc[96].

For example, house builders need to cope with the market demand and government support for affordable and comfortable housing, and this will necessitate the industry to provide more easy-to-build houses that are equipped with better fire-proof, water (rain)-proof, noise-proof capacity with anti-earthquake durability. Also each of them needs to be researched and developed pursuing sound marketability in the given local conditions of regulations, weather, and other environments. Enhanced R&D capacity of ITS housing and human settlement, through its collaboration with industry, can provide solutions for the improvements. From this perspective, it is reasonably said that ITS would significantly impact the industry to improve the quality of housing design and its materials.

5.8 Necessary Process and Schedule to Development Approaches based on the Survey Results at ITS

5.8.1 Financial and Economic Feasibility of the Approaches at ITS

As discussed, proposed ITS activities are well justified by their consistency with the national development plan, and by their focus and intention of benefitting the local society at large (including socio-economically disadvantage groups characterized by EPI in the case of ITS) mobilizing the research and extension capacity to be further enhanced through the proposed project.

Meanwhile, it is unknown yet if ITS proposal is going to be subject to a financial and economic analysis (IRR calculation) as in an education project. Because discussion is still ongoing it is too early to determine which investment would generate income for ITS and to what degree.

Having said this, it is most likely the proposed ITS project would not be subject to financial and economic analysis. In an ordinal economic/financial appraisal of educational programs with IRR estimation, the number of additional student cohort is counted as a source of economic and financial benefit (salary gain of newly accommodated and graduated students is normally counted). In the case of ITS proposing multi-disciplinary research facilities, it would not be realistic to assume enrolment gain attributed to the proposed investment, because students are enrolled not to the multi-disciplinary research facilities but specific faculties.

Even so, it is important for ITS to have a mid-term financial plan to ensure a broad view of the future of the research facilities, to be properly managed with good sustainability, once they are established. The financial plan of the research facilities needs to be reviewed during the preparatory survey period.

[96] According to the latest statistics, construction industry in Indonesia consists of 10% of GDP, and 5% of employee .
Source: BPS (2011) Gross Domestic Product By Industrial Origin,
http://dds.bps.go.id/eng/tab_sub/view.php?tabel=1&daftar=1&id_subyek=11&notab=1
BPS (2011) Population 15 Years of Age and Over Who Worked by Main Industry
http://dds.bps.go.id/eng/tab_sub/view.php?tabel=1&daftar=1&id_subyek=06&notab=2
The figures should be higher if included other industries (e.g. construction materials, housing equipment, etc) related to the construction.

5.8.2 Order and Timeframe of Components of the Project for ITS

(1) Components of the Project

The study team considered the project components by integrating the proposed project plan submitted by ITS and the study team's suggestions written in section 5.6. The project might consist of the following components:

A. Facility Construction

The proposed facility components to be constructed are written in Table 5.2. in section 5.6.

B. Equipment Procurement

It is recommended to divide equipment into two groups. One is equipment commonly used by many researchers of ITS research center and Techno park. The other is equipment that is used by a limited number of researchers for a very specific research topic. The latter can be procured through research fund provision. Equipment procurement through research fund enables a more rapid procurement and flexible selection of the equipment suitable for the specific research topic.

C. Collaborative Fellowship Program

At the early stage of the project, a number of faculty members who will be key members in utilizing facility and equipment provided by the project for their research will be sent to a Japanese university for three months up to a year with a degree/non-degree fellowship. This collaborative fellowship might contribute to: (i) enhancing faculty members' research capability; (ii) establishing and consolidating researchers' human and intellectual network through which collaborative research might be performed even after ITS's faculty members go back to ITS; and (iii) ensuring facility and equipment invested through components in previous paragraphs A and B to be fully utilized. Details of this component can be found in section 5.2 (2) B . This fellowship is complementary with existing scholarship by GOI.

D. Research Fund Provision

This component supports the actual research activities that might contribute to enhancing the research capacity of faculty members as well as graduate students, which might ultimately contribute to ITS in becoming a research-based university. In order to maximize this investment, this component could be implemented on a competitive-basis.

As mentioned in B. Equipment procurement, it is recommended to have room to procure some research specific equipment in this component. Research should involve graduate students and parties outside of ITS, for example, EPI universities in Indonesia, Japanese universities, industries in Indonesia, Japan or other nations, or local governments. This might contribute to strengthening and expanding ITS's network and at the same time expanding the impact of the project especially to the EPI region. The cost to be covered by research funds could include: the cost of research activities, equipment procurement, travel expenses of ITS faculty members or partner researchers to physically research together for a period (for example, three months per year for one research fund), patent application, and attendance in international conferences etc.

E. Academic and Industry Coordination with Japanese Partners

This component has a key role to effectively implement the soft component of the project, especially C. Collaborative fellowship program and D. Research fund provision. This component includes technical assistance to be provided by experts. They will coordinate: (i) research fellowship program by finding and arranging suitable Japanese fellowship destinations

that fit with the fellows' research topics as well as the project direction; and (ii) university-industry collaboration especially with Japanese partners to be implemented through research fund provision. As it is written in 5.6 (5) "Measures to find collaborative partners of Japan", university-industry collaborations with Japanese partners better start from collaboration with Japanese universities that already have joint research with Japanese Industries.

In addition to strengthening the sustainability of university-industry collaboration even after finishing the project, this component should also include: (i) training for a head of LPPM and key persons in the proposed fields to learn about tips, mechanisms and good and bad practices of university-industry collaborations in Japan and (ii) practice in searching for potential collaboration needs with Japanese partners, in order to establish human resource networks with Japanese partners.

This component targets academic and industry coordination mainly with Japanese partners and assistance to establish long lasting partnerships that could benefit both Indonesia and Japan. In this regard, this component can be recommended to be provided by a grant.

When proceeding further into the proposal preparation stage including cost estimation and implementation arrangements, like other Yen Loan Projects, the consulting service component, for example, project management services and engineering services will be considered.

(2) Order and Timeframe of Components

Figure 5.4 indicates order and timeframe of components of the project and its explanation follows. The table below is the idea of the team.

Year / Component		Year 0	Year 1	Year 2	Year 3	Year 4	Year 5	Year 6
1) Tender		■						
2) Facility Construction			■	■				
2) Equipment Procurement			■	■				
3) Collaborative fellowship program	Batch 1		■					
	Batch 2			■				
4) Research fund provision	Batch 1			■	■	■	■	
	Batch 2				■	■	■	■
5) Academic and Industry Coordination with Japanese partners		■ ■	■ ■	■ ■	■ ■	■ ■	■ ■	

Figure 5.4 Order and Time Frame of Each Component for ITS

1) Tender

In the case of a Yen Loan, after concluding a loan agreement, it usually takes more than one and a half years to select the consultant, design buildings and complete tenders for construction and equipment.

2) Facility Construction and Equipment Procurement

After tenders are completed, facility construction and equipment procurement start. Equipment procurement should consider the timing that ensures equipment has proper space to be installed. This process may take about two years to complete.

3) Collaborative Fellowship Program

While facility construction and equipment procurement are in progress, it is recommended to start a collaborative fellowship program at the same time. It is ideal that when fellows come back to ITS, facility and equipment are ready for them to utilize for their research. The collaborative fellowship program can be implemented through two batches, for example, in order to prevent quite a number of key faculty members from being absent from ITS at the same time and imposing a higher work load on the remaining faculty members. A longer term of fellowship is better such as one year, however, the number of batch could be considered due to the condition of university. The fellowship is ideally completed by the facility and equipment installation.

4) Research Fund Provision

Research fund provision can be started after the completion of facility construction and equipment procurement. Research activities that can produce results will take quite a long time. If aiming to implement all the activities written in 5.2 (2) A: Research Projects with Industries and Japanese Partners Accompanied by Research Oriented Education, this component needs a longer timeframe, for example, three to four years. However, the length of supporting period for one research topic could be flexible depending on the nature of the research and the scope of the activities to be covered by the fund. The number of the batches could be determined based on the topic and condition of university. It is suggested, however, that one research topic should continue for 3 years at least from the viewpoint of research quality, and one year for supplementary activities if necessary. Research fund provision can be implemented through two batches, for example, in order to provide some rooms for researches that are very important for the project but not ready at the first batch selection or simply give runners-up a second chance. An annual review should be conducted in any research activity, to find out if the funding should be continuously provided or not.

5) Academic and Industry Coordination with Japanese Partners

Academic and Industry coordination with Japanese partners is necessary at least before starting each batch of the collaborative fellowship program to find and arrange a suitable fellowship destination. However, it is ideal that this technical assistance can be provided throughout the project upon necessity to effectively implement not only fellowship programs but also research fund provision that could initiate university-industry collaboration with Japanese partners.

5.8.3 Environmental Social Consideration at ITS

The Sukolilo district is designated as a school and residential area by the Surabaya Municipality.

Proposed project sites are vacant areas within ITS Sukolilo Campus and separated from surrounding public residential areas. Accordingly, it is judged that new land acquisition and resettlement will not be needed, and any adverse impact on the natural environment will be minimal.

However, a part of proposed buildings may be close to ITS staff housing and student dormitories. Therefore, mitigation or reduction of impact on such residential areas shall be considered during the project implementation process. Especially, the necessary measures shall be taken by the contractor, against noise, vibration and other possible negative impacts which might occur during construction

It is also considered that special attention to improve the site drainage system will be necessary as it is situated in swampy areas with frequent flooding.

Wastewater from laboratories will be sanitized with a treatment tank in a manner that conforms to local standards and will be discharged into a public drainage system outside campus and as the same method as the existing laboratory wastewater treatment. It is not expected that discharge of this treated water will cause any significant impact.

Since environmental impact by implementation of the proposed project is limited and the Campus Development Master Plan of ITS is recognized by the local authority, it is considered that the environmental impact assessment process, such as AMDAL (Analisis Mengenai Dampak Lingkungan Hidup), is not required in advance as long as new development is planned in accordance with the Master Plan. However, a relatively concise environmental management and monitoring process are possibly required as an obligation of ITS during the project implementation phase.

In accordance with the information up until the second survey, this proposed project is classified as Category B under "GUIDELINES FOR ENVIRONMENTAL AND SOCIAL CONSIDERATIONS" (published April 2010) of Japan International Cooperation Agency (JICA) since it is considered that any adverse effects on the environment would not be serious in consideration of the project sector, the project location and the project scale.

5.9 Relevance of the Projects for IPB and ITS

Taking into consideration the submitted proposal by the university, such as IPB and ITS, the study team's suggestions written in the previous sections 5.3, 5.6 and all the findings through this study, the team evaluated the relevance of the projects from the six points of view described below. The points considered as important factors that might affect the decision to proceed further are highlighted:

1. Consistency with Indonesian National Development Policy and Higher Education Development Policy
Both projects are very consistent with Indonesian National Development Policy and Higher Education Development Policy.

2. Concreteness of the proposed research plan
Concreteness of the proposed research plan varies among the proposed fields such as (i) Biopharmaca and (ii) Seed of IPB, and (iii) Energy, (iv) Marine, (v) ICT, and (vi) Housing, human settlement, environment, and disaster management of ITS. (i) Biopharmaca and (iii) Energy have quite concrete research plans to be implemented by utilizing the project inputs, followed by. (ii) Seed and (iii) Marine and then (v) ICT. (vi) Housing, human settlement, environment, and disaster management need more elaboration compared to the other fields.

3. Possibility that the Benefit from the Project will be Brought to Other Universities in Indonesia
(v) ICT of ITS has the highest possibility that the benefit from the project would be brought to other universities in Indonesia because ICT of ITS has already established a strong network with other EPI universities through PREDICT. In addition, both IPB and ITS have many graduate students who are teaching staff of other universities in Indonesia. Therefore, the expected impact to be brought to other universities is already quite high.

4. Future Needs from Indonesian Industries
Future needs from Indonesian industries for joint research or employment in the proposed fields are not yet very visible.

5. Future Needs from Japanese Industries
Future needs from Japanese industries from a point of view of joint research, (i) Biopharmaca and (iii) Energy fields would have higher needs than the others according to the interviews with industries in Japan.

6. Readiness to Proceed to the Next Step of the Proposal Preparation
IPB has a higher score because IPB has already established arrangements to get full support from IPB's top management. ITS is now under preparation to establish those arrangements under the leadership of the newly selected Rector in April 2011.

In summary, the study team judges that both projects have high relevance and potential impact on university development in Indonesia and thus recommends implementing both. However, as a greater variety of academic fields are needed to be covered for ITS, considering the level of current readiness, ITS needs approximately 2–3 times more man-months and time than those of IPB for the proposal preparation to reach the appraisal stage.

Appendices

Appendix 1: RISTEK Incentive Program Recipients

Institutes Receiving Fund from Incentive Program in 2011

No	Institution	Number of Proposal
1	**Research Institute under Ministry of Science and Technology**	**141**
	1. Agency for The Assessment and Application of Technology (BPPT)	100
	2. Indonesian Institute of Sciences (LIPI)	24
	3. National Institute of Aeronautics and Space (LAPAN)	16
	4. National Nuclear Energy Agency (BATAN)	1
2	**Research Institute under other Ministries**	**16**
3	**Universities:**	**129**
	1. Indonesian University	14
	2. Bogor Agriculture University (IPB)	18
	3. Bandung Institute Technology (ITB)	34
	4. Surabaya Institute Technology (ITS)	16
	5. Gajah Mada University (UGM)	3
	6. Diponegoro University (UNDIP)	3
	7. Hasanudin University (UNHAS)	4
	8. Jember University	4
	9. Other universities (26 universities)	33
4	**Local Government of South Sumatera Research Institute**	**1**
5	**Industry**	**1**
	Total	**288**

Appendix 2: IPB Collaboration with Japanese Universities

	Japanese University or Research Institute		Contents of collaboration
	Name	Unit	
1	Central Research Institute of Electric Power Industry		• Collaborative research and research fund provision
2	Chiba University	Graduate School of Horticulture	• Agreement for Double Degree Program
			• Agreement for Academic Cooperation and Exchange – Exchange of faculty members and researchers – Exchange of students – Joint research projects, including conferences and meeting – Exchange of information and publication – Other activities mutually agreed upon by the two institutions – International symposium
3	Ehime University	Department of Life and Environment Science, Faculty of Agriculture	• Academic Exchange • Collaborative research • Student exchange • Researcher exchange
4	Ehime University-Kagawa University-Kochi University-UNHAS, UGM and IPB		• Six-university Consortium for Sustainable Agriculture in the Tropics – Establishing the Consortium; Working Group & Funding
5	Gifu University	Faculty of Applied Biological Science	• Student Exchange • Academic Exchange – Exchange of research and administrative staff and students – Exchange of academic materials and publications – Collaboration in research and the presentation of its result
6	Hiroshima University		• Japan-East Asia Network of Exchange for Students and Youths (JENESYS) Programme
7	Hokkaido University * There is Hokkaido University representative office in IPB	Graduate School of Agriculture and Faculty of Agriculture	• Academic Exchange – Exchange faculty members and research fellows – Exchange academic materials, publications and information – Collaboration in research
		Research Center for Zoonosis Control	• Collaborative Research Agreement
8	Ibaraki University		• MoU for Education & research Cooperation (Faculty of Agriculture) – Exchange of Faculty members, Researchers and Student – Exchange of educational and research

	Japanese University or Research Institute		
	Name	Unit	Contents of collaboration
			information, materials, and publications; – Exchange of invitation and collaboration in conferences, seminars, and symposia
9	Kagawa University		• General Memorandum for Academic Cooperation & Exchange – Exchange of bibliographic and other scientific materials – Exchange of scholars and researchers – Exchange of students – Joint researches and meetings
10	Kagoshima University		• MoU on Academic Exchange – Exchange of teaching and research personnel – Exchange of administrative and other professional personnel – Exchange of students; Collaboration in research projects; Exchange of academic publications
11	Kochi University		• Japan-East Asia Network of Exchange for Students and Youths (JENESYS) Programme • Arrangement for collaborative research on starch accumulating tropical palm
12	Kyoto Gakuen University		• Agreement for International Exchange System – Student and the internationalization of education through an international student exchange program
13	Kyoto University	The Center for Southeast Asian Studies; Graduate Schoola of Asian and Africa Area Studies	• MoU on Improvement of Mal-Developed Indonesian Coastal Region for Agricuultural Production and Community Development
		Faculty of Agriculture / Graduate School of Agriculture	• Student Exchange Agreement
		Dept of Applied Life Sciences, Faculty Of Agriculture	• Collaborative research with Biopharmaca Research Center
14	Mie University		• General Agreement for Academic Cooperation and Exchange – Exchange Materials in Education and Research, Publications and Academic information – Exchange of faculty and research scholars and students – Joint research of meetings for education and research • Collaborative research under IMHERE Project; workshop supported by JSPS
15	Miyazaki University	Faculty of Agriculture	• Agreement on Research programs and exchange of academic staff and students

	Japanese University or Research Institute		Contents of collaboration
	Name	Unit	
16	Nara Institute of Science and Technology		• Agreement of Academic Exchange (Faculty of Mathematics and Natural Science) – Collaborative research, lectures, symposia – Exchange of scholar and researchers – Exchange of information in field which are of interest to both parties – Exchange of graduate students in such fields.
		Laboratory of Comparative Genomics, Graduate School of Information Science	• Collaborative research on jamu database with Biopharmaca Research Center
17	Niigata University	The Faculty of Agriculture, and the Graduate School of Science and Technology,	• Agreement on Academic exchange and cooperation
18	Obihiro University	Agriculture and Veterinary Medicine, Department of Animal and Food Hygiene	• Agreement on Academic Cooperation (Agriculture and Veterinary Medicine) – Exchange faculty members for lectures and research activities – Foster mutual activities in education and research – Exchange scientific publications and information on education and research – Implement a student exchange program • Collaborative research on functional food
19	Okayama University		• MoU and suplement MoU on – Exchange of students, faculty and staff – Collaborative research – Instructional and cultural program – Exchange of research information
20	Osaka Prefecture University		• Agreement of Academic Exchange – Research collaboration – Exchange of faculty members and students
21	Shinshu University		• Collaborative research on biosensor
22	The Tokyo University of Agriculture and Technology		• Agreement for Scholarly Exchange and Collaboration – Exchange of faculty members and students – Joint research and other scholarly activities – Exchange of publications

	Japanese University or Research Institute		Contents of collaboration
	Name	Unit	
23	The University of Tokyo	Graduate School of Agricultural and Life Science	• Student Exchange Program
		Graduate School of Public Policy	• Research on Biofuel policy, titled " Impacts of Palm Oil-Based Biodiesel Export to Japan on Stakeholders, Socio Economics, and Environment in Indonesia and its Policy Strategies"
		Graduate School of Agricultural and Life Sciences, Asian Natural Environmental Science Center, Institute of Medical Science,	• Establishment of a Research Unit for Biological Resources and Development in South-East Asia, The University of Tokyo at The IPB
		The Faculty of Agriculture	• Exchange of students
			• JSPS - DGHE University Program in Applied Biosciences – Collaborative research and Sholarship under RUBRD (Research Unit for Biological Resources and Development) Project
24	The University of The Ryukyus		• Exchange students, faculty and staff members • Exchange of academic materials, publications, and information • Joint hosting of seminar, conference, and symposia, • Joint research and other academic exchange
25	The University of Tsukuba		• Exchange of professors and researcher • Exchange of undergraduate and/or graduate students • Collaborative research and joint academic meetings • Exchange of information, publication, and materials for academic purposes
26	Tohoku University		• Promotion of joint research and educational activities • Invitation to short-term visits of faculty members and researchers for lectures, conferences, colloquia, and symposia or other academic activities • Exchange of information and pertinent publication in fields of interest to both universities • Exchange of faculty members, researchers and students for study and research.
27	Tokyo University of Agriculture		• Cooperative research activities • Exchange of faculty members and students • Exchange of scientific materials, publications and information

	Japanese University or Research Institute		
	Name	Unit	Contents of collaboration
28	Tokyo University of Fisheries		• Promotion of Student Exchange
29	Tokyo University of Marine Science and Technology		• Collaboration among faculty and staff members for research, symposia, and other academic pursuits as feasible and mutually agreed • Exchange visits by students as mutually agreed and jointly arranged: • Joint research activities when mutually agreed and feasible • Exchanges of informational materials on education, training, and research matters • Student Exchange Program
30	University of Okinawa		• Master study sandwich program
31	Utsunomiya University		• Exchange of Faculty Member and Student
32	Yamaguchi University		• Exchange of staff and researchers • Exchange of undergraduate and graduate students • Exchange of academic information and publications • Conducting colloquia, lectures and seminars • Cooperation in research and the presentation of its results

Appendix 3: ITS Collaboration with Japanese Universities

	Japanese University or Research Institute		Contents of collaboration
	Name	Unit	
Energy			
1	Hiroshima University	Energy and Environmental Engineering Lab, Faculty of Engineering	• Joint research (Liquefaction of coal as fuel for diesel engine) • Joint seminar • Staff/student exchange
		PRETTY Program	• Joint research (Internal combustion engine, biodiesel oil combustion propagation), Joint seminar and Post graduate program (PRETTY) funded by MEXT Japan
		Thermal Fluid Engineering and Materials Processing Lab, Faculty of Engineering	• Joint research (Nanoparticle engineering, fine chemical synthesis, hydrogen storage) • Joint seminar • Staff/student exchange
2	Kumamoto University	Dept. of Computer Science and Electrical Engineering Graduate School of Science and Technology	• Joint research, joint seminar, student exchange, non degree training on energy efficiency (electricity)
3	Kobe University	The International Maritime Education and Research Center	• Joint research, joint seminar, student exchange, non degree training on tide energy simulation
4	RIKEN	Next-Generation Supercomputer R&D Center	• Collaborative research on advance and nano-materials • International Symposium
5	Tokyo Institute of Technology (Under preparation)	Department of Mechanical Engineering and Science	• Joint research on conversion of natural gas to liquid fuels and solar energy utilization
6	Kyoto University (Under preparation)	Graduate School of Energy Science	• Collaborative research and staff exchange
Marine			
7	Kobe University	The International Maritime Education and Research Center	• Joint research, joint seminar, student exchange, and non degree training on Automatic Identification System, Dafety Management of Ship
8	Hiroshima University	Graduate School of Engineering	• Joint research and joint seminar on shallow water transportation, safety management, capsizing, etc
9	Kyushu University	Faculty of Engineering	• Joint research and joint seminar on hydrodynamics
10	Osaka University		• Joint research and joint seminar on hydrodynamics
11	Tokyo University	Faculty of Frontier Science	• Joint research on Marine Transportation
12	Tohoku University	Faculty of Engineering	• Joint research and joint seminar on coastal morphology and sediment transport

	Japanese University or Research Institute		Contents of collaboration
	Name	Unit	
ICT			
13	Kumamoto University		• Joint research, joint seminar, student exchange, non degree training through JICA PREDICT-ITS Project
14	Saga University		
15	Tokyo Institute of Technology		
16	Tohoku University		
17	Hiroshima University		
18	JAXA (Japan Aerospace Exploration Agency) and ITB		• Joint research on multicast experiment using the WINDS Satellite
Housing, human settlement, environment, and disaster management			
19	Soka University	Department of Environmental Engineering	• Joint seminar and joint research on solid waste treatment and waste water management
20	Toyo University		• Joint research on hidrology
21	Tokyo Zokei University		• Joint research on product design and human settlement
22	Tsukuba University	Graduate School of Life and Environmental Sciences	• ITS lecturer is currently in a doctorate program on remote sensing, GIS, and Geo-ecology at this university
23	Hokkaido University	Dept. Natural History Sciences, Faculty of Science	• ITS lecturer is currently in a doctorate program on remote sensing, GIS, and Geo-ecology at this university
24	Chiba University		• International consortium, joint research and education on climate change and natural disaster
24	Yamaguchi University		• International consortium, joint research and education on climate change and natural disaster (MoU)
25	Nagasaki University		• ITS lecturer is currently in a doctorate program on air pollution
26	Toyo University		• Joint research on indigenous settlement on the urban fringe
27	Kyoto University	Centre for South East Studies	• Having a visiting professor
			• Joint research on thermal environment for houses with and without air condition • Research internship
28	The University of Shiga Prefecture	Dept. of Design and Architecture, School of Environmental Science	• ITS lecturer is currently in a doctorate program
29	Tsukuba University		• Joint research on constructing eco house

Appendix 4: Tentative List of Equipment and Research Topic: IPB

Appendix 4-1: List of Research Project in Biopharmaca Research Center and the Information related to equipment

No	Title of Project	Status of Project	Used Equipment	Proposed Investment related to the project type	
				Program Number	Main equipment
1	Exploration of Indegenous Property Right in Kutai East Kalimantan	2005-2007		1, 2, and 8	Sampling vehicle, DNA Squencer, PCR, HPLC, UV Vis, FT IR, tissue culture equipment, Soil tester equipment, IT equipment
2	Anti beta-lactamase component from Streptomyces sp	2005-2006	FTIR, GC-MS, laminar air flow, autoclave	6	TLC Scanner, FTIR, HTS, LC MS/MS, GC MS, NMR, HPLC, UV Vis, microscope, SEM, particle size analyzer, TOC, AAS, DSC, pilot plan, biological assay
3	Standardization of flavonoid content using Chemometric method	2005	FTIR	5	TLC Scanner, FTIR, HTS, LC MS/MS, GC MS, NMR, HPLC, UV Vis
4	Calibration model on Zinger and Temulawak determination	2005	TLC, FTIR	5	TLC Scanner, FTIR, HTS, LC MS/MS, GC MS, NMR, HPLC, UV Vis
5	Medicinal plants mapping in West Java	2005	AAS, HPLC, TLC	1 and 11	Sampling vehicle, DNA Squencer, PCR, Soil tester equipment
6	Optimization biomass and bioactive component on Guava and Jati Belanda (*Guazuma ulmifolia*) cultivation	2005 - 2007	HPLC, Spectrophotometer UV VIS	1 and 4	Sampling vehicle, DNA Squencer, PCR, HPLC, UV Vis, FT IR, tissue culture equipment, Soil tester equipment
7	Standard Operation Procedure on Ginger, Temulawak, and Turmeric Cultivation	2005		4	HPLC, UV Vis, FT IR, tissue culture equipment, Soil tester equipment
8	Compiling and sosialization of Indonesian National Standard for Ginger and Temulawak	2005		5	TLC Scanner, FTIR, HTS, LC MS/MS, GC MS, NMR, HPLC, UV Vis
9	Imunomodulatory effect of Bawang Dayak	2005	Column Chromatography, MTT Assay, TLC	6	TLC Scanner, FTIR, HTS, LC MS/MS, GC MS, NMR, HPLC, UV Vis, microscope, SEM, particle size analyzer, TOC, AAS, DSC, pilot plan, biological assay
10	Exploration of Indonesian softcoral as biopharmacy resources	2005	HPLC, FTIR, UV-Vis	5	TLC Scanner, FTIR, HTS, LC MS/MS, GC MS, NMR, HPLC, UV Vis
11	Study of fertilizer effect to medicinal plants	2005	AAS, HPLC, TLC	4	HPLC, UV Vis, FT IR, tissue culture equipment, Soil tester equipment
12	Feasilibity study of Small Scale Biopharmaca enterprice	2005		8	IT equipments
13	Cultivation and domestication Study of *Arcangelisia flava*	2005		1 and 4	Sampling vehicle, DNA Squencer, PCR, HPLC, UV Vis, FT IR, tissue culture equipment, Soil tester equipment
14	Antidiabetic activity of *Phaleria macrocarpa*	2005		6	TLC Scanner, FTIR, HTS, LC MS/MS, GC MS, NMR, HPLC, UV Vis, microscope, SEM, particle size analyzer, TOC, AAS, DSC, pilot plan, biological assay
15	Formulation sidaguri and celery extract as anti gout	2005 - 2008		6	TLC Scanner, FTIR, HTS, LC MS/MS, GC MS, NMR, HPLC, UV Vis, microscope, SEM, particle size analyzer, TOC, AAS, DSC, pilot plan, biological assay

