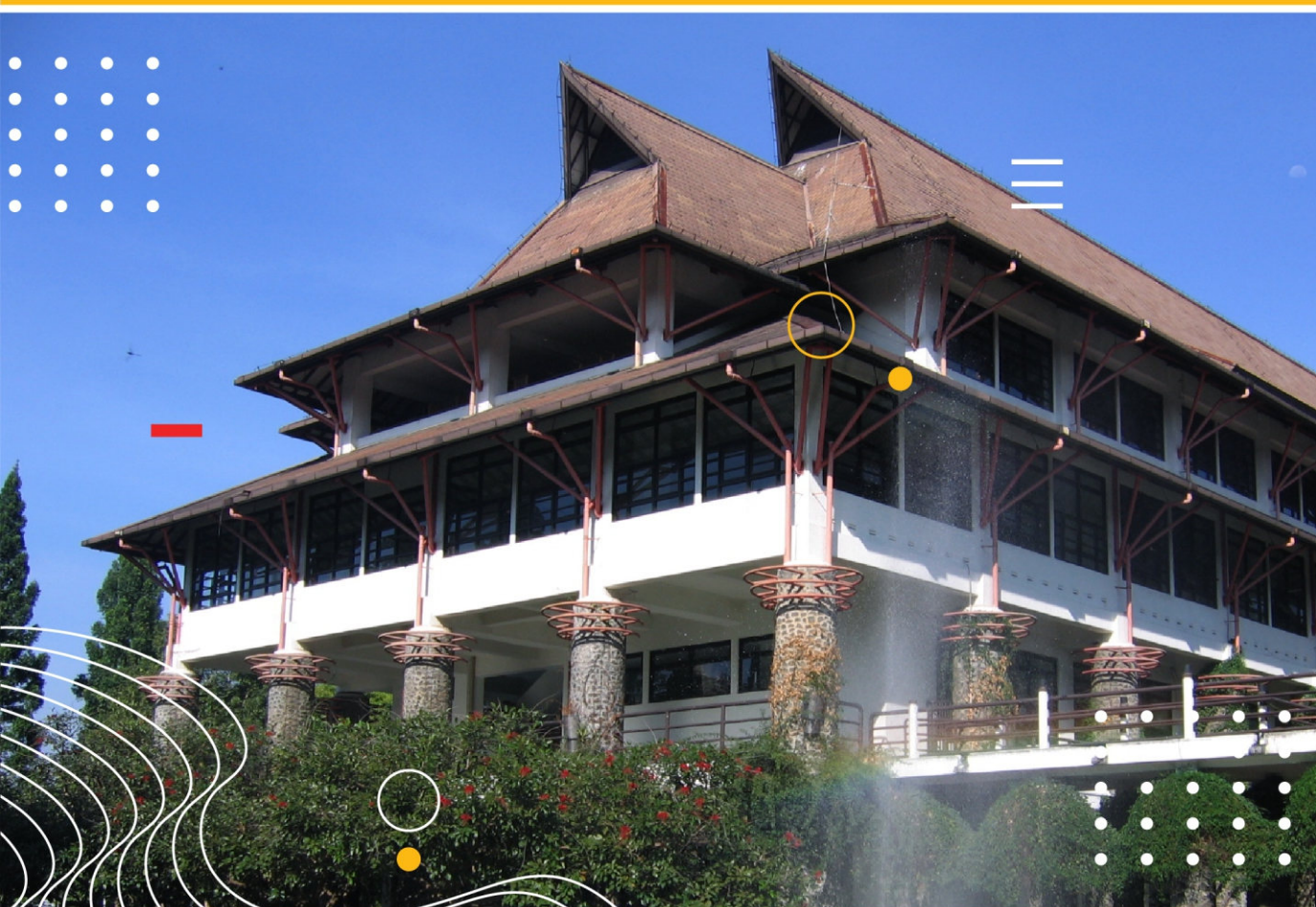
WRRIM ITB
Office of Vice Rector for Research, Innovation and Partnership

RESEARCH, INNOVATION & PARTNERSHIP

ITB 2018



Research, Innovation & Partnership

ITB 2018

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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 98 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 two years from now. This may be old for a human but it is relatively young for a university. 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 entrepreneurship that have impacts on society through technology and building synergy between university, industry, government and community. 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 regional university ranking position, to serve and contribute to community empowerment, and realize entrepreneurship through innovative works that benefit the nation. To achieve it's 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

May 2019

[1]Tri dharma perguruan tinggi = three pillars of tertiary education: education, research and community service.

Prof. Kadarsah Suryadi
Rector for Research, Innovation and Partnership

Preface from the Rector for Research, Innovation and Partnership

"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"

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

Preface from the Vice-Rector for Research, Innovation, and Partnership

"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"

Assalamu'alaikum Warahmatullahi Wabarakatuh

The Office of the Vice-Rector for Research, Innovation, and Partnership in its mission of transforming from a research university into an entrepreneurial university, has set strategic goals in research, innovation and community services 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 enhance international research collaborations; and 7) to support and promote the improvement of the international standing index of ITB 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 and the environment products.

ITB is playing 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 to 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.

Innovation park that will promote the development of 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 2018, 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.

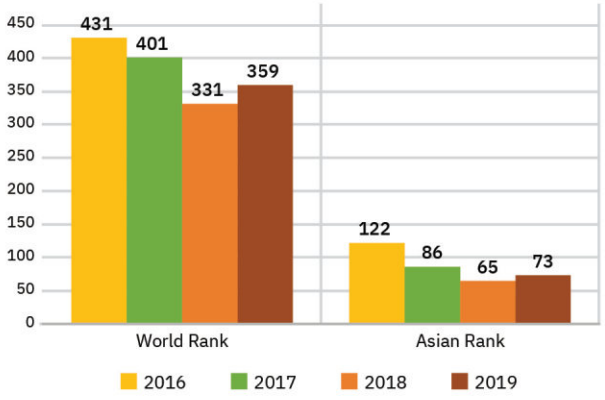
Wassalamu'alaikum Warahmatullahi Wabarakatuh

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

Facts and Figures

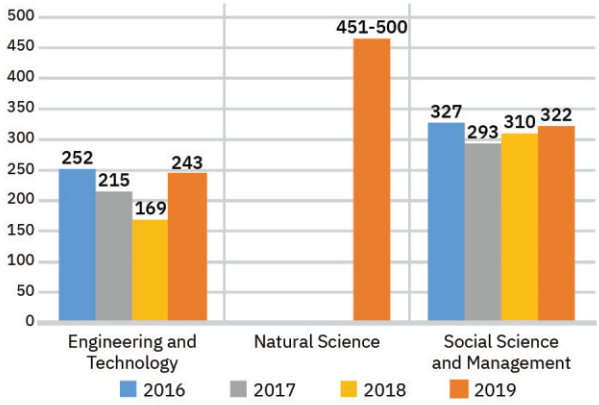
World, ASIA and National Ranking

QS WORLD UNIVERSITY RANKINGS TOP 50 UNDER 50

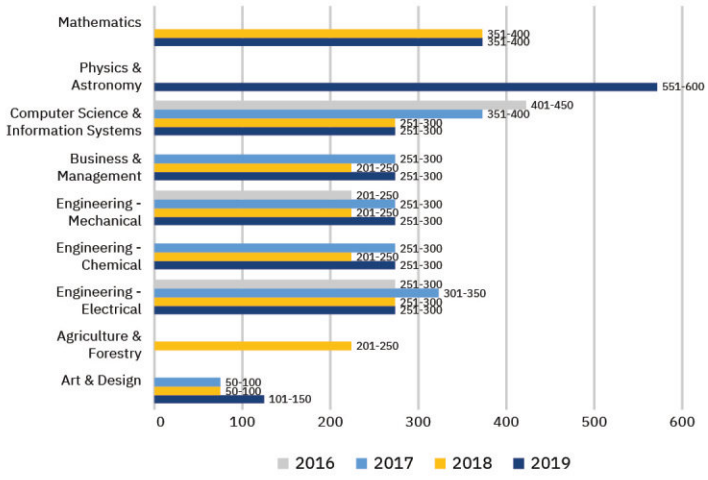


QS UNIVERSITY RANKINGS ASIA

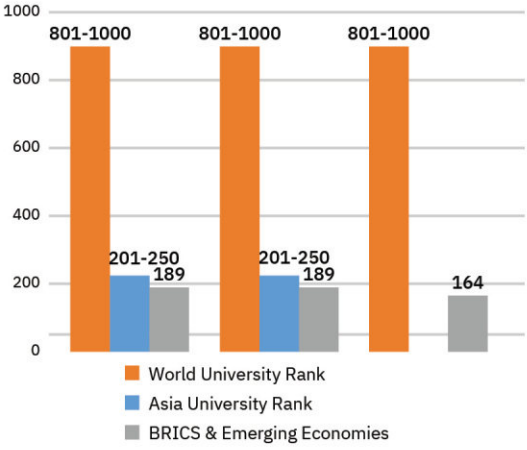
QS WORLD UNIVERSITY RANKINGS by faculty



QS WORLD UNIVERSITY RANKINGS by subject



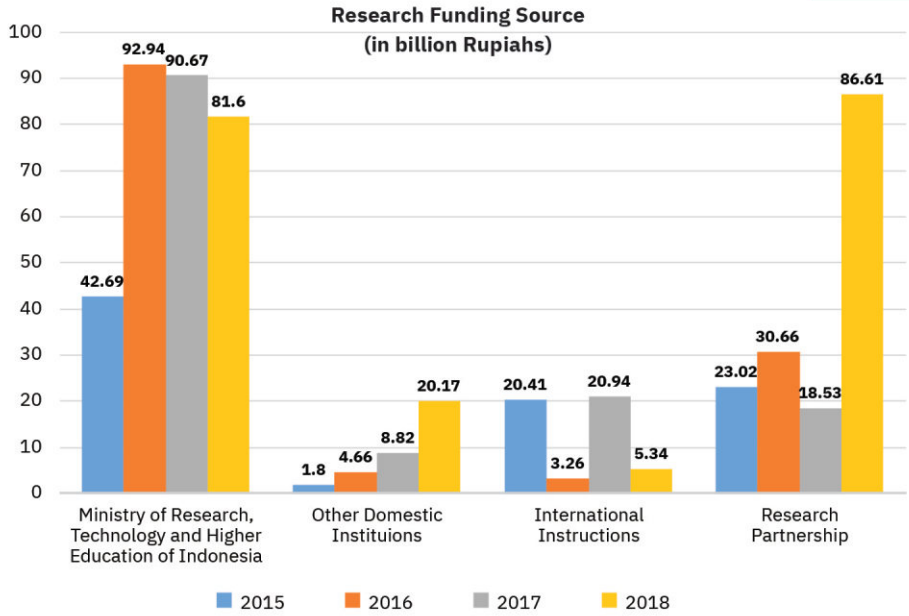
THE WORLD UNIVERSITY RANKINGS | THE ASIA UNIVERSITY RANKINGS | THE WORLD UNIVERSITY RANKINGS ASIA

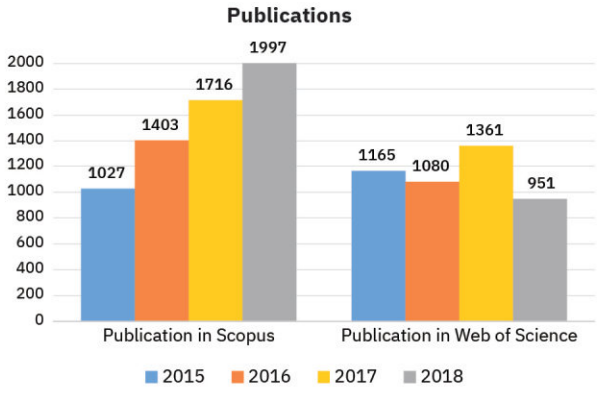


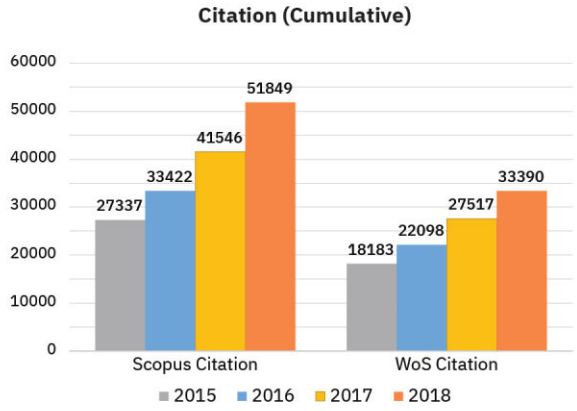
National University Rank

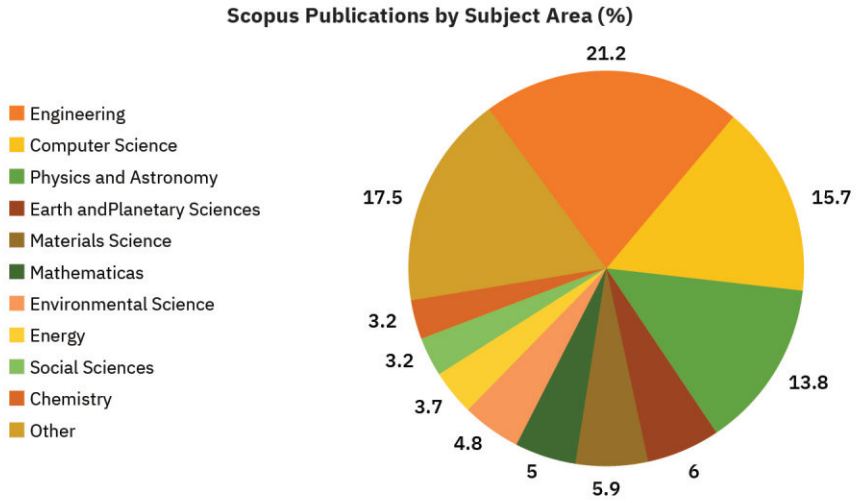
	2015	2016	2017	2018
Ministry of Research, Technology and Higher Education of Indonesia	1	1	2	1

Research Grants, Publications, Citations

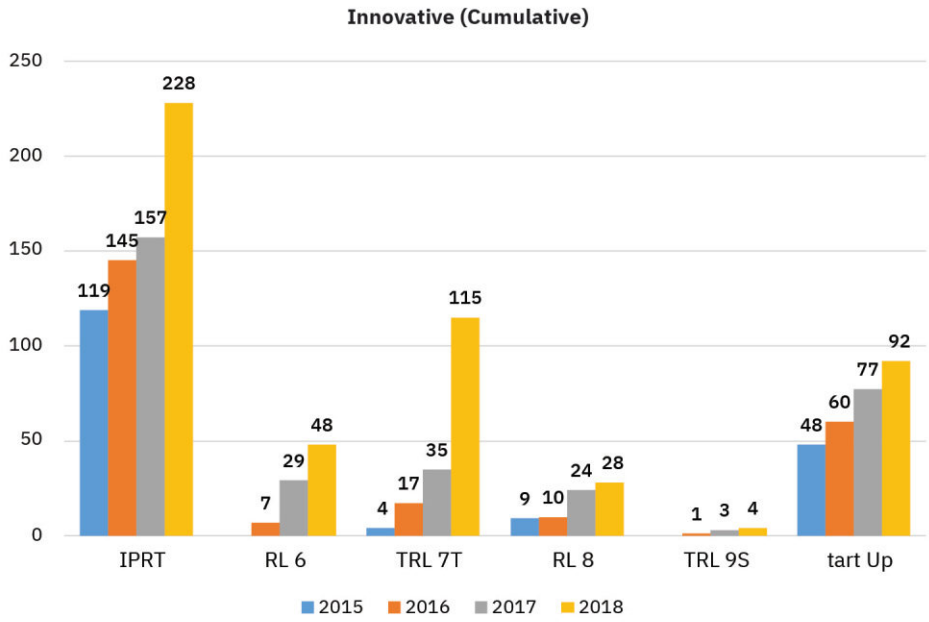




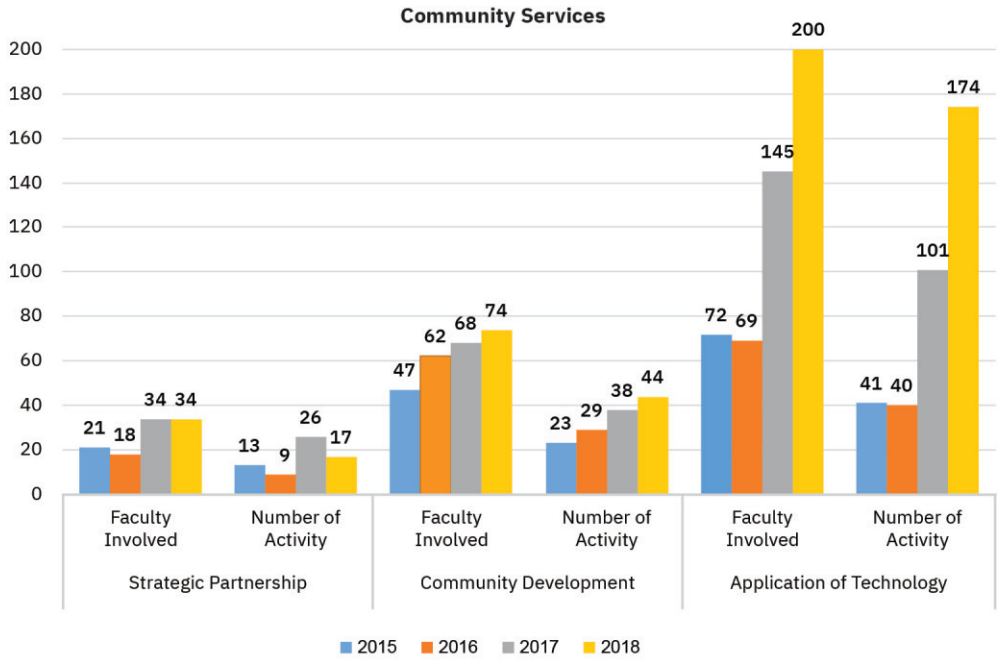




Start-up, Patent, Innovation Product

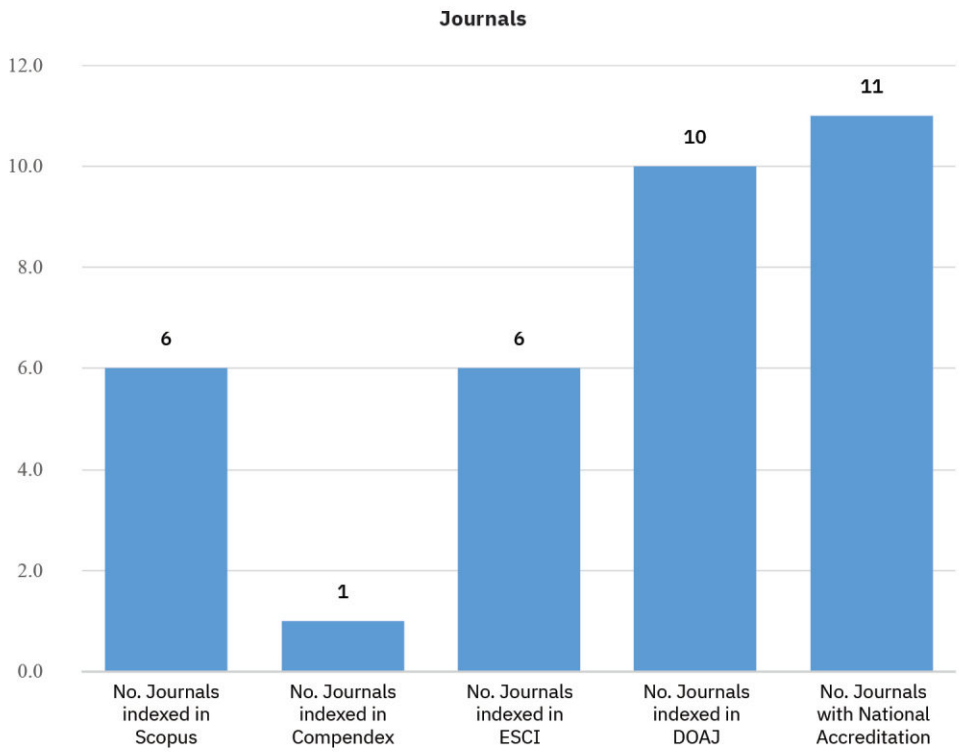


Community Services

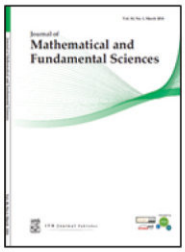


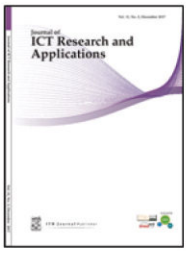
Journals

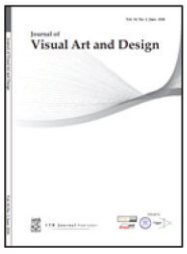
Journal Title	National Accreditation	DOAJ	ESCI	Compendex	Scopus
Journal of Engineering and Technological Sciences	v	v	v	v	v
Journal of ICT Research and Applications	v	v	v		v
Journal of Mathematical and Fundamental Sciences	v	v	v		v
Jurnal Manajemen Teknologi	v	v			
Journal of Regional and City Planning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

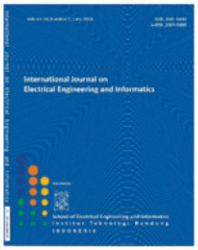


Journals

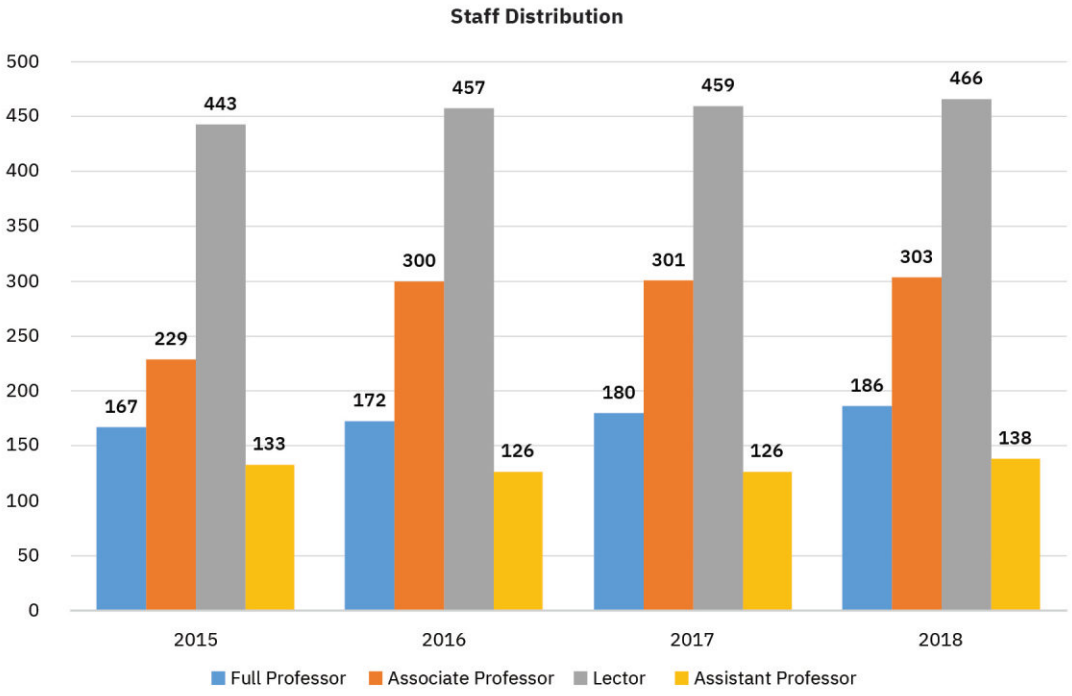




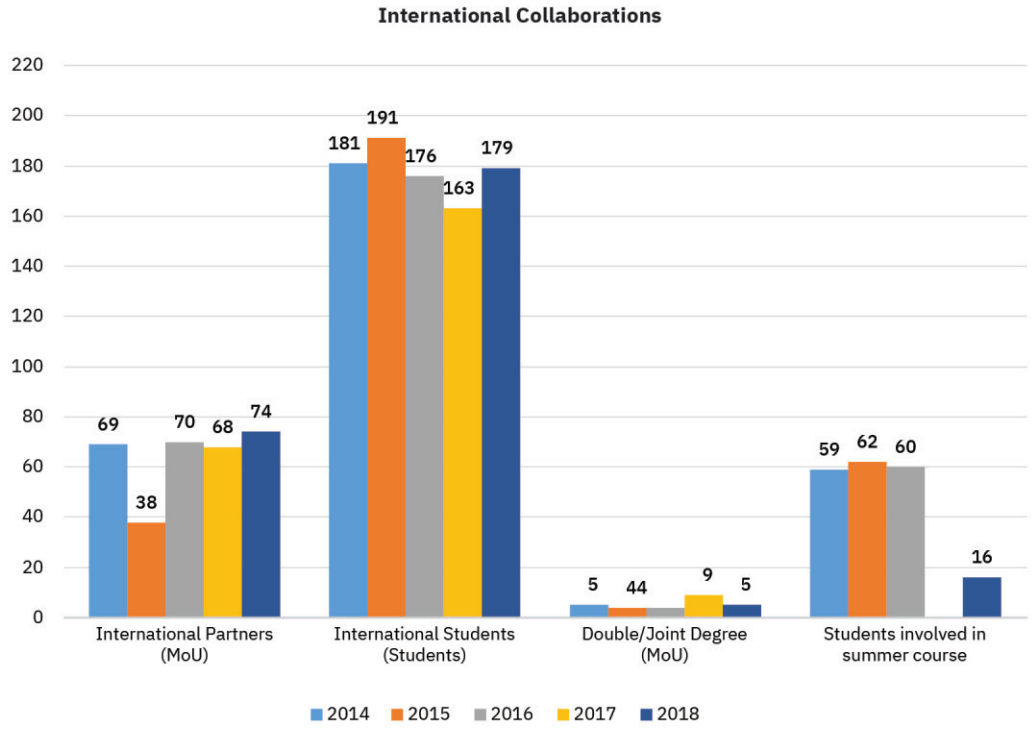


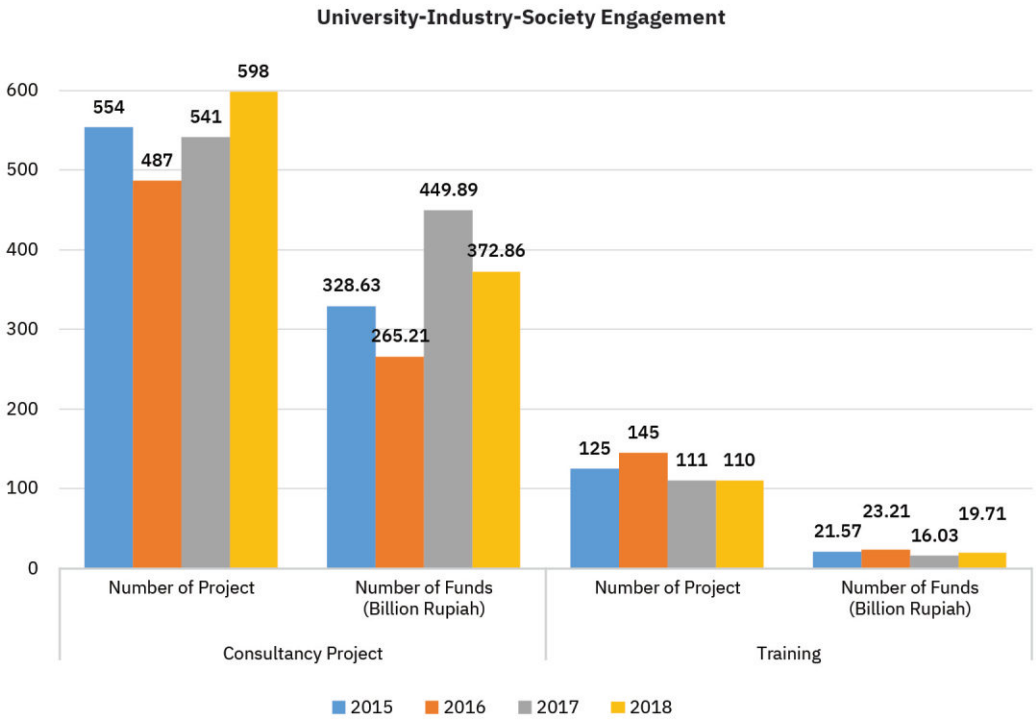


Staff Distribution



International Collaboration





List of International Research Collaboration

Collaborating Institute	Number of Joint Publications
University of Groningen	142
University of Tokyo	119
Tokyo Institute of Technology	117
Universiti Sains Malaysia	91
Hiroshima University	89
Kyoto University	76
Kyushu University	69
Osaka University	63
National University of Singapore	57
University of Twente	56
CNRS Centre National de la Recherche Scientifique	55
Universiti Teknologi Malaysia	55
Chiba University	47
University of Fukui	45
Nanyang Technological University	44
Australian National University	44
Tohoku University	43
Nagoya University	39
University of Newcastle, Australia	39
Tokyo University of Science	38
Delft University of Technology	36
Universiti Putra Malaysia	36
Universiti Kebangsaan Malaysia	35
University of Amsterdam	35
University of New South Wales UNSW Australia	34
University of Western Australia	33
Hokkaido University	30
Tanjungpura University	28
Japan Atomic Energy Agency	27
Sejong University	26
Kyushu Institute of Technology	25
Riken	24
National Institute of Advanced Industrial Science and Technology	24
University of California, Berkeley	24
Konkuk University	23
Wageningen University and Research Centre	23
University of Malaya	23
University of Queensland	22
Van der Waals-Zeeman Institute for Experimental Physics	21
University of Cologne	21
Keio University	21
Universität Hamburg	21
University of Durham	20
Université de Toulouse	20

Collaborating Institute	Number of Joint Publications
Fukui Science Education Academy	19
King's College London	19
Geospatial Information Agency	18
University of West Bohemia	18
Kanazawa University	18
Purdue University	17
Brown University	17
Kumamoto University	17
UCL	17
Waseda University	17
Universite Paul Sabatier Toulouse III	17
National Taiwan University of Science and Technology	17
Pukyong National University	16
The University of Sydney	16
Khulna University	16
Toyohashi University of Technology	15
Universiti Teknologi MARA	15
Utrecht University	15
University of Maryland	15
Nakhon Pathom Rajabhat University	15
Technical University of Kosice	15
University of Wisconsin Madison	15
Resilience Development Initiative	14
IEEE	14
Kyungpook National University	14
Oregon State University	14
California State University Channel Islands	14
University of Michigan, Ann Arbor	14
Virginia Polytechnic Institute and State University	14
Universite Grenoble Alpes	14
Ibaraki University	13
The University of British Columbia	13
Massachusetts Institute of Technology	13
National Institutes of Natural Sciences - National Astronomical Observatory of Japan	13
Universiteit Gent	13
Université de Montpellier	13
The University of Adelaide	12
Julius-Maximilians-Universität Würzburg	12
Radboud University Nijmegen	12
Monash University	12
Tsinghua University	12
University of Oxford	12
University of Illinois at Urbana-Champaign	11
Universiti Teknologi Petronas	11

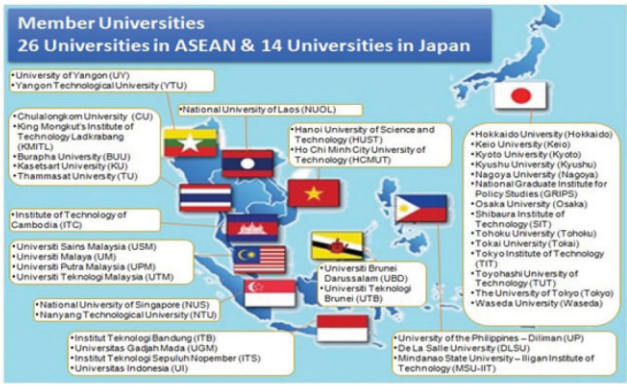
International Office Activities

AUN/SEED-Net

AUN/SEED-Net established in 2001, is a sub-network under auspices of ASEAN University Network (AUN). The Network currently composed of 40 members Institutions from ASEAN, supported by 14 Japanese Universities, was established to develop human resources in Engineering in South East Asia. Within this network, ITB currently host Master and PhD programs in Mechanical and Aerospace Engineering, as well as Energy, Environment and Disaster Mitigation. More than 60 Masters and PhD mainly from Cambodia, Vietnam, Laos and Myanmar has graduated from ITB through AUN-Seed Net Scholarship.

