RESEARCH INNOVATION & PARTNERSHIP

2016

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INNOVATION &
PARTNERSHIP 2016

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Preface from

Rector & Vice Rector

for Research, Innovation and Partnership

Preface from the Rector for Research, Innovation and Partnership

Assalamu'alaikum Warahmatullahi Wabarakatuh.

Praise be to God Almighty for all the grace conferred upon all of us in the journey of the Institut Teknologi Bandung (ITB), carrying out the mission of higher education for 96 years since the founding of the Technische Hoogeschool, Bandung in 1920. As the oldest university in Indonesia, focusing on science, technology and arts, ITB will be celebrating its 100 years anniversary three years from now. This may be old for a human but it is relatively young for a university. However, together with other world class universities, ITB has always been committed to playing a significant role in shaping the future of higher education in the world.

In its journey, ITB has executed its tri dharma mission by supporting research, innovation and partnerships that have an impact on society through technology and building synergy between university, industry and government institutions. As an autonomous public university (PTN BH) that upholds academic excellence, ITB is required to produce graduates who can compete at an international level and display character, integrity and a pioneering spirit.

In carrying out its mission of transforming from a research university into an entrepreneurial university, ITB strives to increase the number of international publications and citations, improve its global and Asian university ranking position, to serve and contribute to community empowerment, and realize entrepreneurship through innovative works that benefit the nation. To achieve its national goals, ITB also intensifies collaboration with world-leading education and research institutions in various forms, such as dual degrees, exchanges of staff and students, joint research and conferences.

In the current era of rapid technological change, global competition and research budget constraints, ITB has to give its best efforts to align the focus of its research and innovation with the goal of improving Indonesia's competitiveness. With the support of all our stakeholders, we pursue the realization of our mission in achieving these goals.

On this occasion, I would like to thank all researchers and inventors who have given their dedication to ITB in improving ITB's research performance and all our partners who have supported the improvement of ITB's role in building the nation.

Wassalamu'alaikum Warahmatullahi Wabarakatuh.

Rector
Prof. Dr. Ir. Kadarsah Suryadi, DEA

"ITB has to give its best efforts to align the focus of ITB's research and innovation with the national goal of improving the nation's competitiveness"

Assalamu'alaikum Warahmatullahi Wabarakatuh

The Office of the Vice-Rector for Research, Innovation and Partnership has set strategic goals in research, innovation and community empowerment as the main pillars for achieving ITB's vision of becoming an entrepreneurial university. As a research-based institute our objectives are: 1) to improve research quality within the institute; 2) to enhance collaboration with partners, both domestic and foreign; 3) to improve research performance measured in terms of the number of publications in reputed scientific journals; 4) to enhance the impact of research publications in terms of number of citations; 5) to promote multidisciplinary research activities; 6) to encourage research collaboration. The societal impact of our research is also important for ITB to contribute to society through the development of science, art and technology; and 7) to support and promote the improvement of the position in international rankings of ITB's journals.

ITB as a leading technological institution in Indonesia aims to contribute scientific breakthroughs and technological advances in a number of frontier science and technology fields, including but not limited to bioscience and biotechnology, information and communication technology, nanoscience and nanotechnology, renewable energy, infrastructure and regional development, disaster management, cultural production and the environment.

"ITB as a leading technological institution aims to contribute scientific breakthrough and technological advances in a number of frontier science and technology fields for improving the nation's competitiveness"

ITB is engaged in an active role toward community empowerment as part of its tri dharma mission of solving national and societal problems. This mission is represented by the following strategic objectives, which are executed in bottom-up as well as top-down programs: 1) to enhance ITB's contribution in shaping Indonesia's competitiveness through research-based industrial consultative projects; 2) to promote an active role of staff in professional and training services for the community and; 3) to engage in the development and implementation of appropriate technologies and enhancement processes within the community, including small and medium enterprises, societal problem-solving and local infrastructures.

ITB as an entrepreneurial university always promotes the continuous development of ITB's contribution in shaping the nation's competitiveness through research and innovation. Our goals are: 1) to drive innovation and stimulate an entrepreneurial spirit and mindset among students, faculties and alumni; 2) to commercialize research output/results by improving their technology-readiness level and transforming knowledge into products; 3) to produce a significant number of patents and other forms of intellectual property; and 4) to develop science and technology based start-ups and spin-offs with the ultimate goal of building an ecosystem of which invention and innovation are the key components.

An innovation park that will promote the development of such an innovation ecosystem, involving researchers and innovators, industries and government, is under construction. In order to achieve these objectives with the available resources, strategic partnerships with other domestic and foreign universities, research institutions, industries, and governmental bodies will be continuously developed.

We highly appreciate all ITB researchers and inventors who have contributed to improving ITB's research and innovation profile at the national as well as at the international level. The publication of the book Research, Innovation and Partnership ITB 2016, containing facts and figures and selected researchers and inventors, is intended to provide an overview of recent research, innovation and partnership activities for all ITB stakeholders.

Wassalamu'alaikum Warahmatullahi Wabarakatuh

Prof. Dr. Ir. Bambang Riyanto Trilaksono
Vice Rector for Research, Innovation and Partnership

Preface from the Vice Rector for Research, Innovation and Partnership

World, ASIA and National Ranking

Research Grants, Publications, Citations

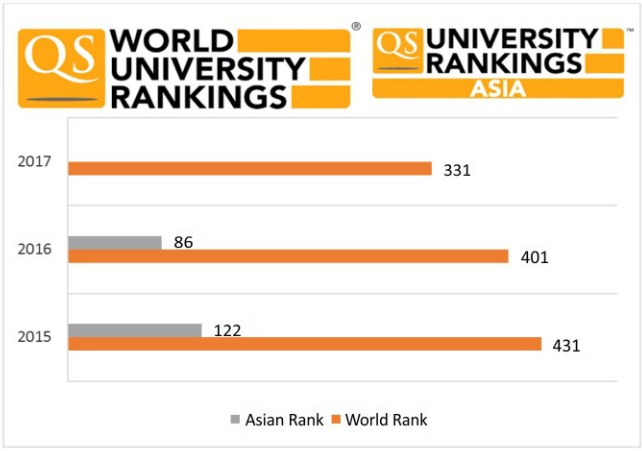
Start-up, Patent, Innovation Product

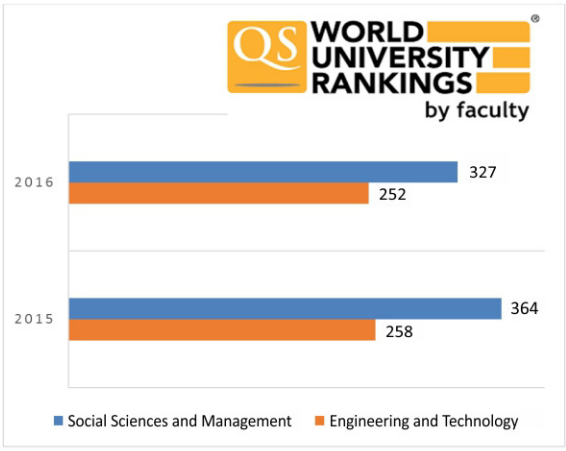
Community Services

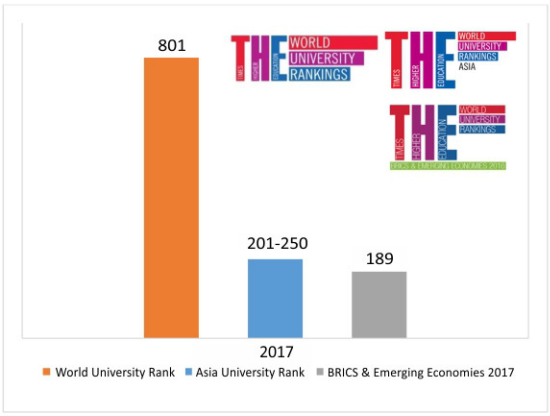
International Research Collaboration

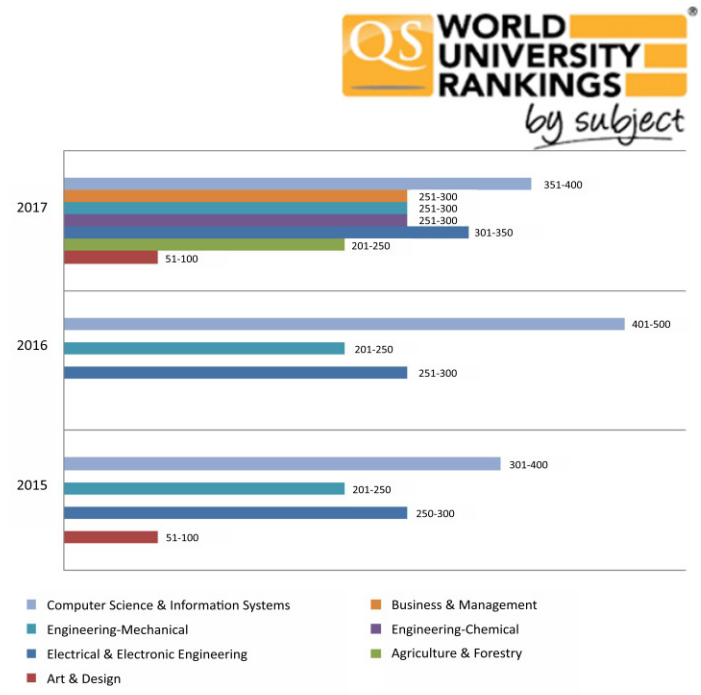
International Office Activities

World, ASIA and National Ranking





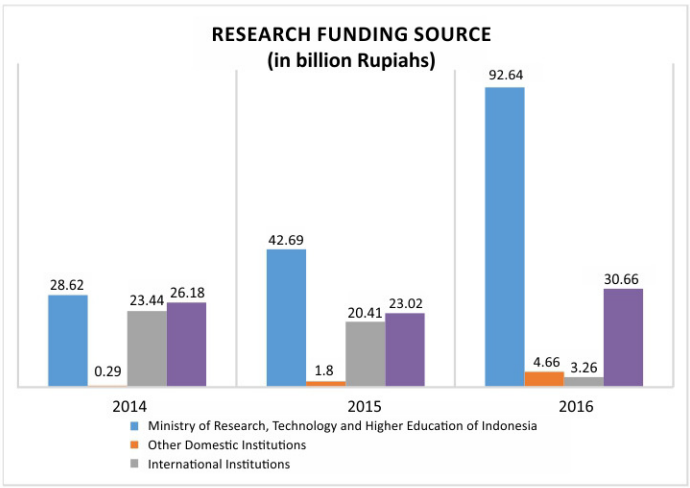


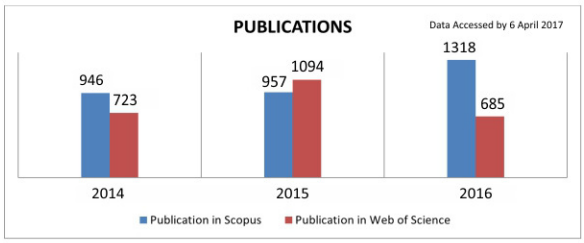


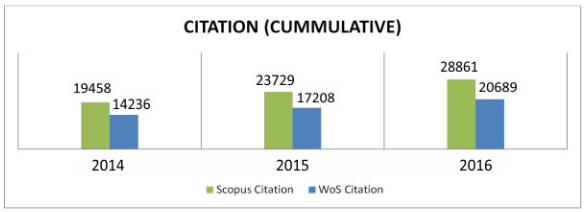
National University Rank

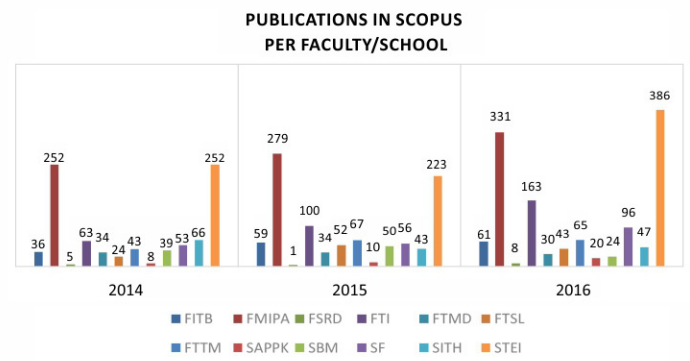
	2015	2016
Ministry of Research, Technology and Higher Education of Indonesia	1	1

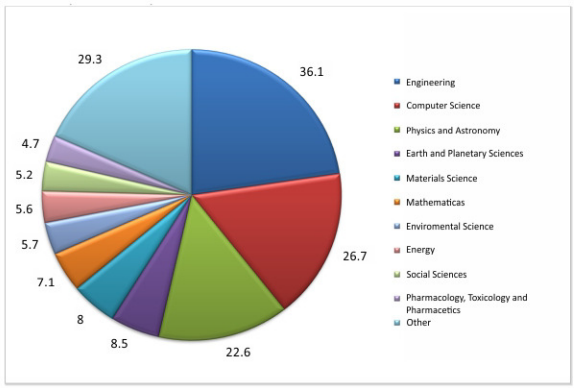
Research Grants, Publications, Citations