16	Promoting selected non timber forest product based on community participation approach to support sustainable forest management in East Kalimantan	2005 - 2009		1 - 11	all the equipments
17	Development of control quality methods of herbal based on FTIR	2006		5	TLC Scanner, FTIR, HTS, LC MS/MS, GC MS, NMR, HPLC, UV Vis
18	Product formulation from bangle and jati belanda	2006		6	TLC Scanner, FTIR, HTS, LC MS/MS, GC MS, NMR, HPLC, UV Vis, microscope, SEM, particle size analyzer, TOC, AAS, DSC, pilot plan, biological assay
19	Bioactivity bangle as anti cholesterol	2006		6	TLC Scanner, FTIR, HTS, LC MS/MS, GC MS, NMR, HPLC, UV Vis, microscope, SEM, particle size analyzer, TOC, AAS, DSC, pilot plan, biological assay
20	GAP of zingeraceae family	2006 - 2008		4	HPLC, UV Vis, FT IR, tissue culture equipment, Soil tester equipment
21	Study of Partnership model and integrated marketing of biopharmaca	2006 - 2007		8, 10, and 11	IT equipments
22	Study of Competitive Strategy of ginger for export	2006		8 and 10	IT equipments
23	Study of domestic and export market of Indonesian medicinal plants	2006 - 2007		8 and 10	IT equipments
24	Mapping of medicinal plants in production area	2006 - 2008		1 and 11	Sampling vehicle, DNA Squencer, PCR, Soil tester equipment
25	Inhibition activity of extracts towards beta-glucosidase enzyme	2006		6	TLC Scanner, FTIR, HTS, LC MS/MS, GC MS, NMR, HPLC, UV Vis, microscope, SEM, particle size analyzer, TOC, AAS, DSC, pilot plan, biological assay
26	Exploration, Optimization and standardization extract of potential medicinal plants	2006 - 2011		1, 2, 3, and 5	TLC Scanner, FTIR, HTS, LC MS/MS, GC MS, NMR, HPLC, UV Vis, Sampling vehicle, DNA Squencer, PCR, HPLC, UV Vis, FT IR
27	Development of national biopharmaca	2006		11	IT equipments
28	Authentication model for herbal composition based on FTIR	2007	FTIR	5	TLC Scanner, FTIR, HTS, LC MS/MS, GC MS, NMR, HPLC, UV Vis
29	Study of antioxidant activity from natural product in cardiovascular treatment	2007		6	TLC Scanner, FTIR, HTS, LC MS/MS, GC MS, NMR, HPLC, UV Vis, microscope, SEM, particle size analyzer, TOC, AAS, DSC, pilot plan, biological assay
30	Development of phytopharmaca for anti coronary heart disease	2007 - 2012		6	TLC Scanner, FTIR, HTS, LC MS/MS, GC MS, NMR, HPLC, UV Vis, microscope, SEM, particle size analyzer, TOC, AAS, DSC, pilot plan, biological assay

31	Insulinotropic activity of mahkota dewa	2007 - 2009		6	TLC Scanner, FTIR, HTS, LC MS/MS, GC MS, NMR, HPLC, UV Vis, microscope, SEM, particle size analyzer, TOC, AAS, DSC, pilot plan, biological assay
32	Potency of standardize temulawak for avian flu treatment	2007 - 2009		4 and 6	TLC Scanner, FTIR, HTS, LC MS/MS, GC MS, NMR, HPLC, UV Vis, microscope, SEM, particle size analyzer, TOC, AAS, DSC, tissue culture equipment, Soil tester equipmentpilot plan, biological assay
33	Bioprospective kamandrah for anti- dengue	2007 - 2009		4 and 6	TLC Scanner, FTIR, HTS, LC MS/MS, GC MS, NMR, HPLC, UV Vis, microscope, SEM, particle size analyzer, TOC, AAS, DSC, tissue culture equipment, Soil tester equipmentpilot plan, biological assay
34	Approved supplier program of biopharmaca product	2007		7, 8 and 10	IT equipments
35	Jamu development, collaboration with Beijing and Chengdu University of TCM	2007 - 2011		7 and 11	IT equipments
36	Development of national roadmap for jamu	2007 - 2011		10 and 11	IT equipments
37	Training of cultivation and biopharmaca processing for local farmer	2007 - 2011		7 and 10	IT equipments and pilot plan equipment
38	Domestic market policy on medicinal plants	2007		8	IT equipment
39	Descrimination of zingiberaceae based on geographical origin using FT IR and chemometrics	2008 - 2010		5	TLC Scanner, FTIR, HTS, LC MS/MS, GC MS, NMR, HPLC, UV Vis
40	Development method for detecting an adulteration in herbal medicine	2008 - 2009		5	TLC Scanner, FTIR, HTS, LC MS/MS, GC MS, NMR, HPLC, UV Vis
41	Activity of phytosterol from katuk for antihipercholesteromia	2008 - 2009		4 and 6	TLC Scanner, FTIR, HTS, LC MS/MS, GC MS, NMR, HPLC, UV Vis, microscope, SEM, particle size analyzer, TOC, AAS, DSC, tissue culture equipment, Soil tester equipmentpilot plan, biological assay
42	GAP sambiloto for standardize raw materials	2008 - 2009		4	HPLC, UV Vis, FT IR, tissue culture equipment, Soil tester equipment
43	Herbal formulation for anti reumatics	2008 - 2012		4 and 6	TLC Scanner, FTIR, HTS, LC MS/MS, GC MS, NMR, HPLC, UV Vis, microscope, SEM, particle size analyzer, TOC, AAS, DSC, tissue culture equipment, Soil tester equipmentpilot plan, biological assay
44	Study of antioxidant activity from natural product for animal husbandry	2008 - 2009		6	TLC Scanner, FTIR, HTS, LC MS/MS, GC MS, NMR, HPLC, UV Vis, microscope, SEM, particle size analyzer, TOC, AAS, DSC, pilot plan, biological assay
45	Formulation and extract microencapulation for antihipertension	2009 - 2010		6	TLC Scanner, FTIR, HTS, LC MS/MS, GC MS, NMR, HPLC, UV Vis, microscope, SEM, particle size analyzer, TOC, AAS, DSC, pilot plan, biological assay

46	Chromatogram and Spectra fingerprint for herbal quality control	2009 - 2010		4	HPLC, UV Vis, FT IR, tissue culture equipment, Soil tester equipment
47	Product formulation and quality control methods of kayu secang as anti acne	2009 - 2011		4 and 6	TLC Scanner, FTIR, HTS, LC MS/MS, GC MS, NMR, HPLC, UV Vis, microscope, SEM, particle size analyzer, TOC, AAS, DSC, tissue culture equipment, Soil tester equipmentpilot plan, biological assay
48	Screaning, chemical identification and standardization of Indonesian medicinal plants as tirosinase inhibitor	2009 - 2011		4 and 6	TLC Scanner, FTIR, HTS, LC MS/MS, GC MS, NMR, HPLC, UV Vis, microscope, SEM, particle size analyzer, TOC, AAS, DSC, tissue culture equipment, Soil tester equipmentpilot plan, biological assay
49	Product formulation for anti mastitis	2010 - 2011		6	TLC Scanner, FTIR, HTS, LC MS/MS, GC MS, NMR, HPLC, UV Vis, microscope, SEM, particle size analyzer, TOC, AAS, DSC, pilot plan, biological assay
50	Cultivation study and Product formulation from pegagan, tempuyung, kumis kucing as anti hipertension	2010 -2011		4 and 6	TLC Scanner, FTIR, HTS, LC MS/MS, GC MS, NMR, HPLC, UV Vis, microscope, SEM, particle size analyzer, TOC, AAS, DSC, tissue culture equipment, Soil tester equipmentpilot plan, biological assay
51	Formulation of standardize temulawak and selected medicinal plants for avian flu treatment	2010 - 2011		6	TLC Scanner, FTIR, HTS, LC MS/MS, GC MS, NMR, HPLC, UV Vis, microscope, SEM, particle size analyzer, TOC, AAS, DSC, pilot plan, biological assay
52	Potency of Indonesian herbs for brain tonic	2010 - 2011		6	TLC Scanner, FTIR, HTS, LC MS/MS, GC MS, NMR, HPLC, UV Vis, microscope, SEM, particle size analyzer, TOC, AAS, DSC, pilot plan, biological assay
53	Indonesian natural zeolit and its nanocomposite as supporting material for antioxidant and antimicrobial	2010 - 2011		6	TLC Scanner, FTIR, HTS, LC MS/MS, GC MS, NMR, HPLC, UV Vis, microscope, SEM, particle size analyzer, TOC, AAS, DSC, pilot plan, biological assay
54	The cellular mechanism of jati belanda and salam extract in the theraphy for cardiovascular disease	2010 - 2011		6	TLC Scanner, FTIR, HTS, LC MS/MS, GC MS, NMR, HPLC, UV Vis, microscope, SEM, particle size analyzer, TOC, AAS, DSC, pilot plan, biological assay
55	Strategic formulation for improving competitiveness small scale industry in free trade era	2010		8	IT equipments
56	Exploration of Indonesian local biodiversity for functional food ingredient	2010		1, 2, 3 and 6	TLC Scanner, FTIR, HTS, LC MS/MS, GC MS, NMR, HPLC, UV Vis, microscope, SEM, particle size analyzer, TOC, AAS, DSC, pilot plan, biological assay
57	Exploration of kepel as whitening agent and deodorant	2010 - 2011		1,2,3 and 6	TLC Scanner, FTIR, HTS, LC MS/MS, GC MS, NMR, HPLC, UV Vis, microscope, SEM, particle size analyzer, TOC, AAS, DSC, pilot plan, biological assay
58	Temulawak as slimming agent aromatheraphy	2010 - 2011		6	TLC Scanner, FTIR, HTS, LC MS/MS, GC MS, NMR, HPLC, UV Vis, microscope, SEM, particle size analyzer, TOC, AAS, DSC, pilot plan, biological assay
59	The comparison research on the chemical composition and affection of nerve cell between Chinese centella asiatica and Indonesia centella asiatica	2010		4	HPLC, UV Vis, FT IR, tissue culture equipment, Soil tester equipment
60	Safety and functional properties of soy-based powder	2010 - 2011		6	TLC Scanner, FTIR, HTS, LC MS/MS, GC MS, NMR, HPLC, UV Vis, microscope, SEM, particle size analyzer, TOC, AAS, DSC, pilot plan, biological assay
61	Development of jamu data base for virtual screening	2010 - 2012		6 and 10	TLC Scanner, FTIR, HTS, LC MS/MS, GC MS, NMR, HPLC, UV Vis, microscope, SEM, particle size analyzer, TOC, AAS, DSC, pilot plan, biological assay, IT equipment

Appendix 4-2: Program number

1	Biodiversity Conservation and Domestication of Medicinal Plant
2	Study of Ethnobotany and Indigenous Knowledge/ Local Wisdom
3	Developing Indonesian Biopharmaca Potency
4	Development of Good Agricultural Practices and Good Agricultural Colection Practices
5	Development of Biopharmaca Standardization Model
6	Development of Leading Biopharmaca Products for Human, Animal and Plants
7	Biopharmaca Education Development
8	Study of Biopharmaca Sosio-Economic Impact
9	Utilization of Biopharmaca Product Through Herbal Clinic
10	Dissemination of Biopharmaca Achievement to Stakeholders
11	Strengthening Networking

Appendix 4-3: List of Equipment and Research Topic: IPB

Research topic	**Facility**	**Output**		**Equipment**	
Enhancing Biodiversity Utilization through Plant Biotech and Breeding In Vitro Propagation	Tissue Culture Laboratory	Research on micropropagation and plant cell regeneration of crop and mass production			
In vitro preservation, germplasm and evaluation	Tissue Culture Laboratory	Preservation of selected mother plant of food crops, horticultural crops and estate crops			
Genetic resources (germplasm) exploration collection and conservation,	Gene Bank Laboratory	Maintaining genetic resources of seed from breeding programs and from exploration			
Gene bank management, reception, Registration and management data on genetic resources	Gene Bank Laboratory	Management			
production of the seed list catalogues,	Gene Bank Laboratory	Development of seed catalog			
Distribution of genetic resources and their data and instruction of their distribution	Gene Bank Laboratory	Distribution of germplasm			
Identification and Evaluation of important candidate genes for breeding fokus on: 1) biotic stress tolerance, 2) biotic stress tolerance, 3) growth development and quality Biodiversity and genetic variation study	Greenhouse	Collection and crossing	400000		
Development plant research population (RIL, F2/F3, NIL)	Greenhouse	Population development	**s.s.a**		
	Laboratory	storage		Heratherm OGH100-S Advanced Security	storage
				Revco 51.1 cf Laboratory Refrigerator	storage
				Revco Ultima plus 17 cf Chest Freezer	storage
QTL study of interesting traits	Greenhouse	Population development	**s.s.a**	Thermo Scientific KingFisher Flex	Fast DNA isolation
	Laboratory	linkage map construction and QTL analysis	1200000	LightScanner® System	genotyping

Research topic	**Facility**	**Output**		**Equipment**	
				4300 DNA Analyzer	genotyping
				C1000TM Thermal Cycler with dual 48/48 Fast Reaction Module	DNA amplification
				NanoDrop 8000	Spectro-phometry
				NanoDrop 2000	Spectro-phometry
				Snowflake Ice Machine for laboratory	Ice provider
				Water distillater	Pure water provider
				Heraeus Biofuge Stratos Centrifuge	centrifuge
				Computer plus software for analysis (Joinmap)	linkagemap construction
			s.s.a	Computer plus software for analysis (MapQTL)	QTL detection
Advance phenotyping study (metabolomic study)	Greenhouse	Population development	**s.s.a**		
	Laboratory	Metabolite study	**s.s.a**	GC-2010	Gas Chromato-graphy
				GCMS-QP2010S	Mass Spectrometer Systems
				LCMS-8030	Mass Spectrometer System
				Nexera	Liquid Chromato-graph
				Unstirred waterbath NE & NE2 series	cell destructor
				Precision Water Bath 283 digital	waterbath
				MaxQ 2000 Shaker - Digital	shaker
				Super-Nuova Ceramic 4-point Stirring Hot Plate	stirrer
Candidate gene study	Greenhouse	Growing plant material	**s.s.a**	Pico 21	Centrifuge
				Fresco 21R	Centrifuge refrigerated
				QIAxcel	DNA fragment and RNA analysis
				QIAgility	Sample preparation and assay setup

Research topic	**Facility**	**Output**		**Equipment**	
				Rotor-Gene®Q	Real Time PCR
				HiScanSQ	Sequencing
Confirmation study and Marker development for MAS	Greenhouse	Growing plant material	**s.s.a**		
	Laboratory	Marker polymorphism study	**s.s.a**		
Plant Breeding program for new varieties Creation of variation	Greenhouse	population development	**s.s.a**		
	Tissue culture Laboratory	hybridization	**s.s.a**		
	Laboratory	Mutation	**s.s.a**		
selection	Greenhouse	selection	**s.s.a**		
	Laboratory	Marker assisted selection	**s.s.a**		
		In vitro selection	**s.s.a**		
multiple location test					
release step for new promising varieties					

Appendix 4-4: List of Equipment and Research Topic: IPB

Linkage between Research Topics/Activities and Main Equipments

No	Objective	Program for Improved Varieties		Main Facilities	Product					
					5 years		10 years		15 years	
					Tangible	Intangible	Tangible	Intangible	Tangible	Intangible
1	Improved Varieties	Collection of germplasm	1. Diversification of gene pool through exploration and introduction	Microbiology safety Cabinet (ESCO)	Increase of species number and entry of each species	Developing capacity of human resources : researchers and local community	Increase of species number and entry of each species	Developing capacity of human resources : researchers and local community	Increase of species number and entry of each species	Developing capacity of human resources : researchers and local community
			2. Development of effective collection system	Deep Freezer (-84C)						
			3. Development of effective identification and retrieval system	Flow Cytometry						
			4. Development of germplasm exchange programs with other institutions	Mobile Incenerator						
			5. Germplasm description,	Liquid Handling						
			6. Development of data base and bioinformatics system	Spectrophotometer for DNA/RNA and Routine Analysis						
			7. Development of barcode system for local genetic materials	Rapid PCR Mechine						
			8. Conservation and Cryopreservation of elite lines	Portable PCR and Extraction DNA						
			9. Collection of underutilized crops	Extraction Engine (Extract DNA Automatic)						

No	Objective	Program for Improved Varieties		Main Facilities	Product					
					5 years		10 years		15 years	
					Tangible	Intangible	Tangible	Intangible	Tangible	Intangible
		Characteriza-tion of Germplasms	1. Characterization for adaptation to specific agroecosystem	LightScanner® System	5 candidate genes will be characterized and 5 marker can be used for marker assisted selection; 10 crops species in the laboratory ready for mass production (food crops, Horticultural Crops and Estate Crops) or fornon conventional breeding program	Developing capacity of human resources and lab capacity: Developing capacity of human resources : researchers and local community and technology for micropropaga-tion and regeneration from plant cell	10 candidate genes will be characterized and 5 marker can be used for marker assisted selection; 15 crops species in the laboratory ready for mass production (food crops, Horticultural Crops and Estate Crops) or for non conventional breeding program	Developing capacity of human resources and lab capacity : Developing capacity of human resources : researchers and local community and technology for micropropaga-tion and regeneration from plant cell	18 candidate genes will be characterized and 5 marker can be used for marker assisted selection ; 20 crops species in the laboratory ready for mass production (food crops, Horticultural Crops and Estate Crops) or for non conventional breeding program	Developing capacity of human resources and lab capacity ; Developing capacity of human resources : researchers and local community and technology for micropropaga-tion and regeneration from plant cell
			2. Characterization for nutritional and antinutritional values	Thermo Scientific KingFisher Flex						
			3. Characterization for product suitability	Swift Stereo microscopes						
		Selection methodology	1. Development of through put selection methodologies for adaptive and economic characters	Analytical Balance (External calibration)						
			2. Development of gene specific markers for adaptive and economic characters	Drying Chamber						
		Breeding program	1. Inheritance study of adaptive and economic characters	Ceramic Hotplate						
			2. Breeding for adaptation to specific agroecosystem	Analytical Balance (External calibration)						
			3. Improvement of nutritional content of adapted genotypes	Grinder						
			4. Breeding for disease resistance							
			5.Development of somatic embryogenic to support conventional seeds							

No	Objective	Program for Improved Varieties	Main Facilities	Product: 5 years – Tangible	Product: 5 years – Intangible	Product: 10 years – Tangible	Product: 10 years – Intangible	Product: 15 years – Tangible	Product: 15 years – Intangible
		6. Development of hybrid and non-hybrid varieties of food, horticulture and estate crops							
		7. Development of finger printing for the improved varieties							
		8. Development of protocol for synthetic seeds							
		9. In vitro propagation of vegetatively propagated crops							
		1. Participatory varietal selection							
		2. Farmer field trials with accompanying technologies	Analytical Balance (External calibration)						
		3. Develop licensing system for farmers and seed industries	Drying Chamber						
		4. Training for farmers and breeders	Ceramic Hotplate						
			Analytical Balance (External calibration)						
		3. Improvement of nutritional content of adapted genotypes	Grinder						
		4. Breeding for disease resistance	Mikroskop binokuler						
		5. Development of hybrid and non-hybrid varieties of food, horticulture and estate crops	LightScanner® System						

No	Objective	Program for Improved Varieties	Main Facilities	Product					
				5 years		10 years		15 years	
				Tangible	Intangible	Tangible	Intangible	Tangible	Intangible
		6. Development of finger printing for the improve varieties	4300 DNA Analyzer						
		7. Development of protocol for synthetic seeds	C1000TM Thermal Cycler with dual 48/48 Fast Reaction Module						
		8. Plant and cell collection technic	NanoDrop 8000						
		9. Non convensional breeding through gene transfer and plant cell culture	NanoDrop 2000						
		10. Biodiversity and genetic variation study	Snowflake Ice Machine for laboratory						
		11. QTL study of interesting traits	Water distillater						
		12. Advance phenotyping study (metabolomic study)	Heraeus Biofuge Stratos Centrifuge						
		13. Candidate gene study	Computer plus software for analysis (Joinmap)						
		14. Confirmation study and Marker development for MAS	Computer plus software for analysis (MapQTL)						
		15. In vitro propagation and cell culture (Embryogenesis, haploid culture, protoplast fusion)	GC-2010						
			GCMS-QP2010S						
			LCMS-8030						
			Nexera						
			Unstirred waterbath NE & NE2 series						

No	Objective	Program for Improved Varieties		Main Facilities	Product					
					5 years		10 years		15 years	
					Tangible	Intangible	Tangible	Intangible	Tangible	Intangible
				Precision Water Bath 283 digital						
				MaxQ 2000 Shaker - Digital						
				Super-Nuova Ceramic 4-point Stirring Hot Plate						
				Pico 21						
				Fresco 21R						
				QIAxcel						
				QIAgility						
				Rotor-Gene®Q						
				HiScanSQ						
				Greenhouse						
				Heratherm OGH100-S Advanced Security						
				Revco 51.1 cf Laboratory Refrigerator						
				Revco Ultima plus 17 cf Chest Freezer						
				Water Distiller						
				Airstream Horizontal Laminar airflow						
				Support Stand, Airstream Horizontal Laminar Airflow						
				PORTABLE AUTOCLAVE, 22 L						
				ENVIRONMENTAL SHAKER INCUBATOR						
				Orbital shaker						
				Ultrasonic cleaner						
				Dispenser Auto 20 ml						
				Dispenser Auto 50 ml						

No	Objective	Program for Improved Varieties		Main Facilities	Product					
					5 years		10 years		15 years	
					Tangible	Intangible	Tangible	Intangible	Tangible	Intangible
				Analytical Balance (External calibration)						
				Analytical Balance (External calibration)						
				PIPETTE; Matrix Hybrid Single Channel Pipette 0.5-12.5ul (elokarsa)						
				PIPETTE; Matrix Hybrid Single Channel Pipette 20-300ul (elokarsa)						
				Waterbath						
				Refrigerator -6 C						
				Seedburo Digital Thermohygrometer						
				Microscope research						
				Refrigerator -6C						
				Almaco Air Blast Seed Cleaner						
				Seedburo Digital Thermohygrometer						
				Pinset						
				Oven						
				Pollen sieve/extractor						
				Laboratory husker model MTH- 35 A						
				Digital Refractometer						
				Udy cyclone sample mill						
				Small bundle thresher						
				QA Ripening Kit						
				Magnifier lamp						
				gas syringes						
				Quantum light meter						
				Z995 FluorPen PAR						

No	Objective	Program for Improved Varieties		Main Facilities	Product					
					5 years		10 years		15 years	
					Tangible	Intangible	Tangible	Intangible	Tangible	Intangible
				Z230 Arch FlourCam						
				Data loggers						
				Sealing machine (aluminium foil bags/ Cans)						
				Sleves, graded						
				Storage trays plastic						
				Laminar Air Flow Cabinet Airstream Horizontal Laminar Flow With Microprocessor Include : UV Lamp, Front cover, support stand						
				Autoclave						
				Water Purifier						
				Glass ware (package)						
		Release and Dissemination	1. Participatory varietal selection 2. Farmer field trials with accompanying technologies 3. Develop licensing system for farmers	Computer and ICT Facilities	local access information	Developing capacity of human resources	intranet access information	Developing capacity of human resources	Internet access information	Developing capacity of human resources

No	Objective	Program for Improved Varieties	Main Facilities	Product					
				5 years		10 years		15 years	
				Tangible	Intangible	Tangible	Intangible	Tangible	Intangible
2	Improved Crop Production Technolo-gy	Response of crop to global warming (High temperature, dry, low solar radiation), new improved varieties, and better quality of product (rice, corn, soybean, vegetables, and fruits)	Phytotron						
			Rhyzotron, Tractor, Irigation system, Cars for transporting production input and products, Tresher, dryer	5 Improve crop production technology in new improve varieties; Good Agriculture Practices of food and horticulture crops	Developing capacity of human resources ; Improve quality of agriculture products	10 Improve crop production technology in new improve varieties; Good Agriculture Practices of food and horticulture crops	Developing capacity of human resources ; Improve quality of agriculture products	15 Improve crop production technology in new improve varieties; Good Agriculture Practices of food and horticulture crops	Developing capacity of human resources ; Improve quality of agriculture products
		Root response to global warming (High temperature, dry, low solar radiation), new improved varieties, and better quality of product (rice, corn, soybean, vegetables, and fruits)	Jeol PC Scanning Electron Microscope (PCSEM) model JSM-6510 LV Low Vacuum SEM						
			Visible Spectrophotometer (72 seroies)						
			Infrared soil nutrient tester						
		Morphological and analytical to global warming (High temperature, dry, low solar radiation), new improved varieties, and better quality of product (rice, corn, soybean, vegetables, and fruits)	HPLC Shimadzu						
			Infraspec NR800						
			Agilent 7890A/7000A GC/MSMS EI System						
		Physiological response to global warming (High temperature, dry, low solar radiation), new improved varieties, and better quality of product (rice, corn, soybean, vegetables, and fruits)	LCMS-8030						
			LICOR LI 6400						