Program & Activity:

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



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

PARE Program

PARE program was established as a a collaborative educational system involving Hokkaido University, Japan and 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.

PARE Members:

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

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

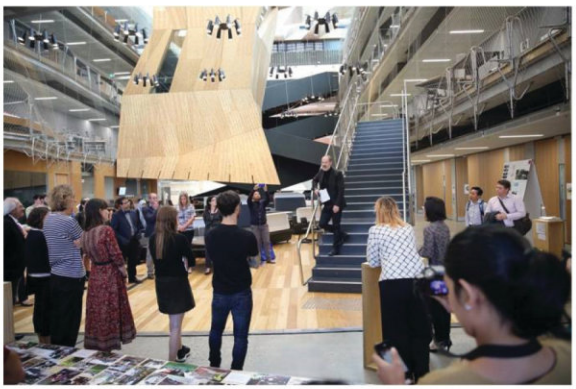
International Joint Capstone Design Project (I-CAPS)

International Joint Capstone Design Project (I-CAPS) is a collaboration program initiated by three universities: Institut Teknologi Bandung (ITB), Universiti Kebangsaan Malaysia (Malaysia), Chonbuk National University (Republic of Korea).

This program aims to improve the students' ability to function in cross-cultural teamwork and their problem-solving skills. In this program, each participant works in an international team to develop ideas, invent and design a product through prototype making based on a given theme. The consortium is now expanding, involving students from NTU (Singapore), Tunghai University (Taiwan) and 11 Korean university members of the Innovation Center for Engineering Education in consortium with Chonbuk National University (CBNU). The participants come from various engineering disciplines and product design from each participating university and are grouped into teams consisting of 4-6 people from 2-3 different countries.

In 2017, ITB-Korean team won:

1. Grand Prize with the Relax Me prototype, a stress level detector and working as well as aromatherapy.
2. Silver with the Re-lease prototype, a urinal tool that can detect health condition from urine.
3. Bronze with the Deblice prototype, a tool that can help communication for the visually impaired and deaf.
4. Bronze with the Azco prototype, an elderly companion tool for the elderly.
5. Bronze with Kof prototype, portable cough filter tool.



International Joint Architecture Studio

International Joint Architecture Studio has been conducted for several years, organized by School of Architecture, Planning and Policy Development of Institut Teknologi Bandung in collaboration with ITB partners. In this activities, ITB students and partners working together for several weeks on a real project to explore sustainable urban planning and design solutions in certain areas.

In 2016 ITB and University of Melbourne working together in "Redefining of New Urban Space Bandung Technopolis in Gedebage".

In 2017, ITB and University of Sydney work together with a research on Settlement Area of Bandung City with Tamansari area as the case study.

The workshop was held as an implementation of academic cooperation between SAPPD ITB and the Melbourne School of Design. In the near future, several schemes of academic engagement (joint research/publications and faculty exchange) will be further developed to foster the cooperation between both institutions.

AIMS Program

The ASEAN International Mobility for Students (AIMS) programme, formally known as M-I-T, is a student mobility program for citizens of all SEAMEO member countries. Starting from 2010, currently the network consist of 43 Member Institutions of ASEAN plus 15 from Korea and Japan. 500 students has taken parts in the program within 10 subject area. Every year about 5 ITB students are studying at partner Institution and International students from member institutions also come to ITB under this program.

The 11th Review Meeting of the ASEAN International Mobility for Students (AIMS) Programme

Sharing at International Study Bazaar

Gaming Simulation Class Discussion

Playing your-own-designed game in the Gaming Simulation Class

International Exchange Student

Every years, about 400 international students come to ITB for short and semester exchange. ITB organized several activities such as orientation week, cultural trip, International day, survival Indonesia language, culture and services to ensure the welfare of International students and create one of the best experiences for the students while staying in ITB.

How to Make Batik

International Students Outing Program

Cultural trip to Bali

International Students Gathering

Visit and Students Interview with Tokyo University of Agriculture and Technology

International Student Orientation Days

ITB International Day

Graduation Celebration

Parade at the Asia Afrika Conference, 24 Juni 2016

International Student Gathering

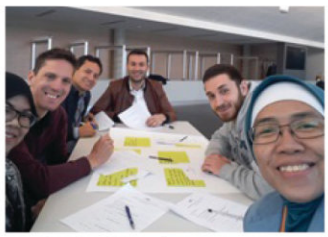
ITB International Students

International Staff Exchange Program

International Relations Office send and receive staff exchange to share and expand the knowledge on Internationalisation issues with partners around the globe.

International Staff Training Week
Radboud University

Staff Mobility with 4 Universities
Alliance (A4U) Spain



International Staff Week Erasmus+ Goes Global
In Vilnius Gediminas Technical University

International Staff Week Erasmus+ Goes Global
In Vilnius Gediminas Technical University

ITB Partners

ITB is actively participating in several networks, as an implementation of ITB's Internationalisation Policy. Various ITB staff and students participate in activities within the network such as mobility, academic collaboration and research collaboration.

Map of ITB Partners

Visit to AUN Secretariat, Singapore

Prof. Khairurrijal
Director of LPPM ITB

The Institute for Research and Community Services (LPPM ITB)

Institut Teknologi Bandung (ITB) as a research university is the center for development of science, technology and art (IPTEKS) on the basis of research and orientation to community services. Sustainable development of IPTEKS has been conducted in order to improve the quality of ITB as one of the leading and most prestigious educational institutions in the world.

LPPM, Institute for Research and Community Services, is an organization within academic unit of ITB and institutionally responsible for facilitation and coordination of collaboration in research and community services activities so as to increase mutual synergy of academic competence of ITB and the community LPPM was established at the end of 2001 wherein the Institute for Research of ITB, settled in 1959, merged with the Institute for Community Services of ITB as a form of transformation program of ITB toward academic excellence within an efficient, transparent, accountable, and professional management and consistently non-profit educational institution in order to perform TriDharma, the three duties of the institution which cover education, research, and community services in balance.

"Sustainable development of IPTEKS has been conducted in order to improve the quality of ITB as one of the leading and most prestigious educational institutions in the world"

LPPM-ITB has well-managed its national and international collaboration with other research institutions, government, industries, private and state-owned enterprises, and community organizations, and formulated the collaboration in research trainings, partnerships, and consultancies. The occurrence of such collaboration reflects a high degree of community reliability to the competence of LPPM-ITB.

To the community as clients and stakeholders, we would like to give a great deal of gratitude for the collaboration which has resulted in empowering each other towards prospering people by the development of IPTEKS through the achievement of improving scholarships of discovery, integration, application, and teaching.

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Dr. Edwan Kardena
Director of DKHI ITB

Directorate of Partnership and International Relations (DKHI ITB)

Directorate of Partnership and International Relations has a function to manage cooperation at the central level of ITB. It has sub directorate of domestic partnership and sub directorate of international Relation which is also manage the international relation office (IRO). The directorate supports ITB in developing network and cooperation with academic, industry, private sector as well as government institutions, both inside and outside the country. Equality, mutual objective, trust and benefit, as well as transparency is its basic principles of partnership. As service has been the mindset, we always try to be in the position of taking challenges as opportunity. The directorate is performed itself as a bridge between competences inside and outside the campus.

The directorate is helping ITB to play significant role in sharpening the future of global higher education. We could not do active partnership, or push driven partnership as it will need a lot of resources which we do not have. So, being active in many networks, forums, meetings, are the effort to make ITB more visible in the international map. Such approach enable ITB to be seen by partners and that opportunities are created. We still be able to select cooperation that meet ITB standards and vision. All of cooperation must give impact to the continuous improvement of quality research and education. With

partnership, ITB would like to progress together and willing to share knowledge as a part of ITB contribution to society, national development, as well as global community.

International relations for a university is a kind of academic diplomacy. Partnership in this case, means also friendship. So, we do realize not all opportunity could meet our expectation. However, being a friend in the network or bilateral engagement could always create unexpected result in the future. So we value friendship more than a rigid partnership.

As a unit under the directorate, The International Relation Office (IRO) provides professional supports and advising services to international students who are coming for full-time study and exchange programs, regarding their study and immigration status in Indonesia. This office is also committed to provide quality advising services and supportive programming to ITB students who are participating in exchange programs. The main objective of the office is to help the international students, scholars, and ITB faculty and staff, navigate many complexities associated with student-and employment-based visa arrangement. We are committed to providing information and services, taking into account institutional policies and ever-changing state regulations.

"The directorate is helping ITB to play significant role in sharpening the future of global higher education"

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LPiK Head Quarter and ITB Innovation Park
at Ganesha Campus

Institute for Innovation and Entrepreneurship Development

LPiK ITB
Lembaga Pengembangan Inovasi dan Kewirausahaan ITB

The Institute for Innovation and Entrepreneurship Development (IIED / LPiK) was established to bring the innovation ecosystem in ITB. The institute main objective is to develop ITB as an etrepreneurial university which has three main characteristics, which are excellence in teaching, excellence in research, and excellence in innovation. The LPiK is responsible for the management of innovation with the goal to encourage the culture of innovation and entrepreneurship of ITB in order to create a direct and significant impact on the community.

Activities related to the LPIK's main tasks and functions include the development of new entrepreneurs as actors for students and faculty members in the form of entrepreneurship training, mentoring, socialization for Intellectual property rights, and various activities that aim as a form of promotion, introduction and data collection of innovation results in ITB.

The LPiK ITB activities are developed to contribute to the development of innovative and creative industrial independence to cultivate the natural wealth and culture of the nation itself. The key to this success is the growth of innovation and entrepreneurship from the academic community of ITB. The Innovation ecosystem often arises from research output, where the value-adding process of the research results has been processed into a form that is ready to be disseminated to society. One process to diffuse the innovation result is through the establishment of a new (industrial) (start-up) business unit, or the establishment of close cooperation with the industrial world that will utilize the innovation. Therefore, the linkage between the results of research, innovation, and entrepreneurship is very tightly related.

A. VISION DAN MISSION

The LPiK mission is to become a reliable and reputable institution, in an effort to bring Indonesian society into a prosperous nation by advancing the competitiveness of Indonesian industries and human resources.

The LPiK missions are:

1. To conduct mediation and coordination within the framework of innovative fundraising through business and industry partnership, and
2. To guide the development and changes made by the community through high quality innovation and entrepreneurship development activities, directly beneficial and have a significant impact on improving the welfare of the people, nation, and state.

B. DIVISIONS

LPIK-ITB consists of 4 divisions with duties and functions that support the efforts of entrepreneurship development and commercialization of research results. The divisions are as follows:

(1) DIVISION OF INDUSTRIAL AND BUSINESS INCUBATOR

The industrial and business incubator has a role in helping the success of new ventures. This concept is very relevant to be implemented in Indonesia. The development of the incubator practically encourages creation and fosters new business growth in particular with regard to the innovation themes of a product. The development of incubators in universities has a goal in helping the process of commercialization of research products in universities that are building new business coming from research results and encouraging students and alumni to become business actors. The incubator focuses on startups that have high innovation content as a value-added characteristic of the product or service they produce. The establishment of the incubator at ITB is to encourage the commercialization of research results that have been produced by faculty members and or students in the hope that the results of the research can benefit society.

Co-Working Space at LPiK ITB

The LPiK ITB is furnished with the co-qorking space to provide facilities and support to the tech-startups. The co-working cpace accommodates startup within ITB to run their business and to improve the quality of innovation and technology. By working in the co-working space environment, it is expected that the sturtups and entrepreneurs can build interaction, communication, cooperation, and co-creation for succesful entreprises. Located at the ITB Innovation Park Genesha Campus, this Co Working Space has the following facilities: high-speed internet, cloud service and entrepreneurship development services and supported by industry partners to make this area the best innovation ecosystem model in Indonesia.

"The Innovation ecosystem often arises from research output, where the value-adding process of the research results has been processed into a form that is ready to be disseminated to society".

Co-Working Space at LPiK ITB

Co-Working Space at LPiK ITB

(2) DIVISION OF INTELLECTUAL PROPERTY AND LEGAL:

The Division of Intellectual Property and Legal has a role in helping the academic community of ITB to obtain information and direction in the management/acquisition of Intellectual Property Rights (IPR) and facilitate the administration of IPR management. In carrying out its role, the Division of Intellectual Property and Legal has various dimensions of activities such as patent draft writing assistance, patent and legal consultancy, patent submission, administration, and arrangements.

(3) DIVISION OF ENTREPRENEURSHIP DEVELOPMENT:

Entepreneurship Development in universities aims to create educated new business actors, generations that create employment opportunities, as well as the commercialization process of research outputs. Universities produce research outputs and highly competent people in their fields. However, it is a fact that very little output from universities is directly beneficial to the community. Universities need a strategy to encourage entrepreneurship independently. Therefore, LPIK-ITB undertakes one of the efforts, namely by opening partnership opportunities with various parties to support the development of new entrepreneurs.

(4) DIVISION OF INNOVATION PARK:

The Innovation Park is designed to serve early-stage enterprises in various stages of development, including business with commercial applications expected from ITB research outcomes. Innovation Park accommodates both research and business activities within a commercial area equipped with supporting facilities. Technological innovation encompasses a range of activities from technical knowledge including ideas, knowledge, and technology translated through a transformation into a product as a physical reality and has a usefulness for society. Collaboration with various parties will be very helpful in identifying and looking at innovation opportunities that arise from research in university. Innovation Park has a role in connection interests to support knowledge-based innovation processes. The various stakeholders on innovation development are: academia, industry, government, and society.

Innovation Ecosystem

The ITB Innovation Park is developed with the integrated innovation ecosystem comprises of strong talented entrepreneurs, state of the art laboratories, strong network with anchor industries, and research innovation product based on Technology Readiness Level 5-9. These innovative products are ready for industrial implementation.

ITB Innovatiotersities, research institutions, companies, entrepreneurs, investors, government, and communities. ITB Innovation Parks exist to stimulate the establishment new companies based on innovation.

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 cafe

ITB will develop 2 types of Innovation Parks:

1. As a general hub (multi-cluster) that links 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 Ganesha Campus

As a general hub, ITB Innovation Park connects various technology sources at ITB, government, businesses, entrepreneurs and investors to increase innovation. The ITB Innovation park at Ganesha Campus represents the general hub for 4 major clusters: Energy, Transportation, Life Science, and ICT. The building construction was started in April 2018.

ITB Innovation Park Ganesha Campus

ITB Innovation Park Bandung Teknopolis

ITB Innovation Park at Bandung Teknopolis Gedebage

ITB Innovation park at Bandung Teknopolis Gedebage will focus on Smart and Creative Industries. ITB Innovation Park Gedebage) 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.

Activities at ITB Innovation Parks include:

1. Business incubator
2. Legal consultation and patent information center
3. Entrepreneurship development
4. Business consultation and management informatio center
5. Information dissemination and discussion activities
6. Fostering business cooperation.

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Dr. Tania — *Application to Detect Plant's Disease*

KAZEE — *Big Data Analytics*

Lightning Protection System

SVARA — *Audio Content Platform*

LAKON — *AI Chatbot*

Technozone — *Ozone based Machine for Sterilize Fruit*

BIOPS AGROTEKNO — *Farming Automation*

Bio-N OILS — *Propolis and Essential Oil*

RDS tech — *Intelligent Robot Solution*

conventory — *Online Inventory Management*

ReadyDok — *Clinic Customer Relationship Management*

halofina — *Financial Robo-Advisor*

lokapoin — *Guesthouse and Travelling Platform*

Dr. Sigit Puji Santosa, MSME,
Director of LPIK ITB

Selected Researchers

Figure 1. New structural system as combination between reciprocal frame and tensegrity called rection of reciprocal tensions.

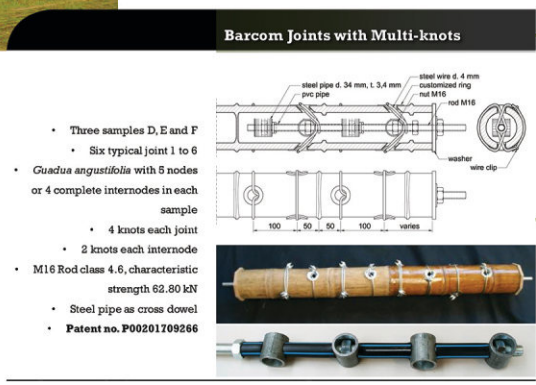

Figure 2. Very high tensile strength bamboo joint in which its strength can be customized based on the number of used knots.

Dr.-Ing. Andry Widyowijatnoko

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Dr.-Ing. Andry Widyowijatnoko was born in Purworejo on August 6th, 1971. He studied in the field of architecture in ITB for his undergraduate and graduate program. He gained his master degree in 1999 with his research thesis on plastered bamboo construction. The main reason of the research was the huge potential of bamboo in Indonesia but it was rarely used as building material due to lack of technology and design. Bamboo is one of the most sustainable material on earth because of its fast growth and self-reproduction system. It is also known as plant for thousand uses and has so many benefits for the environment.

Continuing his thesis research, he developed plastered bamboo construction system for low cost housing and it was applied in many places in Indonesia. Many research had been done to improve the performance of this construction system. In 2006 he was sponsored by Environmental Bamboo Foundation to travel to Colombia to learn about bamboo constructions for about three months. Colombia is one of leading country in research and utilization of bamboo as building material. This journey opened his mind on how to promote bamboo as building material.

After this journey, he changed his approach of promoting bamboo by designing high-end building to increase its value and erase the stigma of bamboo as poor man's timber. One of his achievements in design was award winning Great Hall OBI, an oval building with span of 20m to 30m, entirely made of bamboo.

In 2012, he gained his doctoral degree from the Chair of Structures and Structural Design, Faculty of Architecture, RWTH Aachen, Germany. His dissertation 'Traditional and Innovative Joints in Bamboo Construction' focused on bamboo joints, started with the classification of bamboo construction, followed by the classification of bamboo joint, and then ended by proposing customized lashing-based bamboo joints with very high tensile strength.

Figure 3. Great Hall Outward Bound Indonesia, huge bamboo structure with free span of 20 to 31 m, using more than 8000 bamboos.

"The main reason of the research was the huge potential of bamboo in Indonesia but it was rarely used as building material due to lack of technology and design"

Figure 4. New bamboo joint using new principle: converting tension parallel to the fiber into radial compression force perpendicular to the fiber to the center of its cross section.

The joints was called bamboo radial compression joint or barcom joint, and barcom joint with multiknots. The average strength of the last joint with four knots was 76.91 kN, but still had potency to be increased. The book was published in Germany. This high tensile strength joint can bolster the use of bamboo for tensile member, since bamboo has a very high tensile strength but limited joinery to accommodate this strength. The patented barcom joint was applied for the reconstruction of the famous Three Mountain Building in Bali.

In order to promote bamboo, he widened his research to application of bamboo for advanced structure such as reciprocal frame, tensegrity as well as space structure. Based on the experience on tensegrity structure and reciprocal frame, he invented a new structural system which called rection or reciprocal tension. Differ from conventional reciprocal frame, each element was hanged by another element reciprocally, in such a way, each of rigid element did not touch each other like tensegrity.

Two temporary bamboo rection dome were built so far in Indonesialand 2016 dan in ITB 2017 with diameter of 12m and 10m.

Beside researching, in promoting new ways of constructing bamboos, he conducted so many lectures and hands-on workshop in many countries: Indonesia, Singapore, Malaysia, Philippines, Myanmar, Cambodia, Thailand, Bangladesh, Korea, China, Japan, Australia, Germany, Netherland, Belgium and Colombia.

Dr. Fenny M. Dwivany

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Dr. Dwivany earned her PhD in Biology from The University of Melbourne in 2004. She is an Associate Professor at The School of Life Science and Technology (SITH) - Bandung Institute of Technology (ITB). Her research interest in banana has made her research group called as **the "Banana Group"**. The group's goal is to improve Indonesia's fruits quality through pre- and post-harvest technologies and research activities have been focused to:

1. study fruit ripening process and develop future postharvest technology
2. study plant-disease interaction and develop future bio-control technology
3. study big data correlates with fruit multi-omics

The group has also involved in space biology research since 2007 with LAPAN, Indonesia and JAXA, Japan. In 2011, the team successfully sent Indonesia tomato seeds to International Space Station (ISS) in Space Seeds for Asian Future (SSAF) program and grown the tomato plants as the first Indonesia space biology experiment.

As implementation of research activities, the group has involved in multidiscipline project to develop **Banana Smart Village (BSV)** in Indonesia as part A-B-G-C team together with the Center of Remote sensing (CRS)-ITB, Bali International Research Center for Banana (BICB), INABIG (Indonesia Biogeography and Biodiversity) Research Foundation and Indonesia Tropical Fruit Research Institute - Ministry of Agriculture Republic Indonesia.

Dr. Dwivany's prior accolades include *the International Unesco-L'Oreal for Women in Science Fellowship* (2007), an *Australian Endeavour Award* (2010) and *Schlumberger Award in Faculty for the Future* (2011). She also received *the Science and Technology Award* 2012 (Women Researchers category) from the Indonesian government on the occasion of the 17th National Technology day held by the Ministry of Research and Technology as well as *Karya Inovasi* 2015 from Institut Teknologi Bandung. For her research achievements, she obtained several awards from media such as Femina, TEMPO, NOVA and CLARA magazine

"The group's goal is to improve Indonesia's fruits quality through pre- and post-harvest technologies"

as one of Indonesian inspiring woman. She is also known as one of Forum Peneliti Muda Indonesia (ForMIND) and Bali International Research Center for Banana (BIRCB) founders. Since 2016, she became a member of Indonesian Young Academy of Science (ALMI).

Patent:

1. Method to control banana fruit ripening using gene manipulation method (IDP000051217, granted)
2. Fruit Storage Chamber (FSC) to control Fruit Ripening using Bamboo and Nano materials (S00201708460, registered)

Selected Book:

1. Molecular Genetics Study of Fruit Ripening. 2017. Penerbit ITB, Bandung
2. Planet Banana: Peeling the Scientific facts of Fruit Ripening. 2018. Penerbit ITB, Bandung

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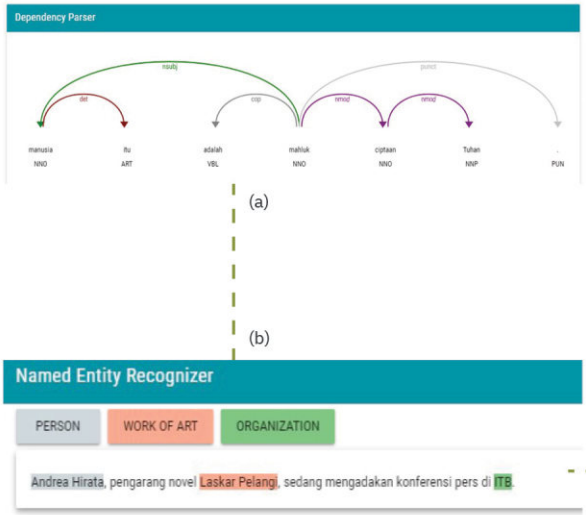


Figure 1. Dependency Parser and Named Entity Recognition Result for Bahasa Indonesia.

Researches on Indonesian Natural Language Processing

Our research focus is on computational linguistics or natural language processing (NLP) of text input, especially for Bahasa Indonesia. The ultimate goal of this area is to make the computer be able to process text written in human language whether in understanding or generating text. These tasks are easy for human, yet it is difficult to be done by computer. NLP research area is pushed by the development of internet and computer device. By the development of internet, there are million of documents available online which make it as the new gold of information era. The computational linguistics is the technology to get important information or knowledge from these million of documents automatically. And by the development of computer device, there is a high demand for user to have a better human computer interaction, which includes an automatic chatbot.

Our first selected research is on developing Indonesian NLP Tools. This tool includes several basic natural language processing tools, ranging from lexical level until document level. In the lexical level, we have developed word normalization, POS tagger, lemmatization and named entity recognition. In the sentence level, we have developed Indonesian sentence parser (constituent and dependency parser). In the document level, we have developed reference resolution tool. These tools are then used to build a bigger system. It is very important to make these tools as accurate as possible. Error caused by these tools will impact the next tool and bigger system. These tools employ two kinds of algorithm: a rule based algorithm and a machine learning based algorithm. Figure shows the output examples of the Indonesian NLP tools.

Our second selected research is chatbot (or dialogue system), including question answering system. A chatbot system consists of three main components such as dialogue understanding, dialogue manager, and response generator. In dialogue understanding, system will conduct dialogue intention classification and entity/keyword extraction. Both are text classification tasks which can

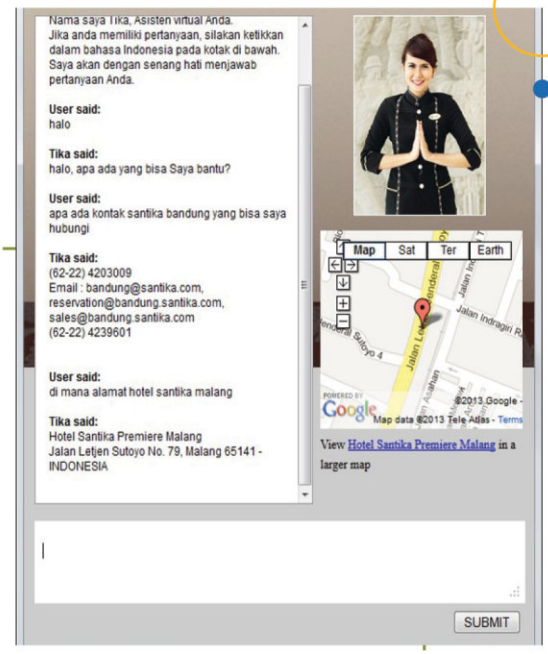
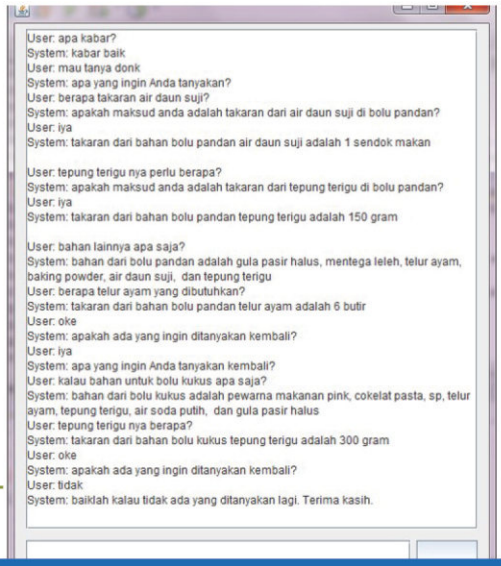


Figure 2. Example on Indonesian Chatbot. (a)

"The ultimate goal of this area is to make the computer be able to process text written in human language whether in understanding or generating text"



(b)

make use sentence parser result. In the dialogue manager, system will execute a scenario related with user input, which can be a task to extract answer from documents (part of question answering system) or to take response from database or from a sequence to sequence model. Figure 2 (a) shows some examples of our Indonesian chatbot.

The next selected research is social media text analytics. One example is a complain management system, a system that processes a social media text input into several information of complain types. The system consists of several components such as complain text classification, complain information extraction and topic classification. In the first component, an input is classified into three classes of complain, response and other, using SVM algorithm. Before the classification, the input is normalized first since it was taken from social media. In the second component, each token is classified into several important information such as location, datetime, the cause and the condidtion. The token classification is conducted using SVM algorithm. For the last component, topic is taken from the social media text using document classification technique. Other than complain management system, we also have conducted another social media processing in extracting information about labour strike. It was a join research with TU Wien and University of Indonesia. In the system, we built several components, including token classification to take information of location, datetime and person/ organization involved in a strike. Another research related with social media is a sentiment classification system that classified a sentiment for an input text to be positive, negative and neutral.

In our recent researches, we investigated deep learning techniques for eac h research topic above. For example, in our Indonesian named entity tagger, we employed bi-lstm algorithm to classify each text token into several named entity classes. Not only the token and document classification, we also investigated sequence to sequence topology for several natural language processing tasks such as non-task chatbot and machine translation.

Figure 1. Propolis extract from MOTIVE

Dr. M. Yusuf Abduh

Agrotechnology and Bioproduct Technology Research Group,
School of Life Sciences and Technology;
Bioscienceand Biotechnology Research Centre
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Dr. M. Yusuf Abduh and his team focus on the development of bioproduct technology using a biorefinery concept. Important elements in a biorefinery concept are optimizing resources, minimizing waste and maximizing profit to achieve a sustainable development. Their current researches involve the development of a mobile biorefinery unit and innovation in precision farming for modular hive/ cage for bees and flies.

Modular Tetragonula Hive (MOTIVE)

Yusuf and his team had developed a modular hive (patent application number: S00201808741) for stingless bees (Tetragonula sp.) that allows easy harvesting of propolis produced by the bees without destroying the colony. The crude propolis can be extracted with a natural solvent to produce a propolis extract that is free from alcohol and contain a high anti-oxidant. The propolis extract may find suitable application as a health supplement as well as for cosmetics.

Mobile Biorefinery Unit (MBU)

The prototype of MBU that has been developed by Yusuf and his team consists of a wheeled container that can be equipped with devices to convert biomass to produce bioproducts such as biodiesel and high protein meal. One of the main advantages of MBU is that it can travels to rural areas to process available biomass for producing biodiesel to satisfy the need of energy of the local people, also known as local resources for local demand.

Modular Fly Rearing Cage (SALAM)

SALAM stands for Sarang Lalat Modular which is designed for the cultivation of black soldier fly (Hermetia illucens) larvae equipped with sensors to monitor and control temperature, relative humidity, and light intensity in the rearing cage. SALAM may be easily installed at every house and used as a dustbin to convert organic waste for producing high protein chicken meal and organic fertilizer.

Figure 2. Prototype of MBU (left) and SALAM (right)

"The crude propolis can be extracted with a natural solvent to produce a propolis extract that is free from alcohol and contain a high anti-oxidant"

Figure 4. Research dissemination activity at South Sumatera

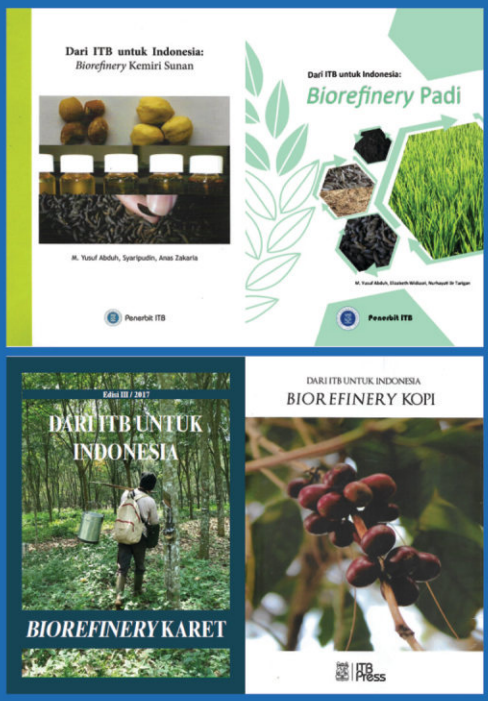

Figure 3. Book Series of Dari ITB Untuk Indonesia

Dari ITB untuk Indonesia

Dari ITB untuk Indonesia is the name of a book series that explain in a layman language the research and innovation activities carried out by Yusuf and his team. Currently, there are four editions that have been published by ITB Press particularly; Biorefinery Kemiri Sunan, Biorefinery Padi, Biorefinery Karet and Biorefinery Kopi.

Research Dissemination

Yusuf and his team actively involve in research dissemination activities at several provinces including Central Kalimantan, West Java, South Sumatera and Bangka Belitung Island

Prof. Tommy Firman

Regional and Rural Planning Research Group,
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Professor Tommy Firman from the School of Architecture, Planning and Policy Development ITB, specializes in urbanization as well as decentralization and regional development. From those main themes, there were several studies that he has conducted since 1988 until recently, namely mega-urban region, population mobility, new town development, urban development, regional disparity, regional proliferation, metropolitan governance, and local leadership. Professor Firman is a well-known researcher for his contribution in urban and regional development planning in Indonesia. He has been listed in various International advisoy boards of several leading international journals: Habitat International, Asian Population Studies, and International Development and Planning Review. Prof Tommy Firman has also received various awards and scholarships from several national and internationa institutions, including the Research and Technology Award (1991), Fulbright Visiting Scholarship (1993 and 2005), Rockefeller Foundation Award (1994), Otto Kornigsberger Prize (1999), Harvard Kennedy School Indonesia Research Fellowship (2014) and Habibie Award (2016). His most recent publications include:

1. Low-tech Industry, Regional Innovation System and Inter-actor Collaboration in Indonesia (2018)
2. Spatial Planning and Urban Development in Jakarta's Metropolitan Area (2018)
3. Suburbanization in Asia: A Focus on Jakarta (2018)
4. The Privatization of Metropolitan Jakarta's (Jabodetabek) Urban Fringes: The Early Stages of "Post- Suburbanization" in Indonesia' (2017)
5. The Urbanization of Java, 2000-2010: Towards 'The island of mega-urban regions' (2017)

Prof Firman is currently working on Progress of Decentralization Policy in Indonesia as well as Mega Region Formation in the Island of Java.