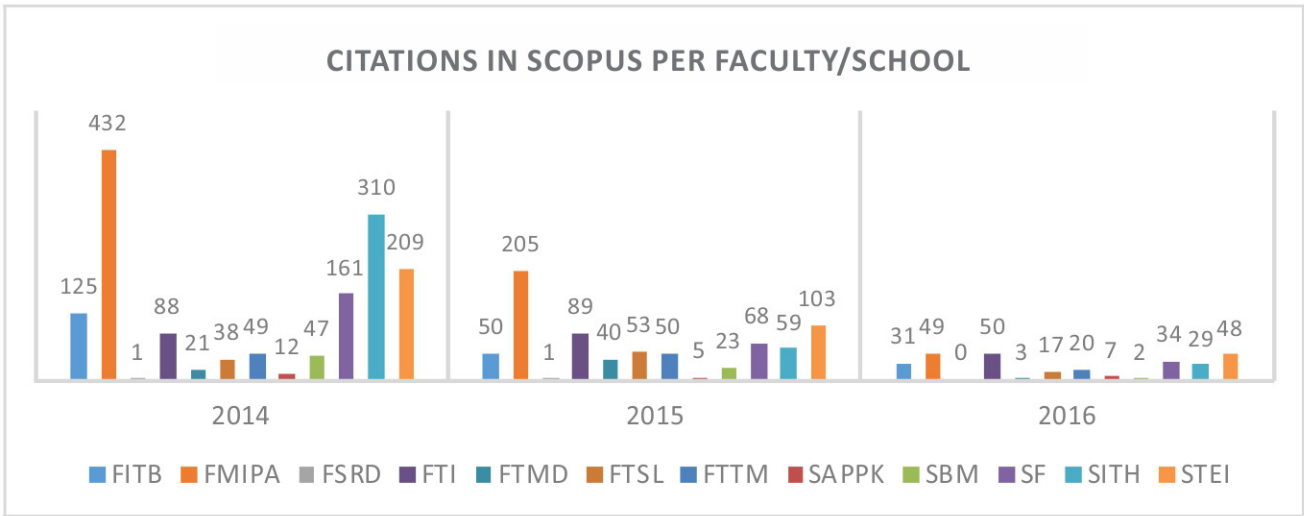






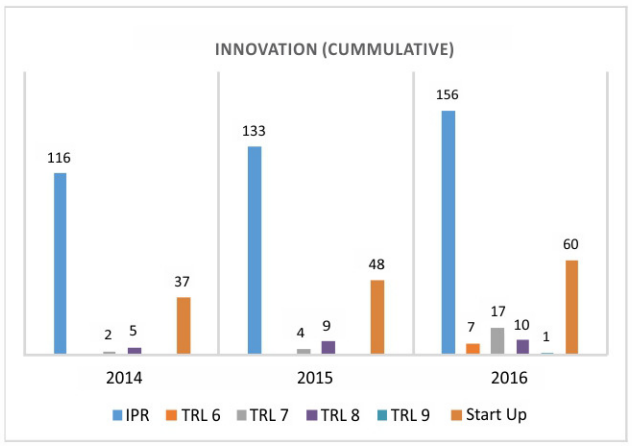


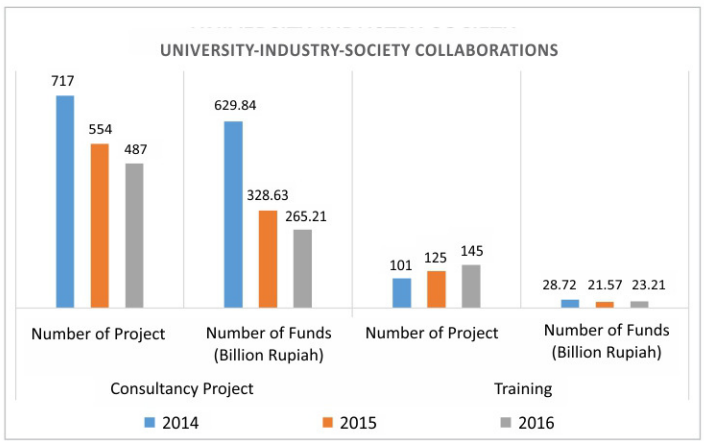


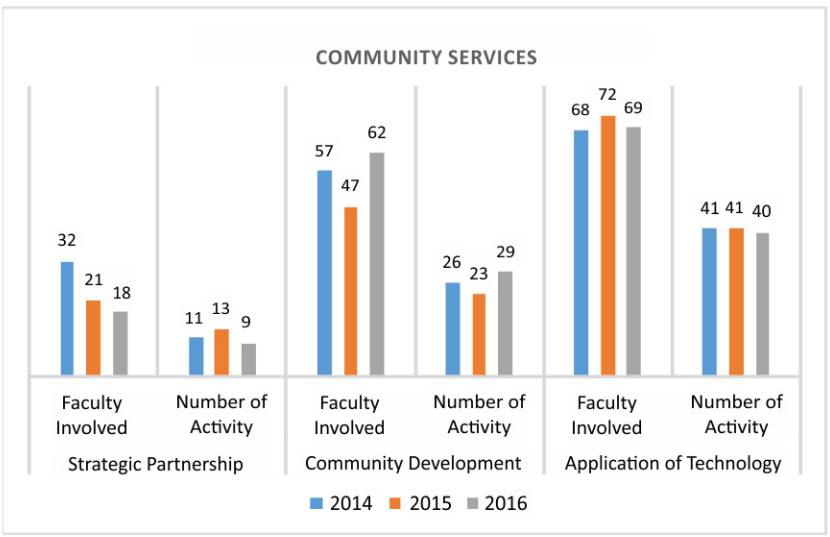


* list of faculties and schools on page ....

Start-up, Patent, Innovation Product, Community Services







International Office Activities

International Collaboration

Collaborating Institutions	Number of Joint Publication
Astronomical Institute Anton Pannekoek	9
Australian National University	28
Brown University	13
Chiba University	27
Chonbuk National University	7
CNRS Centre National de la Recherche Scientifique	12
De La Salle University-Manila	9
Delft University of Technology	28
DeutschesGeoForschungsZentrum GFZ	8
Ente Per Le Nuove Tecnologie, l'Energia e l'Ambiente	8
Federation University Australia	8
Fukui Science Education Academy	9
Government College University Lahore	9
Gunma University	10
Hasanuddin University	33
Hiroshima University	79
Hokkaido University	27
Ibaraki University	10
IEEE	10
International Islamic University Malaysia	8
Japan Advanced Institute of Science and Technology	8
Japan Atomic Energy Agency	23
Julius-Maximilians-Universitat Wurzburg	13
Kanazawa University	14
Keio University	18
Khulna University	16
Konkuk University	21
Korea Advanced Institute of Science & Technology	9
Kumamoto University	9
Kyoto University	63
Kyushu Institute of Technology	19
Kyushu University	46
Massachusetts Institute of Technology	10
Nagoya University	33
NakhonPathomRajabhat University	9
Nanyang Technological University	24
National Institute of Advanced Industrial Science and Technology	19
National Institute of Aeronautics and Space	18
National Institutes of Natural Sciences - National Astronomical Observatory of Japan	12
National Taiwan University	7
National Taiwan University of Science and Technology	11
National University of Singapore	32
Oregon State University	12
Osaka Prefecture University	7

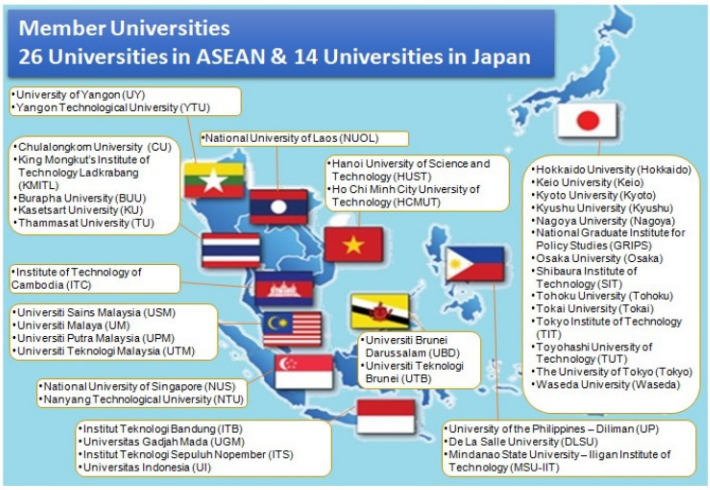
Collaborating Institutions	Number of Joint Publication
Osaka University	50
Pukyong National University	14
Purdue University	13
Riken	15
Sejong University	15
Technical University of Kosice	8
The University of Sydney	12
Tohoku University	33
Tokai University	8
Tokyo Institute of Technology	88
Tokyo University of Science	35
Toyohashi University of Technology	12
UC Berkeley	16
Universitas Udayana	28
Universitat Dortmund	8
Universitat Hamburg	14
Universitatzu Koln	17
Universite de Sherbrooke	9
Universite de Toulouse	15
Universite Montpellier 2 Sciences et Techniques	11
Universite Paul Sabatier Toulouse III	9
Universiti Putra Malaysia	29
Universiti Teknologi Malaysia	47
Universiti Teknologi MARA	11
UniversitiKebangsaan Malaysia	24
UniversitiSains Malaysia	77
University Michigan Ann Arbor	9
University of Adelaide	11
University of Durham	17
University of Fukui	44
University of Groningen	127
University of Illinois at Chicago	10
University of Iowa	8
University of Kansas Lawrence	9
University of Malaya	18
University of New South Wales UNSW Australia	24
University of Newcastle, Australia	24
University of Oxford	10
University of Queensland	9
University of South Alabama	8
University of Tokyo	98
University of Twente	34
University of West Bohemia	7
University of Western Australia	29
Van der Waals-Zeeman Institute for Experimental Physics	20
Virginia Polytechnic Institute and State University	10
Wageningen University and Research Centre	19
Waseda University	9

AUN/SEED-Net

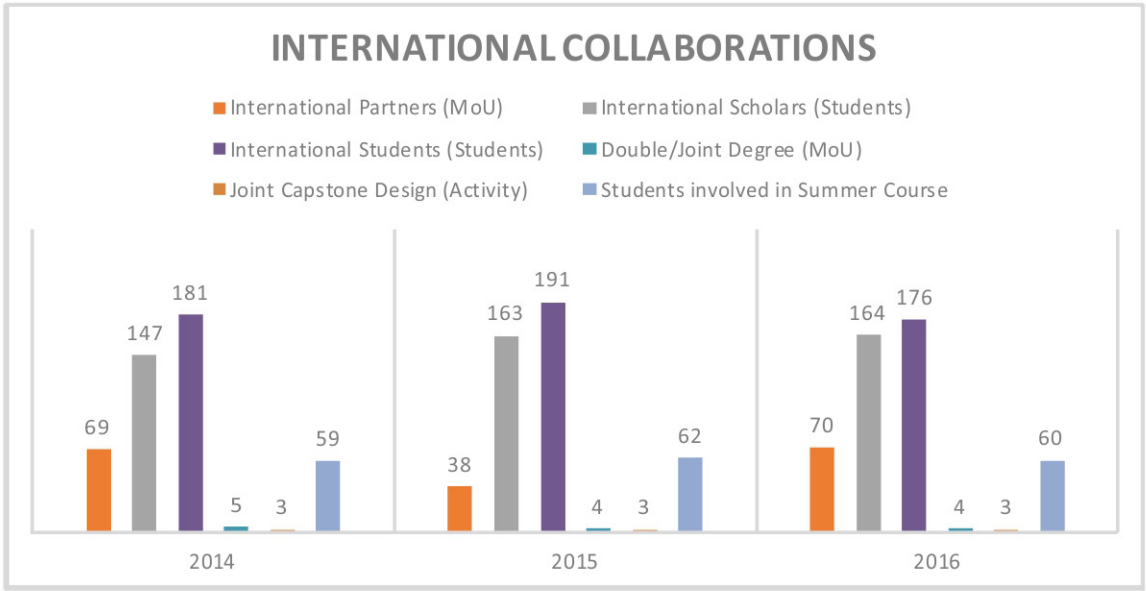
AUN/SEED-Net has been established to promote human resource development in engineering for sustainable socio-economic development of the ASEAN region. The network has 26 member institutions in ASEAN with assistance from 14 Japanese supporting universities

Program & Activity

- Graduate Degree Program
- Research Program
- Mobility and Networking
- University-Industry Linkage



Source: http://www.seed-net.org/



International Research Collaborations

PARE Project

This program will establish a collaborative educational system involving HU's six partner institutions in Indonesia and Thailand for the purpose of developing personnel to become global leaders that will be active in resolving challenges related to populations, activities, resources and environments (PARE) in ASEAN countries.

The program will foster human resources with the following four requisites: field research capacity, cross-cultural capability, frontier spirit, and problem solving competencies, which are essential for practical resolutions in the PARE chain.

source: http://pare.oia.hokudai.ac.jp/en/infromation.

PARE Member:

1. Hokkaido University, Japan
2. Chulalongkorn University, Thailand
3. Institut Teknologi Bandung, Indonesia
4 Kasetsart University, Thailand
5. Thammasat University, Thailand
6. Universitas Gadjah Mada, Indonesia
7. Bogor Agricultural University, Indonesia
8. Hokkaido Summer Institute, Japan
9. Nitobe School Hokkaido University, Japan
10.RJE3, EAST Russia-Japan Expert Education Program

Joint Research with the University of Oxford, UK

Figure : Research collaboration meeting at Oxford University with Prof. Roger Reed on Material modeling and development of ultralight metal structures.

ITB researchers are currently working on the joint research with Prof. Roger Reed at the Dynamic and Impact Engineering Lab, University of Oxford on the material modeling and development of ultralight metal structures applicable for railway vehicles. This joint research will be carried out in 2017-2019, and it is funded by The Royal Academy of Engineering & Newton Fund, UK. The objective of the joint research is to develop material constitutive model for high strength metallic materials and to predict its damage behavior, manufacturability process, and dynamic performance for light weigh railway vehicle such as Light Rail Transit (LRT) and Mass Rapid Transit (MRT) vehicles.

Figure: SHERA Program launching with Minister of Research Technology and Higher Education Prof. Muhammad Nasir, Deputy Chief Mission DCM-US Embassy Brian McFeeters on the Joint ITB-MIT Research for Electric Based Transportation Technology.

Joint Research with Massachusetts Institute of Technology (MIT) USA

ITB has been selected to receive research grant as part of the Sustainable Higher Education Research Alliance (SHERA) Program with MIT as the US partner institution. The joint research will be carried out from 2017 to 2021 with focus on developing the technology for electric based transportation. The National Center for Sustainable Transportation Technology NCSTT - ITB, chaired by Ir. Sigit P. Santosa MSME, Sc.D, will work together with Prof. Tom Wierzbicki from Impact and Crashworthiness Laboratory ICL-MIT to develop and implement a robust battery system for electric vehicle application. The ICL MIT is the pioneer in characterization of Lithium-ion battery cells and their components under mechanical abuse conditions.

SATREPS Project

Research activities under the SATREPS (Science and Technology Research Partnership for Sustainable Development) scheme is a cooperation between ITB and Kyoto University in the field of developing geothermal exploration technology, funded by JICA and ANN for the period of 5 years From April 2015 to March 2020.

Universitas Kyoto (Graduate School of Engineering) Team
Project Coordinator: Prof. Dr. Katsuaki Koike
Project Manager: Prof. Dr. Shigeki Sakurai
Member:
1. Koki Kashiwaya, Ph.D
2. Dr. Yohei Tada
3. Mr. Taiki Kubo

Institut Teknologi Bandung (Fakultas Teknik Pertambangan dan Perminyakan) Team
Project Coordinator: Prof. Dr. Sudarto Notosiswoyo
Project Manager: Mohamad Nur Heriawan, Ph.D
Member:
1. Irwan Iskandar, Ph.D
2. Dr.Eng. Asep Saepuloh (FITB)
3. Nenny Miryani Saptadji, Ph.D
4. Arie Naftali Hawu Hede, Ph.D

GUNDIH CCS PROJECT – INDONESIA:
Integrated Studies For Preparing The First Pilot CCS Project In South And Southeast Asia

Increasing levels of CO^2 from human activities in the atmosphere has become a serious problem which will lead to climate change with the impacts felt around the world. Experts in various fields are now working on technologies to reduce CO^2 emissions. Proposed solutions include injecting anthropogenic CO^2 into subsurface reservoirs. Creating a system to keep CO^2 permanently underground means directly reducing the emissions. This effort is that the main focus of this research activity, i.e. related to the CCS technology (Carbon Capture and Storage). This effort coincides well with Indonesia's commitment, which has been delivered in 2015 during the COP-21 meeting in Paris, i.e. to reduce 29% of CO^2 emissions by 2030 and up to 41% if international support forthcoming.

In September 2012, ITB and Kyoto University started the study for preparing pilot project of CCS within the SATREPS (Science and Technology Research Partnership for Sustainable Development) project, which is funded by JICA (Japan International Cooperation Agency) and JST (Japan Science and Technology Agency). One of the focuses of this project is to determine the best geological CO^2 storage location based on geological and geophysical data analysis available for the Gundih field and surrounding areas. Gundih field is a gas field located in Central Java, which has been in production since the end of 2013. CO^2 content which is generated directly from this field is 21% of the produced gas. To date, the separated CO^2 (max 800 tones/day) has been flared into the atmosphere, where it contributes to man-made climate change.

The target formation for CO^2 storage is Ngrayong formation, which is composed of sandstone (silty sandstone) and lies at a depth of 830 - 1200 m below the surface. After conducting the site selection, the structure around Jepon-1 well (known as Jepon Structure), which is located approximately 22 km to the north of the CPP/Gundih structure, is chosen as the first priority for CO^2 injection. Jepon stucture is a small anticlinal structure, which could store more than 1,000 x 103 m^3 of CO^2 . However, the planned CCS Pilot project will inject only around 30 tonnes of CO^2 per day or totally 20,000 tonnes of CO^2 within 2 years of injection period.

Asian Development Bank (ADB) had contributed in this project by providing research funds to conduct feasibility study of transportation and surface facility, as well as the study of legal-regulatory framework. The outputs of the study are to decide the CO^2 transportation design from CPP to Jepon-1 well, the additional surface facility that must be installed around CPP and well injection, as well as economics. The Royal Norwegian Embassy in Jakarta and Higher Education Directorate contributed also research funding for supporting studies, one of them is the preliminary public engagement plan.

Currently the construction of surface facility and well work over will be started by the end of 2017 by using ADB funding, whereas the injection monitoring will be funded by Indonesian and Japan funding sources. The first CO^2 -injection will approximately be started around end 2018. Since beginning 2017, the government of Indonesia launched “National Center of Excellence (CoE) on Carbon Capture, Utilization and Storage (CCUS)”, in which it is situated in ITB and Lemigas Campuses.