No	Objective	Program for Improved Varieties	Main Facilities	Product					
				5 years		10 years		15 years	
				Tangible	Intangible	Tangible	Intangible	Tangible	Intangible
3	High Quality Seed	Reproductive biology of seed plants in the framework of quality seed production	40X - 1600X TRINOCULAR, Embedding Station uses modular components, COMPOUND LIGHT MICROSCOPE DIGITAL IMAGE CAPTURE SYSTEM PORTABLE STURDY CASE CAMERA FOR TELEVISION	5 varieties of extention seed, 2 artificial seed production techniques, 2 techniques for seed treatment, 2 new techniques of seed analysis, 1 new seed testing equipment, 1 new seed processing equipment	National seed policies; 30 seed engineers, 20 seed scientists (MSc & Dr)	10 varieties of extension seed, 5 artificial seed production techniques, 5 techniques for seed treatment, 5 new techniques of seed analysis, 2 new seed testing equipments, 2 new seed processing equipment	National seed policies; 60 seed engineer. 30 seed scientists (MS & Dr)	15 varieties of extension seed, 15 artificial seed production techniques, 10 techniques for seed treatment, 15 new techniques of seed analysis, 3 new seed testing equipments, 3 new seed processing equipment	National seed policies; 100 seed engineers. 60 seed scientists (MSc & Dr)
		Seed production technology including artificial seeds	Fumehood, PCR Machine, Electrophoreses chamber, micropipette, microwave, shaker, vortex, waterbath shaker, tip + rak micropipette Refrigerator, Glassware, Polaroid camera, microscope stereo dengan camera, laminair air flow, Autoclave, Dish Washer, Exhausted fan						
		Handling and storage in order to maintain the viability and seed vigor	Seedburo Digital Thermohygrometer, Vacuum Packaging Machine(DXDK300), dehumidifier, AC, pH meter digital, thermohygrograph, germinator, Enclosed Spiral separator, Grainmill Laboratory Aspirator, Mater Mat-						

No	Objective	Program for Improved Varieties	Main Facilities	Product					
				5 years		10 years		15 years	
				Tangible	Intangible	Tangible	Intangible	Tangible	Intangible
			Osu Laboratory Debearder, Westrup LA-H Laboratory Brush Machine, Westrap LA-T Laboratory Indent Separator, Seed Chlorophyll Flourensecence, Chlorophyll Meter (SPAD-502)						
		Seed invigoration, Biological seed treatment for improving health and quality of seed	INCUBATOR IFA 110L-1, Refrigerator - 6C, SEEDBURO PORTABLE SIEVE SHAKERS, Laboratory model CC centric coater, Glass wares, Micro pipettes, Vortex mixer, Incubator Shaker With Accessories Block P-12/100 Biosan ES-20, Homogenizer, Laminar air flow, Freezer, Refrigerator, NUV, Centrifuge, Microscope inokuler, Autoclave, magnetic stirrer, Stereo microscope, bunsen, Ose, Dreglaski, Shaker, microscope compound dengan kamera, Germinator, Bayer Crop Science Batch Lab Treater						

No	Objective	Program for Improved Varieties	Main Facilities	Product					
				5 years		10 years		15 years	
				Tangible	Intangible	Tangible	Intangible	Tangible	Intangible
3	High Quality Seed	Development of seed analysis techniques and methods of seed	Vacuum Seed Counting and Planting, INCUBATOR IFA 110L-1, Accelerated aging chamber, X-Ray Sorting for Pumpkin, CA-10 Carbon Dioxide Analyzer Seed (7044F), Glasswares, Chlorophyll Meter (SPAD-502), Analitical balance, PCR mechine, Micropipet, Electroforesis chamber, Vortex, Autoclave, microwave, mortar						
		Review systems and seed policies	Computer and ICT Facilities						
		Design and development of processing equipment, testing, and simulation of seed longevity and Modeling of seed development	Seed blower, Gravity table, Air screen cleaner, 6" Nickel-Plated Bag trier, 11 5/8" Rice Trier, 12" Nickel-Plated Bag Trier, Vacuum Packaging Machine(DXDK300), Purity analysis desk, Analytical Dishes, PERTEN LABORATORY MILL 3303, Rice Miller Tester, SEEDBURO ANTI-STATIC WEIGH BOATS, Desiccator,						

No	Objective	Program for Improved Varieties	Main Facilities	Product					
				5 years		10 years		15 years	
				Tangible	Intangible	Tangible	Intangible	Tangible	Intangible
			Oven, DOLE MODEL 400 Moisture Tester, Seed counter, Glasswares, Pinset, Light Dark Germinator, Seedburo consule germinator, Water bath, Spectrophotometer, Analitical balance, Rectal Magnifier with lamp, pH meter, Conductivity meter						

Appendix 4-5: List of Equipment and Research Topic: IPB

No	Objective	Program for Improved Varieties		Main Equipment	Product					
					5 years		10 years		15 years	
					Tangible	Intangible	Tangible	Intangible	Tangible	Intangible
1	Improved Varieties	Collection of germplasm	1. Diversification of gene pool through exploration and introduction	Microbiology safety Cabinet (ESCO)	Increase of species number and entry of each species	Developing capacity of human resources : researchers and local community	Increase of species number and entry of each species	Developing capacity of human resources : researchers and local community	Increase of species number and entry of each species	Developing capacity of human resources : researchers and local community
			2. Development of effective collection system	Deep Freezer (-84C)						
			3. Development of effective identification and retrieval system	Flow Cytometry						
			4. Development of germplasm exchange programs with other institutions	Mobile Incenerator						
			5. Germplasm description,	Liquid Handling						
			6. Development of data base and bioinformatic system	Spectrophotometer for DNA/RNA and Routine Analysis						
			7. Development of barcode system for local genetic materials	Rapid PCR Machine						
			8. Conservation and Cryopreservation of elite lines	Portable PCR and Extraction DNA						
			9. Collection of underutilized crops	Extraction Engine (Extract DNA Automatic)						

No	Objective	Program for Improved Varieties		Main Equipment	Product					
					5 years		10 years		15 years	
					Tangible	Intangible	Tangible	Intangible	Tangible	Intangible
		Characterization of Germ-plasms	1. Characterization for adaptation to specific agroecosystem	LightScanner® System	5 candidate genes will be characterized and 5 marker can be used for marker assisted selection; 10 crops species in the laboratory ready for mass production (food crops, Horticultural Crops and Estate Crops) or fornon conventional breeding program	Developing capacity of human resources and lab capacity: Developing capacity of human resources : researchers and local community and technology for micropropaga-tion and regeneration from plant cell	10 candidate genes will be characterized and 5 marker can be used for marker assisted selection; 15 crops species in the laboratory ready for mass production (food crops, Horticultural Crops and Estate Crops) or for non conventional breeding program	Developing capacity of human resources and lab capacity : Developing capacity of human resources : researchers and local community and technology for micropropaga-tion and regeneration from plant cell	18 candidate genes will be characterized and 5 marker can be used for marker assisted selection ; 20 crops species in the laboratory ready for mass production (food crops, Horticultural Crops and Estate Crops) or for non conventional breeding program	Developing capacity of human resources and lab capacity ; Developing capacity of human resources : researchers and local community and technology for micropropa-gation and regeneration from plant cell
			2. Characterization for nutritional and antinutritional values	Thermo Scientific KingFisher Flex						
			3. Characterization for product suitability	Swift Stereo microscopes						
		Selection method-logy	1. Development of through put selection methodologies for adaptive and economic characters	Analytical Balance (External calibration)						
			2. Development of gene specific markers for adaptive and economic characters	Drying Chamber						
		Breeding program	1. Inheritance study of adaptive and economic characters	Ceramic Hotplate						
			2. Breeding for adaptation to specific agroecosystem	Analytical Balance (Exsternal calibration)						
			3. Improvement of nutritional content of adapted genotypes	Grinder						

No	Objective	Program for Improved Varieties		Main Equipment	Product					
					5 years		10 years		15 years	
					Tangible	Intangible	Tangible	Intangible	Tangible	Intangible
			4. Breeding for disease resistance	Analytical Balance (Exsternal calibration)						
			5. Development of somatic embryogenic to support conventional seeds	Drying Chamber						
			6. Development of hybrid and non-hybrid varieties of food, horticulture and estate crops	Ceramic Hotplate						
			7. Development of finger printing for the improved varieties	Analytical Balance (Exsternal calibration)						
			8. Development of protocol for synthetic seeds	Grinder						
			9. In vitro propagation of vegetatively propagated crops	Mikroskop binokuler						
			10. Participatory varietal selection	LightScanner® System						
			11. Farmer field trials with accompanying technologies	4300 DNA Analyzer						
			12. Develop licensing system for farmers and seed industries	C1000TM Thermal Cycler with dual 48/48 Fast Reaction Module						
			13. Training for farmers and breeders	NanoDrop 8000						

No	Objective	Program for Improved Varieties	Main Equipment	Product					
				5 years		10 years		15 years	
				Tangible	Intangible	Tangible	Intangible	Tangible	Intangible
		14. Improvement of nutritional content of adapted genotypes	NanoDrop 2000						
		15. Breeding for disease resistence	Snowflake Ice Machine for laboratory						
		16. Plant and cell collection technic	Water distillater						
		17. Non convensional breeding through gene transfer and plant cell culture	Heraeus Biofuge Stratos Centrifuge						
		18. Biodiversity and genetic variation study	Computer plus software for analysis (Joinmap)						
		19. QTL study of interesting traits	Computer plus software for analysis (MapQTL)						
		20. Advance phenotyping study (metabolomic study)	GC-2010						
		21. Candidate gene study	GCMS-QP2010S						
		22. Confirmation study and Marker development for MAS	LCMS-8030						
		23. In vitro propagation and cell culture (Embryogenesis, haploid culture, protoplast fusion)	Nexera						

No	Objective	Program for Improved Varieties		Main Equipment	Product					
					5 years		10 years		15 years	
					Tangible	Intangible	Tangible	Intangible	Tangible	Intangible
				Unstirred waterbath NE & NE2 series Precision Water Bath 283 digital MaxQ 2000 Shaker - Digital Super-Nuova Ceramic 4-point Stirring Hot Plate Pico 21 Fresco 21R QIAxcel QIAgility Rotor-Gene®Q HiScanSQ Greenhouse Heratherm OGH100- S Advanced Security Revco 51.1 cf Laboratory Refrigerator Revco Ultima plus 17 cf Chest Freezer Water Distiler Airstream Horizontal Laminar airflow Support Stand, Airstream Horizontal Laminar Airflow PORTABLE AUTOCLAVE, 22 L ENVIRONMENTA L SHAKER INCUBATOR Orbital shaker Ultrasonic cleaner Dispenser Auto 20 ml						

No	Objective	Program for Improved Varieties		Main Equipment	Product					
					5 years		10 years		15 years	
					Tangible	Intangible	Tangible	Intangible	Tangible	Intangible
				Dispenser Auto 50 ml						
				Analytical Balance (External calibration)						
				Analytical Balance (External calibration)						
				PIPETTE; Matrix Hybrid Single Channel Pipette 0.5-12.5ul (elokarsa)						
				PIPETTE; Matrix Hybrid Single Channel Pipette 20-300ul (elokarsa)						
				Waterbath						
				Refrigerator -6 C						
				Seedburo Digital Thermohygrometer						
				Microscope research						
				Refrigerator -6C						
				Almaco Air Blast Seed Cleaner						
				Seedburo Digital Thermohygrometer						
				Pinset						
				Oven						
				Pollen sieve/extractor						
				Laboratory husker model MTH- 35 A						
				Digital Refractometer						
				Udy cyclone sample mill						
				Small bundle thresher						
				QA Ripening Kit						
				Magnifier lamp						

No	Objective	Program for Improved Varieties		Main Equipment	Product: 5 years – Tangible	Product: 5 years – Intangible	Product: 10 years – Tangible	Product: 10 years – Intangible	Product: 15 years – Tangible	Product: 15 years – Intangible
				gas syringes Quantum light meter Z995 FluorPen PAR Z230 Arch FlourCam Data loggers Sealing machine (aluminium foil bags/ Cans) Sleves, graded Storage trays plastic Laminar Air Flow Cabinet Airstream Horizontal Laminar Flow With Microprocessor Include : UV Lamp, Front cover, support stand Autoclave Water Purifier Glass ware (package)						
		Release and Dissemina-tion	1. Participatory varietal selection	Computer and ICT Facilities	local access information	Developing capacity of human resources	intranet access information	Developing capacity of human resources	Internet access informatin	Developing capacity of human resources
			2. Farmer field trials with accompanying technologis							
			3. Develop licensing system for farmers							

No	Objective	Program for Improved Varieties	Main Equipment	Product					
				5 years		10 years		15 years	
				Tangible	Intangible	Tangible	Intangible	Tangible	Intangible
2	Improved Crop Production Technolo-gy	Respones of crop to global warming (High temperature, dryu, low solar radiation), new improved varieties, and better quality of product (rice, corn, soybean, vegetables, and fruits)	Phytotron Rhyzotron, Tractor, Irigation system, Cars for transporting production input and products, Tresher, dryer	5 Improve crop production technology in new improve varieties; Good Agriculture Practices of food and horticulture crops	Developing capacity of human resources ; Improve quality of agriculture products	10 Improve crop production technology in new improve varieties; Good Agriculture Practices of food and horticulture crops	Developing capacity of human resources ; Improve quality of agriculture products	15 Improve crop production technology in new improve varieties; Good Agriculture Practices of food and horticulture crops	Developing capacity of human resources ; Improve quality of agriculture products
		Root respones to global warming (High temperature, dryu, low solar radiation), new improved varieties, and better quality of product (rice, corn, soybean, vegetables, and fruits)	Jeol PC Scanning Electron Microscope (PCSEM) model JSM-6510 LV Low Vacuum SEM Visible Spectrophotometer (72 seroies) Infrared soil nutrient tester						
		Morphological and analitical to global warming (High temperature, dryu, low solar radiation), new improved varieties, and better quality of product (rice, corn, soybean, vegetables, and fruits)	HPLC Shimadzu Infraspec NR800						
			Agilent 7890A/7000A GC/MSMS EI System						
		Physiological respone to global warming (High temperature, dryu, low solar radiation), new improved varieties, and better quality of product (rice, corn, soybean, vegetables, and fruits)	LCMS-8030						
			LICOR LI 6400						

No	Objective	Program for Improved Varieties	Main Equipment	Product					
				5 years		10 years		15 years	
				Tangible	Intangible	Tangible	Intangible	Tangible	Intangible
3	High Quality Seed	Reproductive biology of seed plants in the framework of quality seed production	40X - 1600X TRINOCULAR, Embedding Station uses modular components, COMPOUND LIGHT MICROSCOPE DIGITAL IMAGE CAPTURE SYSTEM PORTABLE STURDY CASE CAMERA FOR TELEVISION	5 varieties of extension seed, 2 artificial seed production techniques, 2 techniques for seed treatment, 2 new techniques of seed analysis, 1 new seed testing equipment, 1 new seed processing equipment	National seed policies; 30 seed engineers, 20 seed scientist (MSc & Dr)	10 varieties of extension seed, 5 artificial seed production techniques, 5 techniques for seed treatment, 5 new techniques of seed analysis, 2 new seed testing equipment, 2 new seed processing equipment	National seed policies; 60 seed engineer. 30 seed scientist (MS & Dr)	15 varieties of extension seed, 15 artificial seed production techniques, 10 techniques for seed treatment, 15 new techniques of seed analysis, 3 new seed testing equipment, 3 new seed processing equipment	National seed policies; 100 seed engineers. 60 seed scientist (MSc & Dr)
		Seed production technology including artificial seeds	Fumehood, PCR Machine, Electro foresis chamber, micropipette, microwave, shaker, vortex, waterbath shaker, tip + rak micropipet Refrigerator, Glassware, Polaroid camera, microscope stereo dengan camera, laminair air flow, Autoclave, Dish Washer, Exhausted fan						
		Handling and storage in order to maintain the viability and seed vigor	Seedburo Digital Thermohygrometer, Vacuum Packaging Machine (DXDK300), dehumidifer, AC, pH meter digital, thermo						

No	Objective	Program for Improved Varieties	Main Equipment	Product					
				5 years		10 years		15 years	
				Tangible	Intangible	Tangible	Intangible	Tangible	Intangible
			hygrograph, germinator, Enclosed Spiral separator, Grainmill Laboratory Aspirator, Mater Mat-Osu Laboratory Debearder, Westrup LA-H Laboratory Brush Machine, Westrap LA-T Laboratory Indent Separator, Seed Chlorophyll Flourensecence, Chlorophyill Meter (SPAD-502)						
		Seed invigoration, Biological seed treatment for improving health and quality of seed	INCUBATOR IFA 110L-1, Refrigerator -6C, SEEDBURO PORTABLE SIEVE SHAKERS, Laboratory model CC centri coater, Glass wares, Micro pipettes, Vortex mixer, Incubator Shaker With Accessories Block P-12/100 Biosan ES-20, Homogenizer, Laminar air flow, Freezer, Refrigerator, NUV, Sentrifuge, Microscope inokuler, Autoclave, magnetic stirrer, Stereo microscope, bunsen, Ose, Dreglaski,						

No	Objective	Program for Improved Varieties	Main Equipment	Product					
				5 years		10 years		15 years	
				Tangible	Intangible	Tangible	Intangible	Tangible	Intangible
			Shaker, microscope compound dengan camera, Germinator, Bayer Crop Science Batch Lab Theater						
3	High Quality Seed	Development of seed analysis techniques and methods of seed	Vacuum Seed Counting and Planting, INCUBATOR IFA 110L-1, Accelerated aging chamber, X-Ray Sorting for Pumpkin, CA-10 Carbon Dioxide Analyzer Seed (7044F), Glass wares, Chlorophyll Meter (SPAD-502), Analitical balance, PCR machine, Micropipette, Electrophoresis chamber, Vortex, Autoclave, microwave, mortar	5 varieties of extension seed, 2 artificial seed production techniques, 2 techniques for seed treatment, 2 new techniques of seed analysis, 1 new seed testing equipment, 1 new seed processing equipment	National seed policies; 30 seed engineers, 20 seed scientist (MSc & Dr)	10 varieties of extension seed, 5 artificial seed production techniques, 5 techniques for seed treatment, 5 new techniques of seed analysis, 2 new seed testing equipment, 2 new seed processing equipment	National seed policies; 60 seed engineer. 30 seed scientist (MS & Dr)	15 varieties of extension seed, 15 artificial seed production techniques, 10 techniques for seed treatment, 15 new techniques of seed analysis, 3 new seed testing equipment, 3 new seed processing equipment	National seed policies; 100 seed engineers. 60 seed scientist (MSc & Dr)
		Review systems and seed policies	Computer and ICT Facilities						
		Design and development of processing equipment, testing, and simulation of seed longevity and Modeling of seed development	Seed blower, Gravity table, Air screen cleaner, 6" Nickel-Plated Bag trier, 11 5/8" Rice Trier, 12" Nickel-Plated Bag Trier, Vacuum Packaging Machine (DXDK300), Purity analysis desk, Analytical Dishes, PERTEN						

No	Objective	Program for Improved Varieties	Main Equipment	Product					
				5 years		10 years		15 years	
				Tangible	Intangible	Tangible	Intangible	Tangible	Intangible
			LABORATORY MILL 3303, Rice Miller Tester, SEEDBURO ANTI-STATIC WEIGH BOATS, Desiccator, Oven, DOLE MODEL 400 Moisture Tester, Seed counter, Glass wares, Pinset, Light Dark Germinator, Seedburo consule germinator, Water bath, Spectrophotometer, Analytical balance, Rectal Magnifier with lamp, pH meter, Conductivity meter						

Appendix 5: Tentative List of Equipment and Research Topic: ITS

Appendix5-1
Marine Technology (Environmentally Friendly Marine Machineries)

Topics	Sub Topics	Expected Outcome	Necessary Equipment	Request
Environmentally Friendly Marine Machineries	Alternative Energy for ship propulsion		Fuel Oil Analyzer	JICA
			Software TANK	JICA
			GT Suite	JICA
	Development design for marine machinery of small vessel and fishing vessel		Portable Torque meter	JICA
			Small Marine Diesel Engine test bed	JICA
			Software CAESAR II	JICA
			Software CADWorx	JICA
	Non conventional propeller design and propulsion system for energy saving		Workstation Tower 2-socket CPU	JICA
			Server Rack 4-socket CPU	JICA
			Rack System Server	JICA
			Hard disk Server External Support Rack System And Server	JICA
			Software CFD Package	JICA
			Software ANSYS 12 Package	JICA
			Software CAD 2D/3D	JICA
			Ultrasonic Range Finder	JICA
			Software Inventor	JICA
			Software Maxsurf Professional	JICA
			Software Solidworks Professional	JICA
			Scan Propeller (155-1000)mm	JICA
			5 AXIS VERTICAL MACHINING CENTER	JICA
			TURNING WITH Y AXIS MILLING CENTER	JICA
			Master CAM	JICA
			Plotter + Scanner	JICA
			Camcorder Professional	JICA
			Monitor	JICA
	Decision support system for marine machinery maintenance management		Lubricating Oil Analyzer	JICA
			Condition Monitoring Equipment, Microlog The GX-M Series (CMXA 70-M-K-SL) (for Education Institution Price)	JICA
			Sound Level Meter & Calibrator: Type 2 Model LXT2	JICA
	Emission reduction from vessel engine		Exhaust Gas Analyzer	JICA
			Fuel Emulsifier	JICA

Appendix5-2
Marine Technology (Development of Ship Design and Production System)

Topics	Sub Topics	Expected Outcome	Necessary Equipment	Request
Development of Ship Design and Production System	3.1. Innovative design of marine vehicle suitable for small islands and shallow water area		Computer CPU	A: JICA
			LCD Monitor	A: JICA
			Software Cad (latest version)	A: JICA
			Software 3D Max (latest version)	A: JICA
			Software Maxsurf Professional	A: JICA
			Smart Marine 3D (the latest Version)	A: JICA
	3.2. Design of fishing vessel with good sea-keeping performance		Wave maker	A: JICA
			Portable GPS	A: JICA
			Camera	A: JICA
			Handycam	A: JICA
			Software CFD	A: JICA
	3.3. Development of traditional fishing vessel technology		Computer CPU	A: JICA
			LCD Monitor	A: JICA
			Digital Underwater Camera Elite Set	A: JICA
	3.4. Innovative design and development of fishing gears appropriate for EPI		Computer CPU	A: JICA
			LCD Monitor	A: JICA
	3.5. Cold-chain management on fishery industries		Computer CPU	A: JICA
			LCD Monitor	A: JICA
	3.6. Sustainable and environmental friendly for ship production system		Manual Precision Lathe Machine	
			Vertical & Horizontal Milling Machine	
			Manual Shaping Machine	
			Thyristor DC MIG/MAG Welding Machine	
			SMAW DC Welding Machine	
			TIG Welding Torch Gun	
			Hack Saw Machine	
	3.7. New material (alternative) for ships		DAS System for ESH Testing Machine 50 tons	A: JICA
			High Power Metallurgical Microscope MM10A RaxVision	A: JICA
			Nawoo MY-2 Electromagnetic AC Yoke with Articulated Leg 230VAC/50Hz	A: JICA
			Nawoo UV-100 Black Light 100W 230VAC/50Hz	A: JICA
			SH-21 Ultrasonic portable hardness tester (KE-4)	A: JICA
			UT Flaw Detector	A: JICA
			Baitospot CERAM235 Portable X-Ray 235KV-5mA	A: JICA
			Rockwell Type hardness testing Machine	A: JICA
			OMNI-P-PA16128 OmniScan MX and 16:128 Phased Array acquisition module for manual UT inspection (with 1 UT channel). Included: AC Adapter, 1 battery, small carrying case, 2GB CompactFlash card, CompactFlash Reader, CD-ROM including OmniScan software user manuals.	
	3.8. Development of new analysis concept of ships Structures		Advanced Ultrasonic corrosion gage	A: JICA
			MD Nastran	A: JICA

Appendix5-3
Marine Technology (Marine Accident and Casualties)

Topics	Sub Topics	Expected Outcome	Necessary Equipment	Request
Marine Accident and Casualties	Human factor contribution to safety operation and design of vessels	understanding the contribution of human error to marine incident	Intel Fortran Compiler	JICA
			Personal Computer	JICA
			Server	JICA
			UPS	JICA
			Storage server	JICA
			Monitor	JICA
			Thermograph	JICA
			Eye tracking devices	JICA
			Heart beat telemeter	JICA
	Marine traffic assessments		MATLAB Family	JICA
			Computer-based bridge simulator Software	JICA
	Risk management of marine systems	assessment on reliability, availability and maintenance management to reduce risks of marine systems	ArcView 9.3	JICA
			ArcGIS Spatial Analyst 9.3.1	JICA
			ArcGIS Tracking Analyst 9.3.1	JICA
			Micro Saint Sharp Gold	JICA
			ReliaSoft® Family	JICA
			Portable Global Positioning System	JICA
	Measures to reduce marine accident and casualties	understanding factors contribute to marine incidents	MaritimeEXODUS	JICA
			SmarthFire	JICA
	Development of tools for marine crew training		Computer-based Medium Speed Marine Engine simulator	JICA
			Computer-based Low Speed Engine Room simulator	JICA
			Piping Systems FluidFlow3 family	JICA

Appendix5-4
Marine Technology (Efficient and Safe Marine Transport)

Cluster	Topics	Sub Topics	Expected Outcome	Necessary Equipment	Request
M.1. Efficient and Safe Marine Transport	M.1.1. Maritime Logistics in Archipelagic Areas	M.1.1.1. Energy transport	Understanding the marine transport behavior of energy in EPI and developing innovation concept of transport vehicle for energy such as LNG, coal, etc	SERVER IBM X 3850 M3 & client	A: JICA
				RISK SOLVER SOFTWARE	JICA
		M.1.1.2. Conceptual design innovation on ferry	Identification ferry hazard and problems and developing innovation concept in design ferry especially for EPI	HP Pavilion A6638D Desktop	JICA
				UPS, Monitor & Accessories	
				AUTOCAD SOFTWARE	JICA
		M.1.1.3. Marine transportation infrastructures	Developing design of infrastructure for EPI	ARENA SIMULATION SOFTWARE	JICA
				SERVER IBM X 3850 M3 & client	A: JICA
				PLAXIS v.10.0	A: JICA
		M.1.1.4. Roles of shipping on small islands economy	better understanding significant economic parameter driven related to logistics and shipping	SERVER IBM X 3850 M3 & client	A: JICA
		M.1.1.5. Marine transport telemetric	Research and developing computer program and ICT for marine transport and shipping cooperation with industries	Personal Computer	A: JICA
				UPS, Monitor & Accessories	
				SERVER IBM X 3850 M3 & client	A: JICA
		M.1.1.6. Logistics system for small islands in EPI	developing of logistics model for transportation of EPI	Optimization Software	A: JICA
		M.1.1.7. Cargo handling for small island transport	understanding handling behavior of cargoes for transport specification at EPI and developing of innovative design concept	Personal Computer	A: JICA
				UPS, Monitor & Accessories	

Appendix5-5
Marine Technology (Exploration Technology of Marine Natural Resources and Energy)