Welcoming Two Decades Decentralization in Indonesia: a Perspective of Regional Development

Decentralization policy has been implemented in Indonesia since late 1990s, with the purpose among others to encourage regional development initiative from below and local level. However, the capacity of local governments to implement the decentralization policy is greatly uneven, which contributes to the highly different results across the country. In this respect, regional disparity and spatial fragmentation are seen to be important issues to address. In this regards, from regional development perspective, this research raises two important questions , i.e., has the regional disparity in Indonesia decreased since the implementation of decentralization reform at the early 2000s and to what extent does spatial fragmentation occur in Indonesia resulted from the implementation of decentralization?

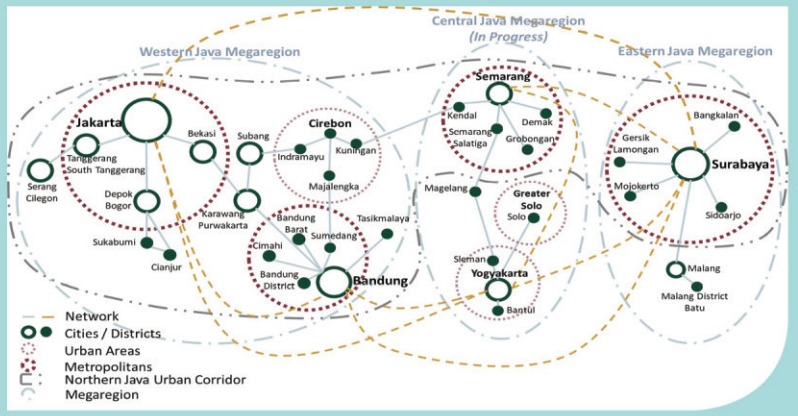

Figure2. Potential "Megaregion Island" Development in Java

"Java's megaregion shows signs of a thriving process of urbanization"

The study shows that regional disparity between provinces in Indonesia slightly increased in the first two decades of decentralization era. It also found out that local government proliferation (Pemekaran Daerah), which refers to the condition whereby a region divided into two or more new autonomous regions, increased significantly after decentralization reform until recently.

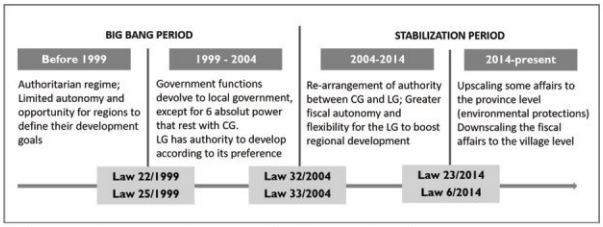

Figure1. The Stages of Decentralization in Indonesia

The study also shows that improvement in the local government financial and institutional capacity could potentially improve the regional development performance. In this respect, each provincial and local governments should be encouraged to develop inter-regional cooperation to promote regional development in Indonesia, most notably in outside Java.

Mega-regionalization in Java

Over the past decades, Indonesia has been experiencing mega-urbanization around its major cities, Iparticulary in Java Island, which is the most populated island in the world. In fact, most of Indonesia's largest investments has been concentrated in Java, which in turn has greatly spured urbanization in the island. This study intends to comprehend the extent to which megaregion has emerged as a new scale of urbanization in Java island. It will focus specifically on three dimensions of urban development, namely urban forms, urban flows, and urban economics. Moreover, this study will also examine the extent to which the national and sub-national policies have been the driving factors of megaregion development in the island.

The analysis shows that the interactions within metropolitan area happen to be much more significant than the interaction between metropolises, which in turn has created an extended urban agglomeration. Urban forms might not fully show this phenomenon, but the spatial flows have clearly indicated how two or more Java's metropolises are interlinked one another. In fact, the largest cities have been linked by the people's mobility and logistic distribution, as a result of economic interaction between them, which in turn have shaped physical expansion of urbanized areas in the island. Moreover, the existing and planned large infrastructures, including road, railway, airport, and seaport, could have largely increased the continuity of the Java mega-urbanization from one edge to another.

This research concludes that Java's megaregion shows signs of a thriving process of urbanization.The interaction between two megaregions, Jakarta-Bandung dan Surabaya-Malang urban corridors tend to amalgamate these two megaregions into nearly one island-scale megaregion (see Figure 2). It also found out that national and sub-national policies has significatnly contributed towards the process of megaregion formation in the island of Java. With respect to planning policy in the near future, the study recommends that there is a need to prepare a megaregion plan and its institutional development for Java Island, as the phenomenon becomes a reality.

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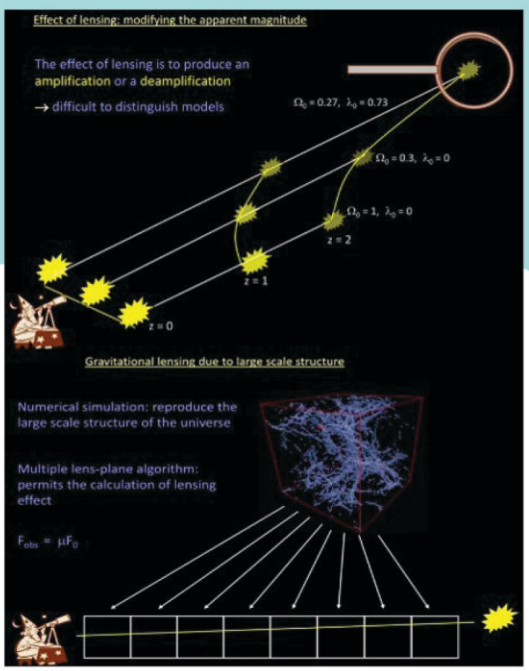

Figure 1. Multi-plane gravitational lensing scheme on simulated universe.

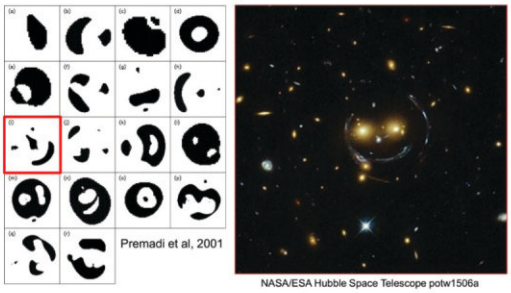

Figure 2. A sample of published gravitational lens simulation and an observed lens case with similar feature.

Figure 3. Preparing students to understand and enjoy the Total Solar Eclipse in Poso, March 2016.

Premana W. Premadi holds a bachelor of science in astronomy from ITB and PhD in physics from the University of Texas at Austin. Her main research interest is cosmology and relativistic astrophysics. She contributed to relativistic cosmology by developing a computational method to trace light propagation through the universe using gravitational lensing simulation. The method combines computer N-body simulation for the distribution and evolution of galaxies as the universe large scale structure and multiple lens planes calculation (Figure 1). The robustness of this method has made it a standard in the field. It heralds the use of gravitational lensing in physical cosmology, particularly in examining various cosmological models, as well as predicting the real occurrence of rare phenomena such as multi-plane lensing and highly-magnified distant supernova and young galaxies. A sample work is shown in Figure 2. Without gravitational lensing acting as natural telescopes, those objects might not be observed using current technology.

Current Research

Figure 4. Astronomy in games for children in Timor.

With her former students and colleagues she continues using gravitational lensing for various purposes: (1) study the mass distribution of clusters of galaxies, including mapping the non-baryonic dark matter; (2) study the lensing effect on gamma ray bursts and on gravitational waves; (3) study the effectiveness of gravitational collapse in structure formation process by inspecting the Lyman alpha lines in the spectra of lensed quasars.

"Technology helps us understand more about the Universe, but makes us rely less on the sky"

Science, humanity, and education

As science is one measure in the advancement of civilization, it must be made relevant to most aspects in humanity. Astronomy has roots in all cultures in the world, particularly as means to construct a reliable spatio-temporal reference. Technology helps us understand more about the Universe, but makes us rely less on the sky. With her team, Dr. Premadi actively creates ways to use astronomy as an entrance towards the refinement of scientific mind as an invaluable agent in human and community. She founded the Bandung Society for Cosmology and Religion as a platform for healthy and constructive dialog between science, religion, and culture. To support informal science education she established the Universe Awareness Indonesia with programs to empower the rational thinking of children as they wonder about the beautiful universe (Figure 3 & 4).

Prof. Lambok Hutasoit

Applied Geology Research Group,
Faculty of Earth Sciences and Technology
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Prof. Hutasoit is the Chairman of the Applied Geology Research Group, Department of Geological Engineering, Faculty of Earth Sciences and Technology, ITB. His expertise is in hydrogeology with the field of study ranges from groundwater as water resource to groundwater contamination, groundwater and geologic processes (e.g. land subsidence), and abnormal fluid pressure.

Related to groundwater as water subject, during his professorship work, he performed numerical simulation to predict groundwater drawdown due to several pumping and artificial recharge scenarios in Bandung Basin for 10 year period. Some of the important results from the simulation are: 1) do-nothing scenario will increase the damage zone of groundwater ~6 times in the period of 5 years, 2) artificial recharge in forms of recharge well in a massive scale is of paramount importance to perform in order to maintain groundwater resource at safe level.

Recently, he has also been actively researching groundwater contamination at least during the last five years. He has been assigned as an expert board by the Ministry of Environment and Forestry of Indonesia. His tasks range from analysing potential groundwater contamination by industries (e.g. oil&gas and mining industries) to subsurface waste disposal (e.g. slurry fractured injection). He is also actively researching the cutting edge topic of groundwater contamination with his PhD students. The most recent work of Prof. Hutasoit and his PhD student analyzing nitrate contamination has been published in several reputable journals such as in Water Research and Hydrogeology Journal.

He is among the first researchers recognizing that land subsidence in Jakarta is caused by four factors, i.e. 1) natural compaction/consolidation, 2) load increase due to infrastructure (e.g. high buildings, elevated highways), 3) groundwater abstraction, and 4) geological structure movement (e.g. fault slip). These findings are in contrary with the commonly assumed factor causing land subsidence, i.e. only groundwater abstraction. Now, he with his PhD student is widening the research area concerning land subsidence to another city, i.e. Semarang. The research finding is confirming what he found in Jakarta, i.e. natural compaction contributes largely to land subsidence in the Semarang City. Their research has been published in Geosciences.

His forward vision, together with his research background, has brought him into the study of abnormal pressure. During the last five year he has been actively researching abnormal fluid pressure in Indonesia's sedimentary basins, with the stressing in abnormally high fluid pressure, better known as overpressure. According to the statistics introduced by Dodson (2015), improper handling overpressure is the major cause of non-productive drilling time as well as the major cause of drilling accident such as blow-out in oil and gas drilling. As the team leader, Prof. Hutasoit has successfully been obtaining funding and data from multinational oil companies operating in Indonesia to run the research. Among the companies sponsoring

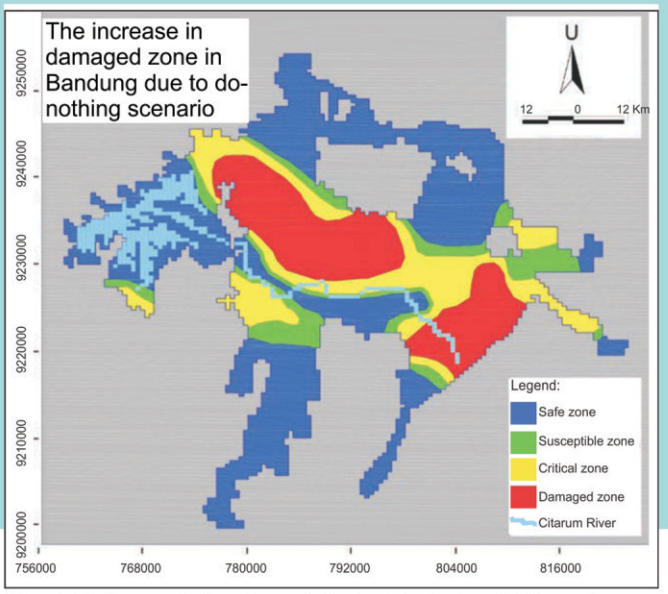

Figure 1. The increase in damage zone in Bandung due to do-nothing scenario.

"Natural compaction contributes largely to land subsidence in the Semarang City"

the research are Pertamina EP, Total Indonesie, Petronas, Petrochina, and Hess. The research has been resulting several scientific publications, master theses, and PhD theses. The research, named as INOV (Indonesia Overpressure Study), is considered as one of the important consortium studies in oil and gas industries in Indonesia.

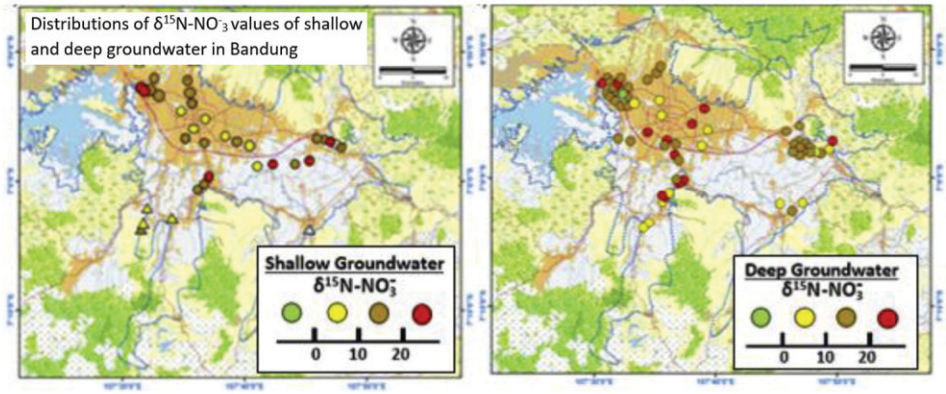

Figure 2. Distributions of $\delta^{15}N\text{-}NO_3$ values of shallow and deep groundwater in Bandung.

Yuliani Dwi Lestari, Ph.D

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Technology and Sustainable Operation Strategy

Yuliani Dwi Lestari, Ph.D holds a Bachelor of Engineering Degree from Institut Teknologi Sepuluh Nopember (ITS), a Master's of Business Administration and Doctorate Degree specialized in Industrial Management from National Taiwan University of Science and Technology (NTUST), Taiwan. In 2009, Yuliani was presented the Youth Outstanding Award from the School of Management, NTUST while in 2018 she was honored with the Innovation Award from Institut Teknologi Bandung; Best Faculty in Social Humaniora Award (2nd place) from the Ministry of Research, Technology and Higher Education of the Republic of Indonesia; and Best Researcher Award from the School of Business and Management, ITB.

Before joining an educational institution, she spent about 6 years in manufacturing and consulting firm. Yuliani began her teaching and research with the School of Business and Management, Institut Teknologi Bandung (ITB) in 2014. She taught various courses in Operation Management in under graduate and graduate study programs. Throughout her career, she has been interested in different aspects of technology and operation management areas, which include technology and innovation management, logistic innovation, sustainable operation strategy, and technology adoption. She believes that technology and innovation have a critical role in the competitive development of a country, so that Yuliani always elaborates this concept in teaching activities, research and community service.

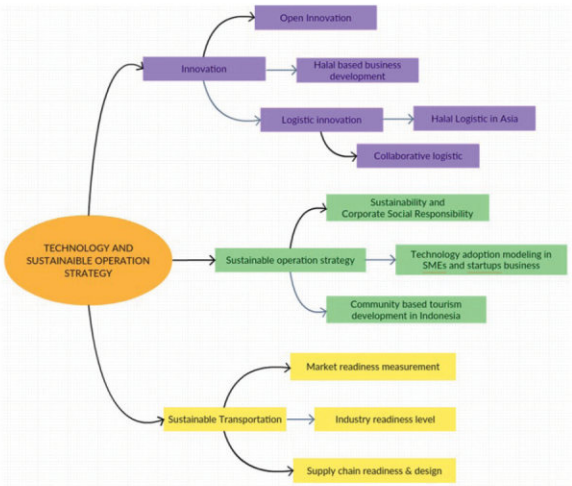


Figure 1. Research Map (2018-Present)

Over the period 2015-present, she has been serving as an expert member for the Ministry of Research, Technology and Higher Education of the Republic of Indonesia particularly for technology based-startups development program. She provides a supervision on regulatory design, program design, coaching for tech-based startups, and evaluation of the program. A list of consultancy projects undertaken by Yuliani include the private and state-owned firms from various sectors such as logistic providers, banking, financial firm, ICT, transportation, tourism, and also the government institutions. Yuliani current primary topics of research include innovation in logistic; sustainability and CSR; technology and operation strategy for startups, SMEs, sustainable transportation as shown in the Figure 1. Her publications include Journal of Business Research; Journal of Business & Industrial Marketing; International Journal of Fuzzy Systems; International Journal of Supply Chain Management; Journal for Global Business Advancement; International Journal of Business & Society; International Journal of Business; Industrial Engineering and Engineering Management (IEEM); Review of Integrative Business and Economics Research; The Asian Journal of Shipping and Logistics; Jurnal Manajemen Teknologi; The Journal of Asian Finance, Economics and Business.

"The halal based business becomes critical in every activity throughout the supply chain, from the supplier to customers"

Global Halal Based Business Development

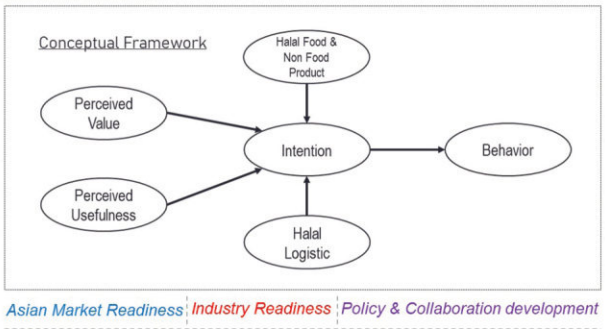
With the growth of the Muslim population worldwide, the halal industry is growing. Therefore, the halal based business becomes critical in every activity throughout the supply chain, from the supplier to customers. As the biggest Muslim population in the world, Indonesian consumers are shifting their expectations towards to halal logistics. This means that the coverage of halal expectations is broader, not only limited to halal product assurance but also covering the logistics process (i.e., warehousing, distribution and transportation).

Halal or 'permissible' is a term in Islam to explain that a product is allowed to be consumed; while halal logistics is a physical activity of storage and delivery of goods which are equipped with directional information and communication between the parties involved in the supply chain, by applying the concept of halal in it activity (Kamarudin et al., 2012). Halal is a universal concept comprises products and services at the premier value to encounter the increasing consumer awareness and needs in a demanding global halal market. In addition to ensure the compliance with Islamic law for halal products and processes, general consumers including non-Muslims can also benefit from the health, security and quality assurance of halal products. Thus, studies related to halal based business development are carried out in an integrated manner including measuring the readiness of Asian markets in accepting halal product and halal logistic concept, measuring industry readiness in supporting halal business, collaborative design and policies that support business halal development in the context of value creation and industrial competitive advantage development.

Based on studies in Taiwan, Vietnam, Thailand and Indonesia, it reveals that in general, trust and awareness of benefits were needed to be able to convince the market to consume halal products. Furthermore, based on studies in Taiwan and Indonesia involving various firms offering halal products, it reveals that in general firm's perceived value and usefulness, along with the internal resources availability and awareness on competition are becoming the drivers for firm to accept and adopt halal based business. Nevertheless, the implementation of halal based business are still facing some challenges: (i) It takes effort to boosting up the awareness and acceptance on halal product and logistic; pressure on continuous innovation; needs to improve value and image through additional competitive advantage of halal product and logistic. (ii) It needs periodic monitoring and evaluation in the context of logistic process. (iii) With halal logistic, company needs to find a good trade-off between better qualities of process following halal standard, with process efficiency.

---- Research Scope: Halal Based Business ----

Awareness → Acceptance → Adoption



Rudi Dungani, Ph.D

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E-mail: rudi@sith.itb.ac.id

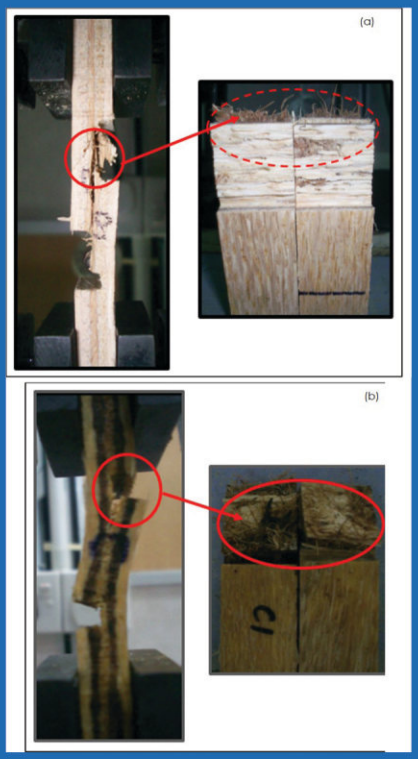

Figure 1. Hybrid plywood composite specimens after bending strength test: (a) hybrid plywood with non-moven fiber mats; (b) hybrid plywood with woven fiber mats

Rudi, Ph.D, known as Rudi Dungani, is currently working as a Lecturer/Researcher in School of Life Sciences and Technology, Institut Teknologi Bandung, Indonesia. He is an expert in Biocomposite Science and Engineering. His pivotal research area is the utilization of biomass materials, mainly from the agricultural wastes in Indonesia, into renewable, sustainable, eco-friendly and economic biocomposites. He has explored the concept of 'waste to wealth' in his research area from agro-based waste for contributing towards a sustainable future. He has successfully produced pre-commercialization innovative products with the agro-based biomass wastes, such as bio-nanocomposite, hybrid composite, high performance composites, natural fiber reinforced composite, etc. The impacts of his research open up a road to enable the bottom billions on transforming their socio-economic well-being for the industry as well as across to the country and globally. His research outputs support manufacturing industries to define alternative materials over the conventional non-renewable materials that can diminish environmental threats, demand of raw materials, technological advancement as well as consumer pressure. From his academic record and his resume, it can see that, Rudi Dungani has made an enormous contribution to research in the multidisciplinary fields of natural fiber and biocomposites engineering science. Due to his outstanding research outputs, his research topics are not only being cited by other researchers, but he has also received industries attention.

Selected topics of our research are:

Coconut fibers and laminates with jabon trunk (Anthocephalus cadamba Miq.) veneer for hybrid plywood composites

The motivation of using coconut fiber as plywood was initiated due to the difficulty in obtaining good quality timber as well as the abundance of coconut fibers in the developing countries like Indonesia. The hybridization of coconut fibers with jabon trunk improved some mechanical properties of plywood, such as dimensional stability, bending strength and screw withdrawal, especially for hybrid plywood using coconut random fiber mats in phenol formaldehyde matrix. The hybrid plywood made using coconut non-woven fiber mats have better properties than plywood made using coconut woven fiber mats on urea formaldehyde and phenol formaldehyde, respectively (Figure 1).

"Exploring the concept of 'waste to wealth' from agro-based waste for contributing towards a sustainable future".

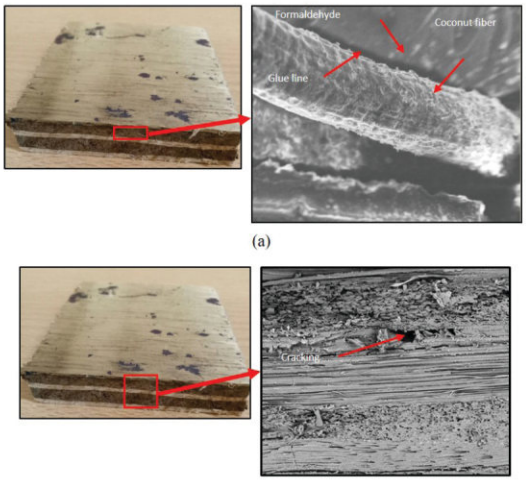

Figure 2. (a) SEM morphology of hybrid plywood; (b) SEM morphology of the glue line of the hybrid plywood

The adhesives were able to penetrate into a few cells above and below the glue line and filled up the lumen void area in the jabon trunk veneer surfaces. This formed an interlock resin of adhesives that joined the jabon trunk veneers together. The bonding between formaldehyde matrix and coconut fibers agglomeration of the fibers and incomplete encapsulation of the matrix over the coconut fibers (Figure 2a). The glue line between coconut fiber and jabon trunk fiber, there are some cracking between the both surfaces which occurred due to the weak adhesion between jabon trunk veneer and coconut fibers (Figure 2b). Coconut fibers can be used to substitute raw materials to produce plywood, which will eventually increase the added value of these residues for use as raw material of structural or furniture.

Laminated bamboo hybrid composite from bamboo strips and laminated with oil palm trunk veneer

In the present study, an attempt was made to develop a wood-like material from a non-wood source to meet the increasing demand of wood-based materials without exploiting forest resources. Bamboo (Gigantochloa levis and Dendrocalamus asper) and oil palm trunk veneer (OPTV) sheets were used to produce 5-layer laminates arranged either in parallel or perpendicular layers using urea formaldehyde. Technology-based research with the

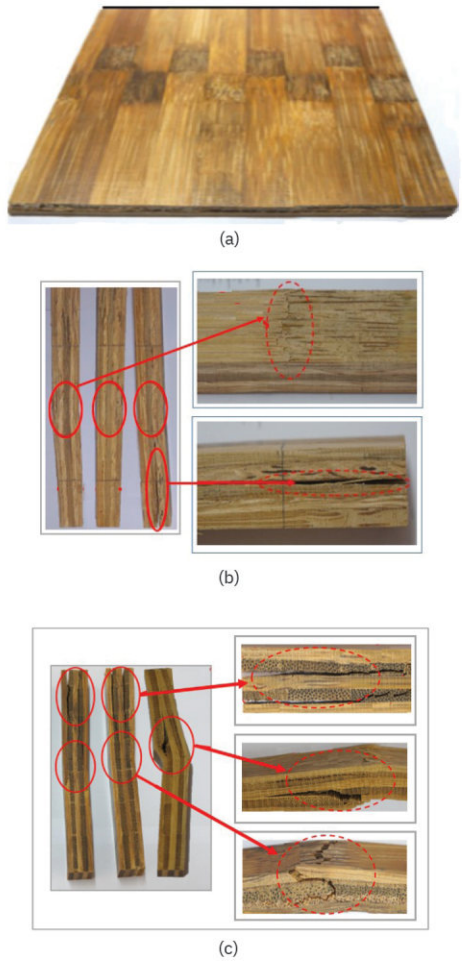

Figure 3. Laminated Bamboo Hybrid Composite (LBHC) Speciment.

focus on bamboo species through high potential hybrids with OPTV can be applied in many applications such as furniture components (Figure 3a).
The results of the testing identified the failure modes of the laminated layer arrangements as illustrated in Fig. 3b for the parallel arrangement and Fig. 3c for the perpendicular layers. The results also proved that the laminated hybrid of OPTV also affected the flexural strength of the Laminated bamboo hybrid composite (LBHC).

Dendrocalamus asper showed optimum results in flexural strength in parallel arrangements, otherwise Gigantochloa levis showed optimum results in screw withdrawal strength in perpendicular arrangements. Based on this finding, it can be concluded that LBHC have a high potential to replace wood material because of their excellent properties through the laminated hybrid.

Prof. Hasian P. Septoratno Siregar

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How OPPINET and OGRINDO Get Research Funding

Since his name, Hasian Parlindungan Septoratno Siregar is very long, his students at the Petroleum Engineering Study Program just call him “mas Septo”. He was born in Bandung in 1951, as a part of the baby boomers generation. He graduated from the Petroleum Engineering Department of ITB in 1975, followed by filling the position of junior engineer in an engineering consulting firm, working both in Jakarta and Denver, CO, USA, before joining ITB as an assistant in March 1977. He completed both his DEA and Docteur Ingenieur degrees in France, both in the area of Polymer Solution Rheology for Enhanced Oil Recovery application under the direction of Prof. S. Bories and Prof. Dr. M. Combarnous respectively, after which he returned to ITB at the end of 1980. A few years later, he started to teach “Introduction to Enhanced Oil Recovery” and “Optimization Techniques”. During the years 1990 -1991, he was involved in a research in “Nitrogen Gas Injection” at the Delft University of Technology (TU Delft) as a research fellow. Before returning to Bandung, his research director at TU Delft, Prof.Dr.Ir. J. Hagoort, encouraged him to establish a research consortium, a research funded by a group of companies. Soon after the 1998 crisis, when research funding from the government was practically not available, together with Prof.Dr. Edy Soewono as the Head of the Center of Mathematical Modeling and Simulation (P2MS), they realized the research consortium idea in the year 2001, carrying the name Optimization of Pipeline Network (OPPINET) under the P2MS office, focusing on oil and gas pipeline surface equipment optimization. In the early years of OPPINET, both Prof. Edy Soewono and him, also learned how to obtain significant industry funds from Prof. H. Neunzert from the Mathematics Department of the University of Kaiserslautern, Germany.

During the early years of interaction with OPPINET industry staff member, Dr. Satya A. Putra, who was a Pertamina high official at that time, suggested him to start another research consortium on oil and gas recovery. Three years later, in 2004, after discussions again with Prof. Edy Soewono, then with Dr. Ucok Siagian, Prof.Dr.Ir. Pudji Permadi and Dr. Leksono Mucharam, Dr.Asep Kurnia Permadi, who supported the idea, he established the second research consortium, Oil and Gas Recovery for Indonesia (OGRINDO), focusing on optimizing oil and gas recovery, primary, secondary, and tertiary (or Enhanced Recovery) from reservoirs. OGRINDO has its base at the Petroleum Engineering Department (note that its status at that time was department). Actually, it is worth noting that about a decade earlier, Prof. Dr.Ir. Purwanto Mardisewojo had established a research consortium called Petroleum Engineering Graduate Study Research Program (PEGSRSP), from which he learned many lessons.

Despite the ups and downs of oil and gas company activities, which are highly affected by crude oil price fluctuations, by God’s grace, both OPPINET and OGRINDO have so far enjoyed uninterrupted funding from their members.

OPPINET and OGRINDO research activities have facilitated a large number of undergraduate, graduate students and even fresh graduates who are waiting for an employment or graduate study opportunities with experience on how to provide solution to real industry problems.