Figure : Parade at the Asia Afrika Conference, 24 Juni 2016

Figure : International student gathering

International Joint Capstone Design Project (I_CAPS)

International Joint Capstone Design Project (I_CAPS) is a collaboration program conducted by three universities: Institut Teknologi Bandung (ITB), Universiti Kebangsaan Malaysia (Malaysia), Chonbuk National University (Republic of Korea). This Program aims to escalate student's ability in cross-cultural teamwork between nation and problem solving skills. In this program, each participants are challenged to be able to work in an International cross-cultural team in finding ideas, designing and inventing a product through prototype making based on a specific theme that was given. Joining students from the three University founders of this program are students from NTU (Singapore), Tunghai University (Taiwan), and 11 other Republic of Korea university members of the Innovation Center for engineering Education consortium with Hub in Chonbuk National University (CBNU). The participations consisted of students from various engineering disciplines and product design from each participating Universities, grouped into teams consisted of 4-5 people from 2-3 different countries.

International Joint Studio Architecture. The second Joint Studio Workshop, organised by School of Architecture, Planning, and Policy Development ITB and Melbourne School of Design, took place in Bandung from 3-11 Oct. 2016. With the title "Redefining of New Urban Space Bandung Technopolis, in Gedebage", this workshop tries to problematice and explore more sustainable urban planning and design solutions for the future of the new Sub Centre in Bandung East.

Thanks to PT SummareconTbk, site visits, discussions with the representative of the developer and field observations of the surrounding areas had been conducted, and are the important part of the workshop. The planning and design workshop was attended by SAPPD students from urban design, landscape architecture programms. On the other the MSD students come from various programms as well, such as architecture, urban planning and urban design. The studio tutors/reviewers are Budi Faisal PhD, Dr. Gideon Aschwanden, Prof. H. Winarso, Prof. Dr.-Ing. WidjajaMartokusumo, Dr.-Ing. HeruPoerbo, Endang Triningsih, TMA Soelaiman, including students's tutors Laras Primasari and Susan Krisansti.

International Joint Studio Architecture.

This workshop was held as implementation of academic cooperation between SAPPK ITB and MSD, the University of Melbourne. In the near future several schemes of academic engagement (joint research/publication and faculty exchange) will be further developed to foster the very exciting cooperation between both institutions.

Figure : Lecture by Nobel Laureate Prof. Gerard 't Hooft

Figure : The awarding of an Honorary Doctorate to Nobel Laurate Dr. Peter Agre

Selected Research Products

Development of GMSTech Software for Geothermal Exploration and Reservoir Monitoring

The Development of a National Weather Radar System

4G Basestation Product Development for Increasing Communication Equipment Local Content

Metro Kapsul: Indonesian Mass Rapid Transit

Prefabricated Interim Housing System Using Cold Formed Steel

Development of GMSTech Software for Geothermal Exploration and Reservoir Monitoring

Prof. Sri Widiyantoro

GMSTech (GaneshaMicroSeismic Technology) is an innovation in software development and micro-earthquake (MEQ) activity monitoring systems developed through a collaborative research program between ITB and PERTAMINA-UTC for the purpose of strengthening the development of geothermal exploration in Indonesia. GMSTech has been built to accurately determine the locations of micro-earthquake hypocenters, calculate moment magnitude, determine 3-D subsurface structures using P- and S-wave arrival times and ambient noise, as well as analyze fracture/anisotropy using the shear-wave splitting method. The integration of some of these methods can be used to precisely detect and determine the location of MEQ activity associated with the movement of the fluid injected into the production cycle of geothermal systems for the purpose of near real-time monitoring (related to the formation of new fractures). The anisotropy analysis can also be used to describe high fracture density zones, which can then be studied further for the development of geothermal fields. GMSTech usage is not limited to geothermal fields, but can also be used for oil and gas fields.

Fig 1. Software display.

""GMSTech is innovative software for geothermal, oil and gas field development"

Application of GMSTech is not limited to geothermal fields. It can also be used for oil and gas fields.

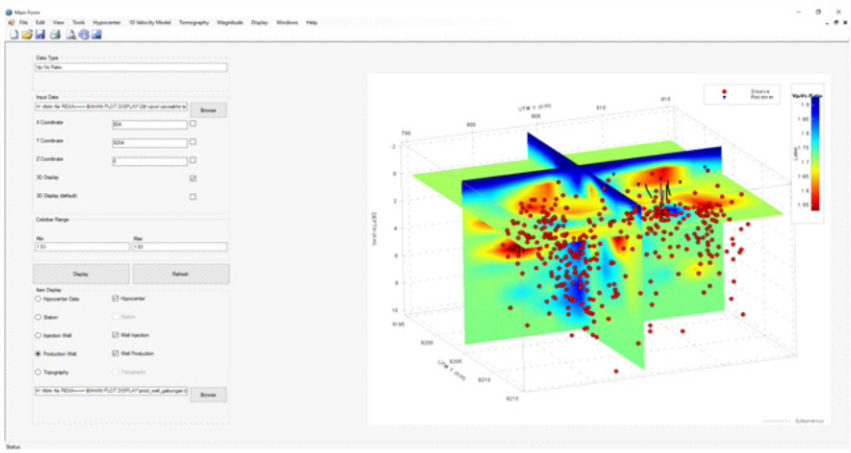


Fig 2. Sample result and 3-D model display of Vp /Vs ratio.

Research Team: Prof. Sri Widiyantoro, Ph. D.,
Dr. Andri Dian Nugraha, Dr. Tedi Yudistira, Rexha Verdhora Ry, M. T.
Research Group: Global Geophysics, Faculty of Mining and Petroleum Engineering
E-mail: sriwid@geoph.itb.ac.id or sriwidiyantoro@yahoo.com.sg

The Development of a National Weather Radar System

Dr. M. Ridwan Effendi

Climatological data show that some parts of Indonesia are impacted by extreme weather phenomena. Several phenomena currently occurring in Indonesia, such as El Niño, smoke haze in Sumatera and Kalimantan, and tropical cyclones in the northern part of Indonesia, cause a decrease in surface water temperatures, resulting in drought, which hinders the control and mitigation of the smoke haze. This disrupts community activities as well as transportation of goods and people.

Currently, the nationwide demand for radar systems is mostly fulfilled by importing equipment from foreign companies. In addition to reducing the country's foreign exchange reserves, there is a potential danger in 'ruling out' the security of radar data, which are strategic to Indonesia's sovereignty. To prevent this, the Indonesian government has to recognize the importance of independence in the development and production of radar systems. Against this background, ITB is running research projects aimed at building an independent national radar industry, in collaboration with several related institutions such as BMKG and PT INTI.

The first objective was to create a basic design, prototype and detailed design for several weather radar subsystems and modules. This will be followed by the integration and testing of the weather radar system, the design and development of weather radar network interoperability, and the integration of national radar management.

The researchers come from various faculties in ITB and are among others:
Dr. Ir. M Ridwan Effendi, Dr. Ir. Nana Rachmana M. Eng., Dr. Ir. Ian Yosef, Prof. Dr. Andriyan Bayu Suksmono, Dr. Ir. Irma Zakia, Dr. Eng. Yosi Agustina Hidayat, S.T., M.T., Riza Satria Perdana, S.T., M.T., Dr. Donny Danudirdjo, S.T., M.T., Dr. Ir. Tutun Juhana S.T., M.T., Iskandar, Ir., M.T., Dwita Astari Pujiartati, S.T. M.T., Rulli Tri Cahyono.

The proposed weather radar system was designed based on an analysis of the requirements of the user, as represented by the Indonesian Agency for Meteorology Climatology and Geophysics (BMKG). The latest radar technology used at their sites is a frequency-modulated continuous wave (FMCW) X-band system with an operating range of 60 km. The antenna subsystem for this weather radar has to meet a minimum gain of 32 dBi with a maximum beam width of 3° in angular range azimuth 000-360°, elevation –2-90°, and a maximum scanning speed of 10 rpm. The transmit power of this radar is limited to 100 W with a maximum pulse width of 150 µS and PRF 100-10 kHz. The radar system includes a signal processing subsystem with a 4-channel receiver, noise figure < 2dB and a minimum 12-bit analog-to-digital quantization at a minimum sampling rate of 250 MSPS.

"Integration and testing of weather radar system, design and development of weather radar network interoperability and integration of national radar management"

In the first year, the research was focused on designing and developing subsystems and modules for the weather radar system that meet the user requirements. The achievements from this phase include a weather radar system specification based on a requirement analysis, a basic design document, a system simulation, a mini scale prototype, a detailed design document, a field survey report of the existing FMCW weather radar system at BMKG Palu station, a focus group discussion report of research papers on radar technology, modules for the weather radar subsystems, and a preproduction document for devices and modules for the weather radar subsystems.

In the second year, the research was focused on the integration and testing of the weather radar system and implementation of a weather radar program at the Teaching Industry Lab, ITB. The output from this phase includes a TRL-8 weather radar prototype, a weather radar installation and field testing documents, a TRL-8 weather radar production document, an RFC document for weather radar certification and standardization, a requirement analysis document for the Teaching Industry Lab, syllabus design documentation for the Teaching Industry Lab, and an evaluation document for the Teaching Industry Lab.

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Dr. Ir. M Ridwan Effendi

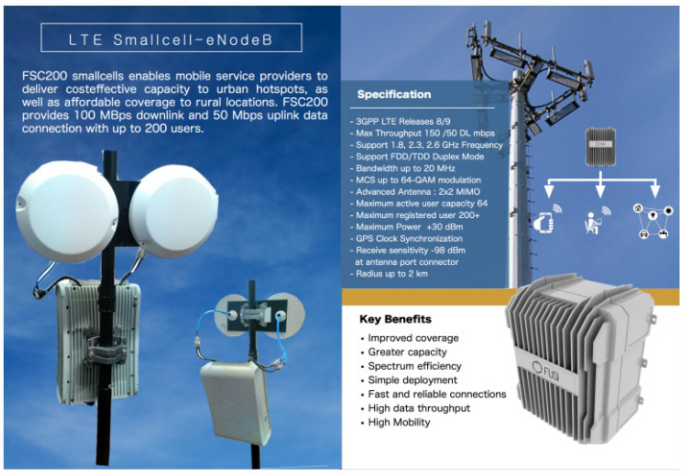
4G Basestation Product Development for Increasing Communication Equipment Local Content

Trio Adiono, PhD

Under-development of the local electronics industry is the main cause of the absence of a communication infrastructure industry in Indonesia. In the communication sector, Indonesia spends up to 100 billion rupiah each year, especially for cellular phone systems. Most of the budget is used for purchasing telecommunication equipment and devices, which are mainly imported. Only 2% of the budget is spent with local industry (local content). Moreover, the expenditure is limited to equipment with small added value and low technology content, such as antennas or power supply cables. However, the latest data show that the development of this sector is growing.

One of the most important infrastructure elements in telecommunication is the basestation. In an attempt to stimulate the development of telecommunication equipment and devices in Indonesia, a small-cell basestation is being developed, taking advantage from the technology transition from 3G to 4G. The 4G basestation uses broadband wireless access (BWA) technology, which has a number of advantages, such as high-speed data transfer (6 to 10 times), efficient bandwidth and broad range coverage.

The development of such devices stimulates high technology development in Indonesia. Currently, this sector is dominated by international industries, such as Qualcomm, Intel, Texas Instruments, Broadcom, etc. The availability of higher local content of communication equipment and devices will have a huge impact on many aspects of Indonesian society. Besides decreasing the volume of import, the availability of the technology can also decrease Internet service fees and increase the availability of communication access in urban and rural areas. Ultimately, it will stimulate economic development in Indonesia.
The growing need for bandwidth can be fulfilled through existing LTE technology. It gives a good indication of the development and growth of the economy sector and other productive sectors. Therefore, LTE technology has to be developed in Indonesia as soon as possible. One of the solutions to overcome the need for high data traffic is by using small-cell technology (micro cells, pico cells, femto cells). These are different from macro-cells, which are driven by the coverage aspect, whereas small cells are driven by the capacity aspect.
For the operator, the return on investment (ROI) of small-cell technology is shorter. Comparing cost and revenue, the study indicates that for a coverage area of 2.6 km2: “Macro cells need 1 device at a cost per cell (CAPEX + OPEX) of 90.000 USD while small cells need 10 devices at a cost per cell of 60.000 USD.” Covering an area with macro cells costs 3.46 USD/kbps while it only costs 2.67 USD/kbps with small cells. Therefore, the profit from small cells is higher than that from macro cells.



”4G basestations have advantages such as high-speed data transfer (6 to 10 times), efficient bandwidth and broader range coverage”

The use of small cells is not limited to basestations but they can also be used for:

- Home/office gateway
- Home/office cloud
- M2M

The 4G small-cell basestation that has been developed can be connected to existing smartphones. It can also be used for triple play, web browsing, video streaming and audio communication.

Biography

Trio Adiono received a B. Eng. degree in electrical engineering and an M. Eng. degree in microelectronics from ITB in 1994 and 1996, respectively. He obtained his Ph.D. degree at VLSI Design, Tokyo Institute of Technology, Japan in 2002. From 2002 to 2004, he was a research fellow of the Japan Society for the Promotion of Science (JSPS) at the Tokyo Institute of Technology. In 2005, he was a visiting scholar at MESA+, Twente University, the Netherlands. He received the Japan Intellectual Property Award in 2000 from Nikkei BP for his research 'Low Bit-rate Video Communication LSI Design'. He is author and co-author of more than 150 publications in national and international journals and conferences. He was also actively involved in the development of the integrated circuit (IC) industry Xirka Silicon Technology, Bandung. He achieved an award from the President of Indonesia, Satya Lencana Wira Karya, for his work on the development of a chip for broadband wireless access. He holds a Japanese patent on a high-quality video compression system. Currently, he is a lecturer at the School of Electrical Engineering and Informatics and also serves as the Head of the Microelectronics Center and IC Design Laboratory, ITB. He is the current Chair of the Indonesia Chapter of IEEE SSCS. His research interests include VLSI design, signal and image processing, smart cards, electronics solution design and integration. He has designed products such as a chipset smartcard, an LTE basestation, an IoT system, a smart home system, a WiMax baseband chipset, an eFishery system, and others. He has also published a number of books, among which Perancangan Sistem VLSI, LTE Handbook, LTE and LTE-Advanced Physical Layer. Currently he is an active member of the international organization committee of ISPACS, APSIPA, ISESD among others.

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Metro Kapsul: Indonesian Mass Rapid Transit

Prof. Dr. Ir. Muljo Widodo Kartidjo

Many fast-growing cities experience accute traffic jams due to a lack of anticipation of the increasing number of vehicles on the limited road capacity they provide. Adding new roads or widening existing roads is a costly solution, especially in cities where the cost of land is already very high. An elevated or underground public transportation system is an alternative solution, but the costs involved in building such systems are also very high.

"Metro Kapsul, based on patented automatic train operating system, was developed in Indonesia"

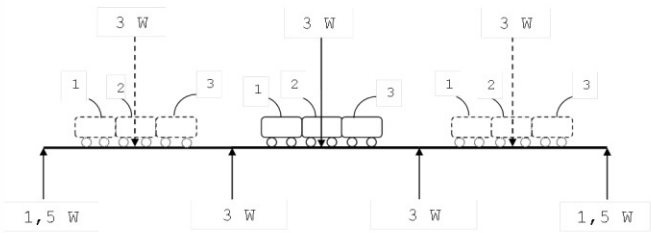

Fig. 1 A set of 3 trains on an elevated track.

Metro Kapsul is a new elevated public transportation system for big cities based on a patented automatic train operating system that was developed in Indonesia. The patented system regulates a set of trains by controlling the distance between the individual trains in such a way that only one train is allowed on one girder of the elevated track at a time. Thus, the elevated girder only has to be able to support one train, meaning that the load strength can be much lower, as can be seen inFig. 1. Hence, the dimensions of the girders can be made smaller compared to other elevated systems. As a result, the total invesment cost to develop an elevated transportation system for big cities can be reduced. In station areas, special girders with more supporting columns are able to take the load of several trains.

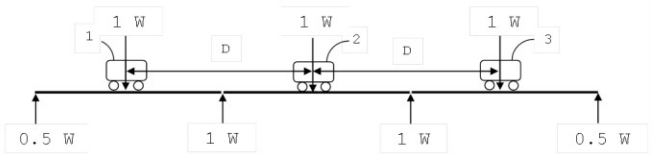

Fig. 2 One individual train on an elevated track.