Cluster	Topics	Sub Topics	Expected Outcome	Necessary Equipment	Request
M.2. Sustainable exploration of marine resources and environment	M.2.5. Exploration Technology of Marine Natural resources and Energy	M.2.5.1. Design development of floating structures for energy resources	understanding the interaction between structure and hydrodynamic to offshore floating structure for	MOSES	A: JICA
				ORCINA	A: JICA
				SACS	A: JICA
		M.2.5.2 Development of under water system and technology	understanding the underwater system and interaction between structure and hydrodynamics for underwater system such as pipeline, riser, PLEM, etc	SHEAR 7	A: JICA
				ANSYS AQWA Hydrodynamic Analysis	A: JICA
		M.2.5.3 Ocean and deep water energy	understanding and capability in design of facility for offshore renewal energy such as wave energy, current energy and wind offshore energy	SERVER IBM X 3850 M3	A: JICA
				ANSYS FLUID DYNAMICS version 13.0	JICA
			Local microbial isolates for potential agent producing friendly gas hydrogen as alternative energy	Acid safety cabinet	JICA
				GCMS	JICA
				Floor shaker incubator	JICA
				Multichannel micropipettes	JICA
				Multichannel micropipettes	JICA
				Multichannel micropipettes	JICA
		M.2.5.4 Deep ocean water application	Understanding and development application of ocean water for industrial purposes	Magnetic Particle Inspection:	A:JICA
				Permanent Yoke PM-50	JICA
				Handy Magna MP-2D, DC Yoke	JICA
				Electric Yoke Y-6 “Magnaflux”	JICA
				UV Lamp / Black Light BD-100	JICA
				Test Bar 10 pound	JICA
				Gauss Meter Field Indicator	JICA
				Model A Brass Sprayer S. Steel	JICA
				WCP Mi-Glow	JICA
				Black Ink 820AX	JICA
				920 P Magnetic Flourescen Powder	JICA
				Dye Penetrant Test :	
				Developer Magnaflux	JICA
				Penetrant Magnaflux	JICA
				Cleaner Magnaflux	JICA
				Fluorescent Penetrant	JICA
				Comparator Aluminum Test Panel	JICA

Cluster	Topics	Sub Topics	Expected Outcome	Necessary Equipment	Request
				UT Test: Olympus Panametric UT Thickness Gage	JICA
				Olympus Panametrics UT Flaw Detector EPOCH LTC Digital Ultrasonic Flaw Detector	JICA
				A549S-SM Angle Transducer	JICA
				ABWM-7T-45 Angle Wesge	JICA
				ABWM-7T-60 Angle Wedge	JICA
				ABWM-7T-70 Angle Wedge	JICA
				BCM-74-6	JICA
				TB7541-1 V1 Test Block	JICA
				G-2 Medium Temp. Couplant 2 oz	JICA
				Radiography Test:	JICA
				X-Ray Machine	JICA
				Film Viewer KDE	JICA
				DENSITOMETER DIGIT X – X OGRAPH	JICA
				Digital Survey Meter	JICA
				Pocket Dosimeter	JICA
				Charger Pocket Dosimeter	JICA
				Radiation Flag	JICA
				Long tongue 1,5 meter	JICA
				Apron	JICA
				Film lead Screen Uk. 4” x 10”	JICA
				Film Lead Screen Uk. 4” x 15”	JICA
				Film Cassette Uk. 4” x 10”	JICA
				Film Cassette Uk. 4” x 15”	JICA
				Lead Letter A – Z	JICA
				Lead Number 0 – 9	JICA
				DR-10 Safety Lamp	JICA
				Developing Tank Steel	JICA
				Penetrameter FE Wire 6 FE EN 2”	JICA
				Penetrameter FE Wire 10 FE EN 2”	JICA
				Penetrameter FE Wire 1 FE EN 2”	JICA
				Film FOMA R4/R5/R7IF Uk. 4” x 10”	JICA
				Film FOMA R4/R5/R7IF Uk. 4” x 15”	JICA
				FOMA FIX	JICA
				FOMA DEV	JICA
		M.2.5.5 Aquaculture	understanding the behavior of fish and underwater habitat and the structure interaction	ROV (Remote Operated Vehicle)	A:JICA
				ANSYS Structural version 13.0	JICA

Cluster	Topics	Sub Topics	Expected Outcome	Necessary Equipment	Request
				Spectrophotometer	JICA
				Oven	JICA
				pH/ORP/EC/TDS/NaCl/ Temperature Laboratory Bench Meter	JICA
				Chest freezer volume 300 L	JICA
		M.2.5.6 Coastal and marine resources health assessment	assessment on coral reef health, coverage, recruitment and intertidal organism for marine environment monitoring and rehabilitation	Direct Reading Electromagnetic Current Meter	JICA
				Underwater camera with housing	JICA
				Compressor, Bauer Type : Junior	JICA
				Nabertherm Professional Furnace	JICA
				Van Dorn water sampler	JICA
				Plankton Net Flowmeter (General Oceanic Mechanical Flowmeter)	JICA
				Spectrophotometer	JICA
			An inventory, understand & conserve local natural resources (Coastal and Terrestrial Environments)	Wildco Surber Type Stream Bottom Sampler	JICA
				Soiltech Digital Soil PH, Temperature, Light and Moisture Meter	JICA
				Tinytag Plus 2 Dual Channel Temperature and Relative Humidity Data Logger.	JICA
				Insect Collecting & Mounting Starter Kit	JICA
			An inventory, understand & conserve local natural resources on Coastal Environment	Inverted Microscope (Research Inverted System Microscope Phase Contrast with Micro Digital Imaging standard set)	JICA
				pH/ORP/EC/TDS/NaCl/ Temperature Laboratory Bench Meter	JICA
				WaterMark Surber Type Stream Bottom Sampler	JICA
		M.2.5.7 Information system for marine and coastal management	developing of marine information system and marine informatics	Notebook	JICA
				HP ProLiant ML370 G6 Server	JICA
				HP Pavilion A6638D Desktop	JICA
				Handycam / Camcorder DVD	JICA
				Projector	JICA
				UPS	JICA
				Cable Network Rj - 45	JICA
				Intel Fortran Compiler	JICA
				Autodesk AutoCAD 2010 Fullversion	JICA
				Matlab product Family	JICA
				Printer Laser Color	JICA
			Local microbial isolate collection and bioinformatical data bank	Centrifuge	JICA
				PCR machine	JICA
				Vertical Electrophoresis	JICA
				Horizontal Electrophoresis	JICA
				Power Supply	JICA

Cluster	Topics	Sub Topics	Expected Outcome	Necessary Equipment	Request
				Integrated Pure and Ultra Pure Water Purification System	JICA
				Chest freezer volume 300 L	JICA
				Multichannel micropipettes	JICA
				Multichannel micropipettes	JICA
				Multichannel micropipettes	JICA
				UV/VIS for DNA/RNA/Protein measurement	JICA
				Spectrophotometer	JICA

Appendix5-6
Marine Technology (Protection on Coastal and Marine Environment)

Cluster	Topics	Sub Topics	Expected Outcome	Necessary Equipment	Request
M.2. Sustainable exploration of marine resources and environment	M.2.6. Protection on Coastal and Marine Environment	M.2.6.1 Impact of marine hazard to quality of life	understanding of marine hazard and impact to the quality of life people surrounding the coastal area	Sidescan Sonar 1 set	A: JICA
				Van Dorn Water Sampler	A: JICA
				DO Vertical Water Sampler	A: JICA
				DO Test Kit	A: JICA
				Suspended Load / Marine Science sampling & measurement outfit	A: JICA
				PIV System; Visivector G DP3D	A: JICA
				RTK/DGPS Surveying system	A: JICA
				Gravity Core sampler	A: JICA
		M.2.6.2 Soft engineering approach for marine protection	alternative solutions using soft engineering approach for coastal and marine protection against marine hazard	Turbidity Meter	JICA
				Flow Meter	JICA
				Polar Grab	JICA
				Particle Counter	JICA
				Video Housing	JICA
				Fluoresence Microscope	JICA
				Digital Camera for Microscope	JICA
				Stereo microscope	JICA
		M.2.6.3 Coastal morphologies and protection technology	understanding the physical phenomena of coastal processes and development of innovation design methodologies of coastal structures	DELFT 3D Package	A:JICA
				FLOW3D Modeling Package	A:JICA
				Surfacewater Modeling System	A:JICA
			understanding of sediment process and boundary layer phenomena at coastal environment	Sedimentation and boundary layer test	
				Flowexplorer system	
				Dantec Dynamics PIV System	
				Mini wave generator system	
				Oscillating tunnel	
				Accessories	
		M.2.6.4. Impact of global warming and climate change to small islands	understanding the impact of global warm effect and climate change to physical and quality life aspects	MIKE 21 complete module	A:JICA
				Mini basin	A:JICA
				Wave generator system	A:JICA
				Data Acquisition System	A:JICA
				Sensors	A:JICA
				Calibrator	A:JICA
				Accessories	A:JICA
				Wave Height Meter (Wave probe)	A:JICA
				Amplifier for Wave Probes	A:JICA
				Software SONWAVE Pro	A:JICA

Cluster	Topics	Sub Topics	Expected Outcome	Necessary Equipment	Request
				ADP - Sontek 16 MHz Micro ADV	A:JICA
				ADP - Sontek 1.5 MHz Mini ADP	A:JICA
				Hardware & Software for	A:JICA
				Discharge Measurements	A:JICA
				Radio Modem EDL	A:JICA
				Training for Laboratory operation	A:JICA
		M.2.6.5. Marine environment monitoring	understanding of the marine environment changes and its impacts for marine biology	Autoclave	JICA
				Horizontal Laminar air Flow	JICA
				Stereo Microscope	JICA
				Stainless Steel Syringe Holder	JICA
				Benchtop Open Air Shaker	JICA
				Dedicated platform (clumps included) for 125 ml flask	JICA
				Dedicated platform (clumps included) for 250 ml flask	JICA
		M.2.6.6. Marine and coastal pollution prevention	Local microbial isolate for potential agent cleaning the contaminated environments	Digital Autoclave	JICA
				Hot plate stirrer	JICA
				Analytic balance	JICA
				Oven incubator	JICA
				PH METER	JICA
				Floor shaker incubator	JICA
				Chest freezer volume 300 L	JICA
				Multichannel micropipettes	JICA
				Multichannel micropipettes	JICA
				Multichannel micropipettes	JICA

Appendix5-7
ICT

Cluster	Topics	Sub Topics	Expected Outcome	Necessary Equipment	Procure-ment
Information and Communi-cation Technology	Information Technology applications and services	Modeling and Simulation	understanding model for continuous system	CASE Tool	A: JICA
		Requirements Analysis	understanding requirements properties that determine the quality of requirements document	Repository	A: JICA
		Edugame Development	scenario and approach for developing education game for Indonesia student.	Augmented Reality Toolkit	A: JICA
		Model Management System (SCM - IS for Small and Medium Enterprise) SCM - IS for Small and Medium Enterprise (Manufacturing Information System)	Develop information system that provide and support all information related to production process including all activities regarding planning and production	Software	A: JICA
		Model Management System (SCM - IS for Small and Medium Enterprise) SCM - IS for Small and Medium Enterprise (Marketing Information System)	Develop information system that provide and support all information regarding order, market and price analysis, and sales trend	Software	A: JICA
		Model Management System (SCM - IS for Small and Medium Enterprise) SCM - IS for Small and Medium Enterprise (Financial Information System)	Develop information system which provides and support the management of all information regarding balance reports and journals, enabling the analysis of cash flow to support management in marketing decision-making	Software	A : JICA
		Knowledge and Data Management System - Information System for Cloud Social Company	Understanding the Elements of Social Company, and Cloud Works and Workers. Creating the design and execution blueprint for the foundation of cloud social company	Software	A: JICA
			Enabling group of people that work and operate online as a social company. (Output: Information system prototype that manage the operation of Cloud Workers, Contracts, Workflow, and Transaction.)	Software	A: JICA
			Enabling group of people to manage and measure their collaboration as a social company. (Output: Information system prototype that help the manager to monitor, assign, deadline keeping of the works.)	Reference books	A: JICA

Cluster	Topics	Sub Topics	Expected Outcome	Necessary Equipment	Procure-ment
			Enabling other projects to use dashboard components that haven't been developed before. (Output: Reusable collection dashboard components and design that can be implemented for operational and managerial.)	Reference books	A: JICA
		Knowledge and Data Management System - Data and Workflow Management for Small/Home Business	(Output: Design information system with low learning curve to manage the workflow. Develop a prototype and test it on a case study.)	Reference books	A: JICA
			(Output: Capture the most important requirements of unstructured communication. Design information system that pervasively structurized the communication. Develop a prototype and test it on a case study.)	Reference books	A: JICA
			(Output: A prototype of Information System that aggregate structured and unstructured communication. Visualize the information in easy to read and actionable manner.)	Reference books	A: JICA
				Document books	A: JICA
		e-Business Technology and Infrastructure		Document books	A: JICA
				Document books	A: JICA
		IT Strategic Planning, Governance and Audit - IT Strategic Planning	Master planning: strategy and direction of Information Technology (IT) implementation for an enterprise within next coming years	Workstation Tower 2-socket CPU	A: JICA
		IT Tactical Planning	Investment planning:	Server Rack 4-socket CPU	A: JICA
				Rack System Server	A: JICA
		IT Governance	Documents of policy/governance related to IT implementation within an enterprise	Hard disk Server External Support Rack System And Server	A: JICA
				Server	A: JICA
		IT Evaluation (Audit)	Documents of evaluation and recommendation related to IT implementation within an enterprise	Laptop	A: JICA
		Requirement & Software Engineering - Requirement Engineering	- software requirement documentation - techniques for improving requirement specification	Laptop	A: JICA
		Software Engineering	Tool/application/software to solve a problem using IT/IS	Laptop	A: JICA

Cluster	Topics	Sub Topics	Expected Outcome	Necessary Equipment	Procure-ment
		Testing and Implementation of IT/IS	Test case document	Laptop	A: JICA
				Personal Computer	A: JICA
		IT Project Management - Feasibility Study	Feasibility study document	External Hard Drive	A: JICA
		Costing	Cost of activities in a project	UPS	A: JICA
		Project Management	Technique, model, method to manage IT project	UPS	A: JICA
				UPS	A: JICA
		Business Process Reengineering - Mining of transactional business processes	A tool to evaluate the business process of an enterprise information system based on its event logs	Monitor	A: JICA
			A generator of mining-XML to convert .txt and .log into .MXML	Printer	A: JICA
		Business Process Improvement	method/techniques to improve business process of ERP	Printer	A: JICA
		Customizable Enterprise Information System	customizable ERP service intended for Small and Medium Enterprises	Scanner	A: JICA
		Evaluating of IT implementation costing	- Costing model - Costing document related to IT	Switch	A: JICA
				Camera Digital SLR	A: JICA
		Information system security and information assets Protection - Information system security	provide model and solution to information security for e-application in society	UPS	A: JICA
		Digital Forensic		Plotter	A: JICA
		Information assets Protection		Digital Map	A: JICA
		Mobile Computing Security		Scanner	A: JICA
				Camera Digital	A: JICA
				Digitizer	A: JICA
				IP Camera	A: JICA
				Mobile Device	A: JICA
		e-Learning Development for rural and infrastructureless remote areas	developing infrastructure and system distance learning models and e-learning platforms in rural area	Blade server system for central content and computing resources	A: JICA
				Routers	A: JICA
				Routers	A: JICA
				Switches	A: JICA
				Switches	A: JICA
				HF transceivers	C: Ada, A: JICA
				VHF transceivers	C: Ada, A: JICA
				Wireless routers	A: JICA
				Videoconferencing set	A: JICA
				Modem HF/VHF	A: JICA
				Modem HF/VHF, high speed	A: JICA
				UPS	A: JICA

Cluster	Topics	Sub Topics	Expected Outcome	Necessary Equipment	Procure-ment
	Bio medical appliances	Medicare	understanding image properties that indicate the condition of a patient	Humanoid robot	A: JICA
				Image Professional Editor	A: JICA
		Low cost electrolaryns for Indonesian laryngectomiced patient	prototype of electrolaryncs for Indonesian	Physiological Signal Measurement and analysis System	A: JICA
				speech and hearing signal analysis system	A: JICA
				Advanced Humanoid Robot Development system	A: JICA
		Intelligent Electronics for Rehabilitation Engineering	modeling medical rehabilitation	- 3D Motion Capture System - FES electrodes - Physiological data evaluation systems (ECG, EMG, respiratory, etc.)	A: JICA
				- Gyroscope sensors - Accelerometers - Single board computer - Wireless transceiver systems	A: JICA
				- high resolution camera for wound image acquisition to develop noninvasive evaluation of wound healing.	A: JICA
				- Digital stethoscopes - Multi-channel cardiac data acquisition system for cardiac sound characterization, ECG, echocardiography, real-time blood pressure (medical ultrasonic equipment, Pro Sound 2, SSD-650 and software support).	A: JICA
	Intelligent Devices and Systems	Embedded System	Object detection and recognition	Video surveillance on single FPGA Altera	A:JICA
				Universal programmer	A:JICA
				Altera embedded system Development Kits	A:JICA
				Virtex-6 FPGA embedded kit	A:JICA

Cluster	Topics	Sub Topics	Expected Outcome	Necessary Equipment	Procure-ment
				HD Video Surveillance Camera on single FPGA Altera	A:JICA
				Nanoboard NB2	A:JICA
		Odor Detection and Analysis	Odor Analysis in industrial, medical, and environmental fields	Mobile Ultra-Fast GC zNose	A:JICA
		Intelligent and distributed control systems	Model and prototyping of intelligent and distributed control system for industries		
	Communicat-ion and Networks	HF/VHF broadband communication system and network	To develop HF and VHF communication system and network for radio communication applications in Indonesia, e.g., communications for fisheries, sea navigation, communications between infrastructureless remote areas, etc.	HF Broadband Dipole Antenna	A:JICA
				HF Antenna Mast	A:JICA
				HF Antenna Mast	A:JICA
				HF Transceiver	C: sudah ada
				IQ Modulator	A:JICA
				IQ Demodulator	A:JICA
				HF Power Amplifier	B: Other resource
				HF Low-Noise Amplifier	B: Other resource
				VHF Standard Dipole Antenna	A:JICA
				VHF Power Amplifier	B: Other resource
				VHF Low-Noise Amplifier	B: Other resource
				Up-converter	B: Other resource
				Down-converter	B: Other resource
				Pulse Pattern Generator	A: JICA
				ADC board for PC or notebook	B: Other resource
				FPGA-based programmable radio transceiver platform	A: JICA
				mini Vector Network and antenna analyzer	A: JICA
		Broadband multi-antenna indoor wireless communications	To develop high-capacity wireless communication network technology for indoor applications in infrastructureless areas, e.g., offices and schools in remote, backward areas, disaster-damaged areas/buildings, etc.	Programmable platform for multi-antenna communications	A: JICA
				UHF dipole standard antenna	B: Other resource
				UHF biconic antenna	C: sudah ada
				Spectrum analyzer	C: sudah ada
				Vector network analyzer	A:JICA
				FPGA programming platform	C: sudah ada
				Pulse Pattern Generator	A:JICA

Cluster	Topics	Sub Topics	Expected Outcome	Necessary Equipment	Procure-ment
				Multi Axis Antenna Measurement System including Anechoic Chamber	A:JICA
				Signal generator	A:JICA
		Small satellite communication systems	To develop small (pico or nano) satellite communication systems for educational and experimental uses, e.g., emergency communications, remote sensing, etc.	Ground station equipment	C: sudah ada
				PCB etching machine	A:JICA
				PCB CNC machine	A: JICA
				Workshop	B: Other resource
				TNC FX.25	B: Other resource
				Vector network analyzer	A: JICA
				Computational EM software	A: JICA
				Programmable radio transceiver platform,	A: JICA
		Wireless Sensor Environmental monitoring	to develop monitoring system for environmental (land slide, volcano, pollution)	Wireless Sensor Nodes, (Floor space experiment: 16m2)	A: JICA
				Network Simulator	A: JICA
				Function/ Arbitrary Waveform Generator	A: JICA
				Vector Signal Generator	A: JICA
		MANET Protocol	modeling requirements analysis into graphical notations and metrics	network simulator	JICA
		Fiber Optics Sensors Network for the monitoring of civil engineering structure	To develop a tool allowing a monitoring from within the structure itself and with high precision and good spatial resolution	Tunable Laser	A: JICA
				Broadband light source	A: JICA
				Broadband light source	A: JICA
				Optical Spectrum Analyzer	A:JICA
				Translation stage	C: sudah ada
				Optical Time Domain Reflectometer 1310 nm	C: sudah ada
				Fiber Cleaver	C: sudah ada
				Fiber Fusion Splicer	C: sudah ada
		Distributed Optical Fiber Sensor for Environmental Monitoring	To develop fiber sensors and networks for monitoring temperature, humidity, pH, and trace gases, which are important in environmental and safety management.	Environmental Test Chamber	A: JICA
				Optical Time Domain Reflectometer 1550 nm	A: JICA
				pH,CO, CO2 sensors	C: sudah ada
				Fiber Cleaver	C: sudah ada
				Fiber Fusion Splicer	C: sudah ada

Cluster	Topics	Sub Topics	Expected Outcome	Necessary Equipment	Procure-ment
		Integrated optical waveguide sensors	To develop optical waveguide sensors for green technology with compact size and low energy consumption	Clean room class 1000	A: JICA
				Lithography Benchmark	A: JICA
				Sputtering Machine	A: JICA
				Reactive Ion Exchange Etcher	A: JICA
				Evaporator	A: JICA
				Furnace	A: JICA
				Profiler	A: JICA
				Tunable Laser	A: JICA
				Optical Spectrum Analyzer	A:JICA
				Software	A:JICA
					A:JICA
					A:JICA
	Cultural Heritage	Traditional Dance Documentation	To preserve traditional dance in Indonesia using motion capture equipment.	Body Motion Capture System	A:JICA
				Face Motion Capture System	A:JICA
				Motion Capture Plus Package	A:JICA
				Motion Capture Software	A: JICA
				Motion Capture Software	A: JICA
				Motion Capture Accessories	A: JICA
				Motion Capture Software	A: JICA
				Capturing PC	A: JICA
				3D Animation Software	A: JICA
				Storage Server	A: JICA
				Studio Lighting	A: JICA
				Camera	A: JICA
				Video Mixer	A: JICA
				UPS	A: JICA
				Designer Tablet	A: JICA
				Audio Mixer	A: JICA
				Sound Effect Machine	A: JICA
		Objects of cultural heritage	To preserve objects of cultural heritage in Indonesia using 3D scanner.	3D Scanner	A: JICA
				Capturing PC	A: JICA
				Studio Lighting	A: JICA
				3D Modeler Software	A:JICA
	Telemedicine	Telemedicine for skin disease	A framework of telemedicine for skin disease	Camera for Skin with Illumination	A: JICA
				Camera for General Purpose	A: JICA
				Camera for Skin Disease	A: JICA
				PC for Telemedicine Center	A: JICA
		Telemedicine for Pathology	A framework of telemedicine for Pathology	Digital Microscope	A: JICA
				Digital Printer	A: JICA
				PC-based Ultrasound	A: JICA

Appendix5-8
Housing, Human Settlement, Environment and Disaster Management (Building Studies)

No	Cluster	Topics	Sub Topics	Expected Outcome	Necessary Equipment	Request
3	Housing and Human Settlement	Building Studies	Behavior of Innovative Precast Concrete Member Connections	To provide Innovative Precast Connections Suitable for Implemen-tation in EPI	Universal Testing Machine for 2000 kN	JICA
					Loading frame for 250 kN	JICA
					Loading actuator 250 kN	JICA
					Loading actuator 50 kN	JICA
					Strong wall strong floor	JICA
					Bi-axial (X-Y) direction shaking table for seismic testing	JICA
			Behavior of Seismic-Resistant Housing and Building Systems	To come up with New Systems of Seismic-Resistant Housings and Buildings for Implemen-tation in EPI	Universal Testing Machine for 2000 kN	JICA
					Loading frame for 250 kN	JICA
					Loading actuator 250 kN	JICA
					Loading actuator 50 kN	JICA
					Strong wall strong floor	JICA
					Bi-axial (X-Y) direction shaking table for seismic testing	JICA
			Innovative Cement-Based Materials	To come up with Innovative Cement-Based Materials Suitable for Structures Built in EPI	Canine+ Corrosion Analyzing Instrument with Rod and Wheel Electrodes	JICA
					Resipod	JICA
					Dyna Pull-off Tester	JICA
					Torrent	JICA
					mobile moisture meter for sand and gravel	JICA
					Hygropin	JICA
			Structural Assessment and Innovative Retrofitting/Repair ing Systems	To provide Assessment Methods and Innovative Retrofitting/Repairing Systems Applicable for EPI	Profometer 5+ Scanlog	JICA
					Test block	JICA
					Silver Schmidt PC N	JICA
					SilverSchmidt anvil	JICA
					Punditlab	JICA
					Transducer 24 kHz	JICA
					Transducer 150 kHz	JICA
					Exponential transducer 45 kHz	JICA
					Amplifier for long cables	JICA
					Calibration rod 25 μs for Pundit	JICA
					Calibration rod 100 μs for Pundit	JICA
					DMS 340 Core Drilling	JICA
					K970 Power Cutter	JICA
					TS400F Table Saws	JICA
					DD EC-1	JICA
					DD 200	JICA
					TE 2	JICA
					TE 30-C-AVR	JICA
					TE 70	JICA
					TE 706	JICA
					TE 1000 AVR	JICA
					PD 42	JICA
					PMC 36	JICA
					PR 20	JICA
					PRI 2	JICA
					PS 200	JICA

No	Cluster	Topics	Sub Topics	Expected Outcome	Necessary Equipment	Request
			Behavior of Innovative Ductile Structural Members	To come up with New Types of Ductile Structural Members Suitable for Implemena-tion in EPI	Universal Testing Machine for 5000 kN	JICA
					Loading frame for 250 kN	JICA
					Loading actuator 250 kN	JICA
					Loading actuator 50 kN	
					Strong wall strong floor	
					Bi-axial (X-Y) direction shaking table for seismic testing	
			Building Structure and material for disaster mitigation and reconstruc-tion	Model of disaster resilient housing (except for Tsunami)	Shaking Table	JICA
				Rapid building construction for disaster housing (less than 8 hours)	Camera SLR	JICA
			Urban Heat Island Mitigation (UHI) in warm-humid tropic	Profile of thermal environment in urban housing and settlement	HOT WIRE ANEMOMETERS	JICA
					DIGITAL THERMOMETERS	JICA
					THERMAL CAMERA	JICA
				Influence of ground coverage on thermal environment in housing and settlement, To encourage development of ground coverage (buildings and outdoor spaces).	Weather station	JICA
					Desktop PC (Gaming/Graphic Desktop PC built up)-2	JICA
					Printer A3	JICA
			Bioclimatic and energy efficient building design for warm-humid region	Thermal performance and design of buildings	Thermohygrometer	JICA
					Pyranometer	JICA
					Desktop PC (Gaming/ Graphic Desktop PC built up)-2	JICA
					Printer A3	JICA
					Camera SLR	JICA
					LCD Proyector	JICA
					Printer A4	JICA
					Internet TV 48"	JICA
				2. Ventilation performance and design of buildings, and Indoor quality control	Anemometer	JICA
					Software for Ventilation/ air movement Study	JICA
					Desktop PC (Gaming/Graphic Desktop PC built up)-2	JICA
					Printer A3	JICA
				3.Daylight performance and design of buildings	Lightmeter	JICA
					Desktop PC (Gaming/Graphic Desktop PC built up)-2	JICA
					Printer A3	JICA
				4.Acoustic performance and design of buildings	Sound level meter	JICA
					Desktop PC (Gaming/Graphic Desktop PC built up)-2	JICA
					Printer A3	JICA