Figure 1. Splash Screen Oppinet Software

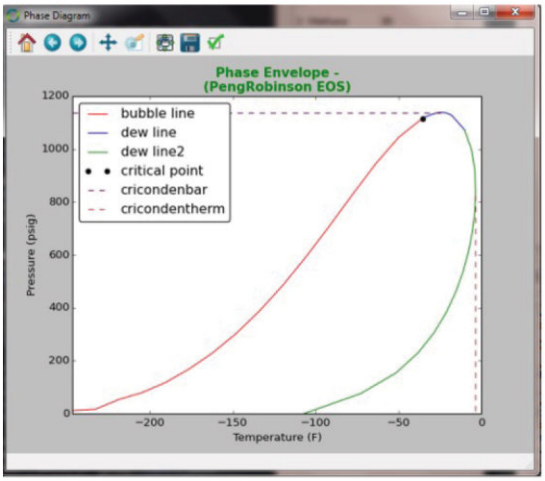

Figure 3. PVT Analysis Compositional Model

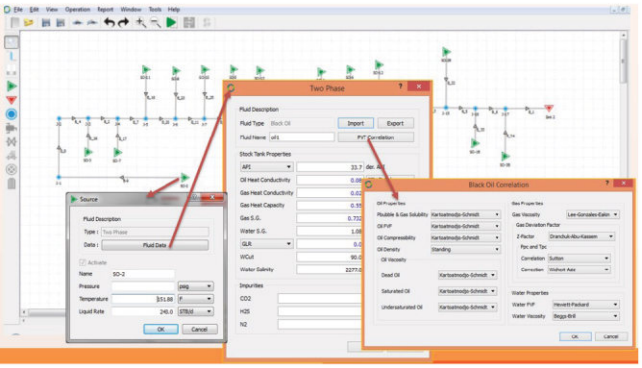

Figure 5. Multiphase Flow Black Oil Model

"Despite the ups and downs of oil and gas company activities, which are highly affected by crude oil price fluctuations, OPPINET and OGRINDO have so far enjoyed uninterrupted funding from their members"

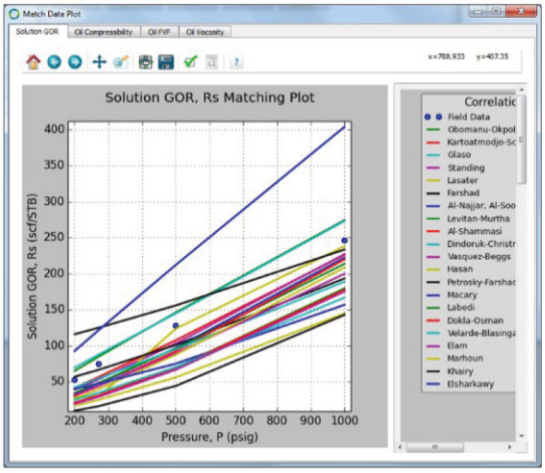

Figure 2. PVT Match Data Black Oil Model

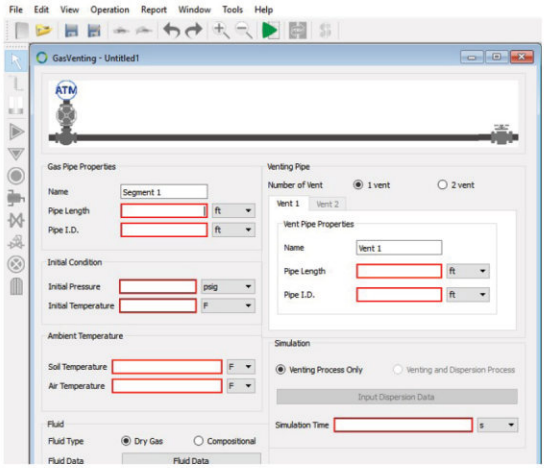

Figure 4. Gas Venting Model

SUMMARY OF OPPINET

OPPINET Selected Research Topics

The OPPINET research topics have evolved dynamically in accordance with the request of members. At the beginning of standing, only three research topics, namely the production pipeline network, transmission pipeline and gas distribution pipeline. Currently there are more research topics consist of PVT Analysis Black Oil Model, PVT Analysis Compositional Model, Gas Transmission Pipeline, Gas Distribution Network Model, Oil Water Flow Model, Multiphase Flow Black Oil Model, Two-Phase Compositional Model, and Gas Venting Model. Most of the models above have been tested using field data and provide good results. The following are the capabilities of several models developed by OPPINET.

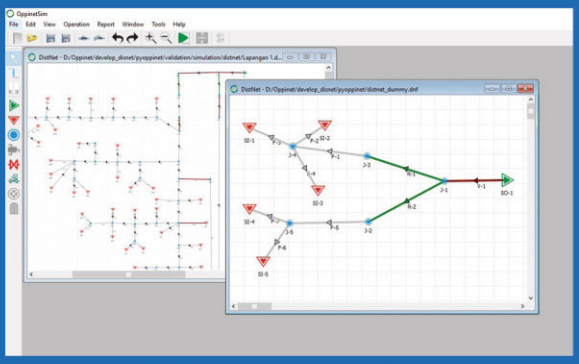

Figure 6. Gas Distribution Pipeline Network Model

1. PVT Analysis Black Oil Model
   - Able to generate fluid properties profile for different pressure and/or temperature.
   - PVT Match data for Black Oil and Dry Gas Model.

2. PVT Analysis Compositional Model
   - Able to calculate the properties of gas phase, oil/ condensate phase
   - Able to generate fluid properties profile for different pressure and/or temperature.
   - Generate Phase Diagram

3. Gas Transmission Pipeline Model
   - Determine distribution of pressure, temperature, and gas properties along inclined pipeline network
   - Flexibility in pipe segmentation
   - Provide various flow equation with different gas physical properties and correlations
   - Calculate linepack volume and linepack energy in each segment of pipeline network
   - U-Value calculation
   - Provide flexibility in pressure input.
   - Flexibility sink location in the multi-source and multi-sink network.

4. Gas Distribution Pipeline Network Model
   - Find the distribution of pressure at each node
   - Add valve and regulator model
   - Display flow direction at each pipe segment
   - Show flow rate at each pipe segment
   - Accommodate pressure drop correlations: Panhandle A, Panhandle B, Weymouth
   - Input gas composition data

5. Oil Water Flow Model
   - Predicting pressure and temperature distribution of oil-water flow in single pipeline.
   - Water fraction sensitivity (manually)
   - Insulator sensitivity (manually)
   - U-Value calculation

6. Black Oil Model for Multiphase Flow
   - Determine distribution of pressure, temperature, liquid hold up, gas superficial velocity, liquid superficial velocity, and flow pattern of multiphase flow along pipeline including inclination.
   - Provide flexibility in pipe segmentation.
   - Provide various flow equations and multiphase fluid properties correlations.
   - U-Value calculation
   - Provide flexibility in pressure input.
   - Flexibility sink location in the multi-source and multi-sink network.

7. Compositional Model for Multiphase Flow
   - Determine distribution of pressure, temperature, liquid hold up, gas superficial velocity, liquid superficial velocity, and flow pattern of gas condensate flow along pipeline including inclination.
   - Able to calculate the properties of gas phase, oil/ condensate phase and their mixture along pipeline such as apparent molecular weight, Z-factor, density, specific gravity, viscosity, surface tension, and heat capacity.
   - Provide flexibility in pipe segmentation.
   - Provide various flow equations and compositional fluid properties correlations.
   - Generate Phase Diagram

8. Gas Venting Model
   - Calculate pressure and temperature drop in main pipeline and venting pipeline section.
   - Estimate the duration of gas venting process.
   - Display pressure, temperature, flowrate, and density trends during gas venting process.
   - Provide two fluid model: Dry Gas or Compositional.
   - Provide two venting line model: Single-Vent or Dual-Vent.

Dr. Rachman Setiawan

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Dr. Rachman Setiawan is an associate professor at the Faculty of Mechanical and Aerospace Engineering, ITB, and also a professional engineer in the field of mechanical engineering. He holds of Bachelor of Engineering from Mechanical Engineering undergraduate program, ITB, Master of Science in Mechanical Engineering Design of UMIST, United Kingdom, and Doctor of Philosophy in Computational Engineering Design, at University of Southampton, UK. Among his expertise and experience, are mechanical engineering design, crashworthiness, static equipment, Heavy equipment, Material handling equipment, Design Optimization.

Crashworthiness Technology for Safer Railway Vehicles

In transportation, the risk of collisions between two or more vehicles or a vehicle with other objects is still high. Record of accidents with fatalities worldwide remains a major mortality factor. Hence, transportation safety has to be a main concern in vehicle design. The strategy to reduce the risk of impact is to minimize the possibility of impact incident, and to reduce the consequence of impacts. The first strategy is called the active safety, that is by installing collision avoidance technology that involves a series of sensors and micro-controllers and actuators. Our research interest is focused on the passive safety technology, by improving the crashworthiness of vehicles. Crashworthiness is defined as the ability of a structure or vehicles to protect its passengers or cargo during an event of impact. In railway transport, where both mass and speed are high, the consequence of impact if it happens is also high.

The impact kinetic energy of colliding trains could cause the trains derails, overrides between each other, deforms, and still the remaining kinetic energy be transferred to the passengers and causes major injuries and even fatalities to the passengers. In order to reduce the consequence of impact to the passengers, the train must be designed so that the structural deformation takes place in a controlled manner, absorbing as much kinetic energy as possible, and at the same time minimizing energy transferred to the passengers.

The crashworthiness technology has been implemented in many countries for various vehicles, including railway vehicles. A number of international standards are available, such as European standard BS EN 15227, and US regulation CFR 238.203. The crash energy management in the railway vehicle design, for instance by the presence of crash zone area, specification of minimum impact energy absorbing capability, minimum longitudinal strength and size of the passenger survival space, limit of the deceleration, and the minimization of the overriding.

Figure 1. Tragic accident involving two colliding trains in Indonesia that caused many casualties.

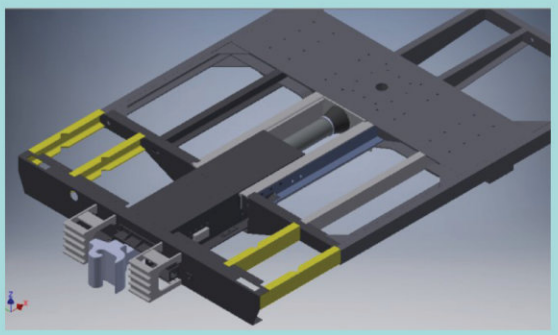


Figure 2. Conceptual design of the crashworthiness design on the underframe of national railway vehicles, including: main impact energy absorber, sliding mechanism, anticlimber, secondary impact absorber (patent registered).

Figure 3. Prototype train underframe equipped with crashworthiness technology.

Figure 4. simulation on the train equipped with the anticlimber showing the effectiveness of the device

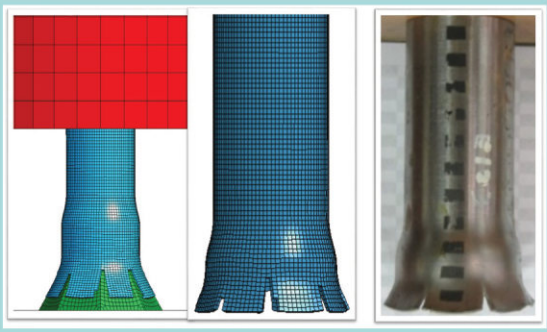
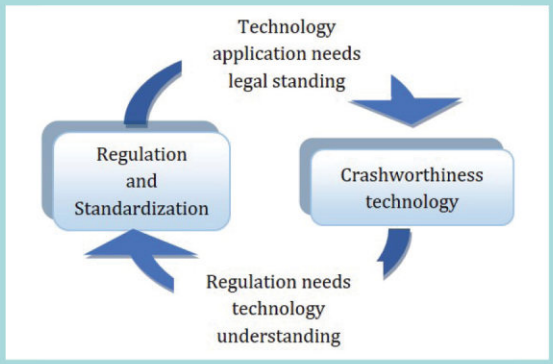


Figure 5. Simulation and experimental results of impact energy absorbing module.



"The strategy to reduce the risk of impact is to minimize the possibility of impact incident, and to reduce the consequence of impacts"

In order to apply the passive safety technology in the national railway vehicles, a series of research of crashworthiness technology has been carried out. First, the research activity results in the design of main impact energy absorber specific to be applied to the national railway vehicles and by minimum modification of the existing design. The module is based on the combination of the tube inversion and axial splitting mechanism that utilizes the efficiency of plastic deformation of the tube inversion, and axial splitting for maximum depth of the deformation for a given crash zone area. Secondly, in order to avoid overriding phenomenon that could also cause fatalities, an anti-climber has been designed. Both devices can be implemented specifically for the Indonesian passenger trains, but could also be implemented worlwide with a number of modifications.

Up to now, prototypes have been produced, field test is planned in 2019, a patent of efficient impact energy absorbing modules is registered and anticlimber patent application follows.
In parallel, national standard and regulation are currently developed with the related institutions. The regulation and standardization are equally important with the technology development itself since the implementation of the technology requires a legal standing and at the same time, the development of the regulation and standardization requires the understanding on the technology.

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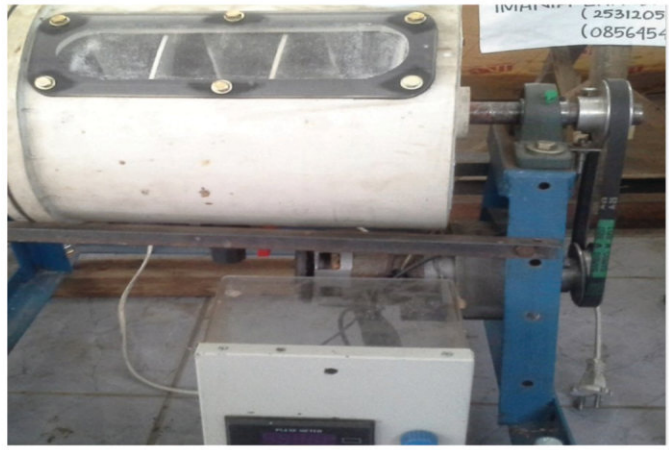
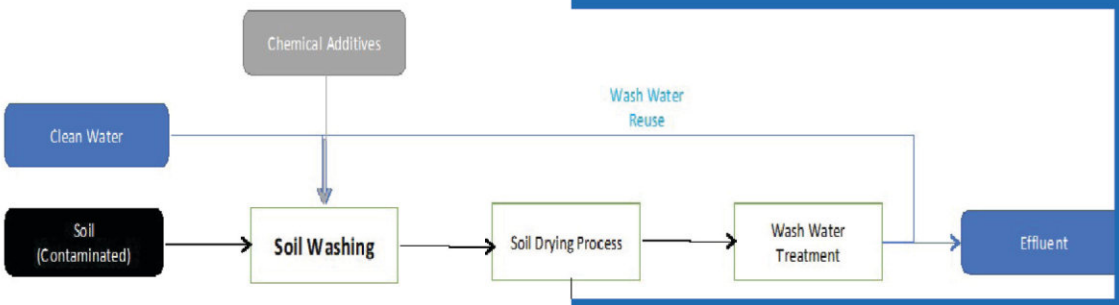
Source control to reduce and avoid emission of pollutants to the environmental is the best approach in avoiding further contacts of these pollutants with receptor. However, environmental contamination, for some extend, occasionally could be occurred due to some reasons such as operation failures as well as improper pollutants handling. Our research is basically focusing on remediation of contaminated soil by using physical, chemical and biological as well as thermal processes approach. The current most popular approach to remediate contaminated soil in Indonesia is bioremediation that rely on the ability on microorganisms to degrade the pollutants. Physic-chemical remediation technology could overcome the disadvantages of bioremediation approach. These technologies could be used individually or combined as pre-treatment for bioremediation process.

Agus Jatnika Effendi currently is a faculty member of Faculty of Civil & Environmental Engineering (FCEE) – ITB. He graduated and hold Ph.D degree from University of Wales, Cardiff-UK. His current research interest is in the field of environmental restoration and rehabilitation especially related to contaminated soil remediation. From hundreds of remediation technologies, bioremediation, soil washing, electrokinetics and sonication and also smoldering remediation are some of the many that are being explored and developed intensively in our research focus. Since contaminated soil is not limited to hazardous waste only, he also works in fecal sludge handling related to emergency sanitation. Improper fecal sludge disposal might lead to soil and groundwater contamination. Not only in laboratory scale, he has implemented his expertise in remediation technology in some areas in Indonesia that were proven to have contaminated by Man-made activities.

Enhancing Soil Washing Technology for Contaminated Soil Remediation Process

When time consumed and soil characteristics becoming the main concerned in contaminated soil remediation process, especially relate to mass transfer and bioavailability of the pollutants, transferring pollutants into liquid phase is expected to increase the mass transfer rate as well as





the pollutants bioavailability. Soil washing remediation conceptually removes from adsorbed pollutant from soil matrix into soluble forms. Since type of pollutants and soil characteristics are varied and very site specific, many challenges should be faced especially in Indonesian case where geographically has its own uniqueness. High humic acid content with very fine soil particles size is one example that making the remediation process of contaminated soil in Indonesia needs more effort to have a success result.

Desorption and solubilization mechanisms are two main factors that play an important role in soil washing process. By combining with some chemicals additives, the attrition of pollutants from the soil surface increases. Kind of chemical additives and environmental factors such as pH and solid/liquid (S/L) ratio affect the soil washing process significantly. In case of crude oil contaminated soil (COCS), S/L ratio and type of surfactant used strongly affected the removal efficiency of soil washing remediation. On the other hand, type of chelating agents added and pH of wash water significantly influenced the result when applied to remediate mercury-contaminated soil. Physical and chemical soil properties also should be considered in applying this technology such as particle size distribution (PSD) of the contaminated soil.

However, in contaminated soil remediation process, soil washing cannot be stood alone. It should be configured with other operation and/or process units to have a comprehensive solution as shown in the following diagram.

"Soil washing remediation conceptually removes from adsorbed pollutant from soil matrix into soluble forms"

Prof.Dr. Bambang Riyanto Trilaksono

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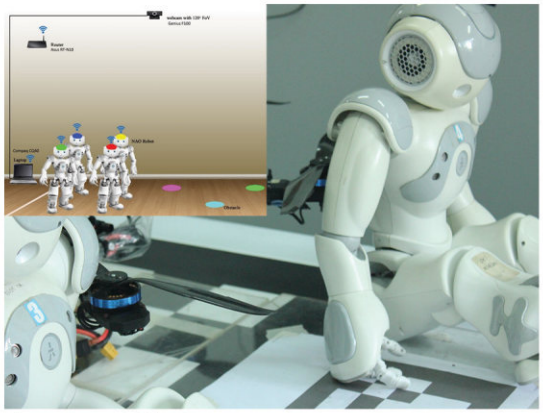

Figure 1. Humanoid Robot Swarm.

Figure 2. Unmanned Aerial Robot and Autonomous Ground Robot working Collaboratively.

Control systems, robotics and artificial intelligence have been my fields of interest. In the area of control systems, I have been interested in developing robust control theory and design, and its applications, particularly in flight control of aircraft. Following my work in robust control, I worked in linear parameter varying control design with my students, and applying it in flight control and linear parameter varying identification for ammonia process. I was also interested in active noise control—a problem of canceling unwanted acoustic noise using a secondary controlled sources in the form of loudspeakers, and sensors in the form of microphones, based on the principle of destructive interference. Some adaptive nonlinear filters based on artificial neural networks were proposed to reject the unwanted noise, which is possible due to the advances in digital signal processor. Later, I worked on energy management and control of hybrid power sources consisting of fuel cell, supercapacitor and battery. A bidirectional converter was designed and model predictive control was applied to the management of hybrid power source which results in good stability and performance.

Figure 3. Robot Research Lab Facility.

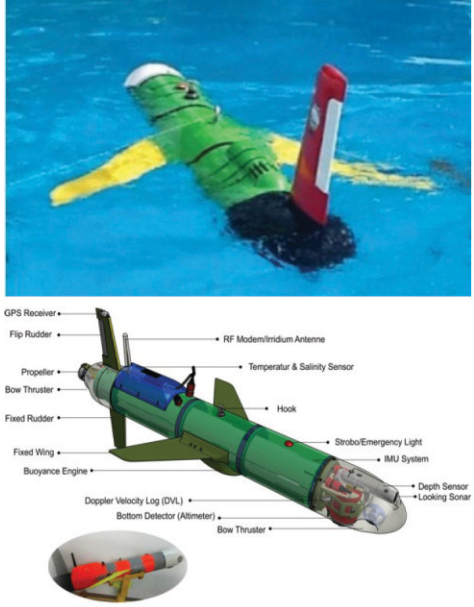

Figure 4. Autonomous Underwater Robot.

"To enable robot determine its location and map the environment a mechanism should be developed which allows robot using its sensors and odometry to simultaneously carrying out localization and mapping"

My recent interest is in robotics, particularly robot swarm. My work in this area includes distributed formation control for a group of humanoid robots with collision and obstacle avoidance. A consensus algorithm combined with social force model was developed, designed and experimented for a group of humanoid Nao robots. Along this line of research, we developed formation control of unmanned aerial vehicle with collision and obstacle avoidance. To enable robot determine its location and map the environment a mechanism should be developed which allows robot using its sensors and odometry to simultaneously carrying out localization and mapping. A distributed localization and mapping for a group of connected robots were developed using consensus algorithm. We also develop 3D simultaneous localization and mapping using depth camera. Object based simultaneous localization and mapping for a mobile robot is being developed to improve performance of localization and mapping, which in the same time to equip the resulting map with some semantic features.

More recently, I worked on the collaboration between unmanned aerial robot with ground mobile robot to measure and map the chemical hazard contaminating a certain area. To enable collaboration the unmanned aerial robot is equipped with a number of sensors that include inertial measurement unit, GPS, altitude sensor and camera in addition to chemical sensor. An algorithm is developed which allows the unmanned aerial robot to automatically track the ground mobile robot, to take-off and landing autonomously from/on it, and together they monitor and map the contaminated area. A coverage control algorithm is being developed to enable a group of unmanned aerial vehicle to navigate a contaminated area based on the sensory data information.

In the area of robotics, we also design an autonomous underwater glider which has capability to ascent and descent based on the buoyancy principle to enable the glider to operate in large area and loner duration with limited power. The autonomous glider is equipped with control, guidance, and navigation that allows way point tracking. A CTD sensor is installed on the glider to measure the temperature and salinity of the ocean, which in turn transmitted through the wireless communication to web based ground station. More recently, a hybrid version of underwater robot is designed by combining gliding capability of autonomous glider and maneuvering capability of unmanned underwater vehicle.

In the area of Artificial Intelligence (AI), my work is focused on using AI and Deep Learning for self-driving car which is essentially an autonomous vehicle without human driver. Specifically, based on several sensors installed on the car, we develop perception, localization and mapping, and path planning for self-driving car. We also developed a bridge health monitoring system using wireless sensor networks and multi agent system with in network processing capability.

Development of Rock Mass Deformation Monitoring Method by using Total Station

Prof. Budi Sulistianto

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Professor Dr. Ir. Budi Sulistianto, M.T., was born in Kudus on June 16th, 1964. He is currently working as a lecture and researcher in Faculty of Mining and Petroleum Engineering, Institut Teknologi Bandung, Indonesia. His research interest includes the field of rock mechanics, specialized on in-situ stress determination, slope stability, underground opening stability and rock deformation monitoring. He has been developing the application of rock mechanics to the specific rock condition of Indonesia, which mainly weathered and categorized as soft-rock geology.

His current research focus is developing practical yet accurate rock deformation monitoring. Rock mass deformation monitoring has prominent role in assessing slope and tunnel stability, thus the safety can be ascertained. Currently, infrastructure in Indonesia has been growing rapidly, such as the construction of toll roads, railway and road tunnels, bridges, etc. In order to pursue this rapid development, it is imperative to have a practical yet accurate rock mass deformation monitoring method to support the development.

Total station is an equipment that common to be used as surveying equipment in every infrastructure project. However, it is rarely used as monitoring equipment for monitoring rock mass deformation, particularly in the tunnel. Using total station for monitoring rock mass deformation will give more advantages compared to other monitoring equipments such as slope stability radar, convergencemeter or extensometer. One of the advantages is total station could offer absolute displacement generation rather than relative displacement. By having

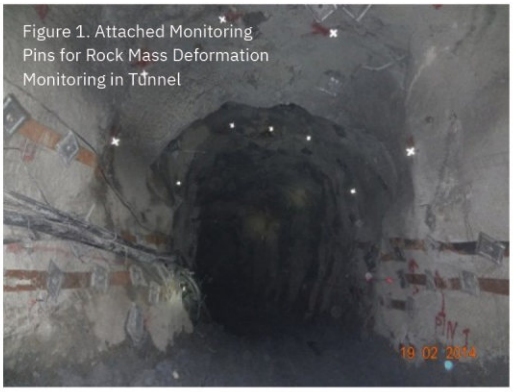

Figure 1. Attached Monitoring Pins for Rock Mass Deformation Monitoring in Tunnel

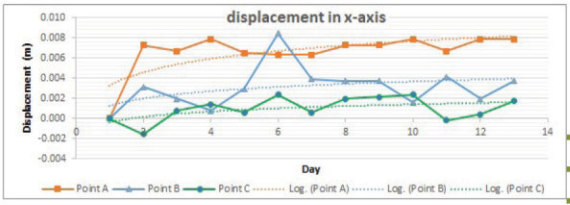

Figure 2. Typical of Rock Mass Deformation Monitoring Data in Horizontal Axis.

Figure 3. Example of Monitoring and Observation Point Determination for Rock Mass Deformation Monitoring in Slope.

absolute displacement data, not only the rock mass deformation data can be used to assess slope or tunnel stability, but also possible to use the deformation data for some extents such as rock mass properties evaluation or in-situ stress condition determination. Last but not least, total station utilization is more economical since it is not the special equipment for monitoring, therefore its price cheaper than other equipment with specific usage. Challenges in developing such method are the equipment accuracy and determining the reference point. Nowadays, the accuracy of the total station is getting better along with easier determination of reference point. By these reasons, the application of total station as monitoring equipment is promising.

Education:

1. *Undergraduate – Mining Engineering, Institut Teknologi Bandung*
2. *Master – Mining Engineering, Institut Teknologi Bandung*
3. *Doctor – Yamaguchi University, Japan*

"Rock mass deformation monitoring has prominent role in assessing slope and tunnel stability, thus the safety can be ascertained"

Prof. Iswandi Imran

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Professor Ir. Iswandi Imran, MASc., PhD., was born in Medan on December 6th, 1963. He is a Professor in the field of Concrete Materials and Structures, in the Faculty of Civil and Environmental Engineering, Institut Teknologi Bandung, Indonesia. His current research focus includes structural behavior of alkali activated concrete, seismic detailing of reinforced concrete structures, and structural assessment, repair & retrofit. He is also active in the development of several Indonesian Nasional Standards for concrete materials and structures.

The Development of Green Concrete in Indonesia

Concrete as a key material in construction industries in Indonesia is considered as non-environmentally friendly material. The reason is because its production is usually involving excessive consumption of ordinary Portland cement (OPC) and natural resources such as stone, sand, and water. In addition, world production of Portland cement itself is known to contribute as much as 7% of the total CO2 (greenhouse gas) emission to the atmosphere.

To make the concrete material to be more environmentally friendly, the structural engineering research group of ITB has initiated the development of green concrete in Indonesia since more than 20 years ago. At the beginning, the strategy used in that development is to reduce the consumption of Portland cement by utilizing fly ash (Industrial waste from electrical power plants) as Portland cement partial substitution. Indonesia has abundant fly ash from several coal fuelled power plants. One of the results from this research activity is the recommendation for optimum fly ash contents that can be utilized for concrete production. The research carried out covers both material and structural aspects. Since then, the construction industry slowly develops confidence to use fly ash as OPC replacement in concrete. Right now, fly ash has been becoming the important ingredients in many ready mix concrete producers in Indonesia. Besides reducing the concrete production cost, the use of fly ash can result in more durable concrete and more environmentally friendly concrete materials.

The research on the development of high volume fly ash (HVFA) concrete is also pursued in the structural engineering research group of ITB. The slow strength gain in HVFA concrete has triggered the shifting of concrete strength acceptance from the traditional 28 day rule to 56 or even 90 days. This approach has been implemented in the construction of several thick raft foundations (with the minimum thickness of 1,5 meter) in Jakarta.

Recently, along with the operation of new steel plants that use a blast furnace in the steel production, the ground granulated blast furnace slag (GGBFS) produced from the side product of the steel production is becoming available with abundant volume. This GGBFS material has also the potential to be used as OPC substitution. The structural engineering research group of ITB has been the pioneer in

Figure 1. Composition of Fly Ash Activated Concrete

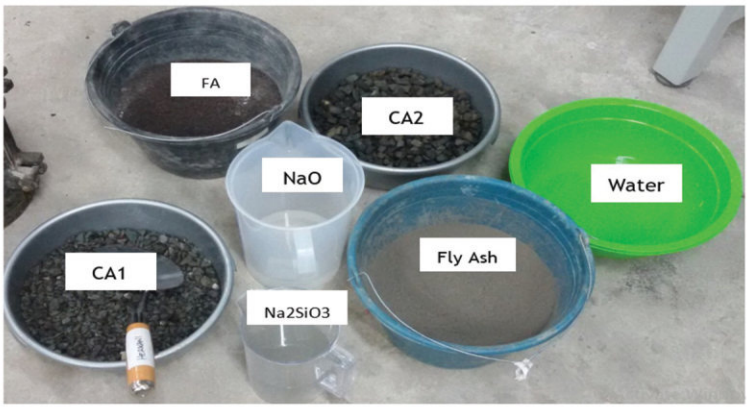

Figure 2. Structural elements made of green concrete with no OPC.

researching the utilization of GGBFS as the Portland cement substitution in concrete. Using GGBFS, the cement substitution can be up to 70%. Concrete produced with this approach has much superior performance compared to conventional concrete, especially with respect to its microstructure and long-term performance (including durability). The results from the research activities are now used to convince the construction industries to start using GGBFS for their concrete production.

The development of green concrete with no OPC (Alkali Activated Material) has also been consistently researched within the Structural Engineering Research Group of ITB since 10 year ago. Alkali Activated Material (AAM) is a solid material formed by alkali activation on materials rich in silica and alumina. Indonesia has a plenty sources of natural and waste materials rich in silica and alumina. Examples are volcanic ash, certain types of mud, kaolin, fly ash, blast furnace slag, silica fume, rice husk ash etc. AAM has mechanical characteristics that can be compared well to those of OPC based materials in every phase i.e., paste, mortar and concrete. In addition to studying the short term and long term properties of the material behaviour, research on the structural behaviour of structural elements made of this type of green concrete, especially with respect to simulated seismic forces is also being carried out recently. From these research activities, the Alkali Activated Material (AAM) has been becoming the most promising material to substitute the entire OPC in concrete. This is the concrete material for the future.

"Fly ash has been becoming the important ingredients in many ready mix concrete producers in Indonesia"

Prof. Wawan Gunawan A. Kadir

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Professor Wawan Gunawan A Kadir is Professor at Faculty of Mining and Petroleum Engineering, Bandung Institute of Technology (ITB), and Vice Rector for Finance, Planning and Development of Bandung Institute of Technology (ITB). After he received a Master degree in Geophysic at Graduate Program of Natural Science from Gajah Mada University, he joined Bandung Institute of Technology (ITB) as the research assistant in 1993. He received his Doctoral degree in Graduate Program of Engineering from Bandung Institute of Technology in April 1996 by submitting the dissertation. After he promoted to Lecturer in 1996 and Associate Professor in 2006, he became Professor on Exploration Geophysics in August 2010. Not only active as researcher and lecturer, but also ITB trusted him for management appointments in some position since 1998. In 2010 to 2015 he was as Vice Rector for Research and Innovation and at the same time he was also as Chairman of Institute for Research and Community Services which consists of 22 centres, 6 Research Centres and 3 Concortiums in Oil and Gas. Futhermore, in 2015 he is appointed as Vice Rector for Finance, Planning and Development until now. Almost 35 years, he was conducted and involved in many research projects and collaboration with industries (community services) in Oil and Gas, Mining, and Geothermal fields to implement his profesional carrier as exploration geophysicist as well paper publications through national and international journal.

Carbon Capture, Utilization, and Storage (CCUS)

Increasing levels of CO2 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 CO2 emissions. Proposed solutions include injecting anthropogenic CO2 into subsurface reservoirs. Creating a system to keep CO2 permanently underground means directly reducing the emissions. This effort is that the main focus the research activity at the Center of

Excellence (CoE) of Carbon Capture, Utilisation and Storage (CCUS) at ITB. 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 CO2 emissions by 2030 and up to 41% if international support forthcoming. ITB has initiated the realization of Gundih Carbon Capture and Storage (CCS) Pilot Project. This project will inject 20,000 – 150,000 tons of CO2 in Central Java, Indonesia, and is planned to enter the implementation phase by the end of 2019.

"Creating a system to keep CO2 permanently underground means directly reducing the emissions"

Besides that, together with National Research Center for Oil and Gas and PT Pertamina, ITB will work together for completing feasibility study for the first CO2-EOR (Enhance Oil Recovery). CO2-EOR is believed as the best approach for maintaining oil production in Indonesia. Pilot Project in Indonesia, which will be on stream around 2022. Currently the CO2-EOR Pilot Project in Sukowati field (East Java) is proposed by Indonesian stakeholders as the first priority. ITB research members must work hard until the end of September 2019, since the comprehensive feasibility study document must be finalized at that time. ADB will then decide within September 2019, whether the proposed Indonesian CCS and CO2-EOR Pilot Projects in Gundih and Sukowati fields could be constructed by using ADB and other international grants. It is hoped that the implementation phase of both pilot projects could be started in October 2019.