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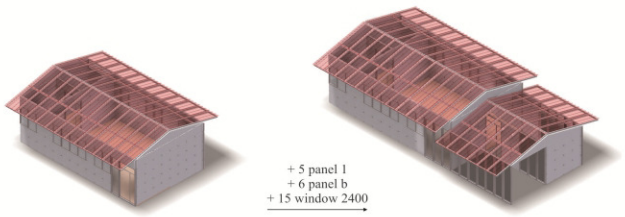
Prefabricated Interim Housing System Using Cold Formed Steel

Prof. Dr. Ir. Sugeng Triyadi S., MT

This prefabricated interim housing system uses panels from cold formed steel. Each module, with a floor area of 8400 x 4800 mm, can accommodate four people. The cold formed steel frame modules are strong and durable while the modular design makes it easy to transport and to construct, flexible, and effective. Another advantage is that the system is simple and does not require heavy equipment, can be constructed by four unskilled workers easily and quickly, including carrying and assembling parts on site. Once constructed, the module can be developed into a permanent dwelling. Because the system uses panel configurations, they can be extended into a variety of shapes and sizes with a flexible layout.

40 panel 1
4 panel 2
14 panel 3
6 panel 6
48 panel b
1 window 2400
2 window 1800
14 window 600
2 door panel
1 plumbing panel



"A simple building system that does not require heavy equipment, can be constructed by unskilled workers easily and quickly"

The modular connections allow the panels to be arranged either vertically or horizontally so as to facilitate the construction process. The connection system is made as simple as possible, using nuts and bolts, so that construction can be done by unskilled workers. Another advantage is that the panels can be transported in a 20' container. This simplifies the packaging of the modules, which can be easily transported, especially by truck over land.

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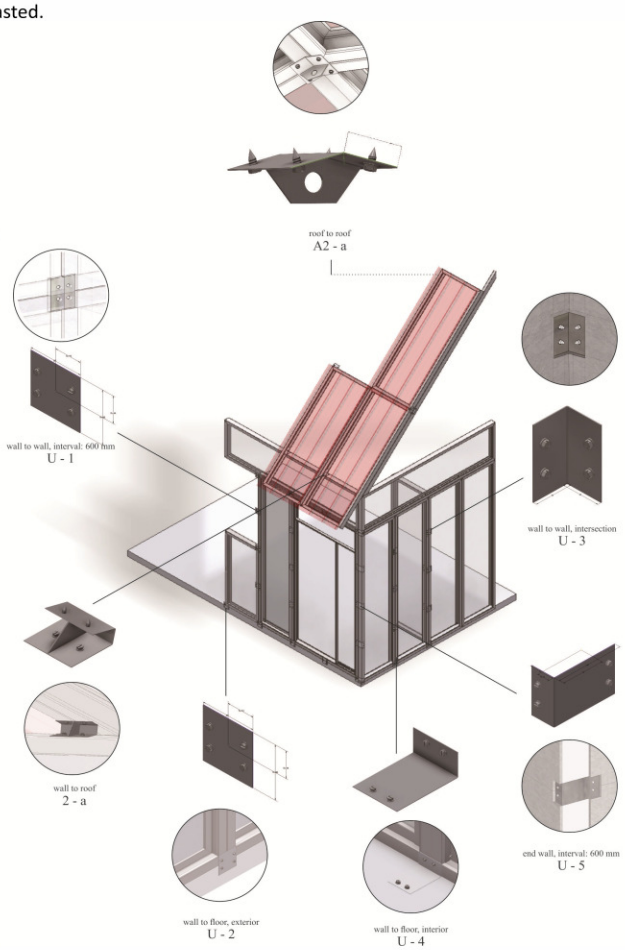
The wall panels are made in a rectangular shape with a width of 600 mm and lengths of up to 2400 mm, adapted from the dimensions of wall finishings on the market: gypsum, plywood and fiber cement. For special purposes, panels with a size of 1200 x 2400 mm can be used (door panels, window panels and plumbing panels). The roof panels are made in a rectangular shape with a width of 700 mm and lengths of up to 2400 mm. The width is based on the dimensions of the roof covering so no material is wasted.



Selected Researchers

Prof.Dr. Djoko T. Iskandar

Dr. Rino R. Mukti

Dr. Heni Rachmawati, Apt., M.Si

Dr. Eng. Ferry Iskandar

Prof.Dr. Djoko T. Iskandar

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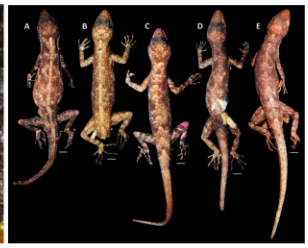
Professor Dr. Djoko T. Iskandar from the School of Life Sciences and Technology, ITB specializes in biodiversity, evolution and conservation. He uses amphibians and reptiles to evaluate environmental disturbances, although in some instances he has also used various other groups of animals. He is known as a pioneer in herpetology and as a result he has had the opportunity to work all over Indonesia during the last 40 years, together with counterparts from many developed countries, producing more than a hundred publications in reputed journals.

He is the discoverer of two of the most bizarre frog species in the world. The first one, found in Central Borneo, is a primitive and unique species in the world, without lungs, ears and stereoscopic vision (Barborula kalimantanensis), representing a new family for Indonesia (1978). The second one, found in Sulawesi, is the only frog species in the world that bears tadpoles instead of eggs (Limnonectes larvaepartus, 1989, 2014). His research on frogs focuses on several genera. Limnonectes is his main obsession, as Indonesia possesses the largest diversity of this genus (tiny to huge in size and the males bear fangs). One of his discoveries in the Lesser Sunda Islands is a giant frog, which he named after his senior at the Museum Zoologicum Bogoriense (Limnonectes kadarsani, 1996). His work on Sulawesi showed the existence of many undescribed species with immense variations in size and many unique reproductive strategies. He has discovered that the invasion of this genus into Sulawesi involved a complex migration pattern, in and out of Sulawesi and the Philippines.



Another genus that is among his favorites is the Indonesian gecko. He published about two giant forest geckos from Sulawesi, the Wallace and the batik geckos (Cyrtodactylus wallacei and C. batik). He has discovered five tiny geckos in Sumatra, all named after local toponyms (Cnemaspis aceh, C. andalas, C. minang, C pagai and C. tapanuli). 2017). His research revealed that this group of species has nothing to do with species from Malaysia, Borneo or Java, but surprisingly enough are related to a species from Sri Lanka. Their biogeographic connection happened about 60 to 40 million years ago. Numerous findings are still in queue to be finished, but 33 new species have already been published since 1978.

His research in relation to the geological history of Indonesia, to explore the origins of animal species groups in Indonesia and to pose academic questions about the geological history of a region, has resulted in new insights on the nature of the southern part of Sulawesi, the multi-island geological history of Sumbawa, Halmahera and Alor, and the impact of ancient watersheds in Sunda (Miocene up to the present), supported by molecular genetic analysis. His expertise is well acknowledged in the academic community and his name figures in six animal species, from a fly to a lizard, a snake and a number of frogs. He also produced several books on frogs and turtles, and contributed to many chapters of other books.

"The only species of frog in the world which bears tadpoles instead of eggs (Limnonectes larvaepartus, 1989, 2014)"

His work on nature conservation is considered very important, as he is appointed to five separate commissions of the International Union for the Conservation of Nature based in Switzerland. His findings have been used by many conservation agencies, such as World Wildlife Fund, Conservation International, Wildlife Conservation Society, The Nature Conservancy, etc. He has contributed to the Global Amphibian Assessment project since 2001, changing world opinion about amphibians: from useless organism to the most resistant vertebrate against global climatic change.

He has received several awards, among others the Kennedy Award (2000), the Habibie Award (2005), and Ganesha Cendekia Widya Adi Utama (2011). He was appointed as a lifetime member of the Indonesian Academy of Sciences (2015). Webometric lists him as the 19th best academician of Indonesia (2017). As a professor at ITB, he has the highest Hirsch index (26, Google Scholar) and the highest contact score worldwide. Research Gate lists him 43,000 reach and 50,000 read, with citations above 1200 (Scopus), 1600 (Research Gate) and 2800 (Google Scholar).

Dr. Rino R. Mukti

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Zeolites are one of the most important materials in chemistry and are widely applied in various industrial processes, such as petroleum refining and chemical production, adsorption and separation. Moreover, owing to functional properties such as their microporous structure, acidity, large surface area and thermal stability, zeolites have also found use in emerging applications such as membrane, sensor, electronic device, drug delivery, biomass refining and carbon dioxide sequestration. However, several challenges still remain to be countered, such as the development of efficient approaches to improve catalyst activity, selectivity and lifetime using facile, versatile and inexpensive routes. For this reason, our group at ITB develops several routes for synthesizing zeolites with enhanced performances.

Various synthesis techniques involving design from conventional zeolite to hierarchical zeolite (with micropore and mesopore structures) have been proposed and rationalized to offer attractive advantages. The control over synthesis variables that govern the crystallization of zeolite with tunable morphological evolution has been our interest. For example, the strategy of having larger pore diameters in the mesoscale range, in the presence or absence of a hierarchical pore-architecture of the crystalline material, is crucial to enhance catalytic performance. Achieving this type of material would lead to solving disadvantages of thermal instability and mild activity that are known to be the trade-off phenomena between crystalline and nanomorphous materials.

Selected topics of our research are:

Synthesis of zeolites using sustainable silica precursors

Silica is found in waste materials from big and small industries. For example, rice husks are the major by-product of rice production with an annual global production of 120 million tons, ranking as the second highest-volume agricultural processed residue, after sugarcane bagasse. Rice husks are recognized as an abundant source of natural silica with a mass content of around 15-28 wt% depending on several factors, such as climate, rice variety, and geographical condition. This means that 18 million tons of silica from rice husk are produced each year across the globe. Considering this huge amount, the development of products with high added value is desirable. However, rice husk is commonly disposed as waste through open-field burning.

Exploration of making full use of rice husk has been conducted for decades. However, the application of rice husk so far has been focused mostly on products with low added value, such as fertilizer additives and paving materials. To address this issue, rice husk must be considered as a sustainable silica source for the fabrication of silicon based materials with high added value. In this study, we extracted silica by sequential base-acid treatment without damaging the lignocellulosic content of the rice husks. The extracted silica is then used to synthesize zeolite ZSM-5. We have developed a new method for synthesizing zeolite with a hierarchical pore structure (containing micropores and mesopores) at a low temperature and in the presence of a reduced amount of an organic structure directing agent (OSDA) and in the absence of any mesoporogen (Fig. 1). The OSDA seems to play an additional role as a nontemplating SDA for mesopore generation. Our study also showed that control of the molar composition is essential for the crystallization of hierarchically porous zeolite.

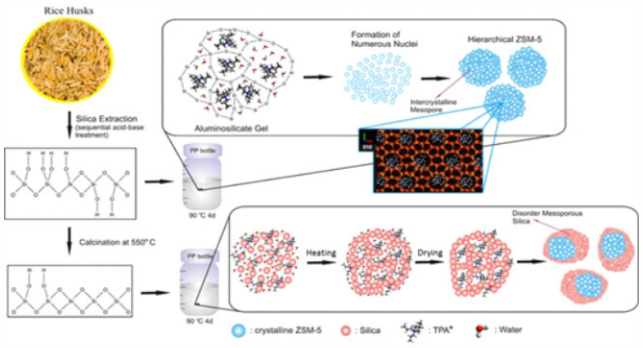

Fig. 1. The plausible mechanism of the effect of silica structural properties in the synthesis of hierarchical ZSM-5 below 100 °C.

Fotografer : Nicky Nugroho

"Control of the molar composition is essential for the crystallization of hierarchically porous zeolite"

Obtaining luxury zeolite via interzeolite transformation

Silicoaluminophosphate CHA zeolite is currently used as catalyst in methanol refining, an important downstream process of the petrochemical industry. Further, the aluminosilicate type of CHA zeolite has found application in the removal of NOx via selective catalytic reduction. The synthesis of CHA zeolite is considered to be complicated and challenging. In this study, we followed the route of obtaining CHA zeolite by means of seed-assisted, complete exclusion of OSDA and interzeolite transformation of FAU-type zeolite (Fig. 2). The resulted products may exhibit a higher Si/Al ratio as a result of the epitaxial growth on the surface of the seeds. The seeds with Si/Al ratio of 2 are normally produced from the hydrothermal conversion of FAU-type zeolite. The synthesis of CHA-type zeolite can be performed by adding the seeds in the initial mixture prior to the hydrothermal treatment. Thus, the resulted synthesis is completely free of OSDA. XRD patterns were used to show the zeolite structure and to further prove the role of the seeds with respect to zeolite crystal growth.

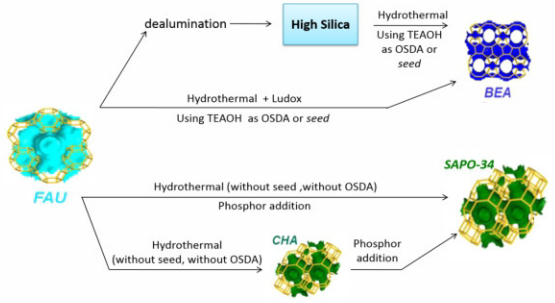

Fig. 2. Several routes to obtain important zeolites by means of interzeolite transformation.

Dr. Heni Rachmawati, Apt., M.Si

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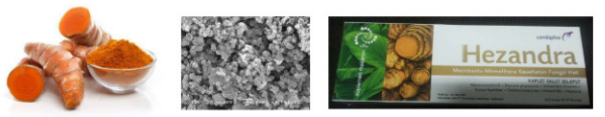
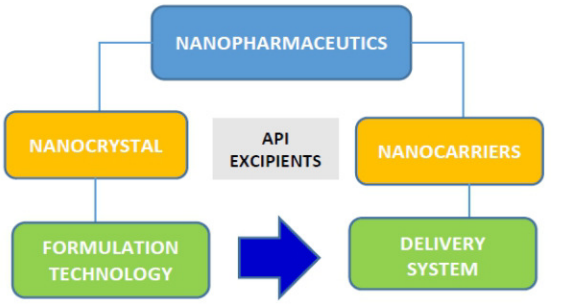


Curcuma | nanocurcumin | Hezandra containing nanocurcumin

Nanotechnology-based targeted drug delivery system and formulation

The research interest of Dr. Heni Rachmawati is the application of nanotechnology in pharmaceutical formulation and the design of targeted drug delivery systems. Nanotechnology is a recent smart technology applied to modulate physical properties of materials through their size in the nano range. At the nano scale, materials demonstrate unique and extraordinary characteristics for various purposes, including medicinal targeting. The potential promise of nanotechnology in medicine is its capability to improve the therapeutic index by: increasing efficacy while reducing toxicity; accumulation of site-specific drugs; and prolongation of drug action.



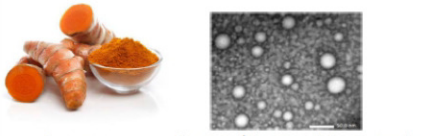
Particularly from a pharmaceutical point of view, many active compounds face problems during the development phase of formulation and delivery. Each molecule, either produced by chemical synthesis or isolated naturally, has unique characteristics that make it difficult to handle as a compound. They have different sensitivities to the environment and in vivo conditions; biological systems respond differently to them. However, with smart formulation technology all these properties can be modulated and improved. In order to achieve the target, two main approaches are applied: top down-based nanoparticles and bottom up-based nanocarriers.

Numerous nanoparticles from medicinal herbs have been produced that exhibit superior properties as compared to corresponding macro-size materials: curcumin (curcuma sp), stilbenoids (Gnetum gnemon), and xylan-derived pineapple stem waste (Ananas comosus (L) Merr). Curcumin nanoparticles demonstrate better anti-inflammatory activity at lower therapeutic doses, both in vivo in animals and humans with liver diseases (unpublished report on patients after consuming Hezandra, a supplement containing nanocurcumin). Xylan-derived pineapple stem waste is a potential polysaccharide for producing a mesalamine pro-drug for colonic targeting therapy (ongoing project).

Curcumin is a golden natural active compound model for nanotechnology based research. Various nanoforms of curcumin have been explored for different targets. Nano emulsions and polymeric micelles containing curcumin have been successfully established, showing incredible promise in therapy. Complete and careful evaluations were performed to ensure the benefit of these smart nanocarriers for commercialization.