Appendix 5-9
Housing, Human Settlement, Environment and Disaster Management (Housing Studies)

No	Cluster	Topics	Sub Topics	Expected Outcome	Necessary Equipment	Request
3	Housing and Human Settlement	Housing Studies	Planning and design for rational use in local land, energy and material	Village Planning, Island-based development plan, Building Code and building guidance, etc	Desktop PC (Gaming/Graphic Desktop PC built up)-1	JICA
					Printer A0	JICA
					Printer A3	JICA
			Planning local economy, social and cultural aspects of housing and settlements	Eco region (economy, ecology and tourism), Home-based Economical housing plan	Desktop PC (Gaming/Graphic Desktop PC built up)-2	JICA
					LCD Projector	JICA
					Printer A4	JICA
					Internet TV 48"	JICA
			Strategic Housing for fishing village and border settlement	Settlement development for fishing villages, Transmigration settlement models, Strategic models for border settlement.	Camera SLR	JICA
					Office Printer (telp-scan-fax-copy) A4	JICA
			Furniture design	Development of eco-design and natural material for furniture design in EPI.	Technical drawing/modeling	JICA
					PC workstation	JICA

Appendix 5-10
Housing, Human Settlement, Environment and Disaster Management (Sanitation)

No	Cluster	Topics	Sub Topics	Expected Outcome	Necessary Equipment	Request
2	Infra-structure	Sanitation	1. Wastewater treatment prototype for housing/small communities	1. A package for wastewater treatment plant which are reliable applicated in a small communities/rural area @EPI.	Spectrophotometry	JICA
					Spectrophotometry	JICA
					pH meter	JICA
					Analytical balance	JICA
					Oven	JICA
					Furnace	JICA
					Spectrophotometry	JICA
					Close Reflux for COD examination	JICA
			2. Constructed wetlands	1. Comparing different media and plants to treat heavy metal and organic compounds (DO, BOD) in wastewater @EPI.	DO meter	JICA
					Turbidimeter	JICA
					Conductivity	JICA
					Jar test aparatus	JICA
					Burette	JICA
					Burette clamp	JICA
			3. Membrane bioreactor for housing/small communities.	1. Understanding membrane used and application in small communities/rural area.	Stereo Microscope	JICA
					Microscope with camera	JICA
					BOD incubator	JICA
					TOC analyzer	JICA
					Peristaltic Pumps	JICA
			4. Water treatment prototype for housing/small communities	1. Treating water for small communities/rural area @EPI from rain water, river, etc.	Gas chromatography	JICA
					Autoclave	JICA
					Atomic Spectrophotometry (AAS)	JICA
					Labu erlenmeyer 100 mL	JICA
					Labu erlenmeyer 200 mL	JICA
					Labu erlenmeyer 500 mL	JICA
					Petri dish	JICA
			5. Solid waste for compost	1. Composting solid waste in small communities/rural area @EPI.	Beker glass 100 mL	JICA
					Beker glass 200 mL	JICA
					Beker glass 500 mL	JICA
					Cylinder glass 25 mL	JICA
					Cylinder glass 100 mL	JICA
					Cylinder glass 1000 mL	JICA
					Desicator	JICA
			6. Solid waste for methane production based on small communities	1. Methane production communities/rural area @EPI.	Measuring Pipette 1 mL	JICA
					Measuring Pipette 5 mL	JICA
					Measuring Pipette 10 mL	JICA
					Measuring Pipette 25 mL	JICA
					Measuring Pipette 1 mL	JICA
					Measuring Pipette 2 mL	JICA
					Technical balance	JICA
					Durham tube	JICA
			7. Green area modeling for pollutant (i.e.$CO_{2)}$ reduction	1. Modeling CO2 reduction.	Impinger	JICA
					High Volume Air Sampler	JICA
					Sound level meter (SLM)	JICA
					Portable Multi-Gas Analyzer (Emission)	JICA
					Ambient NOx Monitor	JICA

No	Cluster	Topics	Sub Topics	Expected Outcome	Necessary Equipment	Request
			8. Septic tank and solid waste landfill methane gas utilization	1. Utilization of methane gas for any purposes.	Ambient Carbon Monoxide Monitor	JICA
					Ambient Sulfur Dioxide Monitor	JICA
					Portable Automotive Emission Analyzer	JICA
					Ambient Dust Monitor	JICA
					Ambient THC monitor	JICA
					Zeta potential analyzer	JICA
			9. Water resources management for health sanitation @EPI.	1. Water quality management in surface water @EPI.	Volume pipette 5 mL	JICA
					Volume pipette 10 mL	JICA
					Volume pipette 25 mL	JICA
					Winkler bottle 120 mL	JICA
					Winkler bottle 150 mL	JICA
					Pro pipette	JICA
					Bunsen burner	JICA
			10. Water resources management based on community development @EPI.	1. Understanding water management in community development @EPI.	Magnetic stirrer	JICA
					Computer Desktop	JICA
					Printer	JICA

Appendix 5-11
Housing, Human Settlement, Environment and Disaster Management (Transportation)

No	Cluster	Topics	Sub Topics	Expected Outcome	Necessary Equipment	Request
2	Infra-structure	Transpor-tation	Analysis of Land Transport Overload in EPI	To identify the overloading on the road and cost incurred as a result	Weigh in Motion (WIM)	JICA
			Evaluation of the Early Deterioration on the Land Transport in EPI	To identify and evaluation the early deterioration on the road and invent new methodology to solve the problem.	Wheel Track Machine	JICA
					Molding Machine	JICA
					Falling Weight Deflektometer	JICA
					Weigh in Motion (WIM)	JICA
					Pavement Density Meter	JICA
					Surface Profilometer	JICA
			Land Transport Pavement Design and Management in EPI	To design pavement and management system on the land transport to reduce the cost of transportation and increasing the economy cost in Eastern Part of Indonesia	Wheel Track Machine	JICA
					Molding Machine	JICA
					Falling Weight Deflektometer	JICA
					Skid resistance	JICA
					Pavement Density Meter	JICA
					Surface Profilometer	JICA
			Transportation for Land Development and Disaster Mitigation	To design evacuation road on the road transport disaster mitigation in Eastern Part of Indonesia	Computer	Already have
					GPS	APBN
					Software	APBN
			Green Transportation (Sustainable Transportation)	To attain some recommendation/initiative to increase Green Transportation (sustainable transportation) of land transportation in Eastern Part of Indonesia	Computer	
						Already have
					Weigh in Motion (WIM)	JICA
					Software	APBN
			Evaluation of the Casualty and Accident in EPI	To attain some recommendation/initiative to increase the safety level of land transportation in Eastern Part of Indonesia	Computer	Already have
					Speed Gun	APBN
			Transportation vehicle design	Development of identified design for automotive, bicycle, train, ship, aircraft and its component in EPI	Engineering design analysis	JICA
					3D modeling	JICA
					Technical drawing/modeling	JICA
					PC workstation	JICA
			Environmental design	Development of eco and human friendly design for street furniture, signage, outdoor ads, etc. in EPI	3D modeling-rendering-animation	JICA
					Technical drawing/modeling	JICA
					PC workstation	JICA

Appendix 5-12
Housing, Human Settlement, Environment and Disaster Management (Disaster)

No	Cluster	Topics	Sub Topics	Expected Outcome	Necessary Equipment	Request
1	Regional Develop-ment	Disaster Mitigation & Construction Management	construction management	understanding the construction method and project management practice	AMOS / LISREL	JICA
					SPSS	JICA
					AutoCAD 2010 Education	JICA
					PRIMAVERA PP	JICA
					DecisionTools Suite 5.5 (Professional)	JICA
					(@ RISK, Precision tree, Top Rank, Neural Tools, StatTools, Evolver, Risk Optimizer)	JICA
					WinEst Pro	JICA
					Matlab Student	JICA
					Matlab Pro	JICA
					Project Pro 2007	JICA
					Project Standard 2007	JICA
					MAPINFO Professional Ver 9.5	JICA
					Minitab 15	JICA
					PC Desktop	JICA
					Primavera Contractor Application User - Perpetual	JICA
					Primavera SureTrak Application User - Perpetual	JICA
					Peach Premium Accounting 2010 Construction Edition for 5 Users	JICA
			Earthquake and microseismic zoning	Maps of vulnerable area due to earthquake in EPI	GIS Software	
				Disaster mitigation measures for earthquake in EPI	Magneto-telluric	
			Soil liquefaction potential	Map of vulnerable area to soil liquefaction	RECORDER WITH BUILT IN AXIAL ACCELEROMETER (Microtremor tester)	
				Mitigation measures due to soil liquefaction	GROUND PENETRATING RADAR (GPR)	
					CPT	
			Tsunami & tsunami modeling	Maps of vulnerable area due to tsunami in EPI	GIS Software	
				Inundated area by tsunami waves runup in certain area in EPI can be predicted	delf 3D tsunami simulator 5 users	
				Evacuation route & evacuation area can be identified		
			Identification of the vulnerable areas to flash flood & mass movement		GIS Software	
			Establishment of suitable mitigation measures to each			

No	Cluster	Topics	Sub Topics	Expected Outcome	Necessary Equipment	Request
			area in EPI for disaster risk reduction			
			Study on the local community tradition related to the volcanic disaster risk reduction			
			Establishment of the suitable mitigation measures to each area in EPI for the volcanic disaster risk reduction			
			Study on the height of the SLR	Information of the height of SLR in Indonesia		
			Study on the sea water intrusion	information of the predicted area of the seawater intrusion and how to mitigate	Water Quality Checker	
					Water level measurement with build-in data logger	
					Water Level Sensor for tide level measurement	
					GPS handheld type	
					Total Station	
					Portable Ground Penetrating Radar	
					Resistivity meter	
					Standard water-level dip meter	
					Surface wave profiler	
			Study on the coastlines changes	Information of coastline changes can be provided and future coastline changes can be predicted		
			Prediction of the inundated area due to SLR	Information of the inundated area by SLR		
			Prediction of the impact due to SLR	Information & data of the impact due to SLR		
			Study on damages & loss assessment due to SLR	Information of the damages & loss due to SLR		

Appendix 5-13
Housing, Human Settlement, Environment and Disaster Management (Disaster)

No	Cluster	Topics	Sub Topics	Expected Outcome	Necessary Equipment	Request
1	Regional Development	Geospatial	Low Cost and Rapid Mapping	Using UAV and Photogrammetry Methode	Unmanned Aerial Vehicle	JICA
					Camera UAV	JICA
					Medium Format Metric Camera	JICA
					Leica Photogrammetric System (LPS)	JICA
			Development of Spatial Data Base Using GIS	GIS Modeling	Software GIS	JICA
			Deformation and Landsubsidence Study	Knowing the causes of Deformation and Land Subsidence in Surabaya	GPS CORS RTK	JICA
			Coastal Mapping for Resettlement Area	Survey Bathymetry	Echo Sounder	JICA

Appendix 5-14
Housing, Human Settlement, Environment and Disaster Management (Regional Studies)

No	Cluster	Topics	Sub Topics	Expected Outcome	Necessary Equipment	Request
1	Regional Development	Regional Studies	Biodiversity Study in EPI	Understanding biodiversity characteristic ini EPI	PC workstation	JICA
			Land use study in EPI	Understanding land use pattern in EPI	PC workstation	JICA
					ArcGIS Spatial Analyst 9.3.1	JICA
			Enhancement of local wisdom institution to support regional development in EPI	Improvement of local wisdom institution to support regional development in EPI	PC workstation	JICA
			Development of society participation to support disaster mitigation in EPI	Improvement of society participation to support disaster mitigation	PC workstation	JICA
			Footwear design	Development of style, trend and new function for design of shoe, bag, belt, etc. to support SME's in EPI.	Illustration and graphic	JICA
					Photo retouching	JICA
					Technical drawing/modeling	JICA
					3D modeling-rendering-animation	JICA
			Gem and jewelry design	Enhancement of style, trend and new function for gem and jewelry design to support SME's in EPI.	Illustration and graphic	JICA
					Photo retouching	JICA
					Technical drawing/modeling	JICA
					Jewellary Mailing Machine	JICA
					3D modeling-rendering-animation	JICA
			Batik and textile design	Enhancement of design of batik, tenun, lurik and other traditional textiles in EPI.	Illustration and graphic	JICA
					Photo retouching	JICA
					Technical drawing/modeling	JICA
			Branding and packaging design	Development of identity design of branding for product, company, city or environment in EPI.	Lighting studio	JICA
					Camera DSLR	JICA
					Lenses	JICA
					3D modeling-rendering-animation	JICA
					Blitz	JICA
			Toys, souvenir and craft design	Enhancement of design for traditional toys, souvenir and craft product in EPI	3D modeling-rendering-animation	JICA
					PC workstation	JICA
			Animation	Development of education, heritage and cultural design for film, game and comic in EPI	3D modeling-rendering-animation	JICA
					2D vector animation	JICA
					Animation/multimedia/interactive editing	JICA
					Post pro animation and graphic	JICA
					Film and animation editing	JICA
					Camera video hi definition 3D	JICA
					Anime Studio Pro 7	JICA
					Cheetah 3D Animation for Mac	JICA
					AutoDesk Maya	JICA
					Mac Computer	JICA

Appendix 5-15
Energy (Alternative Energy)

Cluster	Topics	Sub Topics	Expected Outcome	Necessary Equipment	Request
Alternative Energy	Geothermal	Low Rank Geothermal Utilization	Utilization of Low Rank Geothermal Energy (low temperature, low pressure geothermal steam)	Steam Power Plant	JICA
				Computer Link Steam Generator and Service Module	JICA
				Gas Turbine Simulator	JICA
	Solar Energy, Wind and Hybrid Energy	Solar cell energy generation system	Understanding power generation and control from solar cells and its connection to power grids	Solar panel system and control unit	JICA
		Internet based Real monitoring control of hybrid wind/fuel cell system	robust control for hybrid system	Wind power generation experiment equipment	JICA
				3000 Watt Fuel Cell System	JICA
	Fuel Cell and Batteries	Fuel cell and batteries utilization	Understanding and utilization of fuel cell and modern battery	Hybrid energy laboratories for training, research and demonstration	JICA
				High Power Fuel Cell System for Lab & Research	JICA
				Laboratory Fuel Cell System, Evaluation kit 720 W	JICA
		Fuel cell and batteries fundamental research	Understanding the fundamental science and technology of modern batteries	Transmission Electron Microscope	JICA
				Helium Picnometer	JICA
				Confocal Laser Scanning Microscope	JICA
				High Resolution SEM	JICA
				Dynamic Mechanical Analysis	JICA
				High performance Potentiodynamic	JICA
				Impedance Analyzer	JICA
				Seebeck Coefficient / Electric Resistance Measuring System	JICA
				Laser Flash Thermal Constant Analyzer	JICA
				Particle Size and Shape Analyzer	JICA
				Computer controlled measuring system to determine magnetic characteristic quantities of hard magnetic materials	JICA
				10 L High Pressure Reactor System	JICA

Appendix 5-16
Energy (Energy Efficiency)

No	Cluster	Topics	Sub Topics	Expected Outcome	Necessary Equipment	Request
	Energy Efficiency	Fuel Conversion	Gas to liquid and Solid to liquid fuel conversion	Conversion of natural gas and low rank coal into liquid fuels	High Pressure Reactor	JICA
					Low Pressure Reactor System	JICA
					Magnetic Stirrer Drive Motor	JICA
					Shaker type hydrogenation apparatus	JICA
					Continuous flow tubular reactor system	JICA
					Surface plasmon resonance	JICA
					Sulphur Analyzer	JICA
					CHNS elemental analyzer	JICA
					HPLC	JICA
					FTIR	JICA
					GC-MS	JICA
					Tube Fitting kit	JICA
					Multiple Reactor System	JICA
		Energy Efficiency/ Energy Audit	Energy Efficiency /Energy Audit	Improvement of Energy Efficiency	3 Stages High Voltage Construction Kit	JICA
					Smoke Point Apparatus	JICA
					Lovibond Color Comparator	JICA
					Vapour pressure of petroleum products	JICA
					Flash and Fire point tester	JICA
					Thermal Imager	JICA
					Ultrasonic Tester	JICA
					Laser Induced Fluorescence	JICA
					Mobile Lab Energy Unit	APBN
					IR Thermometer and Heat Flow Meter	JICA
					Precision Fast Response Thermo Hygrometer	JICA
					Hot Wire Anemometry	JICA
					Transit Time Ultrasonic Flowmeter	JICA
					Particle Image Velocimetry (PIV)	JICA
					FlowLite Laser Doppler Anemometry Systems	JICA
					Power meter	JICA
					Mobile Insulation Diagnosis & Analyzing System	JICA

Appendix 5-17
Energy (Renewable Energy)

No	Cluster	Topics	Sub Topics	Expected Outcome	Necessary Equipment	Request
	Renewable Energy	Biofuels	Biodiesel	understanding process production of biodiesel from various native Indonesian sources	Biodiesel trainer set (Pilot Scale)	JICA
					Gas Chromatography for Biodiesel analysis	JICA
					Cetane rating test engine	JICA
					Fully Automated Fuel Distillation System	JICA
					Ignition Quality Tester	JICA
					Kinematic Viscometer + Viscosity bath	APBN
			Bioethanol	understanding process production of bioethanol from various native Indonesian sources	Bioethanol trainer set (Pilot Scale)	JICA
					TOC Analyzer	JICA
					Ultracentrifuge	JICA
					Gas Chromatography for Ethanol analysis	APBN
			Biogas	understanding process production of biogas from various native Indonesian sources	Biogas trainer set (Pilot Scale)	JICA
					Biofermentor	JICA
					Gas Chromatography for Biogas analysis	APBN
		Biomass	Biomass	understanding gasification of biomass from various native Indonesian sources to feed gas turbine for small scale power generation	Portable Gas Analyzer	APBN
					Vacuum Tube Furnace	JICA
					Portable, Micro GC	JICA
					Combustion Tube Furnace	APBN
					Differential Scanning Calorimetry	JICA
					Two Shaft Gas Turbine	JICA
					Combustion Tube Furnace	APBN

Appendix 6: Research Topic Information IPB as of May 2011

Comparation between Seed Center and R&D under Ministry of Agriculture

No	Activities	Seed Center	R&D Ministry of Agriculture
1	Germplasm collection and perservation	*	*
2	Germplasm exchange and distribution	*	*
3	Conventional breeding	*	*
4	Non Convention breeding (tissue culture, molecular genetic, haploid technology, GMO, protoplast fusion, somatic embryo)	*	*
5	Food Crop, horticultural crop, estate crop	*	*
6	New Varieties	*	*
7	Production of qualified mother seed	*	*
8	Disimination of seed to the farmers	*	*
9	Pilot plant for seed production	*	
10	Seedling production	*	*
11	Integration research center	*	
12	Involvement of many students	*	
13	Involvement of many researcher a cross universities and other institution	*	
14	Possibly joint research with industry	*	
15	Output technology	*	*
16	output publication	*	*
17	output patent	*	
18	output Human Resources	*	
19	Easily access of the communities, NGO or other	*	
20	Easily access funding from competitive grant from many sources worldwide	*	
21	Easily disemination and promotion to the	*	
22	Easily trust building of the product	*	
23	Simplicity bureaucracy	*	
24	Efficiency and effective budget utilization	*	
25	Transparancy and accountability	*	
26	Effectivity on resource sharing with other	*	
27	Possibility for innitiating business incubation and commercialization	*	

Biopharmaca Research Center – Bogor Agricultural University

Vision

To be a leading research center in biopharmaca areas through optimizing added value of natural resources both at national and international level

Mission

1. To assemble, to synergize, and to increase cooperation and networking amongst human resources within units in IPB as well as outside IPB in materializing the enhancement of biodiversity values that have biopharmaca prospects.
2. To develop science, technology, and arts based on advanced research with outputs of science and technology, potency, and biopharmaca products that are fulfill patent requirements and intellectual-property-rights oriented, which can support self-sustained nation.
3. To support capacity building through education, trainings, and community services

Mandate

1. Sustainable use of indigenous knowledge & technology to prevent and cure diseases in human, animals and plants

2. Developing Research of Biopharmaca:
   - Policy: to improve health and welfare of society through developing Biopharmaca and Nutraceutical research activities.
   - Scientific value: to discover and to add scientific information in the field of biopharmaca and nutraceutical; to develop GACP and GMP for indigenous natural resources; to established the standardization model of biopharmaca and nutraceutical products

Organnization of Research Group

1. Division of Natural Resource Development and Cultivation
2. Division of Biopharmaca Product Development
3. Division of Community Empowerment and Market Development and;
4. Non Research Division (Collaboration & Networking Division)

Program

1. Biodiversity Conservation and Domestication of Medicinal Plant
2. Study of Ethnobotany and Indigenous Knowledge/ Local Wisdom
3. Developing Indonesian Biopharmaca Potency
4. Development of Good Agricultural Practices and Good Agricultural Colection Practices (GAP) and (GACP) for Medicinal Plants
5. Development of Biopharmaca Standardization Model
6. Development of Leading Biopharmaca Products for Human, Animal and Plants
7. Biopharmaca Education Development
8. Study of Biopharmaca Sosio-Economic Impact
9. Utilization of Biopharmaca Product Through Herbal Clinic
10. Dissemination of Biopharmaca Achievement to Stakeholders
11. Strengthening Networking

Long-Term Research Plan for Biopharmaca Reseach Center (2011–2016)

No	Reseach Plan/Activities	Responsible Party	Proposed Investment related to the project type	
			Program Number	Main equipment
A	**Established Biopharmaca Development Area**			
	Exploration and identification of prospective biopharmaca accession variety through genetic and metabolomic approach	BRC, Balitro, Leiden University	1,3,5	Sampling vehicle, DNA Squencer, PCR, HPLC, UV Vis, FT IR, tissue culture equipment, Soil tester equipment, IT equipment, TLC Scanner, FTIR, HTS, LC MS/MS, GC MS, NMR
	Establishing strong collaboration between biopharmaca Reseach Center, Private Industry, Local Government, Farmer	BRC, PT SOHO, Sukabumi District Gov, Farmer Group, Balitro, Agriculture Ministry	7, 10, 11	IT equipment and vehicle
	Developing Good Agricultural Practices/Good Collection Practices for some biopharmaca material (curcuma, ginger)	BRC, PT SOHO, Sukabumi District Gov, Farmer Group, Balitro, Agriculture Ministry	4and 5	HPLC, UV Vis, FT IR, tissue culture equipment, Soil tester equipment, drying equipments, pilot plant, TLC Scanner, FTIR, HTS, LC MS/MS, GC MS, NMR
	Developing method for quality control of biopharmaca material (curcuma, ginger) using integrated approach	BRC	5	TLC Scanner, FTIR, HTS, LC MS/MS, GC MS, NMR, HPLC, UV Vis
	Developing strategy for community empowerment through utilization of biopharmaca resources	BRC, Agriculture Ministry	8 and 11	IT equipment and vehicle
	Initiating the development of new biopharmaca area	BRC, Agriculture Ministry	10 and 11	IT equipment and vehicle

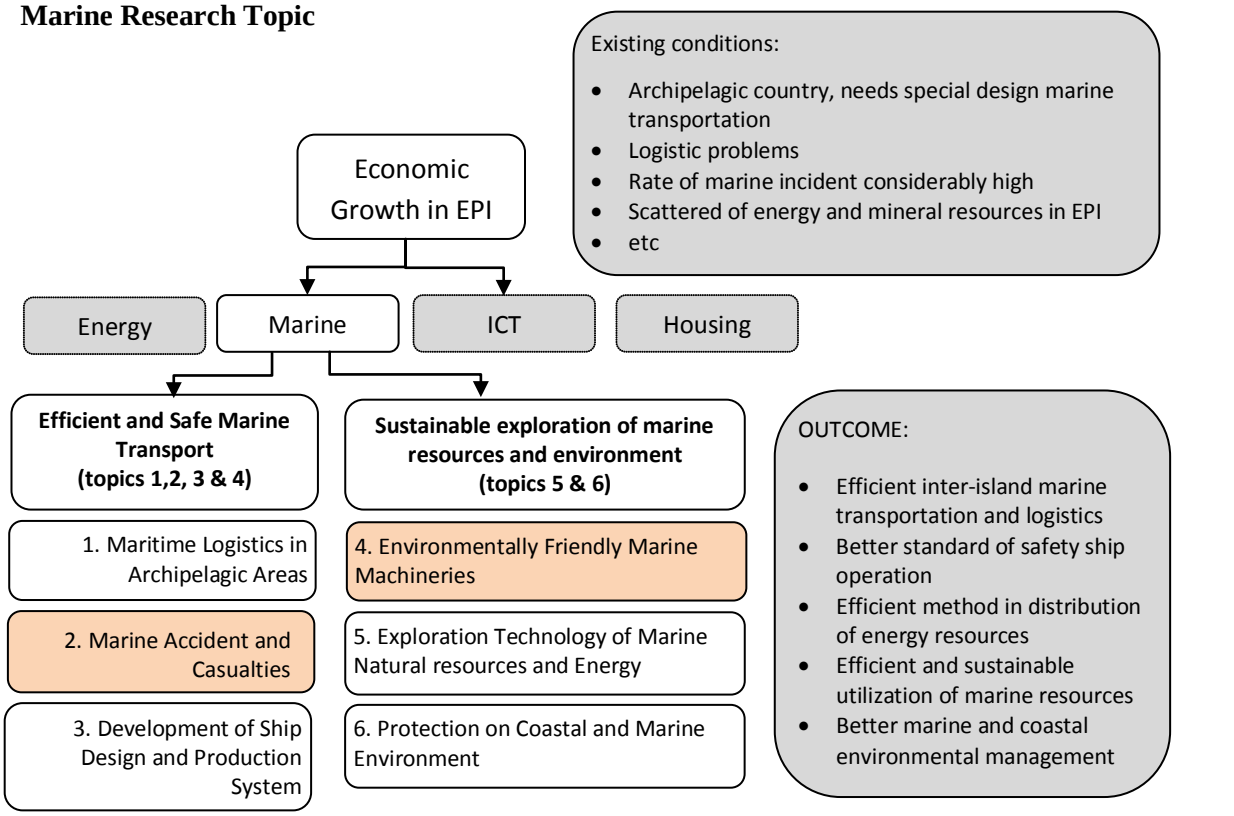
No	Reseach Plan/Activities	Responsible Party	Proposed Investment related to the project type	
			Program Number	Main equipment
B	**Standardized biopharmaca products**			
	Ethnobotanical study and exploration of biopharmaca potency from Indonesian forest area and domestification of selected medicinal plant and animal resources	BRC, Mulawarman University, Palangkaraya University, Lambung Mangkurat University, PT Primax	1, 2, 3, 4 and 11	Sampling vehicle, DNA Squencer, PCR, HPLC, UV Vis, FT IR, tissue culture equipment, drying equipments, pilot plant, Soil tester equipment, IT equipment
	Phytochemical exploration of selected biopharmaca and chemical standardization of product thereof	BRC, Mulawarman University, Leiden University, Palangkaraya University, Lambung Mangkurat University, Avivat AG	1, 2,3, 6, and 11	TLC Scanner, FTIR, HTS, LC MS/MS, GC MS, NMR, HPLC, UV Vis, microscope, SEM, particle size analyzer, TOC, AAS, DSC, pilot plant, biological assay, IT equipment
	Exploring the potency of endophytic microbe from selected medicinal plant (Brotowali, Pegagan, Temulawak, etc)	BRC, Department of Biology	3 and 6	Sampling vehicle, DNA Squencer, PCR, HPLC, UV Vis, FT IR, tissue culture equipment, drying equipments, pilot plant, Soil tester equipment
	Study of selected biopharmaca (e.g. Centella asitatica, Curcuma xanthorrhiza, Phaleria macrocarpa) for degenerative diseases (e.g.anti-dementia) and its product development	BRC, Chengdu University of TCM, PT Kalbe Farma	4, 6 and 11	TLC Scanner, FTIR, HTS, LC MS/MS, GC MS, NMR, HPLC, UV Vis, microscope, SEM, particle size analyzer, TOC, AAS, DSC, pilot plant, biological assay, IT equipment
	Study of selected biopharmaca (Mangrove and flowering plant) for cosmetics and its product development	BRC, Gifu University	3, 6 and 11	TLC Scanner, FTIR, HTS, LC MS/MS, GC MS, NMR, HPLC, UV Vis, microscope, SEM, particle size analyzer, TOC, AAS, DSC, pilot plant, biological assay, IT equipment
	Biopharmaca product formulation (phytopharmaca and standardized extract) for cardiovascular diseases and anti rheumatic	BRC, PT Bintang toejoe	3, 4, 6 and 11	TLC Scanner, FTIR, HTS, LC MS/MS, GC MS, NMR, HPLC, UV Vis, microscope, SEM, particle size analyzer, TOC, AAS, DSC, pilot plan, biological assay, IT equipment
	Nanoparticle product formulation from selected medicinal plant	BRC, Ehime University, PT Soho, Avivat AG	5, 6 and 11	TLC Scanner, FTIR, HTS, LC MS/MS, GC MS, NMR, HPLC, UV Vis, microscope, SEM, particle size analyzer, TOC, AAS, DSC, pilot plant, biological assay, IT equipment
	Study of selected biopharmaca (Guazuma ulmifolia and Syzygium Polyantum) for cardiovascular diseases and its product development	BRC, Ehime University	4, 6 and 11	TLC Scanner, FTIR, HTS, LC MS/MS, GC MS, NMR, HPLC, UV Vis, microscope, SEM, particle size analyzer, TOC, AAS, DSC, pilot plant, biological assay, IT equipment