Based on the gathered experiences, especially on how ITB could develop international scientific and practical networks, the best practice learning processes is now transferred to other neighbor countries in South- and Southeast Asia. Together with some prestigious institutions dealt with CCS/CCUS from developed countries and institutions in South- and Southeast Asia region, ITB is working together in solving problems related to carbon emission from energy sector, such as how to implement CO2-EOR, CCS ready, implementing BECCS, and developing capture technology in the region. Thus, since beginning 2019 ITB initiated the "Asia Pacific Academic Knowledge Network for CCUS (APCAKN-CCUS)", which will promote CCS and CCUS in Asia Pacific region, especially in the South- and Southeast Asia.

Dr. Eng. Hamzah Latief

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"Others potential tsunamigenics are generated by undersea volcanic eruptions and landslide such as the 2019 Anak Krakatau Tsunami and the 2018 Palu Tsunami respectively"

Dr. Eng. Hamzah Latief, MSi was born in Siwa on October 14th, 1962. He is currently working as a lecture and researcher in Faculty of Earth science and Technology, Institute of Technology Bandung, Indonesia. His research interest includes the field of tsunami, wind waves, coastal hazard, coastal processes include littoral sediment transport, coastal protection and coastal management. Currently he also interest on the impact of climate changes to marine and coastal sectors.

Tsunami Hazard assessment in Indonesia and Development of Tsunami Hazard Map and Tsunami Animation

Indonesian archipelago is lying on the collision area of 3 major plates and many minor plates constructing a very complicated tectonic setting and produce very high seismic activities, some of them occur in subduction zone where are located at underneath of the sea that potentially generate tsunami. Others potential tsunamigenics are generated by undersea volcanic eruptions and landslide such as the 2019 Anak Krakatau Tsunami and the 2018 Palu Tsunami respectively. Since the 17th century, at least 120 tsunami events occurred in Indonesian region, it means that at least one occasion for every 3 or 4 years. These tsunamis caused hundreds of thousands of casualties and high loss of property and severe infrastructure damages.

In order to determine the level of tsunami hazard in Indonesia, the studies have been conducted by identifying tsunami sources due to submarines earthquakes, volcanic eruptions and landslides. These potential sources are used to calculate the potential of tsunami hazard along the shoreline of Indonesia by using Deterministic Tsunami

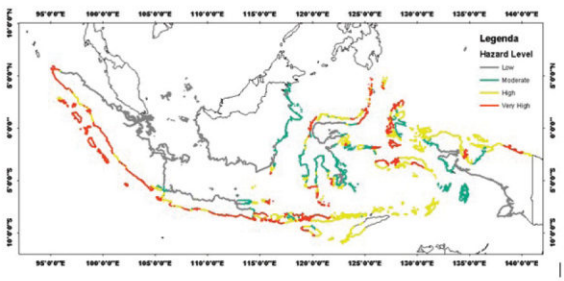

Figure 1. Level of Tsunami hazards along the shoreline in Indonesia by using DTHA; note: very high (H>8m), High (8m>H>4m), Moderate (4m>H>1m), and Low (H < 1m).

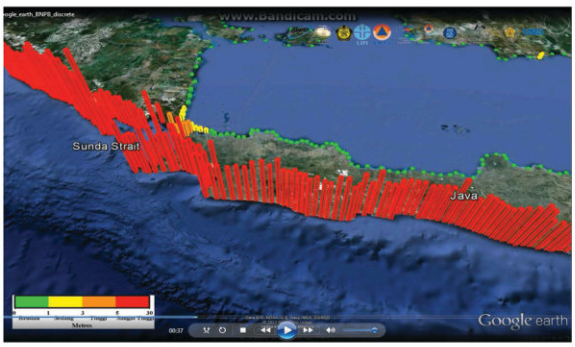

Figure 2. Tsunami height along the shoreline by using PTHA with return period of 500 years.

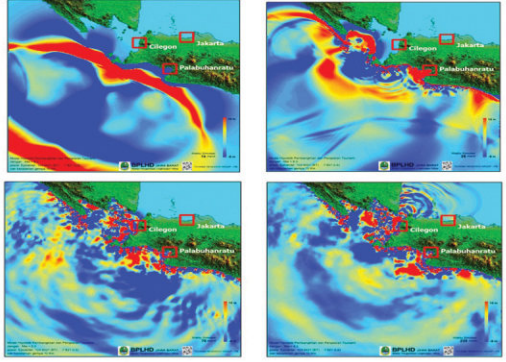

Figure 3. Hypothetic model of Tsunami propagation and its animation from southern of Sunda Strait.

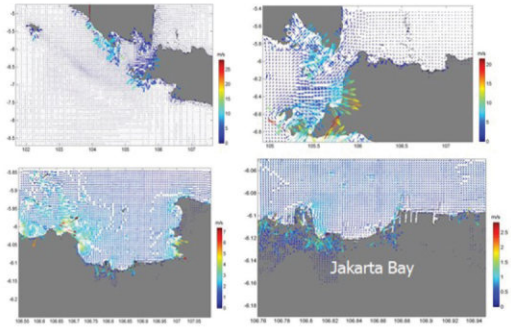

Figure 4. Hypothetic tsunami current with tsunami source from southern of Sunda Strait.

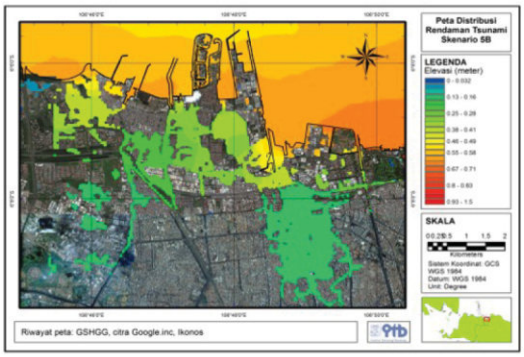

Figure 5. Hypothetic tsunami inundation in Jakarta with tsunami source from southern of Sunda Strait.

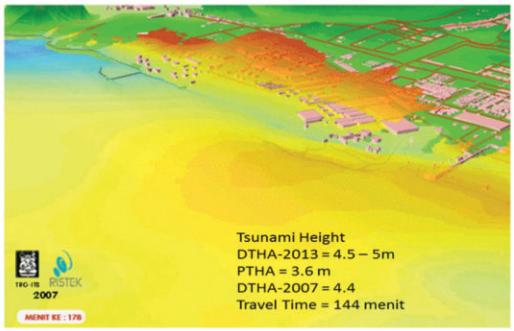

Figure 6. Hypothetic tsunami inundation at Candra Asri, Anyer.

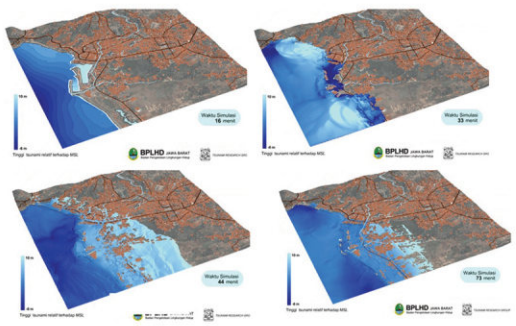

Figure 7. Hypothetic tsunami inundation and its animation at Palabuhanratu.

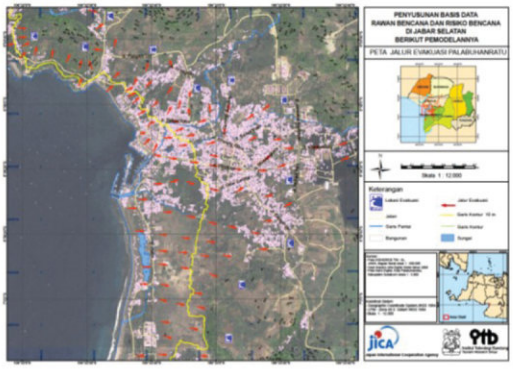

Figure 8. Tsunami evacuation map are produced base on tsunami inundation map at Palabuhanratu.

Hazard Analysis (DTHA) and Probabilistic Tsunami Hazard Analysis (PTHA) as shown in Figure 1 and Figure 2 respectively. From these studies we found that there are 146 district cities are located at the tsunami front area. Thirty six (36) cities of them are categorized as very high which is the tsunami height more than 8 meter (H>8m), 57 cities are categorized as High (8m>H>4m), 37 cities are Moderate (4m>H>1m) and 16 cities are Low (H < 1m).

Furthermore the numerical model is used to analysis tsunami height, run-up, inundation extent, current, and estimate arrival time. These results are used to provide tsunami inundation maps and tsunami animations. Some studies have been done for instance the hypothetic tsunami model at Sunda strait, which is generated by earthquake at the subduction zone and its potential tsunami inundation at several sites such as Jakarta, Anyer, and Palabuhanratu. These researches were results collaborations with International institute such as Australia-Indonesia Facility for Disaster Reduction (AIFDR), AusAid, Hokkaido University, the University of Tokyo, JICA and also with National agencies and local government such as Menristekdikti, BNPB, BMKG, BPPT, LIPI, PVMBG, Univeritas Syah Kuala, and BPLHD Jabar.

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Professor Bermawi P. Iskandar's research interests include product warranties, maintenance and reliability models, maintenance service contract, lease equipment contracts, remanufactured products, lot sizing models for a supply chain system, and facilities layout design. He has published more than 50 conference proceedings papers, two book chapters (John Willey and Springer), and 25 papers in a number of high reputable international journals (Q1) –i.e. Operations Research (USA), European Journal of Operational Research (EJOR), Asia Pacific Journal of Operational Research (APJOR), RAIRO-Operations Research (France), Reliability Engineering and Systems Safety, International Journal of Reliability, Quality and Safety Engineering, International Journal of Mathematical and Computer Modelling, Journal of Computers and Operation Research and Journal of Quality Technology and Quantitative Management, Journal of Computers and Industrial Engineering. His email address is bermawi@mail.ti.itb.ac.id. In the last 10 years, his research works have been focusing on service contracts (e.g. product warranties, maintenance and reliability models, maintenance service contracts (MSC) and lease contracts (LC)) for equipment used in mining industries).

Two cases have been studied – (i) the case where the manufacturer only sells products alone (called a product oriented system) and maintenance services are provided by external agents, and (ii) the case in which a package of product and services (called as a product-service system (PSS)) is offered by the manufacturer - providing not only product but also after sale services. Under a PSS business model, some additional functions will be created, and hence it will increase product values and provides solution to the customer (e.g. adding maintenance services, providing a smart remote monitoring system which can monitor its performance continuously, and this will minimise failure during operation and improve the performance of the equipment).

In Case-1, when the equipment is used intensively (or with high usage) per unit of time, the usage experienced affects significantly the deterioration of the equipment. For instances, heavy equipment used in mining industry such as dump trucks, excavators, bull dozers, etc. This indicates the need to consider age and usage in modelling the failure and also defining the lease contract which involves two parameters –i.e. age and usage limits (called a two dimensional lease contract). Recently, the revenue of a mining company decreases as the prices of ore, coal and other mining materials have fallen significantly. This situation imposes the mining companies to cut back on capital expense. As a result, leasing the equipment to an external agent or Original Equipment Manufacturer (OEM) is the alternate option to fullfill with the need of the equipment. In the paper published in Journal of Computer and Industrial Engineering, we developed a new two dimensional

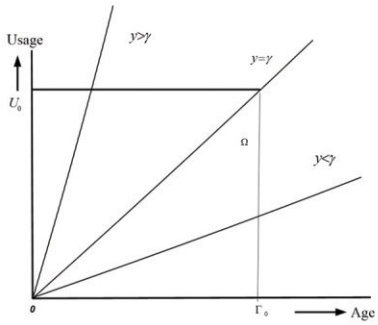

Figure 1a. Two-dimensional lease region.

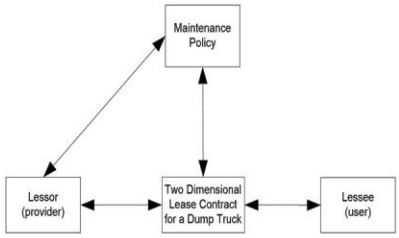

Figure 2. Key elements of a lease contract.

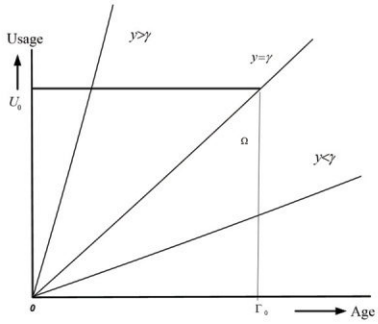

Figure 1b. PM region.

Figure 3. A typical land contour of a mining site.

lease contract (LC) characterized by age and usage limits which form a rectangle region. Under this LC, an equipment is leased for maximum Γ_0(age) or U_0(usage).

We study the two-dimensional LC from the lessor's perspective and look for the optimal PM policy which minimizes the total maintenance cost for servicing the lease contract (See Fig. 1(a) and 1(b)). Fig. 2 represents key elements of the two-dimensional LC under study.

Furthermore, we use the accelerated failure time (AFT) model which is allowed to incorporate the age, usage and the operating condition where the equipment is used for modelling the degradation the dump truck. The AFT factor is given by $\alpha_y = (y_0/y)^{\rho}\alpha_0$ where is the scale parameter of the failure distribution under normal usage (y_0) and $\rho \geq 1$. If $F_0(t,\alpha_0)$ (the time to the first failure under normal usage) is Weibull distribution, then the equipment failure distribution is given by

$$F_y(t;\alpha_y) = 1 - \exp\left\{-\left(\frac{t}{(y/y_0)\alpha_0}\right)^{\beta}\right\},$$

For the truck with high usage intensity $y > y_0, (y_0/y) < 1$, the parameter can be used to represent a level of operating condition, which means that a bigger would represent more intense operating condition and this results in faster degradation. This situation is commonly found in many mining sites where the truck is operated in an intense operating condition (e.g. a high incline or very hilly roads (See Fig.3)) for 3 shifts per day.

In Case-2, we have studied after sale service for re-use and remanufactured products, but the studies only consider a partial aspects of after sale services (i.e. lease contracts). As a results, it needs a comprehensive model (called an **integrated model for service contract**) which includes performance warranty, maintenance contracts, and lease contracts, and also take into account business performance and environmental impacts in solving decision problems for the manufacturer, the external agent, and the consumers (See Fig.4).

In addition, some new topics under an integrated model for service contract it is also incorporated with a smart remote monitoring system which can gather real time data related to the equipment performance, and hence the maintenance action is done based on the condition of the equipment (See Fig.5). This in turn will minimise the downtime and increase the production rate of the equipment. These new research topics are currently under investigation.

"Adding maintenance services, providing a smart remote monitoring system which can monitor its performance continuously, and this will minimise failure during operation and improve the performance of the equipment".

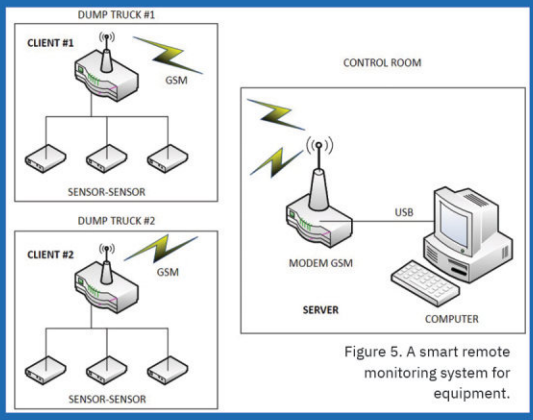

Figure 5. A smart remote monitoring system for equipment.

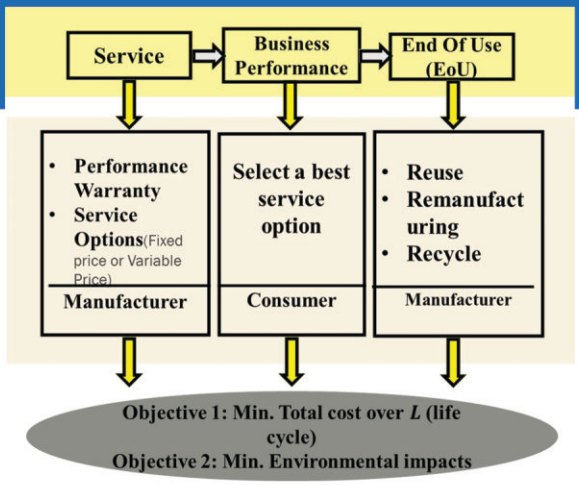

Figure 4. Integrated Model for Service Contract (Circular Economy (CE))

Dr. Edwan Kardena

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Microbial Application for Removal Organic Pollutants in Soil And Water

Organic pollutants in soil and water are existed as a result of improper waste handling and management, poor in-house keeping as well as accidental spillage. As one of the biggest oil production, Indonesia has many oil field operated by national and multinational company. Those oil and gas industries are operated in many major and minor islands of Indonesia archipelago, such as Sumatera, Kalimantan, Jawa, Seram and many others. The upstream industry of this type has been known to also produce wastes such as oil sludge and produce water. Although the statistical data regarding the daily or annually pollutant generated is not available. It is estimated that 1% of oil sludge generated from every barrel crude oil produced. It is not only the waste from current operation, the improper waste handling and management during the past operation has left a huge area of land contaminated by petroleum hydrocarbon. Soil contaminated by petroleum hydrocarbon also found in other activities such in the workshop area, fuel tank for electricity generator of industries, garages and fuel stations.

"This bio surfactant is found to be effective to increase the degradability of long chain petroleum hydrocarbon (heavy oil)"

The Environmental Biotechnology Group under the Water and Wastewater Technology Research Group of The Faculty of Civil and Environmental Engineering has been conducting research, development and innovation on bioremediation of oil contaminated soil as well as treatment of produced water. A constructed consortium of bacteria capable of degrading petroleum hydrocarbon (TPH) has been developed. The bacteria were isolated and screened from several contaminated sites in Kalimantan and Sumatera.

The lab product of such microbial consortium called "PETREA" stands for Petroleum Remediating Agent has been tested in several sites with satisfied result. Other lab products such as "degraBAG" for general biological process of industrial wastewater, "NutriBag" for enhancing biological process in waste water treatment plants have been granted Trade Mark by Indonesia IPR authority. Some of petroleum hydrocarbon could not be degraded easily because of the nature of its chemical compounds. Petroleum hydrocarbon containing long chain compounds need additional treatment such as surfactant application to increase their susceptibility to microbial attack. Since chemical surfactants are not environmentally friendly, we researched and developed surfactant base on microbial secondary metabolite product. This bio surfactant is found to be effective to increase the degradability of long chain petroleum hydrocarbon (heavy oil). All works on this research and development has been published in several international publications and its resume was written in the form of book chapter. Two chapters have been published in two separate books. The first chapter was entitled "Biosurfactant-Enhanced Petroleum Oil Bioremediation" in Microbial Action on Hydrocarbon, published by Springer, Singapore, 2018 and the second chapter was "Biosurfactants and Soil Bioremediation" in Biosurfactants: Production and Utilization—Processes, Technologies, and Economics, published by CRC Press, USA, 2015.

Dr. Edwan Kardena has been working with Dr. Qomarudin Helmy, Dr. Syarif Hidayat, and Dr. Agus Jatnika. All the researchers are member of Water and Wastewater Technology Research Group in the Faculty of Civil and Environmental Engineering.

Figure 1. The Product – NutriBAC and PETREA.

Dr. Eng. Yosi Agustina Hidayat

Industrial Systems and Techno-Economics Research Group,
Faculty of Industrial Technology
E-mail : yosi@mail.ti.itb.ac.id

"To develop the health technology, included optimal medical treatment for TBC patient with comorbidity of Diabetes Mellitus Type II"

Dr. Eng. Yosi Agustina Hidayat received her doctoral degree in Industrial Engineering from Hiroshima University in 2010 at the age of 28 years old. She is an Assistant Professor at The Faculty of Industrial Technology – Institut Teknologi Bandung. Her research interests are including:

1. Supplier-Buyer Relationship in Supply Chain Management
2. Technology Transfer Process in Supply Chain Management
3. Decision Analysis in Health Care Industry

After she came back to her homeland in 2010, she joined the Industrial Systems and Techno-Economics Research Group that experts on the Large-scale Modelling Systems, Decision Science, Industrial Planning Systems and Optimization, Logistics and Supply Chain Management, Value Chain Systems, Socio-techno-economics Systems, and Design of Industrial Policy.

Dr. Eng. Yosi Agustina Hidayat achievements include the National Fellowship Award L'OREAL-UNESCO for Women in Science (2013), Top 5 Nominee of Indihome Woman Scientist & Technologist (2014), Best Paper Awards in International Conference on Industrial Management, Beijing (2010), Best Paper Awards in Service Science and Innovation (ICSSI), Sixth International Conference, Taipei, Taiwan (2014), and Best Presenter Award the 5th International Conference on Global Optimization and Its Applications (ICoGOIA) (2016).

After receiving the L'Oréal-UNESCO for Women in Science Fellowship in 2013, she enhanced her research through collaboration with Lung Health Community in Bandung and soon with the TBC and HIV center of Hasan Sadikin Hospital in order to develop the health technology, included optimal medical treatment for TBC patient with comorbidity of Diabetes Mellitus Type II. In the future, she expected that her research could help the Indonesian Government to establish an optimum insurance policy if the patient treatment were funded by the government. She was one of the team of ITB collaborated with Hiroshima University for Japan Science Promotion Society (JSPS) project, Directorate General of Higher Education (DIKTI) for FY 2014-2015.

After joining ITB, she has received 15 research grants and research collaborations with several foreign universities, published 10 international journals, 1 national journal, 22 publications which presented in the international conferences, 2 national and regional conferences. She became the reviewer for 3 IEEE conferences and 4 international journals. Since 2015, she has been appointed as a member of International Symposium on Scheduling Program Committee, one of a regular conference organized by Scheduling Society of Japan, representing ITB as the only one South-East Asia University among more than 40 prestigious universities in Japan.

Prof. Edy Tri Baskoro

Combinatorial Mathematics Research Group,
Faculty of Mathematics and Natural Sciences
E-mail : ebaskoro@math.itb.ac.id

Edy Tri Baskoro was born in Jombang, Indonesia, received his B.Sc degree in mathematics from Institut Teknologi Bandung (ITB) Indonesia in 1987, and his PhD degree from the University of Newcastle, Australia in 1996. Since then he has held a senior academic position at ITB. Since July 2006, he has been honoured a professor in mathematics of ITB. Currently, he is holding a position as a Dean of Faculty of Mathematics and Natural Sciences, Institut Teknologi Bandung (since 2015). He has been also an adjunct professor at the University of Newcastle Australia and the Abdus Salam School of Mathematical Sciences, GC University, Lahore Pakistan.

His main research interests are graph theory and combinatorics. He is a pioneer in the development of graph theory and combinatorics community in Indonesia. For his leadership, he was elected as the President of Indonesian Combinatorial Mathematics Society (2006-2013). For his contributions to these fields he has been awarded Habibie Award in Basic Science Research (2009), Australian Alumni Award for Excellence in Education (2009), and the Extraordinary Intellectual Quality Award (2010). He was appointed as the President of Indonesian Mathematical Society (2006-2008). He also plays a significant role in the development of mathematics in South East Asia region. He was the President of South East Asian Mathematical Society (2014-2015), and a member of Scientific Committee of International Center for Pure and Applied Mathematics (CIMPA), since 2009 until now.

His contribution on the development of graph theory and combinatorics in Indonesia is very significant. As a researcher, by February 2019, he has the Scopus h-index 17 with at least 143 research papers published in international journals, and produced 28 PhD graduates. His work has been cited more than 919 times.

"Development of new methods in solving various extremal problems in graph theory (Ramsey theory and Moore digraphs) and determining various new distance-related parameters of graphs"

His current research focus is the development of new methods in solving various extremal problems in graph theory (Ramsey theory and Moore digraphs) and determining various new distance-related parameters of graphs (such as metric and partition dimensions, locating-chromatic number). These include:

1. Ramsey number for tree vs. wheel, cycle vs. wheel, and Ramsey number for union of graphs; Ramsey (mK2, H)-minimal graphs for any H and Ramsey (Pn,Pm)-minimal graphs; size restricted Ramsey number for (2K2,H) and (P3,H) for any graph H; size connected Ramsey number involving matching; and size multipartite Ramsey numbers mj(Pn,H) for certain graph H.
2. Research on distance-related parameters of graphs: characterize all graphs of order n with metric dimension n-3 or locating-chromatic number 3. The characterization of all trees with locating-chromatic number n-t, $t < n/2$, has been successfully done. The research on the partition dimension and locating-chromatic number for certain important graphs, such as trees, corona and product of graphs, Halin graphs and amalgamation of graphs have been carried out.
3. Research on the famous open problem of the existence of Almost Moore (d,k)-digraphs for any degree $d > 2$ has been successfully conducted. His contribution on this topic is to prove the non-existence of these almost Moore digraphs for degree 3 and diameter $k > 2$. For other degree $d > 3$ and $k > 2$, some necessary conditions for its existence in terms of the order distribution of their vertices have been derived. A method called 'repeat technique" is also proposed to be a powerful method of handling such digraphs.

Dr. Pindi Setiawan

Visual Communication and Multimedia Research Group,
Faculty of Art and Design
E-mail: pindisp@gmail.com

Dr. Pindi Setiawan earned his education in Art & Design from Bandung Institute of Technology, with a switch program at Universite Toulouse de Mirail and Centro Camuno in the Preistorici Valcamonica Study in 2010. His focus was on art-work as visual communication - from prehistoric, hindu and tradition era. He already researced prehistoric rock since his undergraduate level. His rock art's first research was in Dunwahan rock art site in Kei Kecil. He also conducted research on dayak ornaments, candi reliefs and traditional drawings. Now, most of his research is interest in human evolution: Adaptations, Dispersals and Social Development of the South East Asian through its art work. His research on rock art in Indonesia and Southeast Asia has given a new perspective to archaeology of arts.

The latest article which is published in Nature, told his research with Griffith University Australia and proves its assumptions about the existence of old rock art in East Kalimantan was created a minimum date of 40 ka years ago, which is currently the oldest date for figurative artwork from anywhere in the world. This research find at least three chronologically distinct phases. The oldest style

"This rock art style may be associated with the movement of Asian Neolithic farmers into the region from about 4 ka, or more recently"

is characterized by large in-filled, red-orange-colored paintings of mamals. The second phase is dominated by hand stencils that are mulberry (dark purple) in color. Many abstracts are mostly in-filled with painted lines, dashes, and small abstract signs that may represent tattoos or other marks of social identification, and some instances are linked together by painted mulberry lines. Some stencils appear to have been retouched with mulberry paints to create similar in-filled designs and kalpataru-like motifs. The second phase also features colorful paintings of anthropomorphs, called 'Datu Saman', are sometimes shown in small groups, and are usually portrayed with headdresses and an array of material that includes possible spear throwers. Some figures are depicted in small deer or pursuing an enigmatic social or dancing activity. The third phase is characterized by anthropomorphs, boats and geometric designs that are usually executed in black pigments. This rock art style may be associated with the movement of Asian Neolithic farmers into the region from about 4 ka, or more recently.

Today, he focus on researching about the distribution of types of images, color materials, and conservation models on rock art sites in Indonesia such as sites in Papua, Maluku, Nusa Tenggara, Sulawesi, Kalimantan and Sumatra. He visited several sites abroad such as from from Portugal, Spain, France, Italy, India and Australia.

Pindi is a research member of the International Federation of Rock Art Organizations, and he is a founder of Indonesian Association of Rock Art. With the Ministry of Education and Culture, and the East Kalimantan Regional Government, he proposed a rock art site in Sangkulirang, East Kalimantan as Cultural World Heritage, since 2014.

Prof. Muhammad Syahril Badri Kusuma

Water Resources Engineering Research Group,
Faculty of Civil and Environmental Engineering
Center for Coastal and Marine Development
E-mail: msbadrik2014@gmail.com

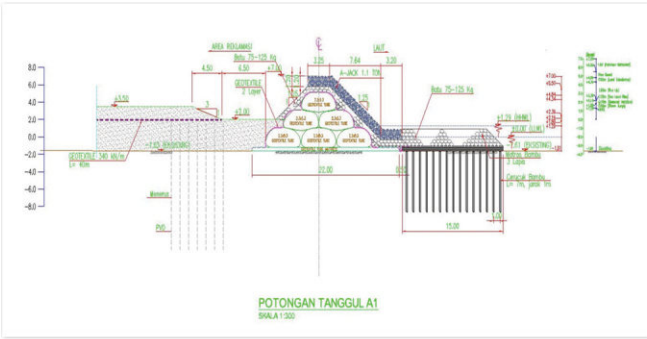
M Syahril Badri Kusuma holds a Bachelor of Civil Engineering from ITB and PhD in Fluid Dynamic from Ecole Central de Nantes. That's why his main research interest is water infrastructure development for built environment. His background in fluid dynamic drive him more than 20 years to develop hydraulic and hydrology model application for water infrastructure in built environment. The final goals of his work is projects application, from conception to completion, rather than research paper. Working partners with a range of scientific disciplines for both national[1a] and international[1b] level is involved. Major research awards received from national[2a] and international[2b] institution. Results of physical and mathematical model is already used as in-house analytical tools to support previous and on-going research and project. IPR that consist of new potential patent (in progress) and modification of existing patent is achieved[3]. The following paragraph is one of the result examples for the development of existing IPR/Patent that yield its license cooperation on armor unit A-Jacks[4].

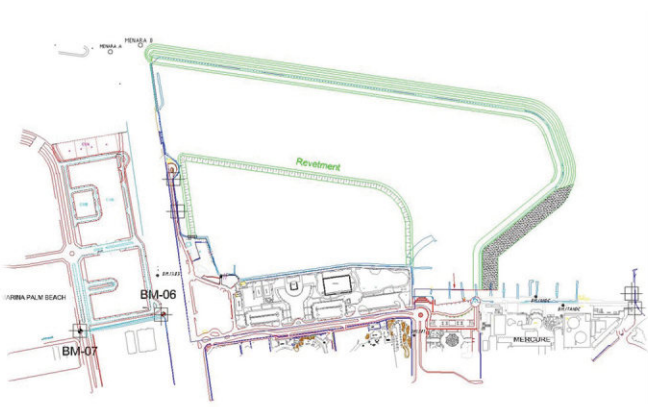
Current Research

Major research and development interest on Resilience Water Infrastructure for Built Environment.

Figure 1. Application of Modified Caisson, Bamboo Matras and armor unit A-Jacks in Palabuhan Ratu Fishery Port:
1) Top left-right Cross Section and A-Jacks; 2) Middle left and right under construction; 3) Bottom right already in operation.

Figure 2. Application of Bamboo Matras and armor unit A-Jacks in Kali Baru Port, Jakarta (under construction).





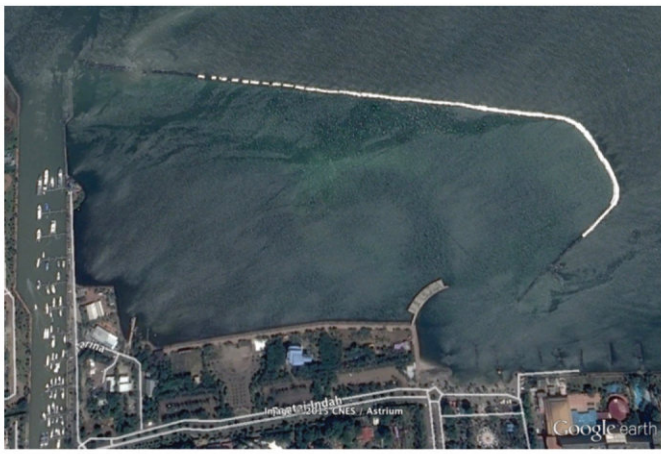


Figure 3. Application of Bamboo Matras and armor unit A-Jacks in Ancol:
1) Top left-right Cross Section and Layout; 2). Bottom right already Constructed.

"Application of Modified Caisson, Bamboo Matras and armor unit A-Jacks"

Notes

[1a]Professors: Martono, M., Hang Tuah, E. Soewono, Khairurrijal, R. Sayoga, B. Kombaitan, M. Irsyam, W. Sengara and Doctors: M. Cahyono, D. Kardana, H.P. Rahayu, M. Farid, A.A. Kuntoro, D. Harlan, H. Kardhana, M.B. Adityawan, N. Oktarianto, I. Hary, Dirhamsyah, H. Latief, N. Yuanita.