"The extraordinary biodiversity of Indonesia in terms of flora strongly encourages the emergence of novel, unique and original researches"

Further studies to understand the interaction of nanocarriers with cells and how the nanocarriers enter the cells and release the entrapped active compound are now ongoing. Due to limited research facilities available in Indonesia to support this advanced project, international collaborations are in progress: with Innovation Center for Nanomedicine, Kawasaki, Japan; and Biomaterials Science and Technology-Targeted Therapeutics, MIRA Institute for Biomedical Technology and Technical Medicine, University of Twente, Netherlands.



Curcuma | Nanoemulsion containing curcumin

Apart from curcumin, other biomaterials are explored to support nanomedicine research. Castor oil isolated from Ricinus communis is another potential biomaterial, used to modulate the release rate of bupivacaine HCl (a local anesthetic) aimed at prolonged management of post-operative chronic pain. A subcutaneous sustained release injection of bupivacaine HCl in the nanocarrier system seems promising for the Indonesian market, as no such formulation is available yet.

It must be emphasized that the extraordinary biodiversity of Indonesia in terms of flora strongly encourages the emergence of novel, unique, and original researches. The support of nanotechnology, on the other hand, helps modernizing these biomaterials for advanced products and uses.

National patents
1. P00201300649
Curcumin nanonization products and processes for in vivo profiles and flawless pharmacological effects.
2. P00201608296
Silane from pineapple stalks as pharmaceutical excipients for drug carriers and drug targeting to the colon.
3. P00201606957
Lectin-like protein potency of the button mushroom (Agaricus bisporus) as a drug carrier for oral delivery.
4. Bupivacaine HCl slow injecting preparations in nano-carrying systems for localized analgesics (in enrollment process to LPIK ITB).

Dr. Eng. Ferry Iskandar

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Dr. Eng. Ferry Iskandar was born in Jakarta on February 17, 1974. He completed his doctoral degree at Hiroshima University in 2002. From 2007 to 2009, after completing his post-doctoral studies at Hiroshima University, he worked as Assistant Professor at this university for about 4 years. From 2009 until now, he has been appointed as a lecturer at the Department of Physics, Faculty of Mathematics and Natural Sciences, ITB. He has authored and co-authored more than 130 papers in peer-reviewed international journals (h-index 29), 15 patents and many conference papers/presentations. His work has been cited more than 3200 times.

Ongoing researches and investigations under development can be found at: https://sites.google.com/view/e2mlab.

He has obtained several awards, including the Habibie Award of Basic Science in 2014, the Extraordinary Intellectual Property Award (AKIL) from the Ministry of Research Technology and Higher Education of Indonesia (Ristekdikti RI) in 2014. He is also active in conducting research incorporated into the Physics of Electronic Materials Research Division, Department of Physics, ITB and he is one of the main researchers at the Research Center for Nanoscience and Nanotechnology (RCNN), ITB. His current research focuses are developing nanomaterials and advanced materials that can be applied in the field of renewable energy as well as environmental fields, including:

1. Research on a fluorescent material (luminescence) with wide applications in electronics and medicine. The latest research results are reported in the international journal Scientific Report.
2. Research on an electrode material for lithium batteries that can be applied in electric vehicles (EV).
3. Research on a porous material applied as catalyst and photocatalyst.
4. Research on hybrid perovskite-based solar cells.

Apart from his material-related research, he has also developed research related to the teaching of physics, one of which is the utilization of smartphone devices in experiments and physical measurements.

"Development of luminescent materials and electrode materials for application in lithium-ion batteries"

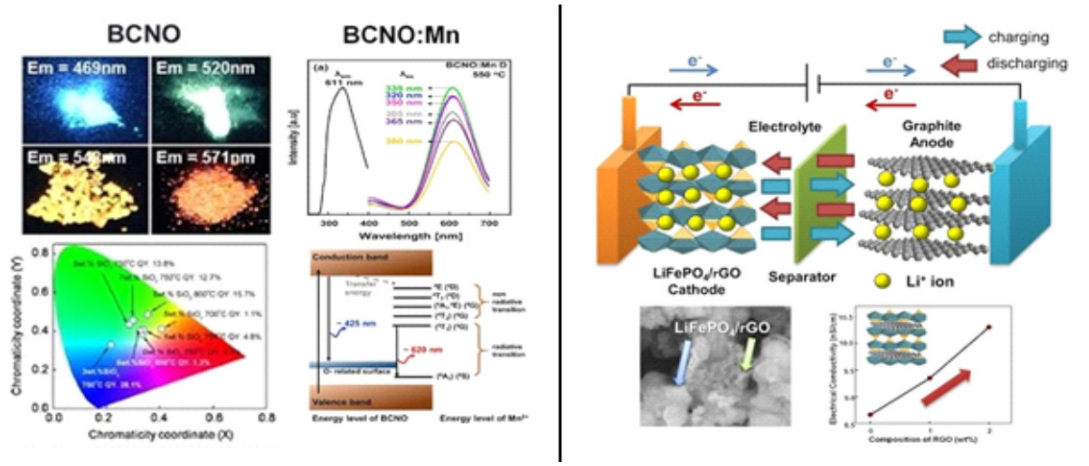

Fig. 1 Research on the development of luminescent materials (left) and the development of electrode materials for application in lithium-ion batteries (right).

Selected Innovators

The Prof.Dr.Elin Yulinah Sukandar

The Development of a Complete Set of Standardized Herbal Preparations for a Combination of Binahong Extracts and Corn Silk Extracts to Improve the Kidney Function

Dr. Sandro Mihardi

Prototype Development of a Low-priced Prosthetic Knee

Dr. Ir. Adi Indrayanto, MSc & Prof. Dr. Tati Mengko

Industrial-scale Prototype of an Integrated EEG/ECG/EMG System: ExG

Dr. Ir. Djoko Darwanto

High Voltage Transmission Network Protection from Lighting

Prof. Dr. Ir. Subagjo, Ir. Kamiso Purba (Alm) & Dr. Ir. Tatang Hernas Soerawijaya

Desulphurization Adsorbent and Its Manufacturing Process

Prof. Ir. I Gede Wenten, Ph.D

IGW Home Ultrafilter

The Development of a Complete Set of Standardized Herbal Preparations for a Combination of Binahong Extracts and Corn Silk Extracts to Improve the Kidney Function

Prof. Dr. Elin Yulinah Sukandar

This particular research is the next step in an effort to provide a complete set of standardized herbal medicine preparations for a combination of binahong extracts and corn silk extracts to improve the kidney function. PT Kimia Farma have expressed an interest in producing these medicine preparations, for which an MoU between the School of Pharmacy, ITB and PT Kimia Farma was signed on May 28, 2013, in Jakarta.

Research progress achieved so far: material standardization (phytochemical screening, chromatography patterning, and marker identification), acute toxicity test, sub-chronic toxicity tests, kidney function improvement test using binahong extracts, kidney function improvement test using corn silk extracts, kidney function improvement test using a combination of binahong and corn hair extracts. Further research is still pursued for stability test of capsule preparation and special pregnancy safety test (teratogenicity test) of the combination.

This research was published in two journals i.e. International Journal of Pharmacology, 9(1); 12-23, 2013, with a title : Study of Kidney Repair Mechanisms of Corn Silk (Zea mays L.Hair(-Binahong (Anredera cordifolia (ten) Steenis) Leaves Combination in Rat Model of Kidney Failure and in Asian J Pharm Clin Res, 9 (1), 311-314, 2016 with a title :Subchronic toxicity study of corn silk-zea mays l. in combination with binahong (Anredera cordifolia (Ten.) Steenis) leaves on Wistar rats. This combination has been registered for patent with an ID number of IDP000044480.

"A combination of binahong extracts and corn silk extracts to improve kidney function"

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Prototype Development of a Low-priced Prosthetic Knee

Dr. Sandro Mihradi

This research produced a sophisticated but low-priced prosthetic knee for people with lower leg disabilities due to transfemoral amputation. Future research will cover the development of a full artificial limb and a robotic prosthetic for lower elbow amputees.

An ideal prosthetic knee has stability in usage and mimics natural motion as in a normal person. Based on the number of joints, prosthetic knees are divided into two groups: single-axis knees and polycentric knees. Polycentric knees can be designed to have an instant center within a stability zone, producing better stability compared to single-axis knees.

A common type of polycentric knee is the four-bar mechanism knee. There is also a type of six-bar mechanism knee and several studies suggest that this six-bar mechanism produces better stability and movement than a four-bar mechanism.

"Polycentric knees can be designed to have an instant center within a stability zone, producing better stability compared to single-axis knees"

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Industrial-scale Prototype of an Integrated EEG/ECG/EMG System: ExG

Dr. Ir. Adi Indrayanto, Msc., Prof. Dr. Tati Mengko

The development of medical devices manufactured in Indonesia is still very limited, as shown by data from the Association of Indonesian Medical Equipment Manufacturers (ASPAKI). Around 80% are imported from foreign manufacturers, so the percentage of medical equipment manufactured locally in Indonesia is very low.
As basic equipment for medical analysis of patients, the demand for EEG, ECG and EMG equipment is predicted to continue to increase. This is due to the lack of such equipment in Indonesian local health centers. These medical devices require product standardization in order to guarantee accurate medical data processing. Bio-signal data acquisition equipment utilized as medical instrumentation in healthcare institutions and laboratories are all imported from foreign countries, resulting higher costs for procurement and after-sales maintenance.

The research and development of the ExG system has produced a product prototype and development documents. The development documents can be used as a reference for the industrialization and mass

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Doctor: Electrotechnique, Institute National Polytechnique de Grenoble – France

"Medical equipment requires product standardization as a reference for industrialization and mass production"

High Voltage Transmission Network Protection from Lighting

Dr. Ir. Djoko Darwanto

The developed products are: I-GSW High Voltage for protecting high-voltage transmission towers and I-GSW Medium Voltage for protecting medium-voltage distribution towers.

The main principle of the I-GSW High Voltage is to protect transmission towers from thunderbolt current flow through the tower construction due to thunderbolt strikes in the protective ground wire or a direct strike in the tower itself. The protection is created by total separation of the protective ground wire from the grounding system in the tower construction. Thus, an increase of tension in the tower construction is avoided during a lightning strike. This prevents a current leap from the tower arm to the phase wire (back flashover). Thus, the phase wire is safe from the effects of lightning strikes.

The I-GSW Medium Voltage is conceptually identical to the I-GSW High Voltage.

Fig. 1 Electricity Transmission Lighting Protection Installation Pekanbaru – Duri Riau (ITB-PLN).

Fig. 2 Lighting Protection Installation PT Pertamina EP Subang (ITB Pertamina).

"The protection is created by total separation of the protective ground wire from the grounding system in the tower construction."

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Desulphurization Adsorbent and Its Manufacturing Process

Prof. Dr. Ir. Subagjo, Ir. Kamiso Purba, MSc (Alm),
Dr. Ir. Tatang Hernas Soerawijaya

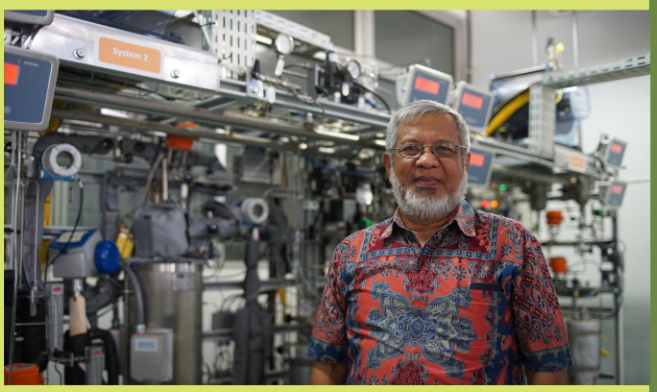
Desulphurization adsorbent is an adsorbent that can be used to remove H2S from natural gas with as active component iron (III) oxide hydrate.
The process of adsorbent production according to this invention is carried out by reacting a soda ash solution (Na2CO3) and an iron sulphate solution (FeSO4). The precipitate formed in the reaction is iron carbonate (FeCO3). The precipitate is then separated, washed and oxidized to iron (III) oxide hydrate (Fe2O3.H2O). Finally, the iron (III) oxide hydrate obtained is pelletized.

The performance of H2S removal by using this adsorbent is superior to that of other equivalent adsorbents and has better mechanical characteristics (crushing strength). The users of this adsorbent are industries that use natural gas as raw material, such as the ammonia industry, the fertilizer industry, fuel and power plants, etc. The H2S gas in the feed needs to be removed because it is corrosive.
The factory producing this iron-oxide-based adsorbent was established in 2009 at PT Pupuk Iskandar Muda (PT PIM), Lhok Seumawe, Aceh with a capacity of 60-100 tons/year. The product is called PIMIT B1. The adsorbent has been used since 2015 by PT Medco Energy at an amount of 90 tons/year.

Fig. 1 Adsorbent sulfide acid (PIMIT B1).

Fig. 2 Reactor in an ammonia plant (PT PIM) containing PIMIT B1 adsorbent.

"The performance of H2S removal by using this adsorbent is superior to that of other equivalent adsorbents and has better mechanical characteristics"



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IGW Home Ultrafilter

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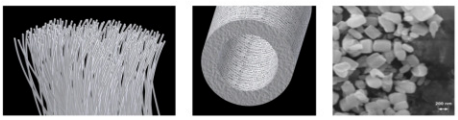
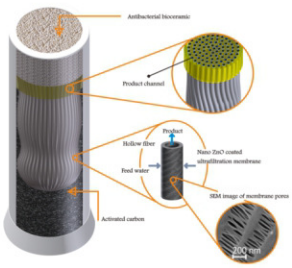
The IGW Home Ultrafilter is an integrated membrane-based technology that combines four processes in one unit. A hollow fiber ultrafiltration membrane with an average pore size of 50 nm and coated with ZnO nanoparticles is used for the primary filtration stage. The ultrafiltration membrane can effectively remove iron (Fe3+), colloids, microbes and particulates while maintaining the mineral content intake. Granular activated carbon (GAC) is used as pretreatment to remove odors, organics and free chlorine. Meanwhile, the freshness of the water is restored in the final stage using a bioceramic. The bioceramic also contains antibacterial particles for final disinfection.

The IGW Home Ultrafilter was developed as an alternative water filter in response to WHO's warning on the health risks of drinking demineralized reverse-osmosis (RO) product water.
(http://www.who.int/water_sanitation_health/dwq/nutrientschap12.pdf).

"The ultrafiltration membrane can effectively remove iron (Fe3+), colloids, microbes and particulates while maintaining the mineral content intake"



Hollow fiber ultrafiltration membrane | Cross section of hollow fiber | SEM image of nano ZnO



Selected Community Services

The ITB ASA Ganesha Suspension Bridge

FEWEAS Application

PKBM Upat-Upat Bumi, Kecamatan Todanan, Blora, Central Java

Community Service of LPPM in Seimenggaris

Cultivation of Medicinal Plants for Herbal Medicine Products in a Community

Utilization of Bamboo as an Alternative Material for Carving in Jepara Area

The ITB ASA Ganesha Suspension Bridge

(Product of KKN Tematik of ITB in 2016)

The ITB ASA Ganesha Bridge is a small suspension bridge spanning the Cilaki River with an approximate width of 30 m. The bridge was inaugurated by the Vice Rector of Academic Affairs of ITB and the Commander of Secapa TNI AD (Army Officer Candidate School), Bandung on 18 September 2017. The bridge is located at the village of Mekarwangi, Garut District, West Java. The bridge is vital since it connects the villages of Mekarwangi and Nyalindung and other surrounding villages. ITB students from the KKN (Kuliah Kerja Nyata) Tematik program along with Secapa TNI AD Bandung and the Center of Rural Area Development of ITB (Pusat Pemberdayaan Perdesaan/P2D-ITB) with their community service program worked together to design and construct the bridge in 2016. The construction of the bridge was funded by LPPM-ITB, LK-ITB, PT LAPI ITB and PT BCA Bandung.