No	Reseach Plan/Activities	Responsible Party	Proposed Investment related to the project type	
			Program Number	**Main equipment**
	Developing functional food and its ingredient from local indigenous biodiversity	BRC, Obihiro University, Universidade Estadual do Norte Fluminense Brasil	3, 4, 6 and 11	TLC Scanner, FTIR, HTS, LC MS/MS, GC MS, NMR, HPLC, UV Vis, microscope, SEM, particle size analyzer, TOC, AAS, DSC, pilot plant, biological assay, IT equipment
	Developing biopharmaca product (herbal medicine for animal) for anticocidia and antimastitis	BRC, Agriculture Ministry, Charoen Pokhpand	1, 2,3, 6, and 11	TLC Scanner, FTIR, HTS, LC MS/MS, GC MS, NMR, HPLC, UV Vis, microscope, SEM, particle size analyzer, TOC, AAS, DSC, pilot plant, biological assay, IT equipment

No	Reseach Plan/Activities	Responsible Party	Proposed Investment related to the project type	
			Program Number	Main equipment
C	**Established Biopharmaca Education and Information center, related national policy**			
	Developing Jamu Databases	BRC, NAIST	2, 3, 10 and 11	IT Equipments
	Establishing Biopharmaca Museum which contain specimen of biopharmaca material and products and result of ethnobotany study for preserving and exhhibiting the richnest of national biodiversity	BRC, GP Jamu, Indonesian district governement	2, 7, 8, 10 and 11	Sampling vehicle, DNA Squencer, PCR, HPLC, UV Vis, FT IR, tissue culture equipment, Soil tester equipment, IT equipment
	Establishing Biopharmaca Clinic for application of research result in national jamu scientification program and for improving community health status	BRC, IDI, Ministry of health	9,10 and 11	Sampling vehicle, DNA Squencer, PCR, Clinic equipment, IT equipment
	Developing curricula for biopharmaca education system for postgraduate (master degree)	BRC, IPB Postgraduate School	7	IT Equipments
	Developing and implementing national roadmap of jamu	BRC and National Jamu Stakeholder	7,8,10 and 11	IT Equipments

Appendix 7: Research Topic Information ITS as of May 2011

Marine Research Topic



1. RESEARCH TOPIC ON:
   - 1.1. Energy transport
   - 1.2. Conceptual design innovation on ferry
   - 1.3. Marine transportation infrastructures
   - 1.4. Roles of shipping on small islands economy
   - 1.5. Marine transport telemetric
   - 1.6. Logistics system for small islands in EPI
   - 1.7. Cargo handling for small island transport

2. RESEARCH TOPIC ON:
   - 2.1. Human factor contribution to safety operation and design of vessels
   - 2.2. Marine traffic assessments
   - 2.3. Risk management of marine systems
   - 2.4. Measures to reduce marine accident and casualties
   - 2.5. Development of tools for marine crew training

3. RESEARCH TOPIC ON:
   - 3.1. Innovative design of marine vehicle suitable for small islands and shallow water area
   - 3.2. Design of fishing vessel with good sea-keeping performance
   - 3.3. Development of traditional fishing vessel technology
   - 3.4. Innovative design and development of fishing gears appropriate for EPI
   - 3.5. Cold-chain management on fishery industries
   - 3.6. Sustainable and environmental friendly for ship production system
   - 3.7. New material (alternative) for ships
   - 3.8. Development of new analysis concept of ships Structures

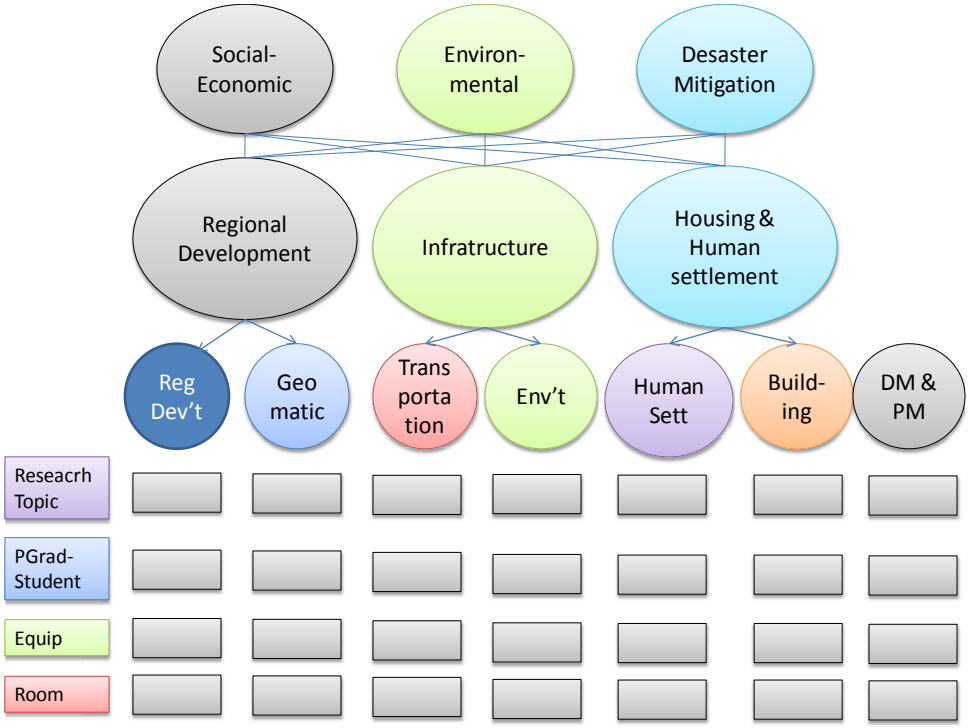
4. RESEARCH TOPIC ON:
   - 4.1 Alternative Energy for ship propulsion.
   - 4.2 Development design for marine machinery of small vessel and fishing vessel
   - 4.3 Non conventional propeller design and propulsion system for energy saving.
   - 4.4 Decision support system for marine machinery maintenance management.
   - 4.5 Waste heat recovery from marine system for energy saving
   - 4.6 Emission reduction from vessel engine

5. RESEARCH TOPIC ON:
   - 5.1. Design development of floating structures for energy resources
   - 5.2. Development of under water system and technology
   - 5.3. Ocean and deep water energy
   - 5.4. Deep ocean water application
   - 5.5. Aquaculture
   - 5.6. Coastal and marine resources health assessment
   - 5.7. Information system for marine and coastal management

6. RESEARCH TOPIC ON:
   - 6.1 Impact of marine hazard to quality of life
   - 6.2 Soft engineering approach for marine protection
   - 6.3 Coastal morphologies and protection technology
   - 6.4 Impact of global warming and climate change to small islands
   - 6.5 Marine environment monitoring
   - 6.6 Marine and coastal pollution prevention

Housing and Settlement Research Topic

No.	Main Topic	Sub-Topic	Department					
			Civ	Arc	Env	Des	Geo	Pla
A	**Regional Development**							
1	Ecoregion Studi in EPI				v			v
2	Small Town Development Studi In EPI							v
3	Local Economic Development Model in EPI	Development of style, trend and new function for design of shoe, bag, belt, etc. to support SME's.				v		v
		Enhancement of style, trend and new function for gem and jewelry design to support SME's.						
		Enhancement of design batik, tenun, lurik and other traditional textiles.						
		Development of identity design of branding for product, company, city or environment.						
		Enhancement of design for traditional toys, souvenir and craft product						
4	Community Development Model in EPI							v
5	Local Institutional development in EPI							v
B	**Geospasial**							
1	Landsubsidence Study	Earthquake Disaster					V	
		GIS Modeling					V	
2	Coastal Human Settlement	Hydrography Marine					V	
		Monitoring Boundary					V	
C	**Transportation**							
1	Flexible Pavement (Design and maintenance)	Pavement Early Deterotation Study	V					
2	Road Maintenance and management	Road Network Development Study	V					
3		Road Management Study	V					
4	Demand and Suply Management	Ferry and Inland Waterway on the EPI	V					v
D	**Sanitation**							
1	Waste Water Treatment	Wastewater treatment prototype for housing/small communities	v	v	v			
		Constructed wetlands			v		v	
2	Water treatment	Water treatment prototype for housing/small communities	v	v	v			
3	Solid waste management	Solid waste for compost			v			
		Solid waste for methane production based on small communities	v		v			
4	.Air pollution control	Green area modeling for CO_2 reduction		v	v			v
		.Septic tank and solid waste landfill methane gas utilization			v			
5	Water resources management	Water quality modeling			v			
		Water resources management based on community development			v			v
E	**Housing Studies**							
1		Housing renewal		V				V
2		Housing development		V				V
3		Housing strategies		V				V
4		Low rise-high density housing		V				V
5		Economy, social and cultural aspects of housing		V				V
6	Furniture design	Public and private community model				V		V
		Planning for rational use in land, energy and material				V		V
F	**Building Studies**							
		1.Housing Design	V	V	V	V	V	V
		2. Building science/bio climatical comfort housing	V	V	V	V		
		3. Building for disaster mitigation and reconstruction	V	V	V		V	
		4. Building construction and material	V	V				



CENTER FOR DISASTER AND EARTH SCIENCES STUDIES (CDESS) OF I T S SURABAYA
RESEARCH ON DISASTER MANAGEMENT

1. INTRODUCTION

1.1 General

Human vulnerability, caused by the lack of appropriate emergency management, leads to financial, environmental, or human impact. The resulting loss depends on the capacity of the population to support or resist the disaster: their resilience. This understanding is concentrated in the formulation: "disasters occur when hazards meet vulnerability". A natural hazard will hence never result in a natural disaster in areas without vulnerability, e.g., strong earthquakes in uninhabited areas.

Geology-related hazards, such as earthquakes, tsunamis, landslides and volcanic eruptions periodically affect Indonesia, causing great loss of life and extensive damage to property and infrastructure. Seismic activities may also trigger landslides, cause ground rupture and/or land subsidence. It has been estimated that during the last 300 years over 2.5 million people have died around the world as a result of earthquakes and nearly 75 per cent of these fatalities occurred in East or West Asia and the western Pacific. In the same period, over 250,000 people died as a result of volcanic eruptions and nearly 85 per cent of these fatalities occurred in the Pacific region. In the last century, over 300,000 coastal residents were killed by 96 destructive tsunamis worldwide. Such tsunamis still continue to exact a toll of lives.

1.2 Tectonic Setting of Indonesian Archipelago

Located at the conjunction of three tectonic plates (Eurasian-Pacific-Indo Australian), caused Indonesia Archipelago exposed to a considerable threat from natural hazards every day. Movements of plates make Indonesia one of the countries most exposed to volcanic eruption and earthquake. Along the plates junction more than 500 volcanoes are line up along this archipelago, and 129 of them are categorized as very active. One of them is categorized as the most active volcano in the world (ie. Mount Merapi; 20 km north of Yogyakarta city).

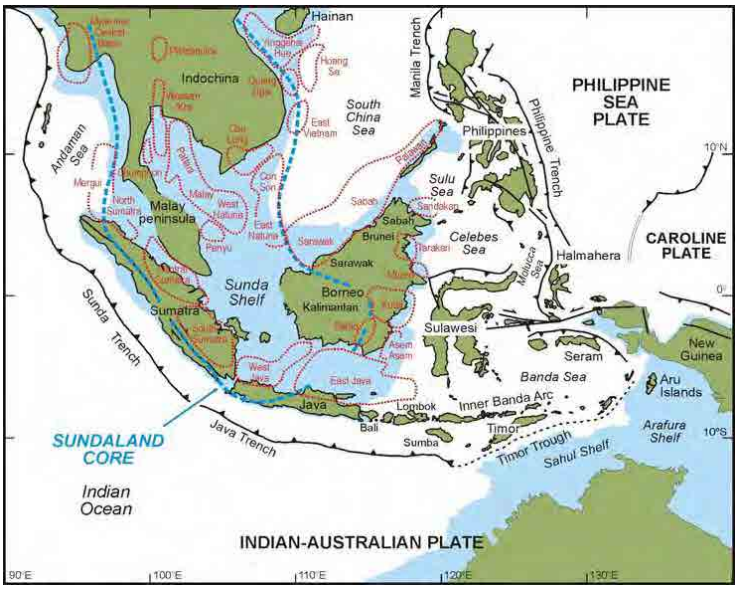


Figure 1. Tectonic framework of Indonesian archipelago (Hall, 2003)

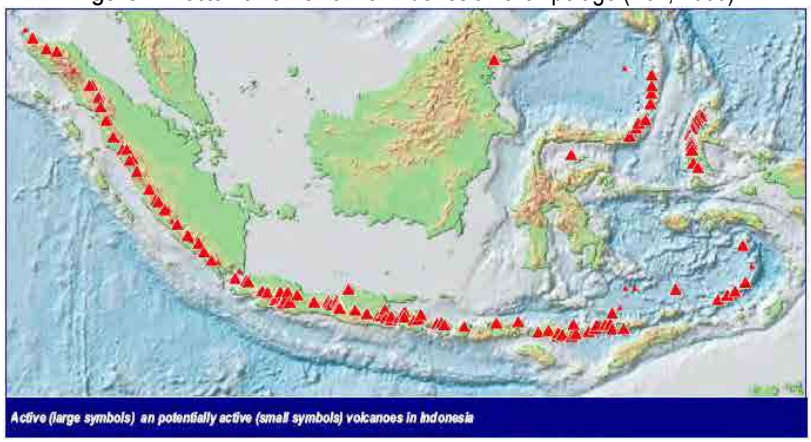


Figure 2. Active volcano in Inonesia (DGMAV, 2005)

1.3 Geographic and Socio-economic

Indonesia is the largest archipelago in the world, consist of more than 17,000 islands, 1,904,569 km^2 with population exceeding 225 million people. Population increases and the competing demands for natural resources forces more and more people to settle on and make use of areas, which originally were not suitable for permanent occupation. They settle in areas like coastal marshlands, the flood plain, the higher flanks of volcanoes, regions with a high earthquake risk or steep slopes prone to landslides and rock falls. This holds true especially for those people who are poor and normally don't have choices for an alternative lifestyle. Furthermore, every human activity creates an impact on nature, thus often exacerbating the natural threats on the fragile ecological equilibrium. Problems in managing natural resources had increased risk of disaster. In rainy seasons, Indonesia threatened by flood and landslide, whereas in dry season by drought and wildfire (forest fire) risk. It is either caused by natural factor as well as it is influenced by human activities

2. NATURAL DISASTER IN INDONESIA

2.1 Statistic of Disaster in Indonesia from 1980-2008

Figure 3 shows that since 1980 until 2008, the biggest number of occurrence of disaster in Indonesia is flood, followed by earthquake, mass movement, and volcanic eruption. The biggest number of people killed by disaster is occupied by earthquake followed by mass movement, flood, and volcanic eruption

(Table 1). Earthquake also stands in the highest position in causing economic damages (Table 2). These information is excluding loss and damages caused by Tasikmalaya earthquake and Padang earthquake in 2009, mass movement in Wasior 2010, Merapi eruption 2010, and earthquake and tsunami Mentawai in 2010.

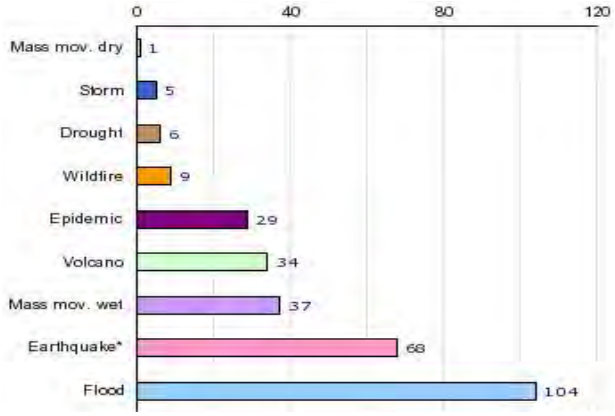


Figure 3. Occurrence of Natural Disasters in Indonesia from 1980-2008 (EM-DAT, 2009)

Table 1. Killed People per Event from 1980 to 2008 (EM-DAT, 2009)

No	Disaster	No of Killed People
1	Drought:	211.00
2	Earthquake*:	2,610.06
3	Epidemic:	126.76
4	Flood:	45.44
5	Mass movement dry:	131.00
6	Mass movement wet:	44.92
7	Volcano:	10.71

Table 2. Economic Damages per Event from 1980 to 2008 (EM-DAT, 2009)

No	Disaster	Economic Damages (USDx1,000)
1	Drought:	14,833.33
2	Earthquake*:	131,804.79
3	Epidemic:	....
4	Flood:	22,815.28
5	Mass movement dry:	1,000.00
6	Mass movement wet:	3,263.38
7	Volcano:	10,123.24

2.2 Earthquake & Tsunami Hazards

During the past 35 years, earthquakes have caused more than 1.5 million deaths worldwide. 70% of the earthquakes measuring seven or over on the Richter scale occurred in the Asian and Pacific region (including Japan and Indonesia), at an average rate of 15 per year. Tsunamis are generated mainly by earthquakes or other geological activity on the sea floor, are other seismic events that severely affect the nearby coastal areas and cause disasters.

The famous Krakatau volcanic eruption of 1883 in Sunda Straits, Indonesia, generated a 35 meter high tsunami, causing the deaths of 36,000 people. The 9.3 RS Andaman earthquake triggered tsunami of 26 December 2004 caused the deaths of more than 250,000 people in the Indian Ocean Region, and 165,000 of them are Indonesian people.

Indonesia is vulnerable to earthquakes and tsunamis. On 12 December 1992, an earthquake with a magnitude of 7.5 on the Richter scale occurred, followed by tsunamis, affecting mainly the Flores island. There were also several aftershocks. Nearly 2,000 people were killed and 90,000 rendered homeless. Another earthquake of 6.5 on the Richter scale shook the southern part of Sumatra island on 16 February 1994, which was also felt in Jakarta. Two hundred and seven people were killed, 464 severely injured and over 2,000 houses, 133 government buildings, 138 schools and 184 mosques were damaged. The total damage was estimated as US$ 170 million. On 2 June 1994, an earthquake occurred south of Java that created tsunamis killing 222 persons, injuring 440, destroying over 1,350 houses and wrecked or damaged 768 fishing boats. A February 1996 earthquake killed over 100 persons and destroyed over 5,000 houses. This earthquake caused a tsunami that reached 7 metres in height which was responsible for a large part of the damages.

2.3 Volcanic Hazard in Indonesia

The 129 active volcanoes of Indonesia are distributed in a belt along the length of the archipelago. In the last 200 years, approximately 175,000 people were killed by volcanic eruptions and the tsunamis generated by these eruptions. The well known 1883 eruption of Krakatau at the Sunda Strait Indonesia is the most violently explosive, with up to 18 km^3 blown out, noise heard up to 5000 km away, and large cloud of ash produced, killing 36,000 persons.

The1815 eruption of the Tambora volcano on Sumbawa island caused the deaths of 80,000 people. Advances in volcano monitoring and the issuing of timely warnings have reduced the fatalities significantly in recent decades. In the six major eruptions between 1980 and 1990 in Indonesia, 38 persons lost their lives. In previous eruptions of the same volcanoes, a total of 5,890 people had died. The 1919 eruption of the Kelud volcano killed 5,110 persons, the 1966 eruption took 210 lives, and in the 1990 eruption, total number of fatalities was reduced to 32.

The November 1994 eruption of the Merapi claimed 58 lives. The January 1997 eruption of the same volcano was much less harmful. The decrease in the number of victims, in spite of the constant increase of the population in surrounding areas, is a good indication of the successful implementation of volcanic hazard mitigation programs in Indonesia.

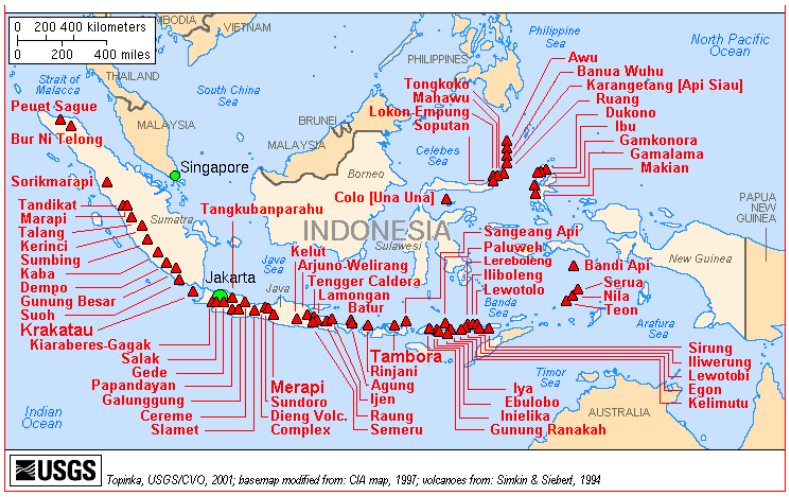


Figure 4. Major volcanoes of Indonesia with eruption since 1900 (USGS, 2001)

2.4 Flood and Mass Movements

Floods have the biggest share to the natural disasters occur in Indonesia every year. Floods cover vast areas and therefore affect a large number of people at the same time. Floods normally affect an area for many days, sometimes even a week or two, before the water retreats. But even when the water withdraws, damages to lifelines, infrastructure and buildings as well as water and soil pollution are persisting for months. The whole social and economic life of the flooded area is disturbed, interfering with the personal and societal development.
During the rainy season, many thousands of Indonesians living and working in the lowlands along the coast, like in the cities of Jakarta, Semarang and Surabaya are exposed to this kind of threat annually. There the floods particularly affect those parts of the cities mostly used for the harbors, industrial areas, and for low-income housing.

Outside the big conurbations as well as at the steeper outskirts of them, landslides and debris flows often occur, bringing the people living there into high risk. Even when the landslide itself covers only quite a "small" area, it has serious impacts on houses, building structures, communications lines and the agriculture.

In Indonesia, especially the islands of Java and EPI are exposed to hundreds of landslides and debris flows every year. The overall coincidence of heavy rainfall during the rainy season with the occurrence of landslides experienced so far, might give useful indicators for local easily applicable and implementable early warning systems (like rainfall gauges indicating a threatening threshold value) for landslides and debris flows.

Figure 5. In 27 December 2007 the Bengawan Solo river burst its banks in Central & East Java due to heavy rains, causing widespread flooding and several landslides, which left about 120 people dead. Above pictures were taken on the new year 2008 at some corners of Bojonegoro city…

Figure 6. Few hours after flashflood and mass movement destroyed some villages in Jember Regency

3. The Center for Disaster and Earth Sciences Studies (CDESS) of ITS Surabaya

3.1 The role of the Center in the Disaster Risk Reduction

The CDESS provides science-based information, service and knowledge assistance to the national, local government, municipal, and other disaster risk reduction (DRR) proponents in implementing their DRR activities;

- Involves in all level of structural organization for DRR and disaster management
- Develop and establish resources supporting research and innovation in the field of disaster management
- Develop and establish cooperation with other institution from the country and foreign universities and institution in research and innovation in the field of disaster management. E.g.:
  - National government (National Board for Disaster Management/BNPB), local Provincial and District Government in East Java
  - UNEP, ENICEF, UNDP, GTZ, Saga University
  - Indonesian Association of Geologist, OXFAM GB, and other NGOs
  - Etc.