[1b] Prof. C. Rey, P.G.D. Mestayer, S. Anquettin, L. Comfort, T. Koike, S. Nasu, A. Mano, W. Mc Dougal, R. Shibasaki, Sucharit K, J.P. Suen, Tanaka, J. Alcazar, R.H., D. Amarutangga, V. Spork, A. Formanek

[2a] Government: DIKTI, DKP, KEMENHUB, KLHK, ESDM, DKI, BIG, BMKG, BAPETEN, PUSAIR, dan lainnya PERTAMINA, HATHI, IABI, PT PP, PT HK, PT Adhi Karya, PT WIKA, USU, UGM, UI.

[2b] UNIV: Tokyo, KUT, Tohoku, Kyoto (JPN), Pittsburgh, Oregon (USA), Huddersfield (UK), Cheng Kung (Taiwan), Univ of Malaya, NTNU (Norway). NSF, USAID, ADPC and Asahi Glass Fondation.

[3] Energy Dissipator, Water Wheel.

[4] Stubby A-Jacks: Prof. W. Mc Dogal, Hang Tuah and M. Syahril B.K.

Selected Innovators

SICA: Integrated Digital Platform Service for Agriculture
Dr.rer.nat Armi Susandi

Industrial Wastewater Degrader Microbe Product Development
Dr. Qomarudin Helmy

The PTC Method for Producing Library of Surfactants Derived from Palm Oil
Dr.rer.nat. Didin Mujahidin

Crowd Counter Software from RGB Images Taken from Drone
Dr. Widyawardana Adiprawita

Hybrid Statistical Neural-Network and Rock Physics for Reservoir Characterization, Laboratories for High Pressure Reservoir Geomechanical Analysis, and Laboratories of Seismic Rock Physics
Dr. Eng Bagus Endar B. Nurhandoko

Communication-Based Container Truck Control (CBCTC)
Augie Widyotriatmo, Ph.D

Dr. Qomarudin Helmy

Water & Wastewater Engineering Research Group,
Faculty of Civil and Environmental Engineering
E-mail : helmy@tl.itb.ac.id

Industrial Wastewater Degrader Microbe Product Development

In 2017/2018, Citarum River pollution received enormous public attention through Citarum Harum Program with the presidential command of Republic Indonesia. Citarum Harum Program was arranged to change the stigma of the world's dirtiest and darkest river into a river that is clean and suitable for drinking water within 7 years (The target program will be completed in 2024).

In order to support the implementation of Citarum Harum Program 2018-2024, it is necessary to further handle the input of pollutant/waste loads (especially from the Industrial sector) related to effluent quality before being channeled to river bodies. These efforts include: construction of a new wastewater treatment plant that meets the requirements; upgrading, and Uprating the capacity of existing WWTPs; and modification and optimization of existing WWTP's performance.

The aim of Wastewater Degrader Microbe is to enhance or optimize the performance of the Wastewater Treatment Plant (WWTP) in degrading polluter before being discharged as effluent into water bodies. Degrader Microbe is formulated to degrade or transform organic pollutant into compounds that are more environmentally friendly so that the pollution load can be reduced and the carrying capacity of water bodies in its self-purification process can be increased.

"The aim of Wastewater Degrader Microbe is to enhance or optimize the performance of the Wastewater Treatment Plant (WWTP) in degrading polluter before being discharged as effluent into water bodies".

Profile of Inventor

Education:

1. Undergraduate – Mathematics and Basic Science Faculty, Majoring in Environmental Biology, Sriwijaya University, 2001.
2. Master – Environmental Engineering Department, Water and Wastewater Treatment Technology, Bandung Institute of Technology, 2006.
3. Research sandwich program, Hokkaido University-Japan, 2007/2009.
4. Doctoral – Environmental Engineering Department, Water and Wastewater Treatment Technology, Bandung Institute of Technology, 2010.

Figure 1. The Product - Industrial Wastewater Degrader Microbe.

Dr. Widyawardana Adiprawita

Biomedical Engineering Research Group,
School of Electrical Engineering and Informatics
E-mail : wadiprawita@stei.itb.ac.id

Crowd Counter Software from RGB Images Taken from Drone

"To develop multirotor drones with configurations, hardware, and software to be able to perform data retrieval and processing functions that can provide information regarding the estimation of the number of people in the crowd and the dynamics of their movements".

Widyawardana was born on 27th September 1974 in Yogyakarta. Graduated from Electrical Engineering Undergraduate Program, Bandung Institute of Technology in 1997, with honor. Got the Master degree from Informatics, Bandung Institute of Technology in 2001. And finally got the Doctoral degree from Electrical Engineering and Informatics, Bandung Institute of Technology in 2011, with honor. Since 1997, he joined the Electrical Engineering Department, Bandung Institute of Technology as lecturer. Since 2014 he was assigned as the Head of Biomedical Engineering Undergraduate Study Program, the newest undergraduate study program in School of Electrical Engineering and Informatics, Bandung Institute of Technology. Married to Rostiany Harahap since 1999, with two children Ronggur Mahendra Widya Putra and Dinda Maharani Widyaputri. When not preparing lecture or researching, he likes doing photography and powerlifting. His current research focuses on .....

Crowd Counter Software from RGB Images Taken from Drone

Gathering events and the movement of large numbers of people have the potential and risk of security disturbances that can lead to riots. To be able to prepare resources that can handle these risks, the important information needed is the volume and dynamics of the mass movement. One effective way is by monitoring from the air using a drone. The operating conditions of observations from the air require a drone that can fly hover, move slowly or stationary, above the crowd that is to be observed. To meet these needs, it was proposed activities to develop multirotor drones with configurations, hardware, and software to be able to perform data retrieval and processing functions that can provide information regarding the estimation of the number of people in the crowd and the dynamics of their movements.

This particular research aims to develop Automatic Crowd Counter Software from Images Taken from Drone. The Crowd Counter Software resulted from this research is expected to have the ability to extract features of human images from their environment, and perform calculations automatically.

Profile of Inventor

Education:

1. Undergraduate – Electrical Engineering, Bandung Institute of Technology, 1997
2. Master – Informatics, Bandung Institute of Technology, 2001
3. Doctoral – Electrical Engineering & Informatics, Bandung Institute of Technology, 2011

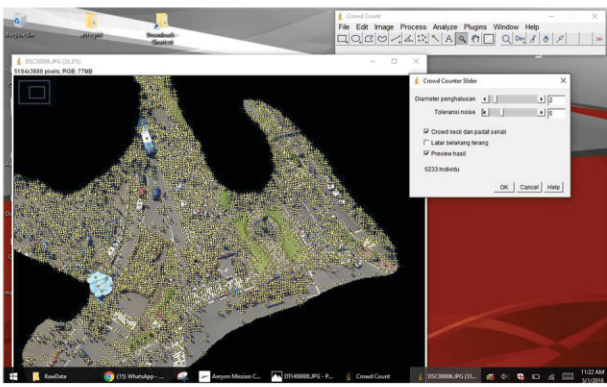


Figure 1. Screenshot of Crowd Counter Software

Augie Widyotriatmo, Ph.D

Instrumentation and Control Research Group,
Faculty of Industrial Technology
E-mail : augie@tf.itb.ac.id

Communication-Based Container Truck Control (CBCTC)

Augie Widyotriatmo received his bachelor degree in engineering physics and master degree in instrumentation and control from the Institut Teknologi Bandung (ITB), Indonesia. He obtained a Ph.D. degree in mechanical engineering from Pusan National University, South Korea, in the subject of intelligent control and automation. He is currently an assistant professor in the Instrumentation and Control Research Group, Faculty of Industrial Technology, ITB, Indonesia. He became a visiting researcher in the University of Melbourne, Australia, in 2016. He has published many technical papers in national and international journals and conference proceedings. He received an outstanding paper award in the 18th International Conference on Control, Automation and Systems (ICCAS 2018), South Korea, best paper award in the 4th International Conference on Industrial Internet of Things 2018 (ICIIOT 2018), Indonesia, and best paper award in the 3rd International Conference on Robotics, Biomimetics, & Intelligent Computational Systems 2018 (ROBIONETICS 2018), Indonesia. He received ITB Innovation Awards in 2016 for the innovation of wheelchair robots and in 2019 for the innovation of Cockroach Robots. He has been serving as an Associate Editor in the International Journal of Control, Automation, and Systems (IJCAS) from 2017 until now. He was the chair of the IEEE Indonesia Section Control Systems and Robotics and Automation Joint Chapter Societies (CSS/RAS) from 2017 to 2018. His current research includes robotics, autonomous vehicles, nonlinear control, energy optimization and automation, biomedical instrumentation, industrial instrumentation, metrology, and process control and automation.

Communication-Based Container Truck Control (CBCTC)

In detecting the position and designing the measurement data networks, it takes a strong basic knowledge of sensors and networks. This sensor and network technology has been mastered by a research team in the field of Instrumentation and Control, Bandung Institute of Technology, demonstrated in research experience such as in the field of vehicle monitoring on the topic of Intelligent Transportation System, and networks research. This research will make a system of communication networks between truck-containers and control their positions. Moreover, the device technology is made in Indonesia, so that the manufacture and maintenance will require lower costs compared to the imported automated monitoring system from foreign countries. This communication-based control system for container trucks was proposed in this study under the name the Communication-Based Container Truck Control or abbreviated as (CBCTC).

The CBCTC system includes a system of combining sensors from several container truck position sensors such as radio frequency identification (RFID), inertial measurement units (IMU), differential global positioning systems (DGPS), and encoders. Combining these sensor values is done by filtering techniques such as Kalman filters, particle filters, and Bayesian filters. With the sensor fusion method, location information and the uncertainty of all container trucks can be estimated. Thus, controlling container trucks can be designed based on accurate location and high rate data acquisition. Sensor fusion computing system is usually the key of navigation equipment and is not open, so that the sensor fusion-based navigation tools are very expensive.

Profile of Inventor

Education:

1. Undergraduate – Engineering Physics, Bandung Institute of Technology, 2002
2. Master – Engineering, Instrumentation and Control, Bandung Institute of Technology, 2006
3. Doctoral – Mechanical Engineering, Pusan National University, 2011

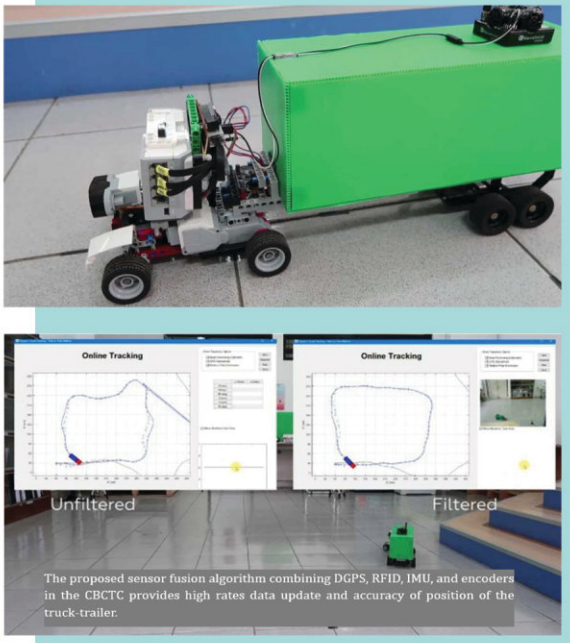


Figure 1. Position Tracking and Monitoring on Communication-Based Container Truck Control (CBCTC).

"With the sensor fusion method, location information and the uncertainty of all container trucks can be estimated".

Dr.rer.nat Armi Susandi

Atmospheric Sciences Research Group,
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SICA: Integrated Digital Platform Service for Agriculture

Dr. rer. nat Armi Susandi, obtained her doctorate in climate change from the Max Planck Institute for Meteorology/ Universität Hamburg, Germany. He is an expert in the field of climate change, environmental meteorology and hydrometeorological disaster management. Various research have been conducted, starting from the application of weather/climate prediction models for agriculture, forestry, renewable energy, to climate risk-related disaster reduction. He has collaborated with several institutions including the National Disaster Management Authority (BNPB), the Indonesian Red Cross (PMI), the International Federation of Red Cross and Red Crescent Societies (IFRC), Winrock International, USAID, Islamic Development Bank (IDB), Stanford University, University of Twente, UC Davis, and other institutions. To support his research, Armi Susandi uses numerical methods, statistics, a decision support system (DSS) approach and a practice to science algorithm. The research products are precise and sophisticated so that they can be used both for academics and the general public. Some of the research products currently in the form of applications include the Citarum and Bengawan Solo Flood Early Warning and Early Action System (FEWEAS), the Multi-Hazard Early Warning System (MHEWS), the Smart Information System on Agribusiness (SICA), and the Information System on Solar Energy Management (SIMES). In addition to academic and research activities on campus, he is also a climate diplomat and had also served as Deputy Chair of the Adaptation Working Group at the National Climate Change Council and head of the Climate Change Center, Bandung Institute of Technology. Currently, he is very active as a member in national and international organizations such as A.NERGY, Indonesian Disaster Expert Association (IABI), key person in the Disaster Intelligence Team of National Disaster Management Authority (BNPB), and Indonesian Geophysical Association (HAGI). Finally, Armi has succeeded in bringing the result of his research from university which can be the main rule in overcoming various community problems and development.

SICA: Integrated Digital Platform Service for Agriculture

At present, a new challenge in increasing national food security is strengthening sustainable agriculture. To achieve this, the application of precision agriculture is needed to prioritize improvements in environmental, social and economic dimensions. Agroindustry is a sustainable and integrated system of integrated and integrated activities from upstream to downstream (from land to table) that must be monitored and controlled so that the journey of product transformation in each supply chain runs well, safely, economically, efficiently, effectively and sustainably. One important factor in improving agro-industry is the good supply chain that is supported by the accuracy of the distribution of planting materials and marketing of crops and the support of appropriate planting strategies in accordance with current and future climate conditions. For this reason, the support of precision technology packaged in information systems will have a very positive effect on improving the implementation of agro-industries in the region.

To answer this challenge, through the digital revolution in Industry 4.0, the implementation of precision agriculture in agrotechnology that is integrated in the form of a

digital service platform has become an important tool for farmers. The digital platform consists of integrated farming systems based on information and production, to improve efficiency, productivity and profitability of agricultural production from upstream to downstream which are sustainable, site-specific and minimize undesirable impacts on the environment. In an effort to meet the needs of the digital service platform for the agricultural sector, the ITB research team innovated **SICA (Intelligent Agribisinis Information System)**. SICA is an information system for agriculture that contains weather prediction information, planting calendars, potential for accurate and high-level floods and droughts and information on agricultural markets for agricultural e-commerce, with high resolution and also high accuracy.

During its development since 2008 (see Figure 1), SICA with its available features has applied most aspects of precision agriculture in the upstream sector. The team won the trust of both the Regional Government and non-governmental organizations in developing models for determining the planting period based on rainfall predictions with high accuracy and resolution.

Profile of Inventor

Education:

1. Undergraduate – Department of Geophysics & Meteorology, Bandung Institute of Technology, 1993
2. Master – Department of Development Studies, Bandung Institute of Technology, 1998
3. Doctoral – Earth Science, Max Planck Institute for Meteorology/Universität Hamburg, 2004.

Figure 1. Home page of SICA

"One important factor in improving agro-industry is the good supply chain that is supported by the accuracy of the distribution of planting materials and marketing of crops and the support of appropriate planting strategies in accordance with current and future climate conditions".

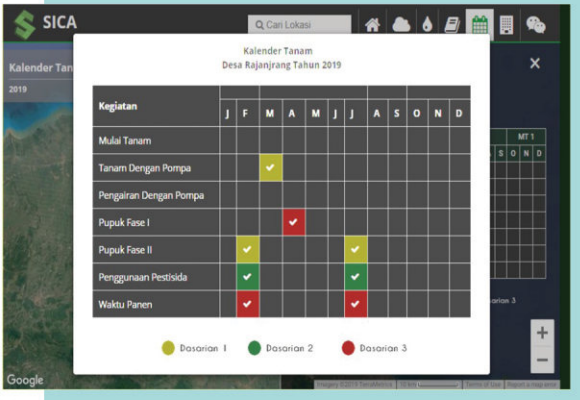

Figure 2. Cropping calendar feature of SICA

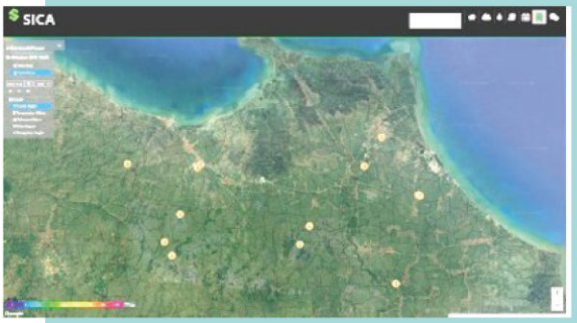

Figure 3. Agricultural shop location for rice sales.

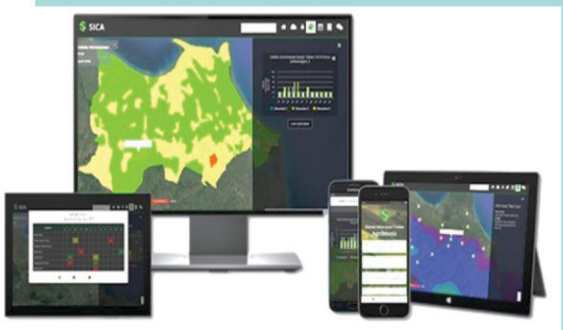

Figure 4. The product SICA in web and Android Apps.

Dr.rer.nat. Didin Mujahidin

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The PTC Method for Producing Library of Surfactants Derived from Palm Oil

Dr.rer.nat. Didin Mujahidin was born in a small village near the Ciremai mountain in Majalengka area. After completion of elementary and secondary educations at his village, he went to Bandung to be trained as chemical analyst in vocational school and continued his bachelor and master program in chemistry at Institut Teknologi Bandung, Indonesia. Dr. rer. nat. was granted by the University of Heidelberg, Germany. After sequential post-Doc in Japan and the Netherland, he began his independent research in field the synthetic organic chemistry at Institut Teknologi Bandung. His research activities focused on the target-oriented synthesis, including new methodology and new route as well as improvements of green and sustainable aspects of the existing chemical transformation to convert an Indonesian natural resource into the high-value organic molecules. The research explores the eco-friendly processes for producing bio-based building blocks, chemicals and materials derived from Indonesian natural resources.

The PTC Method for Producing Library of Surfactants Derived from Palm Oil

Chemical transformations of fatty acids from palm oil to specialty chemicals are a crucial tool to increase the value of this Indonesian national commodity. Several palm-oil-based products, including flavours, perfumes, pheromones, monomers and surfactants, have been successfully synthesized in our group by applying the esterification, olefin metathesis, etherification and sulfonation reactions. One of the major products from our works is a family of surfactants that play an important role in several applications including, health care, pharmaceuticals, cosmetics, agricultural, paint and oil recovery. We developed the efficient phase transfer catalysis (PTC) methods to produce library of non-ionic and anionic surfactants from palm oil. The PTC method is a mild and effective method to combine the hydrophilic unit with the fatty acid derived hydrophobic moieties from palm oil. This method performs low energy consumption and very little organic solvent use. Recently, in collaboration with LEMIGAS, our surfactants are evaluated to develop the effective surfactants or their mixture for chemical flooding in enhanced oil recovery techniques.

Profile of Inventor

Education:

1. Undergraduate : Institut Teknologi Bandung, Indonesia
2. Master : Institut Teknologi Bandung, Indonesia
3. Doctor : Heidelberg University, Germany
4. Post-Doc : Meiji Pharmaceutical University, Japan and Radboud University Nijmegen, the Netherland

"We developed the efficient phase transfer catalysis (PTC) methods to produce library of non-ionic and anionic surfactants from palm oil"

Dr. Eng Bagus Endar B. Nurhandoko

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Hybrid Statistical Neural-Network and Rock Physics for Reservoir Characterization, Laboratories for High Pressure Reservoir Geomechanical Analysis, and Laboratories of Seismic Rock Physics

Dr. Eng. Bagus Endar completed his doctoral degree at Earth Resources Engineering of Kyoto University in 2000. Until now, he is an associate professor at the Department of Physics, Faculty of Mathematics and Natural Science, ITB. He has authored and co-authored more than 112 paper in peer-reviewed national, international, conference paper and presentations, he has five granted patent, and seven pending patent.

Until now, over 40 technologies have been created in his Laboratory, including hardware and software for laboratory and field measurement. His research has focused on seismic imaging technology, Seismic Rock Physics, Reservoir Geomechanics, Reservoir Characterization, Reservoir modeling, Seismic Wave Inversion, Subsurface Temperature Imaging, including Statistical-neural network processing and characterization and Borehole imaging.

He has developed some innovations in Reservoir Characterization and Reservoir Geomechanics technology, such as the prediction of facies lithology distribution, and the identification of pore fluid using Hybrid Artificial Neural Network and Rock Physics. This technology integrates information from wells, cores, and seismic wave to produce an accurate interpretation of the predicted reservoir properties (Granted Patent certificate no: IDP000039874, and no: IDP000046083).

Figure 1. 24 channels Tomography Resistivity: Power 500 watt; Scanned and Controlled by Notebook (PC); Impedance 10 MΩ; Bentangan array cable 2D = 300 meter.

He also developed some imaging technologies, including Seismic tomography and CT-Scan for rock sample. These technologies are integrated software and hardware. The Seismic tomography technology has become an essential tool recently for complex subsurface imaging, such as for basements imaging, and high complexity geological imaging. This seismic tomography is capable also of identifying fractures and can also be used as static correction in very complex structures.

His team developed the Integrated Geomechanical Analysis software and hardware. Ultra high-pressure Triaxial test (48 000 psi), Acidizing fluid injection lab, etc. The geomechanical analysis software can integrate core geomechanics laboratory testing, well data (pressure data, mud pressure, petrophysics & image log), and even seismic data. It is for preventing wellbore instability during drilling and sand production. This geomechanical analysis software can produce accurate pore pressure distribution, sealing-leaking fault, sanding analysis, cap-rock integrity analysis, stress tensor analysis. The technology has been applied in many oil and gas fields in Indonesia, such as CNOOC, Pertamina EP, Chevron Pacific Indonesia, etc. The techniques have been registered in some patents: P00201503210, P00200600054.

Figure 2. 48 channels Tomography Resistivity - Induced Polarization: Power 1000 watt; Scanned and Controlled by Notebook (PC); Impedance 10 MΩ; Bentangan array cable 2D = 1500 meter.

Selected Community Services

The Identification and Development of Teaching Material about the Sound Problems in a Mosque

Dr. R. Sugeng Joko Sarwono

Housing Settlement Architecture Design for Disaster Prone Areas

Dr. Woerjantari Soedarsono

Psychosocial Capacity Building with Art Therapy Approach for Survivors of Natural Disaster

Ardhana Riswarie, M.A.

Built Environment as Mediator for Religiousity and Social Development

Dr. Agus S. Ekomadyo

Developing An Aquaponic System at Cinangsi Disctrict in Cianjur of West Java – A Small Scale Study for Reducing WasteWater to Citarum River – A Community Service from Bandung Institute of Technology (ITB)

Dr. Endra Susila

Dr. R. Sugeng Joko Sarwono

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The Identification and Development of Teaching Material about the Sound Problems in a Mosque

"The teaching material was developed with the focus on three aspects: the room acoustics, sound system, and the practical experience"

The mosque is an essential facility for Indonesia which has the most Muslims in the world. The data from the ministry of religions showed that there is more than 240.000 mosque in Indonesia and dominated with community mosque/masjid jami (83%). Mosque has essential roles in the community as praying facility and as the centre of community service. Although the mosque has been used as a medium to spread information, most of the mosque has a big problem related to sound.

The sound problems in a mosque is a complicated problem due to many reasons such as the mosque design which only focus on the visual aspects, the sound systems which installed without proper considerations, the design of mosque which is never same, and many more reasons. This program was developed to give the knowledge on how to deal with the problems related to sound in a mosque, especially for the mosque keeper. There is three crucial aspects which makes this program different from the other similar program: the identification of the actual problem in a mosque through internet-based survey and in-situ survey, the development of teaching material which is easy to understand, and the spreading of the knowledge as broad as possible.

The survey had identified several sound problems in a mosque, and the most common problem is related to the speech intelligibility. The other problems are related to the sound level, sound character, echo, noise, and sound distribution. This result has been presented in Engineering Physics International Conference 2018. The result has become an essential foundation in developing the teaching material for the community.

The teaching material was developed with the focus on three aspects: the room acoustics, sound system, and the practical experience. The material was developed with the collaboration between building physics laboratory (ITB) and PT TOA Galva Prima Karya (the distributor of TOA sound system). This collaboration was intended to close the gap between the academician and the practitioner. After the development of the teaching material, the next step is the knowledge distribution to the community as wide as possible.

The spreading of knowledge was done using several media. The first one is by arranging training by inviting the representation of several mosques to come to ITB. This event was attended by more than 300 representation from

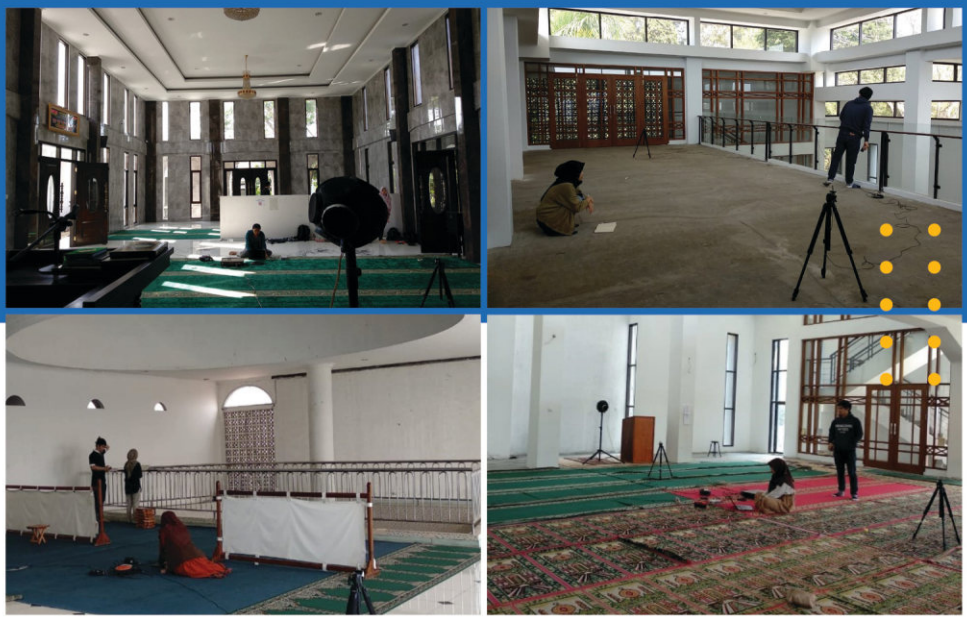

Figure 1. Measurement process.

several mosques such as community mosque, military mosque, the property developer, and also the representation from another island (Sulawesi). The variety of participant indicates that the problems with the sound in the mosque are big problem in Indonesia.

Further distribution of the teaching material was done by arranging live streaming during the training in ITB. The video can be accessed freely in ITB official youtube channel and has been watched by more than 1300 peoples. The teaching material in pdf also can be downloaded freely. This program in one of our contribution to our community with the hope that the impact can be spread continuously and widely.

Figure 2.
Training on understanding acoustics in mosques

(Youtube streaming: https://www.youtube.com/watch?v=Q7sw5Xyx4vg&t=45s; Training material: https://www.itb.ac.id/multimedia/watch/Q7sw5Xyx4vg/itbofficial).

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Housing Settlement Architecture Design for Disaster Prone Areas

Rehabilitation and reconstruction of settlement in disaster prone areas are among the most challenging isues. Settlement needs in the form of housing in disaster prone areas therefore becomes an urgent issue to address in the midst of limited natural resources such as land as well as human resource that could not be easily provided in a short amount of time. Hench, the strategy applied in providing settlements must consider phasing plans, from emergency shelters as first aid, temporary settlements as the next, onto permanent housing settlements as the final phase.

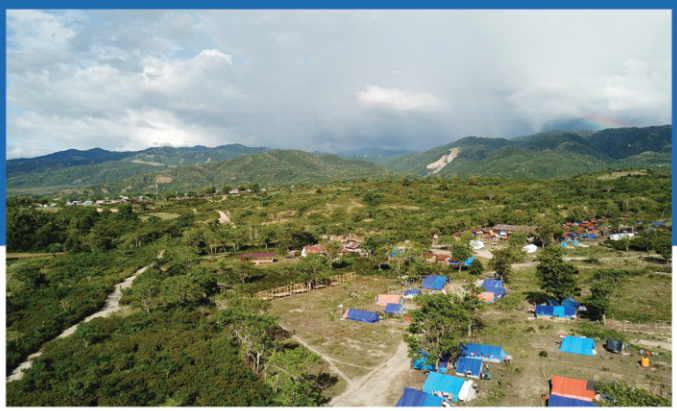
The planning and design process of housing settlements in disaster prone areas requires a multi-sectoral as well as multi-discipline approach and must be accomplished in a short amount of time. Community affected directly by the disaster are among the most vunerable yet sensitive society due to the loss of family and property (home, land, and wealth) they suffer, therefore within the approach of recovery requires public councelling to mitigate the social as well as economic shock they might experience.

So before we prepare in providing recovery of the remaining affected housing or even plan new development of housing settlement in other locations, future disaster possibilities must be taken into account by making sure the planned area is safe.

Responding to the earthquake, tsunami, and liquifaction taken place in Palu and Donggala, South Sulawesi in 2018, The Architectural Design Expert Group of School of Architecture, Planning, and Policy Development (SAPPD) of ITB in collaboration with LPPM ITB and the Ministry of Public Works, Public Housing Division of Indonesia was able to provide housing settlements site plan design in Pombewe, South of Palu City. In determining the location of the design area considers several aspects such as land ownership, location safety in regards to future disaster possibilities and geohidrologycal aspects, access and connection to the city and the surrounding area, availability of public infrastructure and utilities such as clean water, sanitation, and electricity, and the conservation of green open space.

The site plan design of the housing settlements in Pombewe also took account in reorganizing the damaged urban structure of Palu City due to the tsunami along the shore area, and liquifaction in the center as well as in the periphery of the city. The design also considers future development possibilities of the planned area in becoming an integral part of the city therefore applies concepts such as livable and green neighborhood by providing sufficient public facility and infrastructure for the comfort of its future inhabitants.

In 2019, The Architectural Design Expert Group of School of Architecture, Planning, and Policy Development (SAPPD) of ITB in collaboration with other expert groups are also involved in the reorganization of the earthquake-affected area of North Lombok by land consolidation, public counselling, and public participation method for designing better quality neighborhood environment.



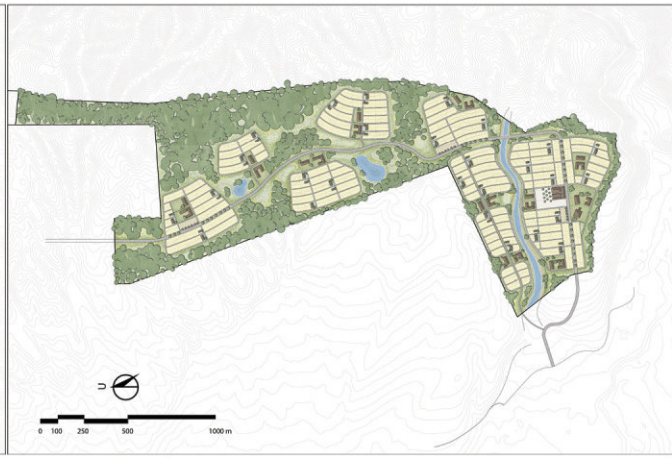


Figure 1. Site plan design for housing in Pombewe, South of Palu City.

"Community affected directly by the disaster are among the most vunerable yet sensitive society due to the loss of family and property".

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Psychosocial Capacity Building with Art Therapy Approach for Survivors of Natural Disaster

At the end of December 2018, a team from the Faculty of Art and Design ran a psychosocial capacity building activity in Batu Rakit village, Lombok, West Nusa Tenggara, following a massive earthquake that happened in August 2018. The team consisted of a lecturer, who is also a credentialed art psychotherapist, an academic assistant, and 8 visual art and design students. This project was done in collaboration with Yayasan Pemuda Peduli who focuses on teacher empowerment in formal education, whose latest program was at a school in Batu Rakit and who was our primary contact with the village elders; and The Red Pencil Humanitarian Service, an international NGO that provides art therapy services in various affected areas.