Visiting the site, the students and their supervisor observed that there was an old and unsafe suspension bridge. Considering the topographic conditions and the location of the bridge, which is situated on difficult terrain and relatively far from the road, it would be quite difficult to transport heavy steel I-beams and install them. Even though a steel bridge could be taken part by part, a temporary support structure embedded in the river bed would be required. This would incur high risks due to the high current velocity of the river, which could potentially cause the temporary structure to fail. Since the village people were already familiar with this type of bridge, a suspension bridge was selected rather than the simpler steel I-beam type of bridge. Another reason was that installation of a suspension bridge is relatively easy, without having to rely on temporary shoring.

To prevent slope failure, the pylon foundations were placed at a distance from the river boundaries and slope crests. Thus, the distance between the two pylons became approximately 38 m. The bridge's approximate clearance above the highest water level of the river is 4 m. The width of the bridge is 2 m to accomodate motorcycles, bycicles and pedestrians. Cars were not considered since the roads approaching the bridge cannot be used by cars.

Fig. 1 The ASA Ganesha Suspension Bridge after Completion.

The anchorage foundations are reinforced concrete blocks at both ends. The foundations of the pylons were strengthened with concrete toes. The block foundations for both the anchors and the pylons were constructed beforehand during the so-called Pre-KNN activities. Almost all steel works (pylons, hangers, floors and fences) were prefabricated at a workshop/factory in Garut.

During the main KKN activities, the brige cables were installed, followed by installation of the hangers and floor decks. The construction of cables, hangers and floor decks took advantage of the old bridge. The fences were installed next. The last works were painting and readjusting the shape of the cables and adding reinforcements to some of the cables connections and hangers due to some imperfections that were discovered.

Overal construction of the bridge took longer that expected due to necessary improvements, heavy rain, the remoteness of the location and the difficulty of the terrain. Nevertheless, in the end, the suspension bridge was succesfully constructed. Another achievement is that the work was successfully completed with zero accidents.

The students, supervised by LK ITB supervisors and TNI soldiers, succesfully designed and managed the construction of the bridge very well.

> The beauty of the suspension bridge along with very beautiful background nature of a junction river, a limestone hill beside the bridge and the very green rice fields has been sufficient to produce a wonderful scenery

Different from bridges previously constructed by KKN Tematik, which have decorations such as lighting, the ASA Ganesha bridge was not provided with such things. The beauty of the suspension bridge itself along with the natural background of a river junction, a limestone hill and the stunning green rice fields are sufficient to create a wonderful image.

The new ITB ASA Ganesha Suspension bridge has replaced the existing bridge, which was far from safe for public usage. The new suspension bridge has cut short the time for commuting between several villages by approximately 30 to 45 minutes. The ITB students who were involved worked individually as well as in teams on relatively difficult challenges. Most importantly, they got a valuable experience in helping local communities in a remote area. Such experiences are invaluable in their future career and life.

Fig. 2 The old bridge and the new one.

PKBM Upat-Upat Bumi, Kecamatan Todanan, Blora, Central Java

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A small group led by a dedicated leader, Supat, 30 years old and only graduated from secondary school (SMP), has successfully established a self-supporting village library, SUMBER ILMU, in 2008. It is located in the village of Dalangan, Central Java Province, approximately 45 km from the city of Blora.

Guided by local community leader Singgih Hartono, an ITB team visited the village and was amazed by the commitment and ambition of Mr Supat to build a business center to accommodate and train young people in the village to create jobs together. Immediately the group was included in the Blora Community Service Program of ITB.

In 2009, a year after the first visit, two persons from the group were invited for oyster mushroom cultivation at ITB. Within the two following years, with persistent trial-and-error and consultation, the group successfully started an oyster mushroom business, which has been continuously growing until now. The group also successfully established a community center (PKBM), which was approved by the local government in 2011, as well as an autonomous cooperation (Koperasi Simpan Pinjam). Business activities are continuously growing with a variety of programs, such as Community Library & Playground, Sewing Training, Computer Training, Oyster Mushroom Cultivation, Cat Fish Cultivation, etc.

This program was supported by IBW-DIKTI (2008-2012) and by PM-ITB (2012-2016). The ITB team greatly appreciates the support of Mr. Djoko Nugroho, The Mayor of Blora.

Fig.1 New Building of PKBM Upat-Upat Bumi 2017

A succesful Business and Community Center (PKBM) Upat-Upat Bumi started from a small village library led by a dedicated Junior High School (SMP) graduate

Fig 2. Library of Sumber Ilmu 2008

Fig.3 Dr. I. Nyoman P. Aryantha

FEWEAS Application
(Flood Early Warning and Early Action System)

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FEWEAS (Flood Early Warning and Early Action System) is an application for anticipating natural disasters, especially floods in certain areas, with high resolution (3 km) and accuracy. This information system is web-based as well as supported by Android/iOS. The application was developed by researchers from ITB with support from the Indonesian Red Cross (PMI), the International Federation of Red Cross and Red Crescent Societies (IFRC), Zurich Insurance Indonesia, and Perum Jasatirta I. FEWEAS can be found at www.feweas.jasatirta1.co.id.

The information delivered includes short/medium-term predictions and observations. Short-term prediction information includes predictions of flood alert status, inundation, water level, and weather in 1- to 3-hour intervals for 3 days ahead. Medium-term prediction information includes flood vulnerability predictions in 10-day (dasarian) intervals for 5 years ahead. The observation information includes real-time weather observations from an automatic weather station and water levels from an automatic water level recorder station spreading in the coverage area.

In addition to disaster risk prediction information, the FEWEAS application also provides recommendations for disaster mitigation action to reduce the impact risk based on the predictive information.

In order for the disaster prediction information to be delivered to communities, the FEWEAS application is also equipped with a Common Alerting Protocol (CAP) feature, which is useful for decision-makers in announcing alert status and sending it automatically via the web, Android/iOS app, or SMS. In this application there is also an adaptation option that aims to reduce the level of disaster vulnerability (flood) from upstream to downstream for 5 years ahead.

As a pilot project, the FEWEAS application is currently utilized by a community for anticipating floods in the Bengawan Solo River basin through two provinces, namely Central Java and East Java. The FEWEAS application is quite easy to understand. Based on the survey results conducted during the training, more than 90% of the participants understood the features available in FEWEAS and could use the warning information to take early action.

The FEWEAS application was launched on 30 March 2016 by the Head of Regional Disaster Management Authority (BPBD) of Central Java Province. Following the launch, the FEWEAS application received a number of augmentations such as the establishment of early action features and the aforementioned CAP feature. Also, an English version was developed. FEWEAS's success story in the Bengawan Solo basin has had a positive impact on its further development. The community where the application was first introduced, requested the development of FEWEAS for the Citarum and Ciliwung river basins and there were requests from private parties and governments to develop it for other regions.

The success of FEWEAS cannot be separated from the role of the team leader, Dr. Armi Susandi, who was responsible for the original idea, the concept and the design. He is a graduate of Max Planck Institute for Meteorology, Germany, and focuses his research on hydrometeorological issues in Indonesia. In addition to the FEWEAS application, he has also developed a hydrometeorological disaster early warning system, which is currently being used on a national scale. In addition, he has also developed a smart climate model (SCM) that serves to make climate predictions that can be utilized in the development of long-term disaster potential prediction.
He involves students in the development of disaster management so that they have experiences to be applied in the future. He currently serves as the Head of Meteorology Department and as the Head of the Laboratory of Applied Meteorology, both at ITB.

> FEWEAS application also provides recommendations for disaster mitigation action to reduce the impact risk based on the predictive information

Dr. Armi is also known to be active in organizations, especially in the field of disaster management and its implementation, such as the Indonesian Disaster Expert Association (IABI) and the Indonesian Geophysical Experts Association (HAGI). In addition, he is also active in international organizations such as A. Nergi, which organizes expert meetings on meteorology, air pollution, and hydrometeorological disasters in the Asian region.

Community Service of LPPM in Seimenggaris

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The Kartini of Seimenggaris

For those of us who live in urban areas, it is unimaginable how life in remote areas is with all its limitations. In the northernmost area in the hinterlands of North Kalimantan Province, in the Seimenggaris Subdistrict to be precise, we find a prominent figure named Rusmini Hakim, born in Sidrap, South Sulawesi, whom her colleagues respectfully refer to as 'the Kartini of Seimenggaris'. Any official visiting this remote area will certainly come to her house, be entertained and presented with interesting stories about daily activities that cannot be imagined in this remote area but surprisingly are actually conducted here.

Seimenggaris Subdistrict, despite its location on the mainland of Borneo, is part of the Nunukan District with its capital on Nunukan Island. Seimenggaris can only be reached via Nunukan Island by speedboat, which takes almost 2 hours, entering the plantation area through a river known as a crocodile habitat.

Rusmini, an agronomy graduate of Hasanuddin University, mother of 5 children and wife of a junior high school teacher, worked at the NJL Palm Oil Plantation from 2003-2010. Seeing the backwardness of the community of Seimenggaris, who are generally former transmigrants, Rusmini left her work at NJL and dedicated almost all her time to pushing Seimenggaris forward through education.

Fig. 1 Rusmini Hakim.

Fig. 2 PKBM Seimenggaris

With limited personal funds and facilities, Rusmini established a playgroup called PAUD at her home, established the Equalization Package Program ABC (Kesetaraan) for Seimenggaris residents, because the ex-migrant worker's diplomas could not be harmonized with the Indonesian education standards. Due to the absence of a senior high school, young people could only work as laborers after finishing junior high school. In her house, Rusmini started a pre-professional school for agriculture (Sekolah Menengah Kejuruan – SMK) for junior high school graduates. After two years of standing, the local Education Office provided 4 ha of land and a building for the SMK, which was inaugurated as SMK Negeri, with Rusmini as the Head of School. This simple SMK is only supported by some honorary teachers, who are assisted through the Corporate Social Responsibility (CSR) program of PT Duta Tambang Rekayasa–MEDCO.

Three years ago, Rusmini financed a building for the Community Learning Activity Center (PKBM) from her own savings on her private land, which is quite luxurious according to local criteria. In this PKBM various activities for women are facilitated by Rusmini. The persistence of Rusmini in developing the community of Seimenggaris is a great example to be shown at the national level to learn valuable lessons from.

> Rusmini "a Kartini from Seimenggaris", in a remote district of Nort Kalimantan Province, succesfully Rusmini built a PKBM and an SMK Agriculture to accommodate children of junior high school graduates

The LPPM-ITB team (Budi Sulistianto, I Nyoman P Aryantha, Dudy Wiyancoko, E. Soewono, Sri Utami, Elisa Khoirunnisa), through ITB's Community Service Program, in collaboration with PT Duta Tambang Rekayasa–MEDCO, through their CSR Program, and PT Sago Prima Pratama have provided Animal Feed and Organic Fertilizer Trainings at SMK Seimenggaris in 2015-16. These activities were initiated by CSR–TDR in order to train young people and SMK teachers to solve serious problems in raising cows. So far the community-owned cows were 'deliberately' released on plantations and where they damaged the palm crops. Later in 2016, one of the teachers and his students were invited for various biotech trainings at the School of Life Sciences and Technology (SITH), ITB.

Fig. 3 SMK Seimenggaris.

Cultivation of Medicinal Plants for Herbal Medicine Products in a Community

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Herbal medicines are developed from traditional medicines for application in rational phytotherapy. The number of herbal medicine products on the market tends to rise every year. To assure their quality and efficacy, several factors have to be considered, such as the plant sources and the processing of the raw materials. The cultivation process of medicinal plants as material source is crucial. High quality of plant sources and material processing is needed for producing herbal products.

Agricultural communities have experience with the cultivation of plants. Hence, it could be beneficial to work together with a community that is familiar with farming activities in cultivating herbal medicines. Through a community services program supported by ITB, several medicinal plants were cultivated in a selected field. This program continued previous cultivation programs in other places. It was aimed at educating the community on how to cultivate medicinal plants and how to process the plants after harvesting and, if applicable, how to produce herbal medicines using the cultivated herbal plants.

Fig 3. Several herbal medicines, some ready to harvest.

Fig 1. From left to right: discussion of team members and community partners in the field; demonstration of seedling process; self made polybag, ready for use; and seedling results of Stevia rebaudiana.

An unproductive field was used to cultivate several medicinal plants, such as various ginger cultivars (Zingiber officinale), turmeric (Curcuma longa, C. heyniana, C. mangga), temulawak (Curcuma xanthorrizha), stevia as natural sweetener, fingerroot (Bosenbergia pandurata), and many others. The seedling process was also included in the program conducted by community partners. In addition to medicinal plants, for economical purposes, some vegetables were also cultivated.

The cultivated plants were tried as sources for herbal tea products and food, and isolated for implementation in other useful programs for the community.

Fig 2. Preparation of unproductive area for cultivation field

> Cultivation process of medicinal plants as a material sources is very important factor

Fig 4. Dr. Elfahmi

Assoc. Prof. Dr. Elfahmi was the leader of this community service program. He has completed his Ph.D. at the University of Groningen, the Netherlands in 2006 and is currently a lecturer at the School of Pharmacy, ITB. He is the Head of the Biosciences and Biotechnology Research Center, ITB. He is also active in research in the field of herbal medicine. He has published more than 20 papers in reputed journals and has served as peer reviewer for a number of national and international scientific journals. He has presented his research results in many national and international seminars.

Cultivation of Medicinal Plants for Herbal Medicine Products in a Community
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Utilization of Bamboo as an Alternative Material for Carving in Jepara Area

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The village of Senenan in Jepara District, Central Java is known for its skillful carving craftsmen. But since hardwood as the main material is increasingly scarce and expensive, it has almost become unaffordable for the craftsmen. If this condition is not resolved then it cannot be excluded that the craft of carving in Jepara will eventually disappear.

The development of the bamboo carving will broaden the craftsmen's perspectives or mindset about bamboo as a material for craft which will further sustain the development in Jepara area.

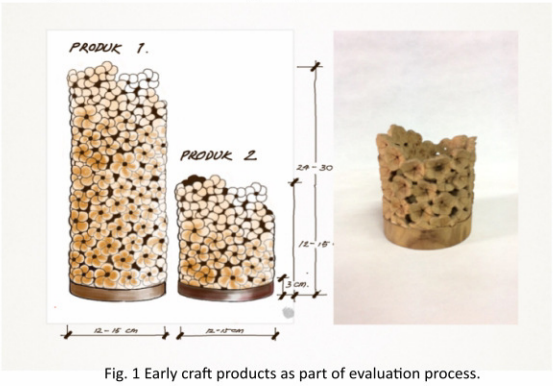


Fig. 1 Early craft products as part of evaluation process.

A genuine breakthrough has been successfully implemented within the communities of *Senenan* by using bamboo as an alternative material for carving. It confirmed that *bambu petung* has physical characteristics, such as its strength, that make it fit for use as a carving material. In this program, several methods and prototypes of bamboo carvings were introduced: *krawang* (open carving) and *lemahan* (solid carving), and combinations of both. Prototypes were produced in the form of ornamental patterns and utensils.

Fig. 4 Bamboo crafting workshop in Bangli, Bali.

Fig. 2 Process of carving.

Fig. 3 Bamboo carving workshop at Unisnu, Jepara

Fig. 5 Tracing *pola ukir asmat* with photocopy (left) and with crayon (right).

Fig. 6 Other utensils

Fig. 7 Lemahan technique with Papua motif

Testimonials have been obtained from the craftsmen during bamboo carving workshops in Jepara and Bali. Almost all participants responded positively to bamboo as a substitution material. It is expected that the further development of bamboo carving will broaden the craftsmen's perspectives or mindset about bamboo as a material for crafting, which will be able to sustain the economic development of the Jepara area.

Fig 8. Prototype 01

Fig 9. Prototype 02

Fig 10. Prototype 03

Research Center For Cultural and Environmental Products
Team: Kukuh Rizki Satriaji, S. Ds., M.T., Kamal Supriyadi
Local partner: LPM Universitas Islam Nahdlatul Ulama (Unisnu), Jepara

National Research Center

National Center for Sustainable Transportation Technology

Center for Microelectronics (PME) ITB

Research Center for Nanoscience and Nanotechnology

Center for Defense Technology Development (PUSTEKHAN)

National Center for Nanoscience and Nanotechnology

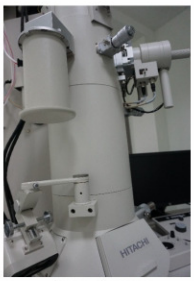
"Advanced Interdisciplinary Technology for Better Future"

http://www.nrcn.itb.ac.id

The Research Center for Nanoscience and Nanotechnology (RCNN), Institut Teknologi Bandung (ITB) is one of the research centers most recently established by ITB in response to modern complex challenges as well as to reaffirm a strong commitment to always be involved in research, development and application of frontier science and technology for the betterment of Indonesia.