3.2 Research Program on Disaster Management

Research activity on the disaster management of the CDESS-ITS is emphasized on the effort related to the action of disaster risk reduction. The topic and objective of the research program are as follows:

Objective of each research topic

No	Research Topic & Sub-Topic	Objectives
1.	Research on Earthquake & Tsunami Hazards: 1.1 Identification of vulnerable area to Earthquake & Tsunami 1.2 Micro-seismic zoning 1.3 Study on the relation of soil properties and its liquefaction potential 1.4 Tsunami modeling 1.5 Establishment of suitable mitigation measures to each area in EPI for the earthquake & tsunami disaster risk reduction	To map the vulnerability areas due to earthquake and tsunami. To formulate mitigation measures to reduce impact of the disaster caused by earthquake & tsunami. To build capacity of the community of the Eastern Part of Indonesia (EPI) in order to Increase and strengthen the resilience of the population to support or resist the disaster. This eventually will be expected to reduce the risk of disaster caused by earthquake and tsunami in EPI
2.	Research on Floods & Mass Movements: 2.1 Identification of vulnerable areas to flash flood & mass movement 2.2 Establishment of suitable mitigation measures to each area in EPI for disaster risk reduction	To map the vulnerability areas due to floods & mass movements. To formulate mitigation measures to reduce impact of the disaster caused by floods & mass movements. To build capacity of the community of the Eastern Part of Indonesia (EPI) in order to Increase and strengthen the resilience of the population to support or resist the disaster. This eventually will be expected to reduce the risk of disaster caused by floods & mass movements in EPI
3.	Research on Volcanic Hazards: 3.1 Study on the local community tradition related to the volcanic disaster risk reduction 3.2 Establishment of the suitable mitigation measures to each area in EPI for the volcanic disaster risk reduction	To explore the local community tradition heritage regarding to resist disaster of volcanic eruption. To build capacity of the local community of the EPI in order to Increase and strengthen the resilience of the population to support or resist the disaster.
4.	Research on Sea Level Rise (SLR): 4.1 Study on the height of the SLR 4.2 Study on the coastal changes	To establish an understanding the importance of action plan to prevent disaster caused by SLR in East Java as well as in EPI coastal areas. To formulate mitigation

No	Research Topic & Sub-Topic	Objectives
	4.3 Prediction of the inundated area due to SLR 4.4 Prediction of the impact due to SLR 4.5 Study on damages & loss assessment due to SLR	measures in order to reduce impact due to SLR.

Energy Research Topic

Energy

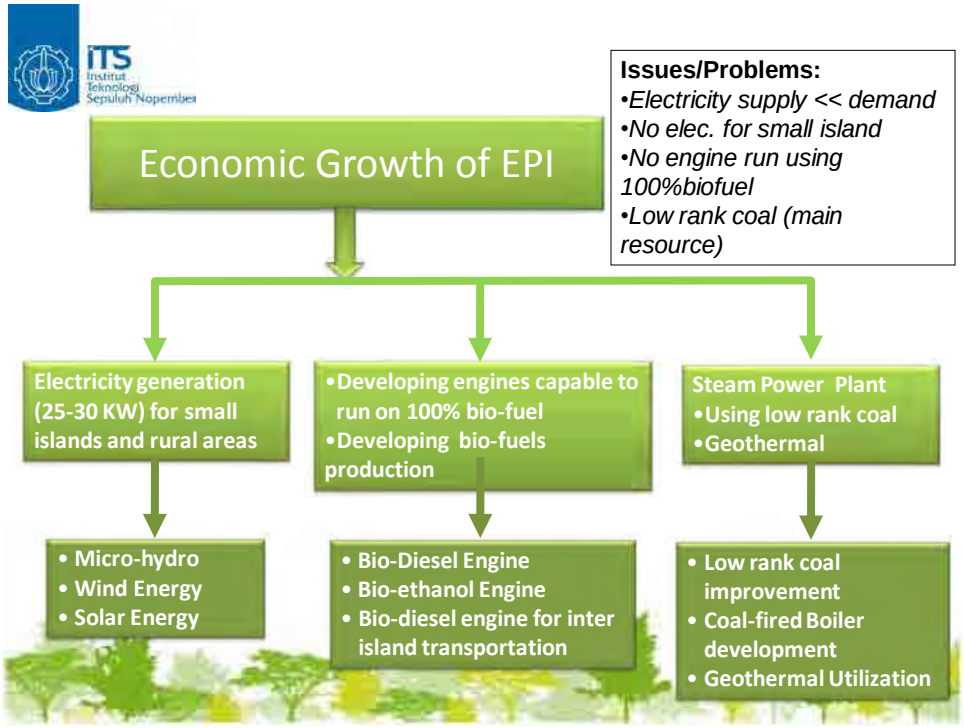
Centre for Energy and Engineering Studies
Institut Teknologi Sepuluh Nopember

Theme

Accellerating the Economic Growth of Eastern Part of Indonesia (EPI) through Research and Development in the Areas of Marine Engineering, Energy, Information and Communication Technology and Housing, Human Settlement, Environment and Disaster Management

Issues

- *Electricity supply << demand*
- *Very limited or no electricity for small islands and rural areas*
- *No engine run using 100% biofuels*
- *Low rank coal (main resource)*



Small Scale Electrical Generation for Rural and Small Islands for 50-100 house

Sub Topic	Problems	Outcomes
Micro-hydro energy	- low 'head' but high flow rate - high sediment content in river's water - low durability materials	- Highly efficient micro-hydro plant using low head river - Strong and durable blade material from corrosion and erosion
Wind energy	- low speed wind (3-4 m/s) - non-steady wind direction	- Small scale wind turbine power generation (20-30 kW)
Solar energy	- low efficiency photovoltaic cell - low efficiency solar energy utilization	- Photovoltaic solar cell technology for individual house (100-200 W)

Steam power Plant and Geothermal Energy

Sub Topic	Problems	Outcomes
Low rank coal utilization	- Low rank coal - High moisture content	- Improvement of combustion system for high efficiency boiler - Increment of steam power cycle efficiency
Geothermal energy	- high sulfur contents - high non-condensable gas contents - Low temperature and pressure geothermal steam	- Basic design for Geothermal power generation (50-250 MW) - Prototype of ORC (Organic Rankine Cycle,10-30 kW)

Bio-fuel Production Technology using local resources and developing engines capable to run on 100% bio-fuel

Sub Topic	Problems	Outcomes
Bio-diesel	-Separation of catalyst from product (common catalyst is homogenous)	- Efficient heterogeneous catalyst for biodiesel production
Bio-ethanol	- Competition for raw materials for bio-ethanol production	- Production of bio-ethanol from cellulose
Biomass	- High moisture content	- Prototype of biomass fueled power generation
Bio-diesel & Bio-ethanol Engines	- High flame temperature and high viscosity fuel - Evaporation of fuel and converter system	- Prototype engine for small ship and small electricity generation

Steam power Plant and Geothermal Energy

Sub Topic	Problems	Outcomes
Low rank coal utilization	- Low rank coal - High moisture content	- Improvement of combustion system for high efficiency boiler - Increment of steam power cycle efficiency
Geothermal energy	- high sulfur contents - high non-condensable gas contents - Low temperature and pressure geothermal steam	- Basic design for Geothermal power generation (50-250 MW) - Prototype of ORC (Organic Rankine Cycle,10-30 kW)

ITS Strengths in fields of Energy Research

Topic	ITS	Competitor
Small Scale Electrical Generation for Rural and Small Islands for 50-100 house	• Rich experience in micro-hydro power generation using low head but high flow rate river (screw type turbine). • ITS is developing vertical wind mill type capable to work in low velocity wind and independent to wind direction. • ITS facilities to produce photovoltaic (PV) solar cell at ITS Research Centre.	•Common micro-hydro turbine is using cross-flow type having low efficiency (30-40%) •Other universities do not have facility to produce PV solar cell.
Bio-fuel Production Technology using local resources and developing engines capable to run on 100% bio-fuel	•ITS develops technology on bio-diesel extraction and production from various seeds. •ITS is also developing method and technology to produce bio-ethanol from non-edible source of carbohydrates like cellulose. • ITS has state of the art facilities for catalyst development located at ITS Research Centre.	•ITB researchers are well known in this area, together with researchers from UGM, BBPT and LIPI. However, all tests were carried out using existing engines. •Most of universities produce bio-ethanol using edible sources (sugar cane, cassava, rice etc).
Steam power Plant and Geothermal Energy	•Nation-wide, ITS has been appointed to carry out research on upper surface geothermal utilization. •ITS is also developing ORC (Organic Rankine Cycle) to utilize low temperature and pressure steam out from production well.	•(ITB/UGM) Usually deal with sub surface geothermal survey because they have geology department

ITS Strengths in fields of Energy Research

Topic	ITS	Competitor
Small Scale Electrical Generation for Rural and Small Islands for 50-100 house	• Rich experience in micro-hydro power generation using low head but high flow rate river (screw type turbine). • ITS is developing vertical wind mill type capable to work in low velocity wind and independent to wind direction. • ITS facilities to produce photovoltaic (PV) solar cell at ITS Research Centre.	•Common micro-hydro turbine is using cross-flow type having low efficiency (30-40%) •Other universities do not have facility to produce PV solar cell.
Bio-fuel Production Technology using local resources and developing engines capable to run on 100% bio-fuel	•ITS develops technology on bio-diesel extraction and production from various seeds. •ITS is also developing method and technology to produce bio-ethanol from non-edible source of carbohydrates like cellulose. • ITS has state of the art facilities for catalyst development located at ITS Research Centre.	•ITB researchers are well known in this area, together with researchers from UGM, BBPT and LIPI. However, all tests were carried out using existing engines. •Most of universities produce bio-ethanol using edible sources (sugar cane, cassava, rice etc).
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ICT Research Topic

ICT Research and Development

Institut Teknologi Sepuluh Nopember

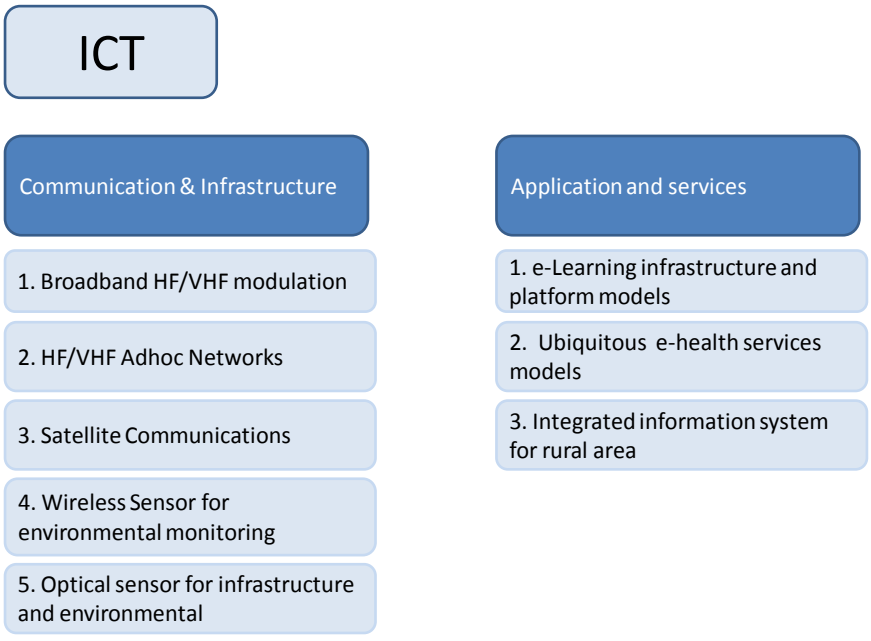
Background issues

- Lack of communication infrastructures
  - Isolates rural and remote areas
  - Obstructs development in education, health and other public services
- ICT based services enable developing efficient and effective systems
- Lack of open source applications and service models available

National ICT Research Agenda

- Communication Infrastructure
- Multimedia Broadcasting system
- Applications & Contents
  - Public services and government
  - Educations
  - SME
  - Health
  - Digital creative

Red ones: our focus



Outcome

- HF and VHF communication system and network for radio communication applications in EPI, e.g., communications for fisheries, sea navigation, communications between infrastructureless remote areas, etc.
- small (pico or nano) satellite communication systems for educational and experimental uses, e.g., emergency communications, remote sensing, etc.
- monitoring system for infrastructure and environmental models

Outcome (cont.)

- infrastructure and system for distance learning models and e-learning platforms in rural area
- tele medecine services model, integrated medical record data model.
- integrated information system (e.q. Food, health, geographic, etc) that provide and support all information regarding order, market and price analysis, and sales trend for rural area.

Communication Infrastructure

- Broadband HF/VHF Modulation
  - Study of HF/VHF propagation in tropical maritime regions
  - Design of broadband modulation suitable for tropical maritime (e.g. Availability, capacity, etc)
- HF/VHF Ad-Hoc Network
  - Study and design of ad-hoc network suitable for tropical maritime and limited energy supply
  - Design ad-hoc network modem for HF/VHF
  - Design mobile ad-hoc network modem for HF/VHF for marine environment
- Satellite Communication
  - Portable transceiver for HF/VHF/S-band communications with satellites
  - Ground station system for HF/VHF/S-band communications with satellites
- Wireless sensors for environmental Monitoring
  - Energy-efficient high-accuracy wireless sensor network for various applications (e.g. Sea, forest, plantation, and other environments)
  - WSN-based monitoring system for: volcanic activities, earthquake, and flood
  - WSN-based environmental monitoring for climatic data and pollution (airborne & waterborne)
  - WSN-based precision agriculture, animal, forest monitoring
  - Underwater acoustic sensor network (UWASN) for measurement of various phenomena

Communication Infrastructure

- Distributed optical sensor for infrastructure and environmental monitoring:
  - Multipoint strain measurement based on fiber optic sensor and optical time domain reflectometer for structural health monitoring system
  - Simultaneous measurement for structural health monitoring system based on fiber optic sensors
  - Low cost environmental sensor (temperature, humidity, pH, trace gases sensors) based on polymer optical fiber.
  - Enviromental monitoring based on multipoints fiber optic sensors and optical time domain reflectometer.
  - Bio-chemical sensor based on integrated optic
  - Integrated optic devices for supporting optical signal processing.

Content & Apllication

- E-Learning infrastructure & platform model development
  - Tutor-less learning technology support, → edugame technology support
  - Film and creative industry tools: Augmented reality, High performance visualization, 3D animation, magic book
  - Parallel processing technology for learning content
  - Integrated service and learning system support for rural area
- Integrated Information systems for rural area
  - Information systems for applications of different characteristics (e.g. Food, health, etc):
    - Development framework: eg. hospital management, disaster management
    - Development Geografis Information systems
  - Requirement analysis framework
  - IT based services model of regional governance
  - Supply chain management model

Content & Applications

- Telemedicine and e-health services
  - Tele-consulting and tele-diagnosis suitable for use by lay people (under-educated) in remote/rural areas
  - Mobile and embedded system e-health integrated Applications
  - Medical rehabilitation
  - Mobile e-Health Vehicle
  - Teledermatology for skin disease
  - Teleopthalmology for eye disease
  - Telecardiology for heart monitoring
  - Teleradiology for TB and lung disease
  - Telepathology for malaria examination
  - Digitally recorded data based on standard format

Appendix 8: IPB List of Collaboration with Companies/Local Government

Current Counterparts of Biopharmaca Research Center

	Name of Counterpart	Address	Contact Person, e-Mail and Telp	Activities
INDUSTRIES				
1.	PT Bintang Toedjoe (National Pharmaceutical Industry)	Jl. A. Yani No. 2, Jakarta 13210	Yunawati Gandasasmita (Business Development Deputy Director)	• Research collaboration from 2006, grant were received from PT Bintang Toejoe and goverment. • Collaboration to develop product of herbal medicine from standardized extract – phytopharmaceutical product (cholesterol reducer, anti rheumatic, anti inflammation, immunostimulan) • Production of herbal medicine as result of research collaboration and Biopharmaca Research Center (BRC) research results. To be Comercilized by PT Bintang Toedjoe.
2.	PT SOHO Industri Farmasi (Pharmaceutical Industry)	Jl. Pulo Gadung No. 6 Kawasan Industri Pulo Gadung Jakarta 13920	Theodora Sri Widowati (Corp. Product Development)	• Collaboration for developing the Biopharmaca plantation region in the Sukabumi district since 2009, Especially for Curcuma xanthoriza and Curcuma domestica. • Mapping of region for plantation and station (Master plan formulation). • Cultivation and production of curcuma *xanthoriza* under supervision of BRC reseacher. • Research on the standardization of *Curcuma xanthoriza* and *Curcuma domestica* through metabolic and genomic approach • Research on the formulation of nanocurcuminoid for increasing bioavality as an antioxidant and antiinflamation.
3.	PT Primax Asia Link	Boulevard Artha Gading Ruko Sentra Bisnis Blok A7 A No 1 Kelapa Gading, Jakarta Utara	Koman Darlim (Product Manager)	• Research collaboration on domestication and cultivation of trenggiling *(Manis javanica*). • Research efficacy of *M.* javanica.

	Name of Counterpart	**Address**	**Contact Person, e-Mail and Telp**	**Activities**
4.	PT Erjan Biocell Pharmaceutical	Pantai Indah Utara II Blok K No. 8 E Mediterania – Pantai Indah Kapuk, Jakarta Utara	Erwin Wijaya Wong	• Collaboration on commercialization of research product, and herbal product of academic venture of BRC. • Research on the scientific background for selected products.
5	The Indonesian Herbs & Traditional Medicine Association (GP Jamu)	Plaza Lippo Lt 8 Jl. Jend. Sudirman Kav. 25, Jakarta 12950	Lili Siswanto	• Colaboration of dissemination of research output to the industries under GP Jamu coordination, through seminar, discussion and bisniss meting. • Collaboration to perform National and International seminar on Indonesian herbal medicine. • To Perform the globalization of Jamu on May 2011.
GOVERMENT INSTITUTION				
6.	Coordinating Ministry of Economic Affairs Republic of Indonesia	Jl. Lapangan Banteng Timur No. 2-4,Jakarta Pusat 10710	Ir. Musdhalifah M., MT (Asisten Deputi Urusan Perkebunan dan Hortikultura)	• To create Jamu as brand of Indonesia since 2007, through seminar, exhibition and policy paper. • To signergizes all of the stakeholder to develop the herbal in the formal health care system in Indonesia. • To create Internationalization of Jamu. • Designed roadmap of jamu in Indonesia collaborated with many ministries in Indonesia. • To perform the globalization of jamu on May 2011.
7.	Ministry of Agricultural Republic of Indonesia	Jl. Harsono RM. No. 3, Ragunan-Jakarta 12550	Dr. Yul Harry Bahar (Direktur Budidaya Sayuran & Biofarmaka, Direktorat Jenderal Hortikultura)	• Research collaboration on cultivation of potential medicinal plants and medicinal plants farmer supervision since 2003. • Supervised groups of farmer to export *curcuma xanthoriza* to Korea. • Research on developing and using the bioregionalization concepts in cultivated the medicinal plants. • Designed roadmap of jamu in Indonesia collaborated with many ministries in Indonesia. • To perform the globalization of jamu on May 2011.
8.	Ministry of Health Republic of Indonesia	Jl H.R.Rasuna Said Blok X.5 Kav. 4-9, Jakarta	Dra. Sri Indrawaty, Apt, M.Kes (Direktur Jenderal Bina Pelayanan Kefarmasian dan Alat Kesehatan)	• To create and established the jamu saintification program. • Designed roadmap of jamu in Indonesia collaborated

	Name of Counterpart	**Address**	**Contact Person, e-Mail and Telp**	**Activities**
				with many ministries in Indonesia. • To perform the globalization of jamu on May 2011.
9.	The National Agency of Drug & Food Control Republic of Indonesia	Jl. Percetakan Negara No.23 - Jakarta 10560	Dr. Sherley, Apt (Direktur Obat Asli Indonesia)	• Collaboration on research and policy since 2004. • Research Collaboration on selected national priority of medicinal plants in cultivitation and efficacy 2005-2008. • Mapping Indonesian Medicinal plants at 2004-2007. • Designed roadmap of jamu in Indonesia collaborated with many ministries in Indonesia. • To perform the globalization of jamu on May 2011.
10.	Accosiation of Indonesian Herbal Medical Doctors	Menara Kuningan Lt. 2 Jl. HR. Rasuna Said Blok X-7 Kav 5, Jakarta 12940	Dr. Hardhi Pranata, Sp.S, MARS (Ketua Umum PDHMI)	• To improve the nationalization of jamu in Indonesia by jamu saintification program (policy seminars, exhibition).
11.	Indonesian Medicinal and Aromatic Crops Research Institute, Estate Crops Research and Development Institute (BALITTRO)	Jl. Tentara Pelajar No. 3 Cimanggu Bogor 16111	CP: Dr. Ir. Nurliani Bermawie , MS	• Collaboration on research and policy since 2002. • Research collaboration for developing cultivation and production of medicinal plants, through the funding of Agriculture Minister since 2004. • Designed roadmap of jamu in Indonesia collaborated with many ministries in Indonesia. • To perform the globalization of jamu on May 2011.
12	Bogor City Goverment	Jl. Juanda No. 1 Bogor	Drs. H. Ade Sarip Hidayat, M.Pd (Pak Beni, Asisten Pak Ade)	• Supporting national and international seminar on Indonesian herbal medicine and other activities of BRC.
13.	Sukabumi City Goverment	Jl. R. Syamsudin, S.H., No. 54, Sukabumi - Jawa Barat	Dedi	• Collaboration in developing Biophramaca region with PT SOHO since 2009. • Supporting and supervising the farmer which involve in the cultivation of *C. xanthoriza.* • Research on cultivitaion of some Medicinal plants which it use in the program of jamu scientification. • Sukabumi City Goverment provided agricultural land to cultivate the potential medicinal plants for research and production.

	Name of Counterpart	**Address**	**Contact Person, e-Mail and Telp**	**Activities**
UNIVERSITIES				
14.	Lambung Mangkurat University, Kalimantan Selatan (South Kalimantan)	Jl. A.Yani, Km.35,5 Banjarbaru Kota. Kode Pos 70714 Kalimantan Selatan	Dr. Hesty Heryani	• Internship and supervising on research in medicinal plants. • Research collaboration on Tabat Barito for product development.
15.	Palangkaraya University, Kalimantan Tengah (Center Kalimantan)	Kampus Unpar Tunjung Nyaho, Jl. Yos Sudarso, Palangkaraya 73112, Kalimantan Tengah	Dr. Saputera	• Research collaboration on cultivation of *croton tiglium* as biological larvacide for preventing dengue haemorraghic fever.
16.	Airlangga University, Surabaya, Jawa Timur (East Java)	Jl. Prof. Dr. Moestopo No. 47 Kampus A Fakultas Kedokteran Unair Surabaya 60131 Telp 031-5020251 Faks 031 5027594	dr. Arijanto Jonosewojo (Ketua Program Studi BATTRA, Fakultas Kedokteran UNAIR dan Kepala Poli Obat Tradisional RS Dr. Soetomo)	• Research collaboration on clinical assay of cholesterol reducer herbal medicine. • Collaboration for pogram of jamu scientification.
17.	Mulawarman University (East Kalimantan)	Kampus Gunung Kelua, Jl. Kuaro I / 5, Kotak Pos 1068, Samarinda 75119, Kalimantan Timur	Irawan Wijaya Kusuma, Ph.D	• Collaboration in emporwerment community of the ITTO (International Tropical Timbre Organization) project since 2003. • Research collaboration on the potency of wood for antibacterial and GTS. • Initiating research collaboration on *Goniothalamus* macrophylus for TNF-α activity.