This project was designed to run during the recovery phase of the disaster. In the cycle of disaster psychology, this is known as the 'disillusionment' period, where people suffer from emotional low and negative reactions due to response aids being no longer available. This commonly lead to social problems and dissociation. The project aims first and foremost to recreate the community cohesion, which hopefully increases resilience and preparedness during the mitigation phase. At Batu Rakit village, one of the crucial social problems that arose was related to different beliefs; some were devout Muslims and another part practiced syncretic Islam which was more animistic.

There were two sub programs during the length of this project: mural making and Train the Trainers (TTT) for local junior high school teachers ran by Syed Ibrahim, a Singaporean therapeutic music practitioner sent by The Red Pencil. It ran for 8 days in total at local village spots and a school and the closing ceremony was done at a newly built children-friendly space. Mural making was designed for children and done in three steps, which were individual art making on paper, group art making on paper, and mural making. All steps were run by the students and closely supervised by the lecturer. The focus of this program was social intervention through art process achieved by taking turns in using tools and raising empathy through carefully responding to each other's drawing. Whereas the TTT was an important addition to sustain the therapeutic uses of art, whether visual art or music. The program was held in two steps, which were learning and teaching practice. At the end of the program, the teachers were given lesson plans to help them maintain the activity. Overall, the average number of children involved in our daily activities reached 50-60 children, although not every child came regularly. The TTT team had an average of 4 teachers coming and up to 30 students got involved in the program.

Figure 1. Mural Creation

Figure 2. Storytelling and another activities.

"The focus of this program was social intervention through art process achieved by taking turns in using tools and raising empathy through carefully responding to each other's drawing".

These two programs were combined during the closing ceremony, when the community celebrated their newly painted wall at the communal space with music, a short documentary film on the process, and a small lantern festival as a symbol of hope. In hindsight, despite the short preparation, the team was able to carry out a meaningful mission. This was reflected from the testimonies given by prominent figures in the area, including Sutana, the Head of the Village, who mentioned that the mission had helped the children to get back on their feet again. Mawa, the Head of School Committee at Semokan Ruak, testified that there were positive impacts on the children who were involved at the mission. Lastly, Mus Mulyadi, a representative of RRA volunteers, extended his gratitude because this program had optimized the use of the space.

To access the project documentary, please go to: bit.ly/AsungRinjani.

Ardhana Riswarie, MA, AThR, is the lead project and a credentialed art therapist. She did her professional training in master level at Goldsmiths University of London, and earned her credential from Australian, New Zealand, and Asian Creative Arts Therapists Association (ANZACATA) in 2014. She has been involved in various community and post-disaster art therapy/art as therapy projects, including in Aceh (2009), West Sumatra (2009), Mitra Muslim orphanage (2009 – 2012) and Rumah Cemara (2013 – 2016). She is now the spokesperson for ANZACATA Regional Group Indonesia. Other team members include: Eljihadi Alfin, S.Ds. (academic assistant and initiator of Semester Alam), Bimanda D. Sahara (SR), Abdurahman Ayasy (DP), Iftikhar A. Rajwie (SR), Kidung K. Wulandari (SR), Rohmah H. Ningrum (DI), Raushan F. El Idhami (DP), Dena I. Pasha (DKV), Alesha Z. Khairunnisa (KL). In cooperation with M. Alfatha Kurniadi, S.Ds (researcher), Issara Rizkya, S.Psi & Resti Nurul (Yayasan Pemuda Peduli), Syed Ibrahim & Aqilah Faizal (The Red Pencil).

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Built Environment as Mediator for Religiousity and Social Development

Learning from Applied Research and Community Service in Ciwidey, Burangrang, Cisema, Lembang, and Kebon Bibit Bandung

Insight about the role of religiousity for social development were gained in research about farming based social movement in Ciwidey, Bandung (Ekomadyo et al., 2015). There were two farmers groups studied: 1) Pesantren al Ittifaq, an Islamic boarding school that also thaught farming for the pupils, and Cisondari farmers group, that developed organic farming and got supports from Melania Cooperation which affiliated to Catholic communities in Bandung (Fig.1). It was found, that these social movements were stimulated by religious spirits of each groups, in many kind of various strategies to gain social acceptance, and they used technology, including built environment, as mediator for the social development activities (Nurfadillah, et al., 2019).

By these findings, the research team develops several community service programs through designing built environment by integrating religious and innovation activities for social development. First program is designing coffee farming innovation facilities in the Burangrang, Bandung, partnership with Pesantren at Taqwa in local site, to provide facilities for muslim pupils (called santri) together with local community to learn the Islamic teaching combined with farming the coffee (Ekomadyo et al., 2018). Second program is designing integrated cattle innovation and training facilities in kampung Cisema, Banjaran, Bandung, partnership with al Amin foundation in local site, to provide a boarding school complex as place where Moslem pupils are trained and innovates the cattle farming as a part of Islamic teaching program (Ekomadyo, et al. 2019b). Both of pesantren are organized under Hidayatullah, an Islamic social organization in West Java Chapter, and then several pesantren teachers (ustad) proposes to continue their post-graduate studies in ITB to upgrade their capabilities to develop the pesantren (Fig. 2).

Religious spirit is also implemented on applied research program for creating creative rural market with astronomical theme in Lembang, Bandung. Located near Bosscha Observatory, this research is conducted by partnership with community observatory “Imah Noong”, which is led by a pesantren astronomers (Ekomadyo, 2018a). The idea of astronomical creative-market is to combine the science (through astronomical events) and Islamic tradition (like “shalawat”, a recital poet as honor to prophet Muhammad) to attract people to visit to the created temporary-market (Fig. 3).

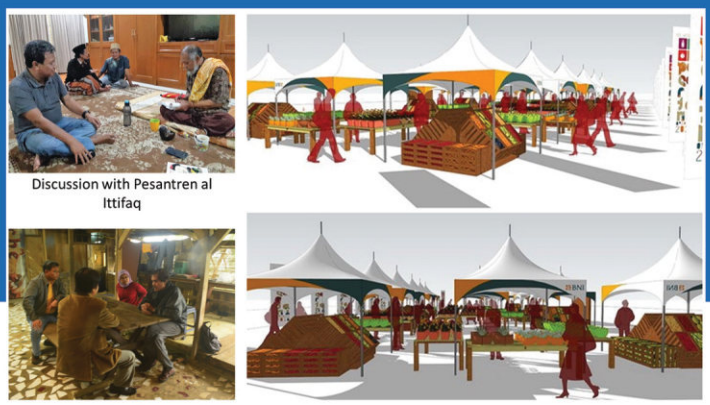

Figure 1. Discussion with religious groups in Ciwidey and the ideas of farmers market (source: Ekomadyo et al., 2015)

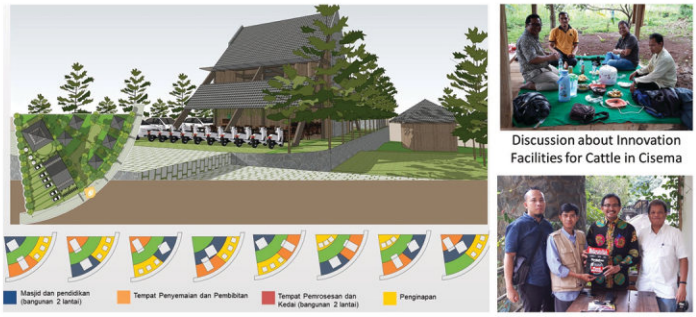

Figure 2. Design coffee farming innovation in Burangrang, discussion about cattle training and innovation in Cisema, and sounding out of education partnership between ITB and Hidayatullah (source: Ekomadyo et al., 2018b, Ekomadyo et al., 2019a)

Figure 3. The idea of rural creative-market with integrate the astronomy and Islamic tradition events (sumber Ekomadyo, 2018a)

The knowledge gained from the field about relation among religiousity, social development, and built environment is followed up in Salman ITB Mosque community through Studia Humanika discourse group. After researched about Rumah Sahabat Salman ITB (Riyadi, et al.,2017) and found that built environtment played role in Islamic community learning (Ekomadyo et al., 2019b), this issue is developed by organizing public lecture series about "Islam and Social Development" (Ekomadyo, et al., 2019c, fig 4.) It is hoped, public lecture series will result a set of knowledge from empirical practices how Islam become spirit of social development, and how technology, including built environment, put as mediator in social activities.

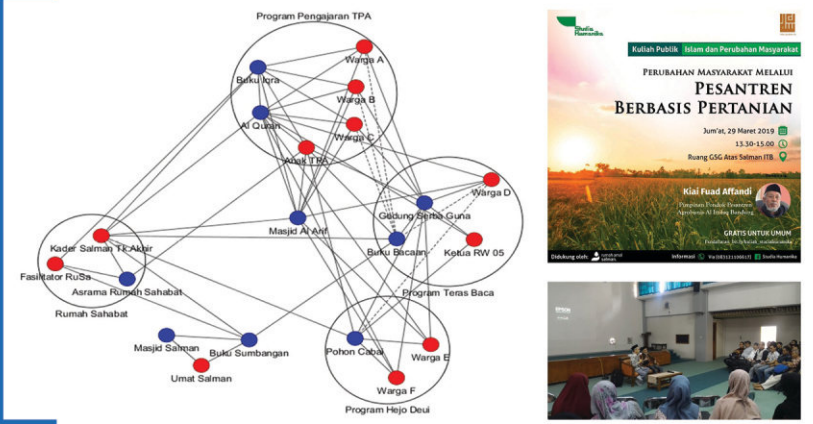

Figure 4. Findings of research of Rumah Sahabat Salman ITB and public lecture series about Islam and Social Development, partnership with Studia Humanika Salman ITB (Riyadi et al., 2017, Ekomadyo, 2019c)

By putting as a part of built environment, architecture is understood as relationship in its social and environmental context (Batruska, 2007). As a technological manifestation, built environment plays role as non-human actor which gets delegate from human actors to make another human actors to do something to gain collective goals (Latour, 1999). Learning from Pesantren al Ittifaq and Rumah Sahabat Salman ITB, built environment is capable to mediate how the religious values are transferred into society through collective learning (Riyadi, et al., 2018). It means, religiousity is potential as cultural capital for social groups to generate social development, and built environment can be designed as the mediator of the movement.

Research and Community Service Team Member:
Angga Dwiartama, Ph.D., Tyas Santri, M.T., Annas T. Maulana, S.T., Ari Nurfadillah, M.T., Andhika Riyadi, M.T., Salim Rusli, M.Kom., A. Taufik Mukhith, M.T.

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"Religiousity is potential as cultural capital for social groups to generate social development, and built environment can be designed as the mediator of the movement"

Dr. Endra Susila

Geotechnical Engineering Research Group,
Faculty of Civil and Environmental Engineering
E-mail: endrasusila@gmail.com

Developing An Aquaponic System at Cinangsi Disctrict in Cianjur of West Java – A Small Scale Study for Reducing WasteWater to Citarum River – A Community Service from Bandung Institute of Technology (ITB)

For contribution to community, Institut Teknologi Bandung (ITB) has developed an Aquaponic System at the District of Cinangsi, Cianjur in West Java from June to December 2018. This community service activity was part of a small scale study to find solutions of reducing wastewater to the Citarum River. This activity was a part community services for the Citarum Harum that was coordinated by the Institute for Research and Community Services of ITB (LPPM-ITB).

This community service program was conducted by the Center for Rural Empowerment (P2D) of ITB leaded by Endra Susila, Ph.D. from the Geotechnical Engineering Research Group, Faculty of Civil and Environmental Engineering of ITB. Endra Susila was the head of P2D ITB at the same time.

Endra Susila and team explained development of the Aquaponic System was aimed to remediate fish water waste and to utilize its wastewater which had rich organic compounds for planting water plants such as: kale, lettuce and other vegetables for daily consumptions.

The Aquaponic System is a combination of aquaculture and hydroponic. Aquaculture is a system how to grow fish while hydroponic is a system to grow plants in water media. Therefore aquaponic is a combination of both systems utilizing the rich compound of wastewater from fish pond to grow plants. Our visual observation and information of the site, we knew that the community had issue of wastewater of fish pond which was flown to Citarum River which still became a national main issue in 2018. The idea of the project was to make use the wastewater for producing daily product. Aquaponic was selected since its system was relatively simple and cheap therefore the it was potentially attractive for community to adopt and develop. Local community would get its main benefits which was the fish pond wastewater output would be cleaner that its wastewater input. It was good for reducing water pollution. If the wastewater output was cleaner enough, it even might be used for daily usages - based on the wastewater condition. The other potential benefit which was attractive was local society would get a potential business of producing fish and vegetables or other water plants. To achieve the main goal, this project involved local community. We performed a practical training of how to develop the system. The local people who took part in the event were enthusiastic.

Figure 1. Constructing the Aquaponic System at Cinangsi District

This Aquaponic Community Service became an active role of ITB in solving environmental issues by reducing wastewater to rivers in this case to the Citarum River. Endra and other team members from P2D ITB hope this activity has triggered local communities, not only in the focused area, to develop sustainable Aquaponic System for producing fish and vegetables. If this activity the focus was developing water plants, the next step was developing for other types of plants such as holtikultura plants and decorative plants.

Figure 2. Fish Pond from which water was used for the Aquaponic.

Figure 4. Taking A Picture After A Practical Training of Developing An Aquaponik System

Figure 3. A Practical Training for Developing Aquaponic for Local People

Selected Artist and Designer

John Martono, M.Ds.

Craft and Tradition Research Group,
Faculty of Art and Design
E-mail : johnmartono198@gmail.com
Website: www.JohnMartono.com

John Martono, M. Ds., known as John Martono is currently working as a lecturer/researcher in textile Craft Study Programme, Faculty of Arts and Design in Bandung Institute of Technology. He is an expert in Creative Surfaces textiles development. He has explored the surfaces with many techniques to the new visual concept through manual traditional and digital ways. Uniqueness and utility the new visual forms for fashion and interior elements

Figure 1. John Martono art on Silk

Design in Textile Craft

In general, there are two processes for designing in textile craft, namely Structure Design and Surface Design. The scope of this research is on the design development on fabric surface by:

1. Combining several methods commonly used in designing shapes or patterns on sheets of fabric,
2. Specifically understanding the characters of medium present, and
3. Directly daubing on the fabric using a brush, as well as the technical basis of watercolour for rather-thin colours.

"He has explored the surfaces with many techniques to the new visual concept through manual traditional and digital ways".

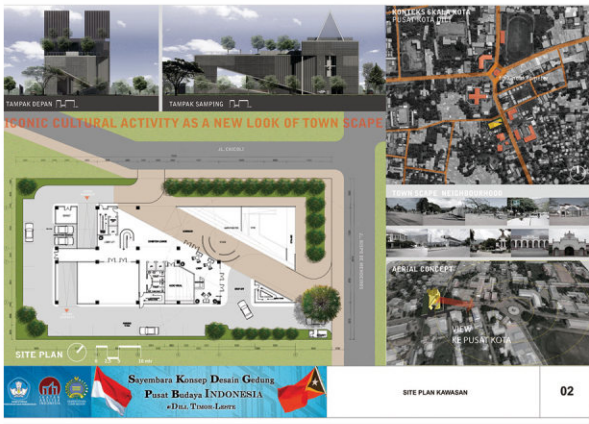
This technique is combined with hand embroidery and collage. Combining these three fabric surface design techniques produces a visual novelty effect on the fabric. The results are divided into two parts, the real texture value that is related with touching experience or visual taste. The second one is only visual. With regard to the aesthetic, styles and functions that are intended for the uniqueness of the fabric, the results are projected for interior and clothing needs. The next step is the documentation process of each sheet to be redesigned digitally in a special format to produce diversified fabric surface designs.

Baskoro Tedjo, Ph.D.

Architectural Design Research Group,
School of Architecture, Planning, and Policy Development
E-mail : baskorotedjo.associates@gmail.com

Baskoro Tedjo, born in Semarang in 1956, completed his Architectural Studies at Bandung Institute of Technology in 1982. In the same year, he was a teaching assistant at that institute. He obtained his Master of Science in Environmental & Behavior from Polytechnic Institute of New York, US in 1989. After that, Baskoro Tedjo earned his PhD in Faculty of Architecture, Osaka University, Japan, and established Baskoro Tedjo & Associates in Bandung. Besides practicing architecture. Baskoro Tedjo is also a senior lecturer in Faculty of Architecture, Bandung Institute of Technology.

He has also won numerous architectural competitions. Among them are, 1st rank of ITB Campus Center Design Competition built in 2003, Kuningan Monorail Station Competition (2005), and WWF Indonesia Design Competition for Branch Office (2006). In addition to that, they won the Central Java Learning Design Competition in 2007 and Indonesian Cultural House Competition, Dili, Timor Leste in 2014. Morever, Baskoro Tedjo & Associates is also awarded with IAI Awards in Selasar Sunaryo Art Space for Culture Facility in 2002.

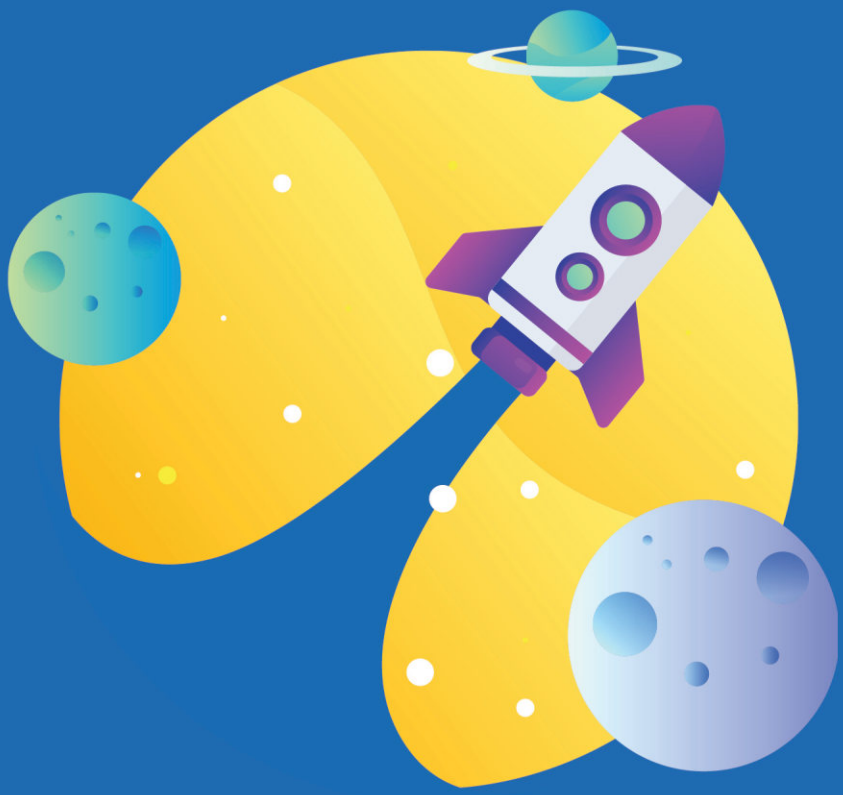


"The Goals of Innovative Design were to create facilities that will strengthen bilateral relations between Indonesia and East Timor"

Indonesian Cultural Center in Dili, East Timor
The clients were Kementrian Pendidikan & Kebudayaan Republik Indonesia (Indonesia's Ministry of National Education & Culture) & Kementrian Luar Negeri Republik Indonesia (Indonesia's Ministry of Foreign Affairs). The Goals of Innovative Design were to create facilities that will strengthen bilateral relations between Indonesia and East Timor. More over, those facilities must be useful ones to enhance the general knowledge of the people of East Timor about Indonesia.
The architecture of the building should reflect the culture of Timor as part of Indonesia culture & also shows the modern technology in building design & construction. The building program comprises an Indonesian culinary restaurant, languages school, amphitheatre, and spaces for the center's annual bazaar. The interiors are flexible, which allow changes to the building usage in the future. Thereby extending the longevity of the structure. The urban outdoor spaces on the site, such as the amphitheatre, function as public spaces, encouraging openness, accessibility and aspects of community.

The design concept stems from the Nusantara (Indonesian archipelago). As a result the mass, which is shaped like a ship, and the form of the roof are the skin to those commonly seen in Indonesian architecture. Additionally, the pattern of the louvers reflects the Indonesian traditional textiles. The mass is divided into the main building and amphitheatre. In between both structures and cutting across the site are a pedestrian walkway and a performance plaza.

The spaces are not covered by the building, which form 55 percent of the total area, are decked out in greenery. Trees are also planted throughout the open surfaces and sky gardens on the building. The amphitheatre's low height and location at the front of the site enable views of the city, while void in the main building for vehicular access ensures that the overall size can be naturally lit and well ventilated. Interiors are airy and kept from direct solar glare.



Selected Start-Ups

A.B.D.I

by: PT. Lakon Teknologi Dwipantara
CEO : Randy Ashari Budiman
Website : Lakon.in

PT. Lakon Teknologi Dwipantara made A.B.D.I products, namely a system of expert sentiment analysis to analyze the tendencies of opinions and explore information contained in posts or content in cyberspace, especially social media and news.

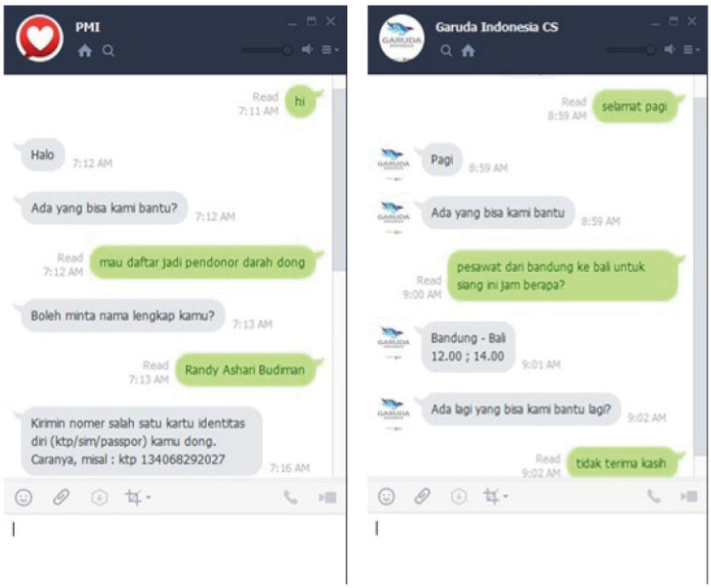
A.B.D.I joined LPIK in 2016 using the previous name, Lumen Helpdesk through the Appcelerate program – a business incubation program which is a collaboration between LPIK ITB and Lintasarta, a data service company.

Achievement:

1. Top 3 Appcelerate 2016
2. Lumen Helpdesk as Smart City Accelerator from IBM at 2017
3. Kemenristekdikti's funding program - PPBT 2017 dan 2018

Address:

Kp. Cikambuy Tengah No. 24 RT. 01
RW. 08 Kec. Katapang, Kab. Bandung,
Jawa Barat, Indonesia – 40971



Bio-N Propolis and Bio-N Oils

By: PT Bio Proshafa Karya
CEO: Mochamad Firmansyah
Website: www.bion-oils.com;
Instagram: bionoils

PT Bio Proshafa Karya is a start-up company established in 2017 that focusses on the development of high quality bioproducts. The vision of PT Bio Proshafa Karya is to create innovation in the management and valorisation of natural resources to produce high quality and beneficial bioproducts whereas its mission is to produce high quality bioproducts that are beneficial to the community through creative and innovative research based on local wisdom and application of technology. Currently, PT Bio Proshafa Karya has two brands; Bio-N Propolis and Bio-N Oils.

Bio-N Propolis are healthy products derived from the valorisation of propolis produced by stingless bees. Crude propolis can be extracted with non-alcohol solvent such as plant oils. Propolis extract contains a relatively high amount of antioxidant that can help to improve one immune system.

Figure 1. Logo of Bio-N Oils and
Bio-N Propolis by PT Bio Proshafa Karya

Figure 2. Propolis by PT Bio Proshafa Karya

Figure 3. Products of Bio-N Propolis: Propolis Extract in Olive Oil (left), Propolis Extract in Grapeseed Oil (center), Propolis Extract in Peanut Oil (right)

Figure 4. Collection of essential oil by Bio-N oils

Figure 5. Formulated products Bio-N Oils: Face oil for dry skin (first from left), Face oil for normal skin (second from left), Face oil for oily skin (third from left), Heal & Shield (fourth from left)

Bio-N Oils are healthy and beauty products derived from the valorisation of essential oils which can be extracted from different parts of essential oil-bearing plants. Essential oils are known for its benefit for pleasant aroma and mood booster as well as for supporting respiratory system and treatment of skin care. Currently Bio-N Oils has 13 variants of essential oils including lemon oil, peppermint oil, lavender oil and many others. In addition, Bio-N Oils also has formulated products based on essential oils and propolis for skincare and healthcare application.

Achievement:

1. Kemenristekdikti's funding program - CPPBT 2017
2. Kemenristekdikti's funding program - PPBT 2018

Address:

Regus Wisma Monex Floor. 9, Jl. Asia
Afrika No.133-137, Bandung 40112,
Indonesia
E-mail: oilsbion@gmail.com

ENCOMOTION

By: PT. BIOPS Agrotekno Indonesia
CEO: Muhammad Fahri Riadi
Website: www.biopsagrotekno.co.id

PT. BIOPS Agrotekno Indonesia or commonly called BIOPS is a company engaged in the field of Agricultural Technology, specifically in Internet of Things (IoT). BIOPS is committed to bringing a new era of agriculture by developing technologies that can improve the farm efficiency so that farmers prosperity increased, and their works become easier while increasing agricultural productivity in Indonesia.

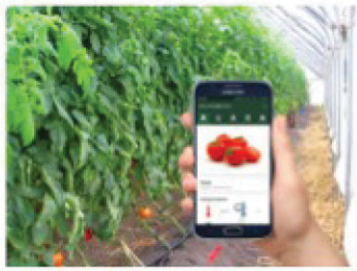
BIOPS established in January 2017 aiming to help the welfare of farmers in Indonesia through the application of agricultural technology. Based on the experience and projects have been done by the members consisting of Engineering Physics, Machinery, Science & Business Management, and Biological Engineering graduates, they have successfully developed their first product, ENCOMOTION. ENCOMOTION is a device to control the environmental conditions of farm and plantation according to the plant needs. Currently the ENCOMOTION has been installed in many places in Java Island which are Lembang, Cisarua, Padalarang, Pangalengan, Purwakarta and Magelang.

Achievement:

1. First Winner of Appcelerate Program 2016
2. Second Runner Up of Swiss Innovation Challenge 2017
3. Second Runner Up of Wirausaha Muda Mandiri, Teknologi non-Digital category 2018

Address:

Jl. Ganesha no.15F, Bandung.
E-mail: info@biopsagrotekno.com

Black Soldier Fly Technology

by: Biorefinery Society
CEO: Bagoes Muhammad Inderaja
Website: www.3-bio.com

Biorefinery Society (BIOS) has a vision to create a biorefinery at every corner of the world and its mission is to implement appropriate technology in the society through development of database and socio-preneurship. A biorefinery concept involves various processes to produce a variety of biological-based products from different biomass sources. There are four main principles in a biorefinery concept:

1. Optimizing natural resources,
2. Minimizing waste,
3. Maximizing profits and revenues
4. Sustainable Development

BIOS currently develops a black soldier fly rearing technology to convert organic waste into valuable bioproducts such as high-protein larvae and organic compost. BIOS has developed MAGIC, a high-protein fishmeal supplement especially for aquarium fish such as Arowana, louhan, and koi.

Achievement:
LPIK ITB's Funding Program – Hibah Startup 2018.

Address:
Jl. Plesiran no 28 Bandung, Jawa Barat
E-mail: biorefinerysociety@gmail.com;

Figure 1. Bioconversion of organic waste using black soldier fly larvae.

Figure 2. Black soldier fly larvae.

Figure 3. Organic fertilizer (bottom), MAGIC Fish Feed (top).

HaloFina

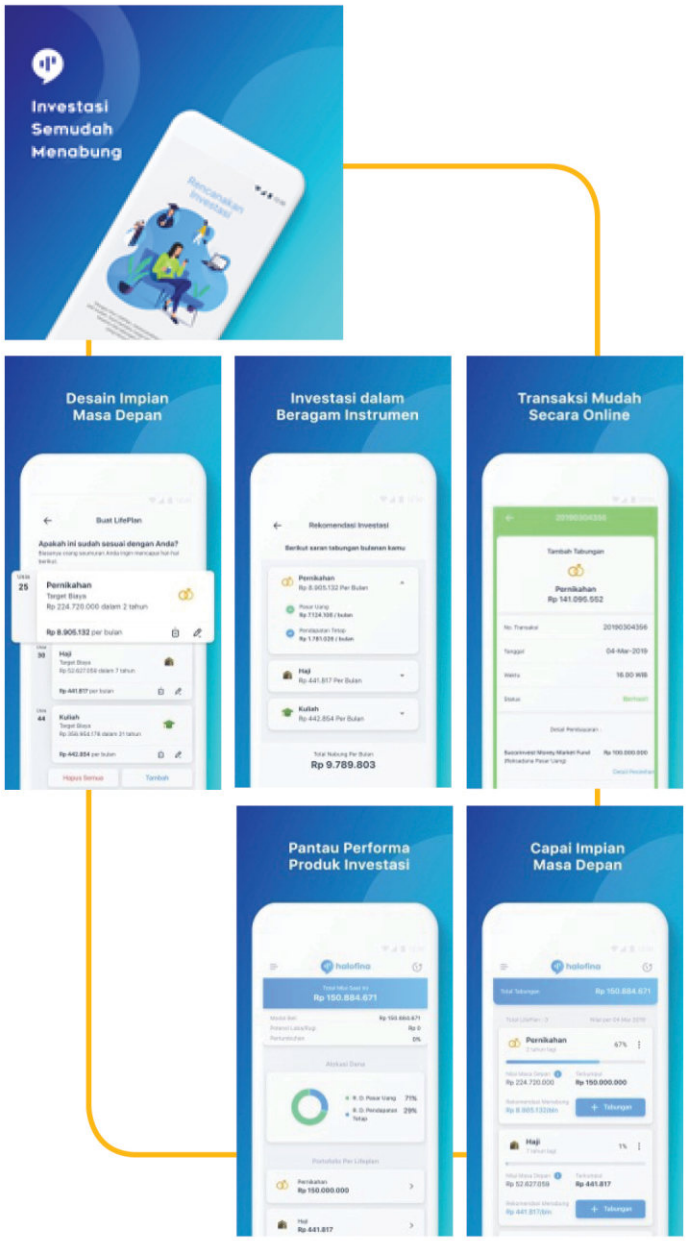
CEO: Adjie Wicaksana
Website: www.halofina.id

Halofina is the first goal-based robo-advisor platform in Indonesia that focus on investment advisory. We introduced an innovative investment system named Goal-Based Investing to provides a purposeful and achievable investment goals for our users. Halofina's robo-advisory system specifically made to give a fit-to-profile investment recommendation that will helps users in achieving their investment goals. Halofina is made as a mobile application in order to be accessible for everyone.

Halofina mobile application consists of these features:

1. **Risk Profile**
   Profiling users' investment risk based on personal data.
2. **LifePlan**
   Halofina's signature feature. A users' goal-based investment management where users can plan their investment goals and monitor its achievement.
3. **Investment Recommendation**
   A fit-to-profile investment recommendation developed by algorithm made by Halofina's financial experts to help users achieving their LifePlan.
4. **Portfolio**
   Real-time investment products performance tracking and monitoring.
5. **FinaPedia**
   In-App financial learning feature. Available on videos, articles, and glossary feature.

Halofina joined Lembaga Pengembangan Inovasi dan Kewirausahaan Institut Teknologi Bandung (LPIK ITB) in 2017 through Appcelerate program. Appcelerate is a collaboration program between LPIK ITB and Lintasarta where Halofina won first place and on September 2018, Chief of Executive (CEO) Halofina, Adjie Wicaksana, has won first place in Wirausaha Muda Mandiri held by Bank Mandiri.