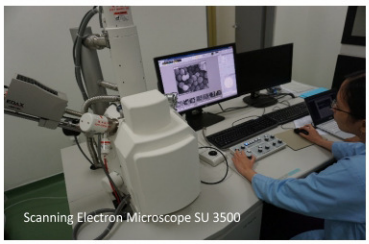
There are 4 research laboratories in RCNN (nano material, nano medicine, nano biotechnology, and nano device), each headed by a faculty member, with 25 faculty members and more than 100 students actively engaged in education, research and community service. Supported by state-of-the-art equipment, such as: high-resolution transmission electron microscope (HRTEM), focus ion beam (FIB), scanning electron microscope (SEM), atomic force microscope (AFM), its activities covers a wide spectrum of science and engineering disciplines.

High Resolution Transmission Electron Microscope H9500 with EDX/EDS



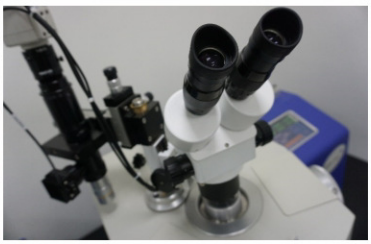
Focused Ion Beam FB2200

Cryo Ultramicrotome



Scanning Electron Microscope SU 3500

Scanning Electron Microscope SU 3500



TEM MILL Model 1050

High Resolution Transmission Electron Microscope H9500 with EDX/EDS

Focused Ion Beam FB2200

PUSAT UNGGULAN IPTEK PERGURUAN TINGGI

Research and educational activities within RCNN emphasize the importance of energy, health, and food related subject areas. For the next five years, RCNN activities are directed toward achieving national center of excellence status and as such key performance indicators are streamlined to the guidelines given by the Ministry of Research, Technology and Higher Education (MRTHE). These indicators include numbers of publications in well-respected international journals with a high impact factor, invited scientists and teachers (inbound and outbound), industrial collaborations, and doctorate graduates. Since the very beginning, faculty members involved in RCNN engagement come from different academic backgrounds.

RCNN believes that with the increasing complexity of the problems faced by society, an interdisciplinary approach is indispensable. It is expected that RCNN will contribute to address and find optimal solutions for these problems. RCNN will make exhaustive attempts to nurture the rich blends and dynamic of diverse academic backgrounds as a powerful vehicle to deal with tomorrow's challenges and fulfill its mission. Last but not least, RCNN also believes that significant contributions to society will never be achieved in a void and hence RCNN welcomes synergetic collaborations for mutual benefit search institutions and universities, both domestic and foreign.

RCNN is established in response to modern complex challenges as well as to reaffirm a strong commitment in research, development and application of frontier science and technology for the betterment of Indonesia

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Center for Microelectronics (PME) ITB

National Center on Broadband Wireless Access

http://www.pme.itb.ac.id

The Microelectronics Center is a research center under ITB and Vice Rector of Research, Innovation and Partnerships, coordinated by the Research Institute of ITB, since 1997. This reflects ITB's new emphasis on research activities in the field of microelectronics, which supports education as well as public and industrial services. The Microelectronics Center aspires to take a leading role in microelectronics research and development to serve the national interest. The Microelectronics Center focuses on the development of technology, products and electronics industries in Indonesia. It is a center of excellence in Indonesia, approved by the Ministry of Research, Technology and Higher Education. The Microelectronics Center was founded in 1986 by Prof. Dr. Samaun Samadikun. Prof. Samaun once graced Google's main page (on Friday 15/4/2016) to commemorate the birth of engineers and scientists from Indonesia.

Figure. 1.1 Google Doodle of the founding father of PME, Prof. Dr. Samaun Samadikun.

The scope of research and development at the Microelectronics Center covers the entire ecosystem of the electronics industry, from upstream to downstream, i.e. chip technology (components), electronic systems technology (ODM/OEM), and electronic equipment manufacturing technologies. The Microelectronics Center is supported by four laboratories and equipped with international standard research equipment, such as IC design and processing, electronic systems design and electronic manufacturing. In addition to conducting research activities, the Microelectronics Center also actively conducts product development activities in collaboration with domestic and foreign industries, disseminating research results through activities such as international conferences, journal publications, workshops and training. The Microelectronics Center also has intensive cooperations with universities from Indonesia and abroad.earch institutions and universities, both domestic and foreign.

The Microelectronics Center aspires to take a leading role in microelectronics research and development to serve the national interest

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The scope of research and development at the Microelectronics Center covers the entire ecosystem of the electronics industry, from upstream to downstream, i.e. chip technology (components), electronic systems technology (ODM/OEM), and electronic equipment manufacturing technologies. The Microelectronics Center is supported by four laboratories and equipped with international standard research equipment, such as IC design and processing, electronic systems design and electronic manufacturing. In addition to conducting research activities, the Microelectronics Center also actively conducts product development activities in collaboration with domestic and foreign industries, disseminating research results through activities such as international conferences, journal publications, workshops and training. The Microelectronics Center also has intensive cooperations with universities from Indonesia and abroad.

Vision

The vision of the Microelectronics Center is to become a center of excellence in the global electronics ecosystem that stimulates the development of microelectronics science and technology through creative and innovative research, development and education.

Mission

The mission of the Microelectronics Center is to create synergy through research, development and education programs on electronic ecosystems that yield technological products and services involving institutions of education and research, industry, and government.

Objectives

- Promote the science and technology capability accumulated in the Microelectronics Center,
- Build a global cooperation network between industries, research institutions and universities,
- Elevate innovation capacity by exploiting the advancement of science and technology,
- Build national capability to master the advancement of science and technology on microelectronics based on the national technology roadmap,
- Promote the establishment of industrial R&D clusters for electronics technology.

Programs

- Expand network cooperation through global-national forums,
- Yielding a more effective ecosystem/techno-industrial cluster,
- Provide training and accumulate expertise,
- Development human resources with high quality skills and expertise in electronics,
- Development of human resources with electronics industry-entrepreneurship,
- Electronics based product research and development,
- Develop innovative microelectronics technology products and services,
- Perform business incubation,
- Incubate electronics technology based start-up companies.

Labs

The research labs in the Microelectronics Center ITB are:

- System and Application Laboratory – uses ICs to develop products and applications. In many cases, these microelectronics devices, products and systems are mass products.
- IC Design Laboratory – develops technology for designing ICs using computer-aided design (CAD) and characterization of the component and devices.
- Devices and Process Laboratory – acquires and develops technology for analysis, characterization, design, developing, and processing of microelectronics components and devices to be used in integrated circuits (Ics).
- Electronics Manufacture Laboratory – studies and develops technology for electronics manufacturers.

Products

The Microelectronics Center has developed electronics products as depicted in the images below. In broadband wireless access (BWA) technology, the Microelectronics Center has been actively involved in the research and development of 4G devices. In 2012, a 4G modem/base transceiver station with WiMax standard IEEE 802.16 was successfully designed. The design covered the whole layer, i.e. from chip, PCB, MAC layer, network layer up to the software. The device was successful tested in a pilot project with a range of 11 km. BWA devices (up to 4G LTE) are being developed for use with base transceiver station and smart phone devices. In addition, PME also focuses on IoT related products, such as smart city devices (bike sharing, smart street lighting and smart home systems, and so forth). In IoT technology, PME starts product development at the level of the application and the user experience. In the final stage, the chip will be implemented. Some chips that have been designed are chips for MPEG codec products, WiMAX baseband processors, Smart Cards (contact and contactless), security engines, and so forth.

Fig. 1 T-Con (Tap an Connect) is a product fusing NFC and wifi. Functioning as wifi access point without having to make complicated settings in your device to connect. T-Con is designed to facilitate users when trying to connect to wifi access points. Users do not need bother with SSID scanning and entering a password. Simply tap your smartphone to T-Con and you are already connected to a wifi access point in the area.

Fig.2 Meshed and Internet Networked Devices System (MINDS) is an Internet-of-Things based system, which connects, controls and monitors all of your home appliances anytime from anywhere.

Fig.3 OwnGrid enables seamless connectivity over sea. It helps fishermen find the best locations for fishing. OwnGrid provides multiple applications, such as navigation, weather prediction, fishing areas, as well as online chatting. The product is also able to report any SOS condition.

Fig. 4 FUSI small cell FSC200 enables mobile service providers to deliver cost-effective capacity to urban hotspots, as well as affordable coverage to rural locations. They also enhance the user experience by enabling faster, more reliable data connections and higher data throughput on 4G networks. FSC200 provides 100 Mbps downlink and 50 Mbps uplink data connections with up to 200 users.

Infrastructure

The Microelectronics Center is equipped with facilities for designing and implementing various electronic devices:

- CAD software tools,
- Electronic measurement devices such as signal generator, signal analyzer, network analyzer, spectrum analyzer, oscilloscope, logic analyzer, and others,
- Compliance test devices such as LTE, WiMAX, DVB and others,
- Clean room for IC processing,
- Development boards such as FPGA, DSP, GPU, software defined radio (SDR), and so forth,
- Electronic manufacturing devices (IC packaging, multi layer PCB manufacturing, assembly and testing), in collaboration with Teaching Factory (TF), Batam.

The National Center for Sustainable Transportation Technology (NCSTT), or Pusat Pengembangan Teknologi Transportasi Berkelanjutan, is a unique multidisciplinary research center focused on conducting, supporting and encouraging applied engineering and technology for transportation systems in Indonesia.

The goal of NCSTT is to develop technology for integrated and sustainable transportation systems that can support economic growth in Indonesia. NCSTT also supports the national transportation roadmap, i.e. improving the competitiveness of Indonesian human resources and local industries.

Network and Collaboration

NCSTT has built network linkages and research collaborations with national transportation stakeholders such as automotive, railway and aircraft industries, as well as research institutions and universities, both domestic and foreign

Fig. 1 NCSTT Network research collaborations with industries and universities.

"Joint research with the Impact & Crashworthiness Laboratory, Massachusetts Institute of Technology (MIT), USA entitled 'Mechanical Integrity of Electric Vehicle Battery Packs' to develop and implement a robust battery system for application in electric vehicles"

Selected joint research collaborations are:

1. Joint research with the Impact & Crashworthiness Laboratory, Massachusetts Institute of Technology (MIT), USA entitled 'Mechanical Integrity of Electric Vehicle Battery Packs'. The aim of this research is to develop and implement a robust battery system for application in electric vehicles. Prof. Tomasz Wierzbicki and Prof. Elham Sahraei of MIT are pioneers in the characterization of lithium-ion battery cells and their components under mechanical abuse conditions. They have published several papers in this area in high impact factor publications such as Journal of Power Sources and Nature: Scientific Reports. Their research at MIT covers a wide spectrum of problems. It includes an extensive experimental and computational modeling program.

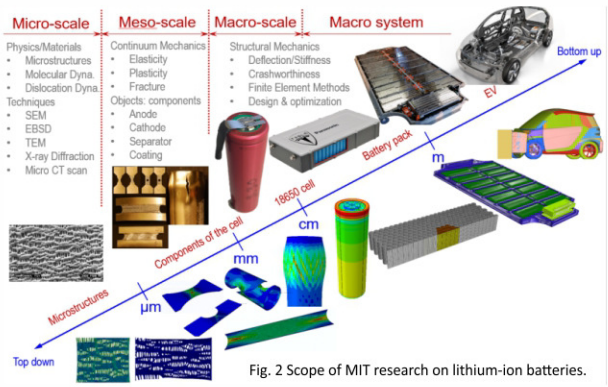

Fig. 2 Scope of MIT research on lithium-ion batteries.

The scope of their research extends from micro scale testing and modeling of components to macro level testing and modeling of battery cells, and development of models of modules and battery packs for Evs.

2. Joint research with the Dynamic and Impact Engineering Lab, Oxford University, UK is entitled 'Material Modeling and Development of Ultralight Metal Structures Applicable to Railway Vehicles'.

3. Green DRIVE Project, a consortium between University of Antwerp (Belgium), University of Deusto, Bilbao (Spain), Loughborough University (England), and University of Bordeaux (French). NCSTT ITB is a partner in the Joint Master's Degree in Sustainable Automotive Engineering.

Prominent research grants are:

a. **Sustainable Higher Education Research Alliance (SHERA) Program from USAID**
SHERA is a program that is funded by the United States Government through USAID and managed by the Institute of International Education (IIE). This program aims to enhance the capacity of researchers in Indonesian higher education institutes as well as creating an environment that enables quality research. The duration of this program is four years, from 2017 to 2021, with a total budget of USD 3 million. NCSTT-ITB has been awarded a SHERA Grant together with Higher Education Institution (HEI) partners from Indonesia and the United States to build a Center for Collaborative Research (CCR) together with prominent partners such as the Massachusetts Institute of Technology (MIT), UNDIP, UNS, UNSRI, ULM, ITK, UNSRAT.

b. **Royal Academy of Engineering (RAEng) IAPP**
Program The main purpose of this program is to initiate linkage between HEI in Indonesia and the United Kingdom as part of the Industry Academia Partnership Program (IAPP). The objective of the IAPP Program is to develop research collaboration on 'Material Modeling and Development of Ultralight Metal Structures Applicable for Railway Vehicles' together with the University of Oxford. NCSTT also involves Indonesian railway manufacturer PT INKA as an industrial partner. It is expected that the research product will be implemented in the design and development of railway vehicles made by INKA.

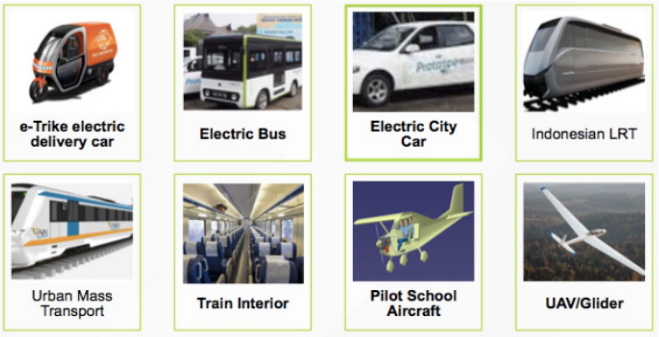

Fig. 5 Ongoing research innovation project.

Transportation infrastructure: NCSTT research on infrastructure for mass rapid transportation and electrification/charging strategies for electric vehicles is conducted in collaboration with worldclass universities and industries.

Policy, planning, and business development: NCSTT research also focuses on strengthening integrated transportation policy for the implementation of technology development, transit oriented development (TOD), and creating national Indonesian standards (SNI) for transportation industries.

Education and training: NCSTT is working on preparing resources to support technology development in transport industries. NCSTT has successfully organized a focus group discussion and workshop on mass transport/Light Rail Transport in Palembang. The national workshop was jointly organized by ITB, University Sriwijaya, Ministry of Transportation, local government and industries (see Fig. 4).

Fig. 3 CCR NCSTT team during SHERA program launch.

Fig. 4 Award ceremony from RAEng IAPP Program.

Product Development and Innovation
In order to achieve the integrated transportation goal, several product innovation solutions for sustainable transportation technology have been developed in four priority sectors (see Fig. 5).
Product innovation technology and design: NCSTT research and development on technology for product design focused on electric vehicles, mass transport and aircraft development in 2016.

Fig. 6 (a) Speakers from the first session of focus group discussion and workshop, LRT Palembang. (b) Audience members.

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Center for Defense Technology Development (PUSTEKHAN)

http://www.pustekhan.itb.ac.id

The Center for Defense Technology Development ITB has been established with the objective to coordinate and synergize research and technology development for application in defense and security from various research and development institutions in universities and industries, either government-owned or private.

The program of defense technology development is supported by three main stakeholders, consisting of R&D institutions, users and government. The stakeholders are strategic partners in pursuing national independence in defense technology capability. Together with all stakeholders, PUSTEKHAN builds and develops the common vision and network necessary to implement its program, to be executed by national consortiums and collaborations.