Current Counterpart Utama Seed Center- IPB

No	Nama Instansi	Alamat	Kontak Person	
			Nama	Jabatan
1	Dinas Pertanian Tanaman Pangan Provinsi Jawa Tengah (PEMDA)	Jawa Tengah	Aris Budiono	Kepala Dinas Pertanian Tanaman Pangan Provinsi Jawa Tengah
2	PT. Bisi Internasional, Tbk (PERUSAHAAN)	Kediri	Dr. Mulyantoro	
3	UNILA (PERGURUAN TINGGI)	Lab. Benih Fakultas Pertanian UNILA Bandar Lampung	Ir. Tjipto Roso Basoeki	
4	Gapoktan Mulya Tani-Kerawang (NGO)	Desa Karang Wetan, Kec. Karang Timur, Karawang	Kinkin Zaenal Mutaqin	PPLH
5	Gapoktan Sawargi-Cianjur (NGO)	Desa Bumi Kasih, Warung Kondang Cianjur	Machpudin S.PKP	PPLH
6	PT. Andal Hasa Prima (PERUSAHAAN)	Lampung	Ir. Achmad Lutfi	Direktur

Current IPB's Collaboration Partners for Forest Research and Conservation

No.	Partners	Contact Person
1	VITRI (Viikki Tropical Forest Research Instute Unive Helsinki)	Olavi Luukanen, Eshetu Yirdaw
2	University of Tsukuba	Prof. Misa Masuda
3	Universitas Hiroshima	Toshinori Okuda
4	Kyoto, Tsukuba, Tokyo Universities	Dr Kosugi Ken'ichirou; Prof Tanaka Tadashi
5	AKECU; SNU	Prof HoSang Kang;
6	APFNet	WANG Qian (Ms)
7	Beijing Forest University	Jun Yang, PhD,
8	Monash University	Dr Paul McShane;
9	Charles Darwin University	Sally Hodgetts
10	The Fenner School of Environment & Society ANU College of Medicine, Biology & Environment	Professor Peter Kanowski
11	TOSO company	Kodrat,
12	Conoco Phillips Co Ltd	Krishna,
13	WWF Indonesia	Dr Wishnu;
14	The Nature Conservation (TNC)	Dr Dicky Simorangkir; Dr Damayanti Buchory;
15	RARE	Dr Harry;
16	Univ Texas Elpaso	Dr Stacy Sowards;
17	Perum PERHUTANI	Lukman,
18	Ministry of Forestry	Dr Hadi Daryanto,
19	Ministry of Environment	Inge,
20	Ministry of Energy and Mineral Resources	Marpaung, MS;
21	Batam City	Ir Dendi;
22	PT. Salim Ivomas Pratama	Ambar/ Eko
24	PT. Subur Agro Makmur	Novi
28	PT. Inti Indosawit Subur	Asrini Subrata
29	PT. Bangun Nusa Mandiri	Norman / Febia / Vira
30	PT. Henrison Inti Persada	Hery Prasetya
31	PT. Bumitama Agro Gunajaya	Emma Isabella
32	PT. Karya Makmur Sejahtera	Yohannes / Yanti
33	PT. Lanang Agro Bersatu	Adik Dwi Retno
34	PT. Henrison Inti Persada	Hery Prasetya
36	PT. SMART	Fauzan

Appendix 9: ITS List of Collaboration with Companies/Local Government

CURRENT UNIVERSITY – INDUSTRY COLLABORATION at ITS

	Name of Counterpart	Address	Contact Person, e-Mail and Telp	Brief Summary of Current and Past Activities with IPB
INDUSTRIES				
1.	PT. Dok dan Perkapalan Surabaya	Jl. Perak Barat No. 433-435, Surabaya 60165	Eriansjah, Sekretaris Perusahaan (Corporate Secretary)	- Marine Technology - Research activities since start of ITS - Student internship
2.	PT Gerbang Multindo Nusantara	Jln. Sapta Taruna Raya No. 16 Jakarta 12310	Mr Chayun Budiono President Director	Energy Monday 25th April 2011
3.	PT Telkom	Jln. Ketintang Surabaya	Mr. Suhendy GM of Consumer Affairs for East Java	ICT
4.	Perusahaan Daerah Air Minum (Local Water Resource Company) Kota Surabaya (Surabaya City)	Jln. Prof. Dr Mustopo Surabaya	Mr. Mohammad Selim President Director	Housing, Human Settlement, Environment, Disaster Management
5	PT. Hamdala Graha	Jln. Ronggolawe No. 19 Surabaya	Mr. Achmad Rudiansyah President Director	Housing, Human Settlement, Environment, Disaster Management
GOVERMENT INSTITUTION				
1.	East Java Provincial Office	DINAS PU CIPTA DAN TATA RUANG PROVINSI JAWA TIMUR, Jl Gayung Kebonsari No. 169 Surabaya 602033	Ir. Budi Susilo, Msc Head of Energy and Mineral Resouce Agency	- Collaboration resarch in geothermal enegy, housing design since 2003 - Receiving staff for academic activities for the Master degree
2.	East Java Provincial Office	Dinas Komunikasi dan Informatika		ICT
3.	KADIN			

Appendix 10: Meeting Member List

Name	Title	Department	Organization
Tanaka Kenji	President		Aneka Tuna
Wolfgang Kubitzki	Senior Social Sector Economist		Asian Development Bank
Rifki Akbari	Staf Perencana		BAPPENAS
Tatang Muttaqin	Head of Sub Directorate for Higher Education, Directorate of Religious Affairs and Education		BAPPENAS
Kalihputro Fachriansyah	Staff of Directorate of Religious Affairs and Education		BAPPENAS
Dimas Suryo	Staff of Directorate of Religious Affairs and Education		BAPPENAS
Yunawati Gandasasmita	Deputy Director		Bintang Toedjoe
Sari Pramadiyanti	Product Innovation Manager		Bintang Toedjoe
Yagi Tetsu	Investment Promotion Policy Advisor		BKPM (Investment Coordinating Board)
Iwana Masato	Group Leader		BTMU (Bank of Tokyo Mitsubishi UFJ)
Iwata Naoki	Group Leader		BTMU (Bank of Tokyo Mitsubishi UFJ)
Musdhalifah Machmud	Assistant to Deputy		Coordinating Ministry for Economic affairs
Djoko Santoso	Director of General		DGHE
Ir. Achmad Jazidie	Director	Institutional and Collaboration Affairs	DGHE
Harris Iskavar	Secretary		DGHE
Dadang Sudiyarto	Head of Planning		DGHE
Illah Sailah	Director	Learning and Student Affiars	DGHE
Suryo Hapsoro			DGHE
Wake Taiji	JICA Advisor		DGHE/JICA
Chairul Djaelani	Former assitant Government for Energy & Development	Commissioner to the Bank Jatim (East Java Bank)	East Java Provincial Government
Budi Susilo, Msc	Head of Civil Works and Regional Spatial Development Agency	Provincial Government of East Java	East Java Provincial Government
Eryono	Representing Head of Marine Affair and Fisheries Agency	Provincial Government of East Java	East Java Provincial Government
Shirley	Fisheries and Marines	Provincial Government of East Java	East Java Provincial Government
Dewi J Putriatni	Head of Energy and Mineral Resouce Agency	Provincial Government of East Java	East Java Provincial Government
Herry Suhardiyanto	Rector		IPB

Name	Title	Department	Organization
Anas M. Fauzi	Vice Rector for Research and Collaboration		IPB
Yonny Koesmaryono	Vice Rector for Academic and Students Affairs		IPB
Arif Imam Suroso	Vice Rector for Business and Communication		IPB
Hermanto Siregar	Vice Rector for Resources and Development		IPB
Latifah K Darusman	Professor	Biopharmaca Research Center	IPB
Agus Purwito	Head of Department	Agronomy and horticulture	IPB
M. A. Chozim	Professor	Deparment of Argonomy and Horticulture	IPB
Hendrayanto	Dean	Department of Forest Management	IPB
Iwan Riswandi	Director	Planning and Development, Research and Strategic Issue Studies (RKS)	IPB
Puji M	Director	Academic administration	IPB
Ahamd Junaedi	Dr.	Agronomy and horticulture	IPB
Satriyas Iiyas	SIL	Agronomy and horticulture	IPB
M. Rahouad Fuhastauts		Agronomy and horticulture	IPB
Desta Wirras	DWI	Agronomy and horticulture	IPB
Sugiyanta	Secretary	Agronomy and horticulture	IPB
Memen Surahman	MSU	Agronomy and horticulture	IPB
Ahmad Junaidi	AJU	Agronomy and horticulture	IPB
Emy Widajati	EWI	Agronomy and horticulture	IPB
Trikoeremaningtyas		Agronomy and horticulture	IPB
Aris Munandar	AMU	Agronomy and horticulture	IPB
I Made Aerika		Biochemistry	IPB
Syamsul Falah		Biochemistry	IPB
Anna P. Roswiem		Biochemistry	IPB
Popi A.K		Biochemistry	IPB
Dimas Andrianto		Biochemistry	IPB
Mega Safithri		Biochemistry	IPB
Agung Zaim	MSC	Biopharmaca Research Center	IPB
Miri Rahminiwah		Biopharmaca Research Center	IPB
Yulin Lestari	Professor	Biopharmaca Research Center	IPB

Name	Title	Department	Organization
Dyah Iswantini	Secretary	Biopharmaca Research Center	IPB
Edy Dyayharl	Researcher	Biopharmaca Research Center	IPB
Heri Purwial	Ir	Biopharmaca Research Center	IPB
Rudi Heryanto	Researcher	Biopharmaca Research Center	IPB
Sulistiyani	MSc	Biopharmaca Research Center	IPB
Dodik Ridho Nurrochamt	Director	CDA	IPB
Iln Solihin	Vice Director	CDA	IPB
Nandi Kosmaryandi	Vice Director	CDA	IPB
Sri Muknani	Lecturer	Chemistry department	IPB
Sri Sugiarti	Lecturer (Secretary)	Chemistry department	IPB
Eti Rohaeti Azis	Lecturer (Secretary)	Chemistry department	IPB
Gustini Syahbirin	Lecturer	Chemistry department	IPB
Irmanida Batubara	Lecturer	Chemistry department	IPB
Rinekso Soekmadi	Director	Collaboration international programs	IPB
Roedhy Purwanto	Professor	Deparment of Argonomy and Horticulture	IPB
Ervizal Amzu	Professor	Deparment of Forestry	IPB
Nastiti Kusumorini	Vice Dean	Department of Veterinary medicine	IPB
Riuwkso Soekmadi	Dr.	Dit Collaboration & International programs	IPB
Erizal	Director	Facilty and property	IPB
Dahrul Syah	Graduate School	Food Science and Technology	IPB
Ellyn K Damayanti	Faculty of Forestry	Forest resource conservation	IPB
Sulistiono	Secretary	Institute for Research and Community Service (LPPM)	IPB
Irmanida Batubara	Researcher	IPB, Biopharamaca	IPB
Qodarian P	Researcher	IPB, Landscape architect	IPB
Ikasandar Siregar	Director	IRCS	IPB
Hasim	Dr.	Mathmatic& Science	IPB
Iskandar Siregar	Director	Research and Strategic Issue Studies	IPB
Rimbawan	Director	Student Affairs	IPB

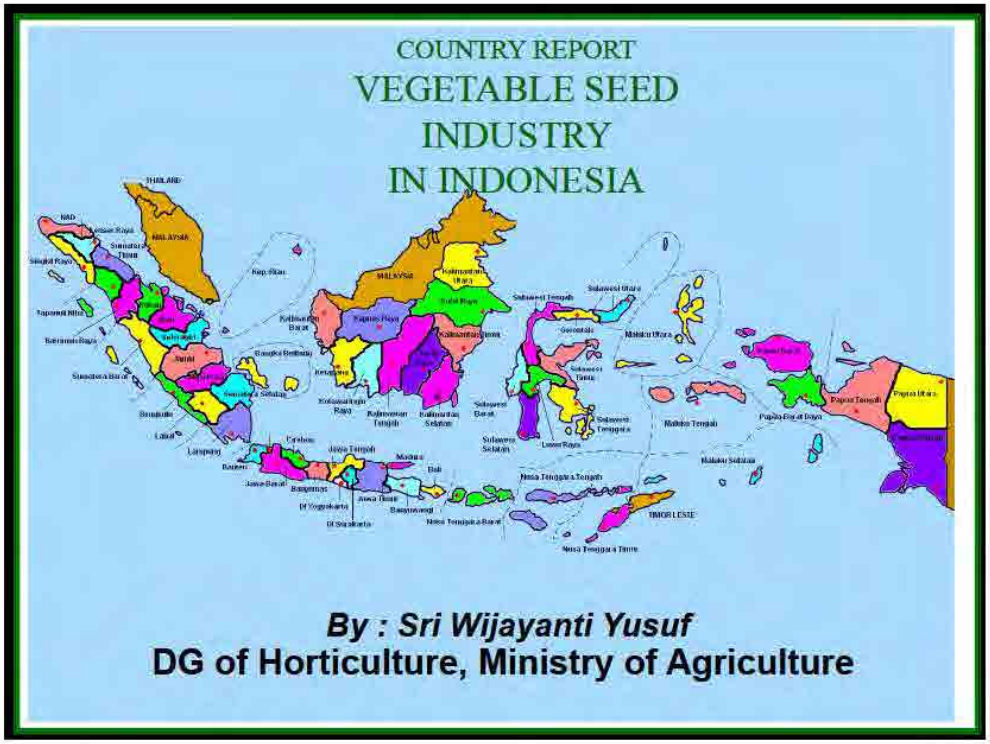
Name	Title	Department	Organization
Kamaluddin Zarkasie	Dr.	Vice President Directror of PT. IPB Shigeta	IPB
Saiani Sujcprihati	SSP		IPB
Makhlani	Field Representative Indonesia		Islamic Development Bank (IDB)
Priyo Suprobo	Rector (Until April 2011)		ITS
Triyogi Yuwono	Rector (From April 2011)		ITS
Eko. B. Djatmiko	Vice Rector	Coop & Development, Offshore Engineering	ITS
Sugeng Winardi	Vice Rector	Department of Chemical Engineering	ITS
Suasmoro	Vice Rector	Department of Mathmatics	ITS
Afif Dunaidy	Vice Rector for Academic Affairs		ITS
Begain Perencanaan			ITS
Ngurah A		Architecture	ITS
Sir Nastiti. N.E.	Dr.	Architecture	ITS
Dain Saprarini	Ms	Biology	ITS
Dian Saptorini	MSC	Biology Department	ITS
Wahyudi		Center for Disaster & Earth Science Studies	ITS
Ispurwano Soeuranno	Dr.	Center for human settlements, Infrastructure and Environment	ITS
Bekti Cahyo		Center ICT & multimedia	ITS
Padcy		Center of Implementation Master Plan (PIMPITS)	ITS
Randy Prantama		Center of Implementation Master Plan (PIMPITS)	ITS
Putu Artama	Dr.	Civil Engineering	ITS
Putu Ede Ariastifa	Dr.	Civil Engineering	ITS
Data		Civil Engineering	ITS
Hera. W		Civil Engineering	ITS
Purwantia Setijanti	PhD	Civil Engineering	ITS
Tavio	PhD	Civil Engineering	ITS
Budi Suswanto	PhD	Civil Engineering	ITS
Wirawan	Professor	Electrical Engineering	ITS
Ngurah	Dr.	Electrical Engineering	ITS
H. Fansur	Dr.	Electrical Engineering	ITS

Name	Title	Department	Organization
Ketut Eddy		Electrical Engineering	ITS
Gamantyo Hendranatoro	Professor	Electrical Engineering / LPPM	ITS
Eko Setijadi	Professor	Electrical Engineering Department	ITS
Hamzah Fansuri	Dr.	Energy & Engineering Lab	ITS
Agus M Hatta		Engineering Physics	ITS
Welly Herumarti		Environmental Engineering	ITS
Alia Bamayanti	PhD	Environmental Engineering	ITS
Agus Zaind	Dr.	Faculty of IT	ITS
Adiuad Affaudi	Professor	ICT Center	ITS
Budi Santosa	Professor	Industrial Engineering	ITS
Sutantra	Director	LPPM	ITS
Ketut Buda Artana	Dr.	Marine Engineering	ITS
I Made Ariana	Professor	Marine Engineering	ITS
Prabowo	Dr.	Mechanical Engineering	ITS
Triwikantoro	Dean of faculty	MIPP	ITS
Areis Sulisetyand	PhD	Naval architecture & Shipping engineering	ITS
Murdjiro		Ocean Engineering	ITS
Joko Lianto Buliali	Professor	Teknik Informatika	ITS
Manfud	Prof. Dr.	Vice Dean for Academic Affairs FTI	ITS
Bambang Pigeega	Civil Engineering Lecture		ITS
Kobayashi Chie	Senior Consultant	JAC Indonesia	JAC Indonesia
Shimizu Riki	Director General		Jakarta Japan Club
Miyata Naoaki	Representative		JICA Indonesia
Miura Mari	Representative		JICA Indonesia
Tanaka Kotaro	Advisor, Deputy Director,	Southeast Asia 1 and Pacific Department	JICA
Ishii Chihiro	Country Officer	Southeast Asia 1 and Pacific Department	JICA
Handito Joewono	Chief Stratefy Consultant, Arrbey	KETUA, Komite Tetap Peningkatan Penggunaan Produksi Dalam Negeri (P3DN)	KADIN
Kinkin		Department of Agriculture,	Karawang Communtiy
Haj Kaada		Mulyatani, Labor Union	Karawang Communtiy
Usagawa Tsuyoshi	Professor	Computer Science and Electrical Engineering,	Kumamoto University, Japan
Mustaid Siregar	Director		LIPI
Syamsul Hidayat	Researcher		LIPI
Rosniati Risna	Research Coordinator		LIPI

Name	Title	Department	Organization
Hayato Nakajima	JICA Expert		Ministry of Agriculture, Indonesia/JICA
Abd. Maliqm	ACDP consultant		Ministry of National Education, Indonesia
Asanuma Shuuichi	Professor	International Cooperation Center for Agricultural Education (ICCAE)	Nagoya University, Japan
Makihara Daigo	Associate Professor	Division of Network Development, ICCAE	Nagoya University, Japan
Itoh Keisuke	Associate Professor	Office of International Strategic Planning, International Exchange and Cooperation Headquarters, Deputy Secretary, Japan Intellectual Support Network in Agricultural Sciences (JISNAS)	Nagoya University, Japan
Nishizawa Takashi	President, Senior Economist		NOMURA AGRI PLANNING & ADVISORY CO., LTD. Japan
Eriansjah	General Secretary		PT DOK DAN PERKAPALAN SURABAYA (PERSERO)
Chayun Budiono	President		PT Gerbang Multindo Nusantara(GMN)
Sagoro Eddy	HR Personnel Assit. Manager		PT SHARP Electronics Indonesia
Asrial Chainiago	Sr. Manager, HRGA Dept		PT SHARP Electronics Indonesia
Muhammad Rudiansyah	Waki Koordinator Regional		PT. Hamdala Graha, Indonesia
Nada Marsudi	Director	International, S&T Programs,	RISTEK
Tiomega Gultom		Program Ristek Internasional	RISTEK
Dinny Afifi			RISTEK
Ahmad Dading Gunadi			RISTEK
Andika Fajar			RISTEK
Indri Hapsari			RISTEK
Hendra. D			RISTEK
Emm Wuryaningsih		School of Entrepreneurship	Splashh SE, Indoensai
Toha WA		District Government, Planning Unit	Sukabumi Community
Dedisullarpdic		District Government, Agricultre Unit	Sukabumi Community

Name	Title	Department	Organization
Widaningsih		Penyulyh Pertanian Lapangan(PPL)	Sukabumi Community
Ade Hidayat		Pertanian	Sukabumi Community
M Oping		Pertanian	Sukabumi Community
Lasidus		Pertanian	Sukabumi Community
Bulbin		Pertanian	Sukabumi Community
A Sanusi		Pertanian	Sukabumi Community
Lucky Indra		Pertanian	Sukabumi Community
Samaya Hidayal		Pertanian	Sukabumi Community
Ai Hohdjal		Pertanian	Sukabumi Community
Nakajima Takamasa	Manager,	Environment and Recycling Business Team, Environmental Solution Business Department	Sumitomo Corporation
Hidayat Kurniawan	Account Manager		Telekom Indonesia
Didik Rudiyanta	Coordinator Account Manager		Telekom Indonesia
Tatik Herawati	Customer Solution		Telekom Indonesia
Kiuchi Yukio	Professor	Director, International Cooperation Center for Engineering Education Development (ICCEED)	Toyohashi University of Technology, Japan
Hozumi Naohiro	Professor	ICCEED / Department of Electrical and Electronic Information Engineering	Toyohashi University of Technology, Japan
Margaret K. Sancho	Director, Education Office		USAID Jakarta
Tarmi Pudjiastuti	Education Specialist		USAID Jakarta
Cheryl A. Anderson	General Development Officer		USAID Jakarta
Sally J Patton	Senior Education Advisor		USAID Jakarta
Muhammad N. Khan	Supervisory Infrastructure Development Advisor, Education Office		USAID Jakarta

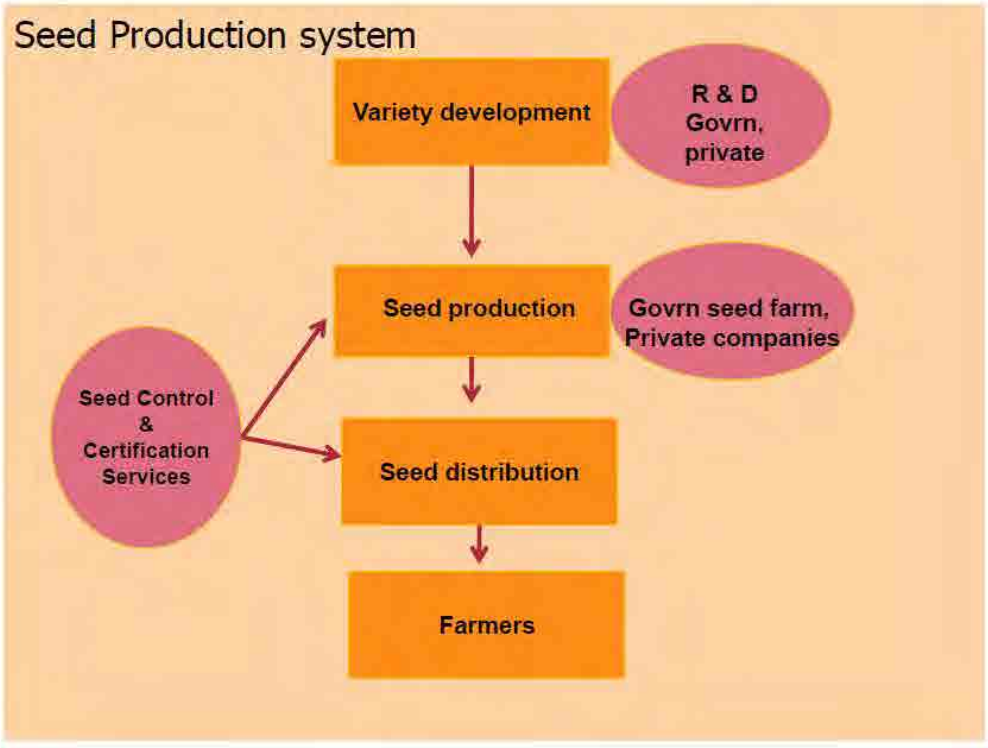
Appendix 11: Vegetable Seed Industry in Indonesia



BACKGROUND

- Agriculture : food crops, horticulture, estate crops, livestock
- Horticulture crops : Vegetables, fruits, ornamental plants and medicinal plants
- Vegetables : potato, shallot, chilli, tomatoes, string bean, bean, cucumber, kangkong, carrot, cabbage, chinese cabbage, etc.
- Fruits : mango, mangosteen, durian, orange, banana, papaya, starfruits, etc.

* Agriculture land > 20 million ha :
  - Fruits : 727.196 ha
  - Vegetables : 995.707 ha
  - Paddy : 12.327.425 ha
  - Maize : 4.001.727 ha
  - Estate crops :



Seed Regulations

- Agricultural Act no 12 year 1992
- Government Regulation no 44 year 1996
- Agriculture Ministerial decrees :
  - No 37 year 2006 on Variety release
  - No 38 year 2006 on import and export of seed
  - No 39 year 2006 on seed production, Certification & distribution
  - Some decrees on quarantine requirement

Important Rules

- All varieties which will be commercialized have to be released by the government
- All commercial seed have to be certified
- Import/export of seed have to have a permit from the minister of agriculture
- Seed producers and traders have to be registered at agriculture office
- Distribution of seed is controlled by government (seed inspectors)
- Seed which can be produced in Indonesia, only 2 years after released could be imported

Problems on Horticulture Seed Development

* Supply of quality seed is limited
* Information on seed supply and demand is weak
* Some of farmers prefer using their own seed
* Price of quality seed are expensive
* Law enforcement still weak
* Number of breeder is limited

Objectives of Seed Development

- To increase quality seed supply to fulfill farmer's needs
- To create job opportunities
- To increase farmers welfare

Vegetable Planting Area 2008

Crops	Planting area (ha)	Seed demand (kg)
Potatoes (ton)	62.375	103.272
Shallot (ton)	93.694	118.655
Chilli	194.588	75.494
Stringbean	85.469	2.454.059
Tomatoes	51.523	19.617
Bean	31.330	1.297.335
Kangkong	47.024	1.380.818
Cabbage	60.711	19.957

Vegetable Planting Area 2008

Crops	Planting area (ha)	Seed demand (kg)
Cucumber	56.636	109.421
Carrot	23.695	107.045
Chinese cabbage	54.973	28.573

Supply-Demand Vegetable Seed 2008

Crops	Demand	Supply			% sup/demand
		National	Import	Total	
Potatoes (ton)	103.272	5.281	2.785	8.066	7,8
Shallot (ton)	118.655	14.022	4.500	18.522	15,6
Chilli (Kg)	75.494	21.998	9.167	31.165	41,3
Stringbean (kg)	2.454.059	1.429.436	1.410	1.430.846	58,3
Tomatoes (kg)	19.617	5.625	4.626	10.251	52,3
Bean (kg)	1.297.335	378.861	150	379.011	29,2
Kangkong (kg)	1.380.818	1.214.516	42.651	1.257.167	91,0
Cabbage (kg)	19.957	-	14.250	14.250	71,4

continued

Supply-Demand Vegetable Seed 2008

Crops	Demand	Supply			% supp/demand
		National	Import	Total	
Cucumber (kg)	109.421	140.264	5.404	145.668	133,1
Carrot (kg)	107.045	1.250	6.014	7.264	6,8
Chinese cabbage (kg)	28.573	18.646	5.434	24.080	84,3

Export-Import of Vegetable Seed 2007-2008

Crops	Export (Kg)		Import (Kg)	
	2007	2008	2007	2008
Chilli	12.606	18.661	9.855	9.167
Stringbean	.	12.386	3.000	1.410
Tomatoes	1.120	2.170	5.667	4.626
Kangkong	575.000	2.138.020	102.000	42.651
Cucumber	11.454	6.309	10.610	5.404
Bean	.	5.000	-	150

SEED INSTITUTIONS

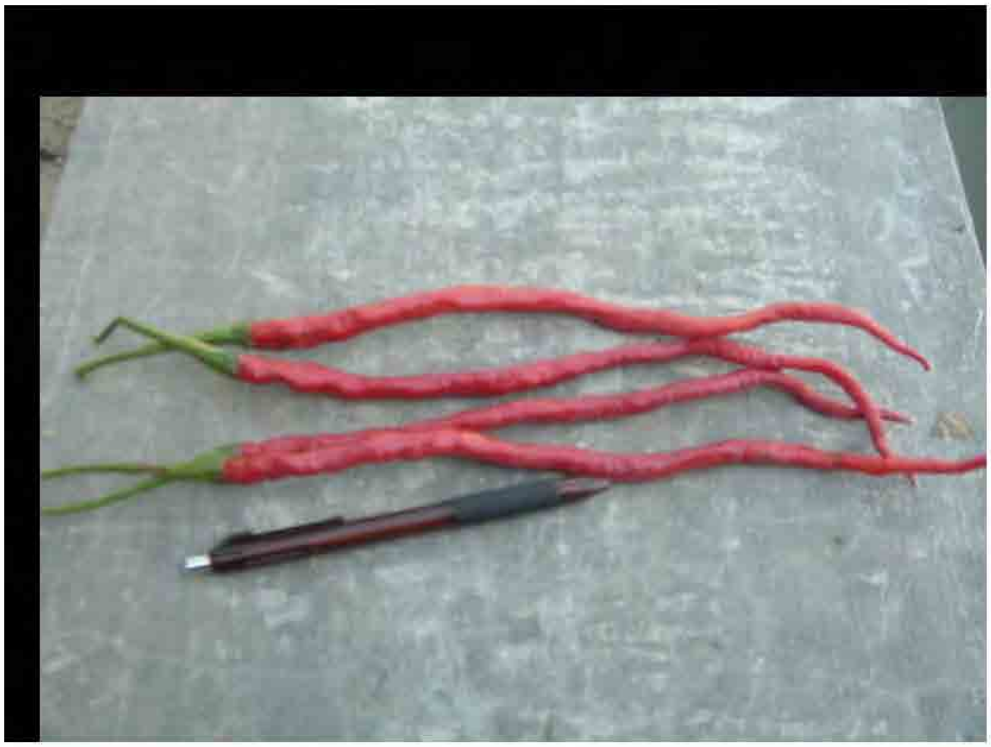
* Horticulture seed farms : 32 units
* Seed Control and Certification Services : 32 units
* Seed inspectors : 1.372 persons
* National Vegetable Seed Associations : 5
* Vegetable seed Producers :
  - Multinational companies : EWSI, BISI, Takii, Syngenta, etc
  - National companies : > 100 companies
  - Government seed companies : 2
* Horticultural Research Centre (Government)

Government strategy

- To improve seed regulation, more suitable for horticulture seed
- To encourage variety development
- To improve capacity of human resource (breeder, seed inspectors, seed producers, seed traders, farmers)
- To encourage private participation on seed industry
- To strengthen law enforcement


BR
Benih Buncis
Seed Beans


KAPASITAS PRODUKSI RUMAH KASA UKURAN 6 X20 M
Kapasitas Tanam 1000 stek dengan hasil rata-rata 25 umbi sehingga dihasilkan 25.000 umbi G0 setiap musim tanam




THANK YOU
TERIMAKASIH