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As an organization, PUSTEKHAN runs its program within a framework consisting of three divisions: Program Development (PD), Project Focus (PF) and Marketing (M).

The Program Development Division defines the program to be executed by PF through a process of evaluation and compilation of a large amount of information from various resources, particularly information gathered by the M Division.

The Project Focus Division coordinates the execution of the program that has been defined by the Program Development (PD) Division.

The Marketing Division focuses on promotion and creating business contacts with the objective not only of promoting and discussing potential products, but also collecting and consolidating information from potential users. The information gathered consists of feedback and comments on proposed products and also information from users about products that are not yet available and could carry out specific functions. The information is used by the PD Division as a reference to define future programs to be executed by the PF Division.

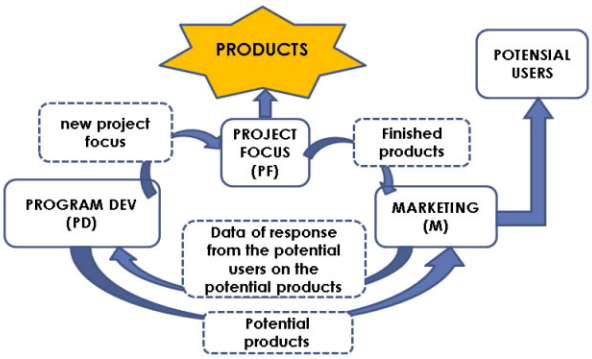

Fig.1 Work flow of the organization.

Currently, the fields accommodated by PD are Mechanical and Aerospace, Electronics and Telecommunication, Systems and Controls, and Materials, which are the main elements in the development of products for defense and security. There is a plan to also include other strategic fields in the future, such as biotechnology and nanotechnology.

Fig. 2 Participation in defense product exhibition IndoDefence 2016.

Fig. 3 Product development of UAV prototype for shooting operation.

Expert services

The expert resources pooled in PUSTEKHAN have the potential to be employed in programs of expert services in the scope of technical assistance, policy-making and program executions. Currently, PUSTEKHAN gives assistance for the running of a grant-awarding program of the Ministry of Defense for industrial prototyping and product development.

Discussion with experts to define a common vision and programs on various strategic issues between partners and stakeholders.

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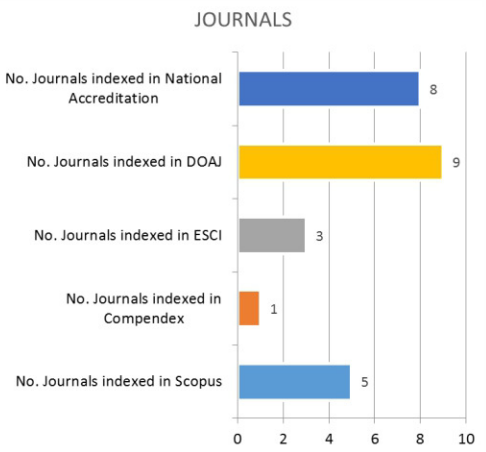
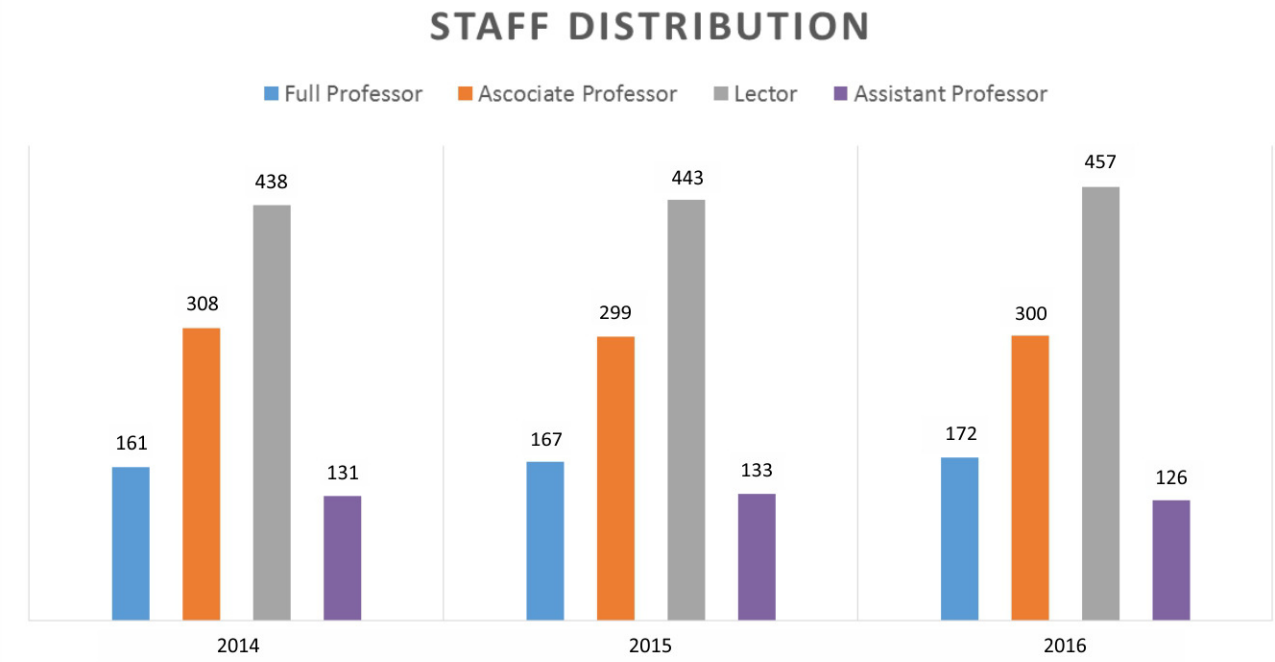
Resources, Directory of Research, Innovation & Partnership

Journals published by Institut Teknologi Bandung

Journal Title	National Accreditation	DOAJ	ESCI	Compendex	Scopus
Journal of Engineering and Technological Sciences	V	V	V	V	V
Journal of ICT Research and Applications	V	V			V
Journal of Mathematical and Fundamental Sciences	V	V	V		V
Jurnal Manajemen Teknologi	V	V			
Jurnal Perencanaan Wilayah dan Kota	V	V			
Electronic Journal of Graph Theory and Applications	V	V	V		V
Asian Journal of Technology Management		V			
International Journal on Electrical Engineering and Informatics					V
JMS (Jurnal Matematika&Sains)		V			
Journal of Visual Art and Design		V			
Jurnal Sosioteknologi	V				
Jurnal Teknik Sipil	V				





Laboratories

Anechoic Chamber, Acoustics and Building Physics Laboratory

Facilities: Anechoic Room (cut-off frequency 100Hz); Hemi-Anechoic Room (cut-off frequency 100Hz); Reverberation Room; Listening Room.

Measurements: Transmission Loss Measurement; Absorption Measurement; Sound Power Measurement; Diffusion Coefficient.

The Structural Engineering Laboratory of FCEE-ITB and Structural Building Laboratory of Engineering Center for Industry-ITB

Both laboratories are designed to facilitate: the needs of undergraduate students for material and structural laboratory; the needs of Structural Engineering researchers for advance testing facilities; the needs of the construction industry for material and structural testing facilities.

The activities of both laboratories in supporting the above demand are: destructive tests of materials; non destructive tests of materials and structural components/elements; destructive tests of structural components/elements, subassemblies, and structures.

Advanced Robotics Laboratory

Equipped with outdoor & indoor mobile robots, people-bot, humanoid robots, drone, underwater robot, robot sensors and accessories.

Nitrogen Fisisorption Tool, Inorganic Chemistry Laboratory

The tool used to determine the surface area and porosity of a microporous material (<2 nm) and mesoporous material (2 <x <50 nm). This tool uses a turbo pump that can create an ultra vacuum atmosphere up to 10^-8 mbar. Zeolite and mesoporous materials are suitable to be analysed using this tool.

ITB Innovation Park - Concept

ITB Innovation Parks are aimed at developing a strong innovation ecosystem involving universities, research institutions, companies, entrepreneurs, investors, government, and communities.
ITB Innovation Parks exist to stimulate the establishment new companies based on innovation.

ITB will develop 2 types of Innovation Parks :
1. As a general hub (multi-cluster) that link various technology sources to foster innovation that can be commercialized by start-ups or joint ventures with established companies,
2. As a specialized hub focusing on one particular area in which all stakeholders foster innovation that can be commercialized by start-ups or joint ventures with established companies.

ITB Innovation Park Gedebage
ITB Innovation Park Gedebage (Smart and Creative) has various facilities, such as laboratories and testing facilities for IC and PCB design. ITB Innovation Park Gedebage will also include software production services for companies in the games, animation, radar, smart city, and medical equipment sectors.

ITB Innovation Park Ganesha
As a general hub, ITB Innovation Park connects various technology sources at ITB, government, businesses, entrepreneurs and investors to increase innovation.

Activities at ITB Innovation Parks include:
1. Business incubator
A. Development of start-up companies
B. ITB information dissemination and innovation promotion
C. Business planning
D. Business partnerships
E. Innovation and business consulting
F. Innovation research cooperation
G. Innovation research management

2. Consultation and patent information center
A. ITB innovation data collection
B. Information dissemination and consultation of intellectual property
C. Training and information scout for intellectual property I / patents
D. Intellectual property registration
E. Intellectual property license / ITB technology
F. Development of intellectual property rules and rules for ITB
G.Legal consultation in entrepreneurship, business and technology fields

3. Entrepreneurship development
A. Education and networking program
B. Seminars, workshops and entrepreneurship exhibitions
C. Collaboration programs with SMEs, industry and government
D. Business coaching and consultancy
E. Post-graduate fellowships

4. Business consultation and management information center
5. Information dissemination and discussion activities
6. Fostering business cooperation.

Facilities that will be available in ITB Innovation Park:
1. Co-working space
2. Prototyping laboratory
3. Testing room
4. Seminar room
5. Intellectual property service office
6. Partner services
7. Lounge and car

Research Groups

No.	Units
1	*Geodesy*
2	*Geology*
3	*Applied Geology*
4	*Oceanography*
5	*Remote Sensing & Geographical Information Sciences*
6	*Atmospheric Sciences*
7	*Hydrographic Science and Engineering*
8	*Surveying and Cadastre*
9	*Algebra*
10	*Analysis and Geometry*
11	*Astronomy*
12	*Biochemistry*
13	*Physics of Complex System*
14	*Physics of Magneticsm and Photonics*
15	*Physics of Electronic Materials*
16	*Nuclear Physics and Biophysics*
17	*Theoretical High Energy Physics and Instrumentation*
18	*Analytical Chemistry*
19	*Physical and Inorganic Chemistry*
20	*Organic Chemistry*
21	*Industrial and Financial Mathematics*
22	*Combinatorial Mathematics*
23	*Statistics*
24	*Aesthetics and The Science of Art*
25	*Design Science and Visual Culture Sciences*
26	*Humanity Science*
27	*Visual Communication and Multimedia*
28	*Craft and Tradition*
29	*Man and Industrial Design*
30	*Human and Interior*
31	*Visual Art*
32	*Energy and Chemical Engineering Processing System*
33	*Ergonomics, Work Engineering and Work Safety*
34	*Instrumentation and Control*
35	*Industrial Management*
36	*Chemical Engineering Product Design and Development*
37	*Chemical Engineering Process Design and Development*
38	*Industrial System and Techno-Economics*
39	*Manufacturing Systems*
40	*Engineering Physics*
41	*Design, Operation and Maintenance of Aircraft*
42	*Flight Physics*
43	*Materials Science and Engineering*
44	*Energy Conversion*
45	*Mechanical Design*
46	*Lightweight Structure*
47	*Mechanical Engineering Production*
48	*Construction Engineering and Management*
49	*Air And Waste Management*
50	*Water & Wastewater Engineering*

No.	Units
51	*Geotechnical Engineering*
52	*Structural Engineering*
53	*Transportation Engineering*
54	*Offshore Engineering*
55	*Coastal Engineering*
56	*Water Resources Engineering*
57	*Environmental Management Technology*
58	*Earth Resources Exploration*
59	*Global Geophysical*
60	*Applied Geophysics and Exploration*
61	*Exploration and Engineering Seismology*
62	*Metallurgy Engineering*
63	*Drilling Engineering, Production, Oil & Gas Management*
64	*Mining Engineering*
65	*Reservoir Engineering*
66	*Policy Planning and Development Management*
67	*Architectural Design*
68	*Urban Planning and Design*
69	*Regional and Rural Planning*
70	*Housing and Human Settlement*
71	*Architectural History, Theory and Criticism*
72	*Economics Systems and Modeling*
73	*Regional and Urban Infrastructure System*
74	*Building Technology*
75	*Finance and Decision*
76	*Entrepreneurship and Marketing Strategy*
77	*Human Management and Operation*
78	*Biology Pharmacy*
79	*Pharmacochemistry*
80	*Pharmacology-Clinical Pharmacy*
81	*Pharmaceutics*
82	*Sports Science*
83	*Agrotechnology and Bioproduct Engineering*
84	*Microbial Biotechnology*
85	*Ecology*
86	*Animal Physiology and Developmental Biology and Biomedical Sciences*
87	*Genetics and Molecular Biotechnology*
88	*Biological Resources Management*
89	*Plant Sciences and Biotechnology*
90	*Forestry Technology*
91	*Electronics Engineering*
92	*Informatics*
93	*Software and Knowledge Engineering*
94	*Control System and Computer*
95	*Biomedical Engineering*
96	*Power Engineering*
97	*Computer Engineering*
98	*Telecommunication Engineering*
99	*Information Technology*

Center

No.	Units
1	*Center for Industrial Technology*
2	*Center for Mathematical Modelling and Simulation*
3	*Center for Microelectronics*
4	*Center for Tourism Planning and Development*
5	*Center for Environmental Studies* (CES-ITB)
6	*Center for Coastal and Marine Development*
7	*Center for Research on Energy Policy* (CREP-ITB)
8	Center for Remote Sensing (CRS -ITB)
9	*Center for Instrumentation Technology & Automation* (CITA-ITB)
10	*Center for Public Policy and Governance* (CP2G-ITB)
11	*Center for Spatial Data Infrastructure* (CSDI-ITB)
12	*Center for Empowerment of Open Source Software*
13	*Center for Health and Sport Technologies*
14	*Center for Unmanned System Studies*
15	*Center for Logistics and Supply Chain Studies*
16	*Center for Water Resources Development*
17	*Center for Climate Change*
18	*Center for Rural Areas Empowerment*
19	*Center for Sustainable Transportation Technology Development*
20	*Center for Defense and Security Technology*
21	*ITB Halal Center*

Research Center

No.	Units
1	*Center for Research on New and Renewable Energy*
2	*Center for Research on Information and Communication Technology*
3	*Center for Research on Bioscience and Biotechnology*
4	*Center for Research on Infrastructure and Regional*
5	*Center for Research on Cultural and Environmental Products*
6	*Center for Research on Disaster Mitigation*
7	*Center for Nanoscience and Nanotechnology*

Faculty and School

No.	Units	Abbr.
1	*Faculty of Earth Sciences and Technology*	FITB
2	*Faculty of Mathematics and Natural Sciences*	FMIPA
3	*Faculty of Art and Design*	FSRD
4	*Faculty of Mechanical and Aerospace Engineering*	FTMD
5	*Faculty of Mining and Petroleum Engineering*	FTTM
6	*Faculty of Civil and Environmental Engineering*	FTSL
7	*Faculty of Industrial Technology*	FTI
8	*School of Architecture, Planning, and Policy Development*	SAPPK
9	*School of Business and Management*	SBM
10	*School of Pharmacy*	SF
11	*School of Life Sciences and Technology*	SITH
12	*Graduate School*	SPS
13	*School of Electrical Engineering and Informatics*	STEI

WRRIM-ITB

Office of Vice Rector for Research, Innovation and Partnership

http://wrrim.itb.ac.id

LPPM-ITB

Institute for Research and Community Services

http://lppm.itb.ac.id

LPIK-ITB

Institute of Innovation and Entrepreneurship Development

http://lpik.itb.ac.id

DKHI-ITB

Directorate of Partnership and International Relations

http://pair.itb.ac.id

WRRIM ITB

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