Address:

Jl. Ir. H. Djuanda No. 299
Bandung 40135
Phone: (022) 20457263

Neurafarm

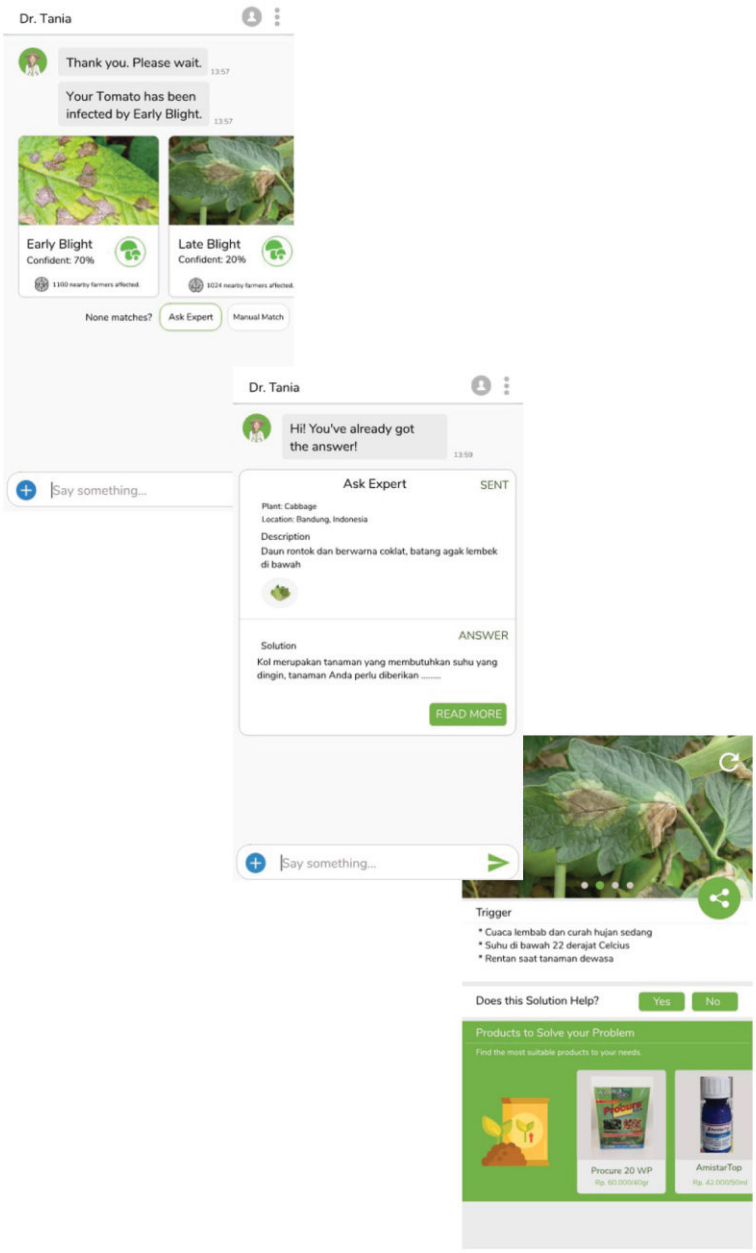
By: PT. Neura Cipta Nusantara
CEO : Febi Agil Ifdillah
Website: neurafarm.com

Neurafarm build Dr Tania, a chatbot-based smartphone application that is able to identify plant diseases through photos using artificial intelligence technology, provide treatment recommendations that need to be done and also direct links to products that can be used to treat the disease, provide a catalog that provides complete cultivation and explanation of diseases. Beside that, users can ask agriculture issue with Neurafarm agronomist expert within the application.

Dr. Tania provide solution for farmers in identifying plant diseases only through pictures. Users can interact with Dr. Tania interactively via chatbot which is user friendly to find out the disease and how to handle the disease. The user can detect the disease by sending a picture of the leaves of the plant to the chatbot Dr. Tania, then the system will detect the image with Deep Learning technology on the server automatically, then the system provides the results of detection and how to handle the disease. Neurafarm joined LPIK in 2018 after achieving some awards such as Technology-Based Company Candidate in 2018, Second Place for Startup Istanbul 2018, Winner of Swiss Innovation Challenge Indonesia 2018, and Third Place in Business Matching Idealogy.

Neurafarm's Team

Address:
LPIK Co Working Space, Jl. Ganesa 15
Bandung
E-mail: hi@neurafarm.com


Dr. Tania
Thank you. Please wait.
13:57
Your Tomato has been infected by Early Blight.
13:57
Early Blight
Confident: 70%
Late Blight
Confident: 20%
None matches?
Ask Expert
Manual Match
Dr. Tania
Hi! You've already got the answer!
13:59
Say something...
Ask Expert
SENT
Plant: Cabbage
Location: Bandung, Indonesia
Description
Daun rontok dan berwarna coklat, batang agak lembek di bawah
ANSWER
Solution
Kol merupakan tanaman yang membutuhkan suhu yang dingin, tanaman Anda perlu diberikan .....
READ MORE
Say something...
Trigger
* Cuaca lembab dan curah hujan sedang
* Suhu di bawah 22 derajat Celcius
* Rentan saat tanaman dewasa
Does this Solution Help?
Yes
No
Products to Solve your Problem
Find the most suitable products to your needs.
Procure 20 WP
AmistarTop

Research and National Center of Excellence

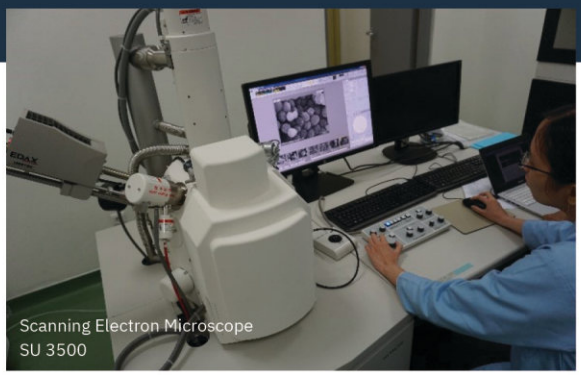
Research Center for Nanoscience and Nanotechnology

Website : 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 is headed by a prominent faculty member with 25 faculty members and more than 100 students actively engaged in education, research and community services. 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 cover a wide spectrum of science and engineering disciplines. 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 such key performance indicators which 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, as RCNN believes that with the increasing complexity of the problems faced by society, an interdisciplinary approach is indispensable. It is, therefore, expected that RCNN will actively contribute to address and seek to 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.

Contact Address :
Director : Prof. Brian Yuliarto
Center For Advanced Science Building (CAS), Fl. 1
Jl. Ganesa No.10 Bandung 40132, Indonesia
Email : nrcn@cphys.fi.itb.ac.id

"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"


Scanning Electron Microscope
SU 3500

Scanning Electron Microscope
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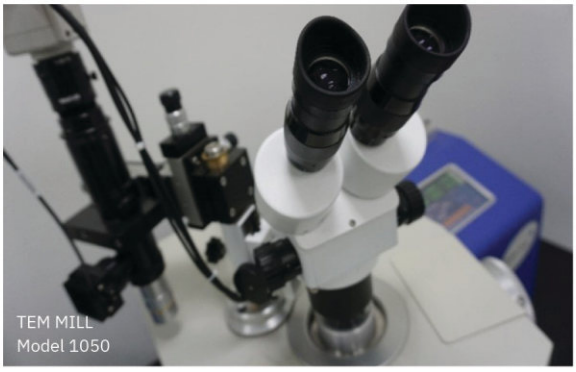
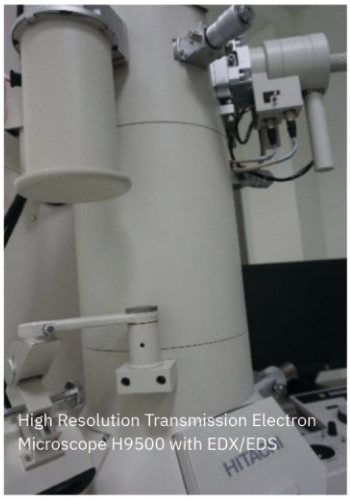

TEM MILL
Model 1050

Transmission Electron Microscope
HT7700 with EDX/EDS


High Resolution Transmission Electron
Microscope H9500 with EDX/EDS


Focused Ion Beam FB2200


Cryo
Ultramicrotome

National Center for Sustainable Transportation Technology

Website: ncstt.itb.ac.id

National Center for Sustainable Transportation Technology

Executive Summary

Transportation industry in Indonesia offers both opportunities and challenges. The transportation issues have shown un-sustainable signs for the economic development, which are a high level of traffic congestion, dependence on non-renewable energy resources (fossil fuel), and high level of pollution. To address these issues, Indonesian transportation industries need to develop a sustainable transportation system such as zero emission electric vehicle and mass transport for urban application. From the economic standpoint, transportation and mobility are very critical, since it is one of the backbones of the national economic advancement, with very high economic multiplier effect (up to 10 times). This is due to the fact that the transportation industry is supported by many layers of tier suppliers, which develop different components and sub-assemblies for the vehicle systems. Major issues in the Indonesian transportation are traffic congestion, pollution, and dependence on the fossil fuel. The traffic congestion in the metropolitan cities, such as Jakarta, Bandung, and Surabaya, needs to be addressed so that it can support sustainable economic growth. The study on integrated transportation master plan Phase II (SITRAMP II) indicates that the yearly economic losses due to traffic congestion in Jakarta alone will reach IDR 65 Trillion by 2020. Therefore, it will need significant transportation strategy and planning breakthrough to resolve the Indonesian transport issues.

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.

Management Team

Director	Ir. Sigit P. Santosa, MSME, Sc.D
Partnership Manager	Dr. Eng. Bentang Arief Budiman
Finance and Grant Manager	Yosa Esvianda Rezkita, M.M
MIT Liaison	Dr. Poetro L. Sambegoro
Monitoring and Evaluation Learning Specialist	Muhammad Farda, M.Sc(Eng).
Accounting Specialist	Natasya Coniyanti Putri, M.Sc.
Management and Information System Specialist	Dita Novizayanti, S.Si.
Account Representative	Rika Felicita, S.Si
Monitoring and Evaluation Learning Assistant	Bejo Ropii, S.Si

Network and Collaboration

NCSTT has been globally recognized as the research center which aims to foster the national transportation industry in developing national economics and welfare. 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, (see Fig. 1).

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

Research Partnership

For research and development, especially on electric vehicle and mass transportation, NCSTT has teamed up with 6 affiliated local universities (UNS, UNDIP, UNSRI, UNSRAT, ULM, and ITK), collaborating with Massachusetts Institute of Technology under USAID Sustainable Higher Education Research Alliance (USAID-SHERA) program. This research focuses on electric vehicle development (e-trike and e-bus), mass transportation (LRT and metro capsule), and its supporting elements. The partnership with local university is also expanding in 2019, one of the initiated collaboration is conducted with Universitas Udayana on feasibility study for Bus Rapid Transit.

Prominent collaborative researches are:

a. **Center of Excellence program from Ministry of Research and Higher Education**
   NCSTT is designated as the host for the national center of excellence (PUI-PT) for transportation by the Indonesian Ministry of Research, Technology, and Higher Education. This grant has been continuously given to NCSTT from 2016 until present.

b. **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. The grant has been launched on March 2017 (See Fig. 2).

The joint research with the Impact & Crashworthiness Laboratory, Massachusetts Institute of Technology (MIT), USA is 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 (See Fig. 3). Prof. Tomasz Wierzbicki and Dr. Elham Sahraei of MIT are pioneers in the characterization of lithium-ion battery cells and their components under mechanical abuse conditions. Their research at MIT covers a wide spectrum of problems. It includes an extensive experimental and computational modeling program. 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.

Fig. 2 CCR NCSTT team during SHERA program launch.

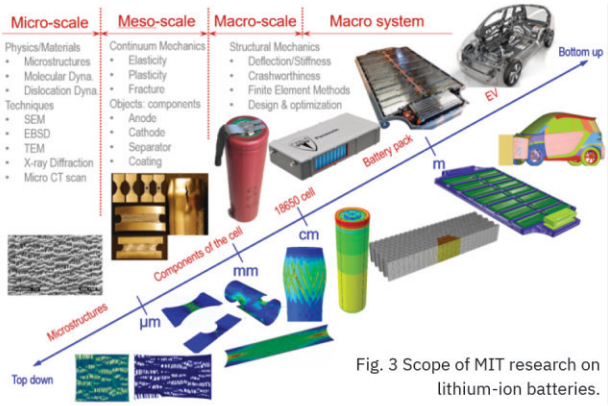


Fig. 3 Scope of MIT research on lithium-ion batteries.

c. Massachusetts Institute of Technology (MIT)

As the continuation from the strong partnership between ITB and MIT through USAID-SHERA program, NCSTT is currently initiating more intense partnership with MIT. This partnership has been started since the visit to MIT on May 2018. Mohammad Nasir, the minister of research and higher education of Indonesia has also supported this collaboration (See Fig. 4).

This collaborative research aims to foster the research capacity in Indonesia, especially on the development of sustainable transportation technology which has already pioneered by NCSTT. MIT as the renowned institution for its cutting-edge research has produced the patent on lithium-based battery. The lithium-based battery has been widely used for automotive and telecommunication industrial products. This collaboration is expected to accelerate the implementation of electric vehicle technology in Indonesia. Besides discussing this ongoing research, other collaboration will still be expanding. One of the big plans is the establishment of MIT – Indonesia Research Alliance (MIRA) as the continuation of the partnership for wider research field.

Fig. 4 Menristekdikti, Prof. H. Mohamad Nasir, Ph.D., Ak., receives the ITB–MIT agreement document from Chancellor for Academic Advancement, Prof. William Grimson, accompanied by Prof. Tomasz Wierzbicki and Dr. Poetro.

Fig. 5 The Collaborative Research team led by Principal Investigator (PI) from NCSTT (Dr. Sigit Santosa) is currently working with University of Oxford led by Co-PI Prof. Roger Reed to formulate the Lightweight Structure Application for Railway Car-body System

d. 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. The research team can be seen on Fig. 5.

e. Beijing Jiaotong University

This program aims to conduct the collaborative research on design of telecommunication system for high-speed railway with Beijing Jiaotong University (BJTU). The partnership with BJTU has been inaugurated on November 2017 (See Fig. 6). The partnership with BJTU has also fostered into bilateral collaboration with Beijing Government. The Ambassador of People's Republic of China to Indonesia, H.E. Xiao Qian has visited the Center for Development of Railway Industrial Technology (PPTI-KA) on December 7, 2018, to see the progress of railway engineering and design collaboration between Indonesian and Chinese researchers. The visit also aims to strengthen the collaboration between Indonesia and China on railway technology.

Fig. 6 The agreement signing between ITB and BJTU ceremony (Left), HE Ambassador Xiao Qian Visited the ITB Railway Engineering and Design Center (Right).

f. Tokyo Institute of Technology (World Class Professor

World Class Professor program invites world-class professors from various well-known foreign universities as visiting professors for placed in various higher education institutions in Indonesia for a certain period. This program is intended for Indonesian scholars to interact with world renowned scientists so they can improve their academic performance, competence, quality and contribution to the development of science and technology. An example of this program is the collaboration with Prof. Kikuo Kishimoto from Tokyo Institute of Technology (Titech) on conducting research to engineer micro-composite structure to maximize the strength. The partnership with Titech has also expanded through Transport Studies Unit (TSU) Tokyo Tech. TSU consists of many study group which conducts a wide range of aspects of transport studies, such as traffic engineering, transport planning, behavioral sciences, and urban studies. NCSTT is initiating the collaborative research on transport modeling and demand projection, big data analysis on passenger behavior, transport mapping, transport safety and crash avoidance, infrastructure development for supporting TOD. This research will involve six laboratories on TSU: Fukuda Lab, Asakura Lab, Muromachi Lab, Yai Lab, Hanaoka Lab, and Inaba Lab.

g. ASEAN NCAP

ASEAN NCAP is a collaborative effort between the Malaysian Institute of Road Safety Research (MIROS) and Global NCAP. ASEAN NCAP is targeted to elevate vehicle safety standards, raise consumer awareness and thus encourage a market for safer vehicles in the region. NCSTT has conducted several collaborative events with ASEAN NCAP, such as vehicle safety course on November 2018, and Automotive Engineering Week which will be held on 2019.

Industrial Partnership

To achieve the NCSTT's target on the integrated transportation system, the synergy between the research partnership has to be fostered with industrial partnership. NCSTT has been collaborating with the various industry, from local industries and overseas. The simultaneous collaboration with prominent industry and higher education institution is expected to build the synchronous progress between research development and the readiness of the related industry to implement the technology.

Fig. 7 Photo session after discussion meeting with Masaki Ogata, Vice President of JR East (second from right)

Fig. 8 Discussion meeting of e-bus research with Transjakarta, Laksana Karoseri and Isuzu.

a. Japan Railway East Corporation (JR EAST)

Japan Railway East Corporation (JR East), is one of the biggest companies that operates and maintains railway in Kanto, Koshinetsu, and Tohoku regions, including Shinkansen bullet train. The focus of collaboration with JR East is to leverage the education and technical skill of human resources of mass transport in Indonesia. JR East recorded as the most successful company that can manage and operate many lines in Japan, in contrary with the nature of many mass transport companies that usually have heavy losses without subsidized by the government. The NCSTT wants to adopt the JR East experience to be implemented in the Indonesian mass transport system. JR East will support NCSTT to develop the curriculum on railway technology, so the graduate students with the program in transportation, policy, planning and TOD, maintenance, service, reliability, and railway safety will be involved. JR East also agree to conduct collaboration in region development near the station to increase the profit of operating mass transport in Indonesia. This partnership is initiated on February 2019 (See Fig. 7).

b. Transjakarta

One of the prominent research product from NCSTT is the electric bus (e-bus). The e-bus will be implemented as Bus Rapid Transit in Jakarta through the collaboration with TransJakarta. Other industries also involved in this project, such as Isuzu Indonesia and Laksana Karoseri to work on the assembly. The discussion with the involved parties has been frequently conducted to smoothen the coordination (See Fig. 8).

c. Kereta Api Indonesia

The collaboration with Kereta Api Indonesia is conducted on the feasibility study of Jabodetabek railway facilities. The result of the study will be forwarded as the recommendation to the management stakeholder. The scope of the study consists of the development of Jabodetabek commuter railway, study of volume uplift, signaling equipment, telecommunication, operation, business development, financial study, and many more.

d. PT. Jakarta MRT

The agreement between ITB and PT. Jakarta Mass Rapid Transit (MRT) is conducted on research and human resources development through training and other events. The workshop on Train Signaling, Control, and Automation Technology: Communication Based Train Control (CBTC) Design and Implementation was held as an initial program on November 16, 2017. This workshop will be an event for sharing knowledge on signal, control and automation technology for the railway vehicle, especially on Communication-based Train Control (CBTC). This workshop is open for academia, vendor and technology user.

e. **PT. INKA**

In line with the objective of the IAPP-RaEng collaborative research program with University of

Oxford, NCSTT is conducting the partnership with PT. INKA on capacity building and R&D of ultra-lightweight high-strength material for railway structure. The collaboration with PT. INKA is also conducted on the design review of Jabodebek LRT.

f. **Bakrie and Brothers, Tbk.**
To support the sustainability of the research product through commercialization, NCSTT also conduct the partnership with Bakrie and Brothers on electric vehicle development and its commercialization. This partnership is supported by Indonesian Endowment Fund for Education (LPDP) by the Ministry of Finance.

g. **Karoseri Indonesia**
NCSTT has been collaborating with the car body (karoseri) industries in Indonesia for e-bus research and development. For the car body using high-strength steel, the collaboration is conducted with Karoseri Laksana, while for the Al-based is conducted with Karoseri Nusantara Gemilang.

Product Development and Innovation

In order to achieve the integrated transportation goal, several product innovation solutions for sustainable transportation technology have been developed in five priority sectors:

a. **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 (See Fig. 9).

b. **Transportation infrastructure**
NCSTT research on infrastructure for rapid mass transportation and electrification/charging strategies for electric vehicles is conducted in collaboration with world-class universities and industries.

c. **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.

d. **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. 10).

The workshop has been continuously developed and broadly conducted for governmental sector and industrial sector. For governmental sector, NCSTT alongside with Lightweight Structure Research Group, Faculty of Mechanical and Aerospace Engineering ITB has held the workshop on land transportation safety for the staff of the ministry of transportation (See Fig. 11). For industrial sector, NCSTT has held the workshop on train signaling, control, and automation technology as the continuation of the signing of the Memorandum of Understanding between PT MRT Jakarta and ITB.

Fig. 9 Ongoing research innovation project.

Fig. 10 Speakers from the first session of focus group discussion and workshop, LRT Palembang (Left) Audience members (Right)

Fig. 11 Dr. Sigit P Santosa, MSME as the speaker in Workshop on Land Transportation Safety (Left) Audience members and speakers (Right)

As one of the NCSTT institutional partner, Massachusetts Institute of Technology (MIT) has also committed to be involved in NCSTT capacity building. Currently, NCSTT has initiated the collaboration with MIT Professional Education regarding the future works on workshop and training for NCSTT's members. (See Fig. 12).

Fig. 12. NCSTT visit to MIT for discussing the future works on capacity building

e. Research Dissemination

The International Conference on Electric Vehicular Technology (ICEVT) is an annual event which aims to provide opportunities for the different areas delegates in the field of Electric Vehicle (EV) technology to exchange new ideas and application experiences and to establish friendly relation among peers for future global collaboration. ICEVT has been held 5 times until 2018 (See Fig. 13) and the next ICEVT will be held in Bali. Dozens of papers have been published in Scopus indexed proceedings through this conference.

NCSTT has also launched International Journal of Sustainable Transportation Technology (IJSTT). This journal accepts original research paper, review paper, technical paper, and short communication paper which covers transportation technology fields such as electric vehicle technology, mass transportation, railways and rolling stock, transport socio-economic impacts, transportation infrastructures, transit-oriented development, and transportation safety (link: https://unijourn.com/journal/ijstt/5ae99ad07348a8567766abe2). The submitted paper will be peer-reviewed with double-blind review process to assure the high standard journal quality. All published papers will be available to be accessed openly to reach a broad and wide audience.

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National Center on Broadband Wireless Access

Website: www.pme.itb.ac.id

Introduction

National Center on Broadband Wireless Access (NC-BWA) is a Research Center at ITB focusing on the development of Technology, Electronic Products and Industries in Indonesia. The field of research and development covers the entire ecosystem of the electronics industry from upstream to downstream, namely Chip Technology (component), Electronic Systems Technology (ODM / OEM), Technology and Electronic Equipment Manufacturing Technology. NC-BWA ITB is supported by four laboratories and equipped with international standard research equipment, such as IC Design (Integrated Circuits), IC Processing, Electronic System Design, and Electronic Manufacturing.
In addition to conducting research activities, NC-BWA ITB is also active in conducting product development activities with local industries and abroad; conducting research results dissemination through activities such as international conferences, journal publications, workshops, and training. PME ITB also has intensive cooperation with universities from home and abroad.
In 2013, through the Ministry of Research and Technology, Microelectronics Center ITB defined as one that fostered Leading Center of Science and Technology from 2014 to 2016 as an Advanced Center of Science and Technology (Pusat Unggulan IPTEK Perguruan Tinggi) on Broadband Wireless Access (PUIBWA).

Vision

The vision of the ***National Center on Broadband Wireless Access*** 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 ***National Center on Broadband Wireless Access*** 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

NC-BWA has four main objectives:

- Enhance the Engineering and Technology.
  Through BWA ecosystem, NC-BWA is always committed to mastering, accumulating, and disseminating the state-of-the-art technology, so that new products that have added value and high local content rate can be produced.
- Develop the Human Resources.
  NC-BWA plays central role in providing high quality human resources for the whole ecosystem hence achieving critical mass. With the strength of human resources, it is expected that new technological innovations and inventions will emerge.
- Grow the BWA Industry Ecosystem.
  The ecosystem of BWA industry is aimed to produce technological products and services which are competitive, creative, and innovative. Within the ecosystem, NC-BWA serves as technology provider and component catalyst of the value chain of product and service industry (Figure 1). NC-BWA also synergizes the whole value chain components to achievesuccessful mass production.
- Increase the Economic Growth.
  NC-BWA is collaborating with various parties (e.g., the Ministry of Industry, the Ministry of Research and Technology, the Coordinating Ministry for Economic Affairs) in producing regulation and investment environment conducive to accelerate the economic growth. NC-BWA has targeted to provide connectivity infrastructures which are affordable, available, accessible, reliable, and high performance. This connectivity fosters the communication inter/ intra economic corridors that impacts on the acceleration of national economic growth.

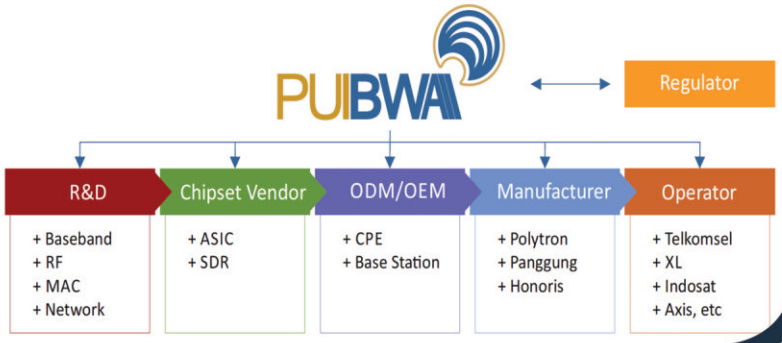

Figure 1. The Role of NC-BWA in the Ecosystem of ICT Industry.

Organization:

Director	Ir. Adi Indrayanto M.Sc.,Ph.D.
Financial & Human Resources Manager	Ir. Amy Hamidah Salman, M.Sc.
Business Unit Manager	Dr. Yoanes Bandung
Information Technology Manager	Dr. Waskita Adijarto
Research & Development Program Manager	Dr. Arif Sasongko
Head of IC Design Laboratory	Prof. Trio Adiono PhD
Head of IC Process Laboratory	Dr. Irman Idris
Head of Manufacturing Laboratory	Ir. Ihsan Hariadi, MSc.

Core Competencies:

- Communication System
- Digital Signal Processing
- Computation, Modeling, and Simulation
- Analog and Digital VLSI/System Design
- ASIC, Back-End Design
- Electronics Manufacturing (IC Packaging, PCB Manufacturing, Assembly and Test)
- Device Manufacturing
- Embedded System
- FPGA Prototyping and PCB Design
- Electronic Product Design
- Cryptography and Network Security
- Smart System

Laboratories

The research labs in the Microelectronics Center ITB are as follows:

- **System and Application Laboratory**, uses the ICs to develop products and applications. In many cases, 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 (IC s).
- **Electronics Manufacture Laboratory**, studies and develops technology for electronics manufactures.

Figure 2. Laboratories in NC-BWA.

Products

The Microelectronics Center has developed electronics products as depicted below:

- Electronics Voting System (MeVote)
- Smart Panel
- WiMax Base Station
- WiMax Subscriber Station
- LTE Smallcell
- LTE Framework
- Smartphone
- WiMax Baseband Chipset
- eFisheries
- AQLite Signal Generator
- AQLite Signal Analyzer
- MINDS Smarthome System
- T-Con Tap And Connect
- BOKS Smart Locker System
- Arduino Board

Figure 3. Broadband Wireless Access Products.

Figure 4. InfiniteBe 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.

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.

With the support from the Ministry of Communication and Information (Kominfo), PUI-BWA has more than 6 years experience in developing BWA technology devices such as Base Station (BS) and Subscriber Station (SS). Those devices are entrely made by Indonesian experts, started from IC component, PCB, RF, antenna, and MAC layer. Based on the evaluation of Indonesian surveyor, those devices contain around 96% local content rate. The technlogy being developed is the current state of the art BWA technology, which are WiMAX, DVB-T, and LTE.

Figure 5. 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.

Infrastructure

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

- 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.

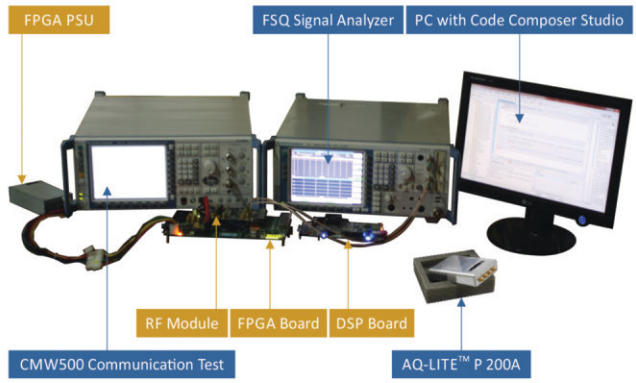

Figure 6. Broadband Wireless Access Development and Measurements Tools.

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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 the research activity at the Center of Excellence (CoE) of Carbon Capture, Utilisation and Storage (CCUS) at ITB. 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. ITB has initiated the realization of Gundih CCS Pilot Project. This project will inject 20,000 – 150,000 tons of CO_2 in Central Java, Indonesia, and is planned to enter the implementation phase by the end of 2019.

Besides that, together with National Research Center for Oil and Gas and PT Pertamina, ITB will work together for completing feasibility study for the first CO_2-EOR (Enhance Oil Recovery). CO_2-EOR is believed as the best approach for maintaining oil production in Indonesia. Pilot Project in Indonesia, which will be on stream around 2022. Currently the CO_2-EOR Pilot Project in Sukowati field (East Java) is proposed by Indonesian stakeholders as the first priority. ITB research members must work hard until the end of September 2019, since the comprehensive feasibility study document must be finalized at that time. ADB will then decide within September 2019, whether the proposed Indonesian CCS and CO2-EOR Pilot Projects in Gundih and Sukowati fields could be constructed by using ADB and other international grants. It is hoped that the implementation phase of both pilot projects could be started in October 2019.

Based on the gathered experiences, especially on how ITB could develop international scientific and practical networks, the best practice learning processes is now transferred to other neighbor countries in South- and Southeast Asia. Together with some prestigious institutions dealt with CCS/CCUS from developed countries and institutions in South- and Southeast Asia region, ITB is working together in solving problems related to carbon emission from energy sector, such as how to implement CO_2-EOR, CCS ready, implementing BECCS, and developing capture technology in the region. Thus, since beginning 2019 ITB initiated the "Asia Pacific Academic Knowledge Network for CCUS (APCAKN-CCUS)", which will promote CCS and CCUS in Asia Pacific region, especially in the South- and Southeast Asia.

Figure 1. Pseudo 3D seismic data acquisition in Gundih area, Central Java.

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National Center for Defense and Security Technology

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The Center for Defense and Security Technology ITB (PUSTEKHAN) 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.

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.

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.

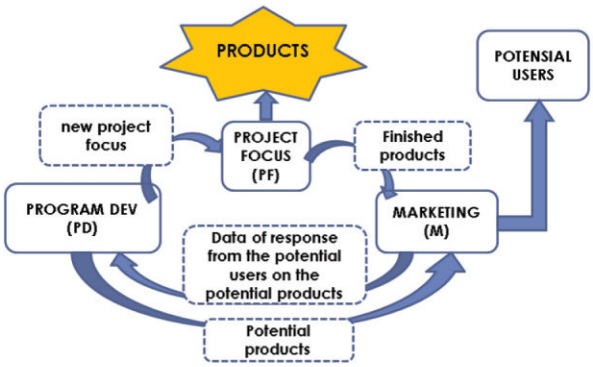

Figure 1. Work flow of the organization.

Figure 2. Product development of UAV prototype for shooting operation.

Figure 3. The Synergy of Defense and Security Development Seminar, 2018

Figure 4. The Indonesian Technical Education Exhibition, 2018

Figure 5. Ritech Expo in Riau, Pekanbaru, 2018

Figure 7. The cover of Jurnal Inovasi Pertahanan dan Keamanan

Figure 6. Study Visit from Indonesia Defense University, 2018

Figure 8. Discussion with experts to define a common vision and programs on various strategic issues between partners and stakeholders.

"Together with all stakeholders, PUSTEKHAN builds and develops the common vision and network necessary to implement its programs, to be executed by national consortiums and collaborations"

PUSTEKHAN also manages Jurnal Inovasi Pertahanan dan Keamanan (JIPK) or Journal of Defense and Security Innovation, a national journal which includes articles with varied themes related to innovation in defense and security field, the emerging security threats and scenarios , civil-military relations, higher defense planning, doctrines and concepts, organizations and structures, command and control mechanisms, logistical support and sustainability issues, budgeting procedures and practices, science, engineering and technology in defense and security, cyber security, and other topics related to defense and security.

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.

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Research Center for Bioscience and Biotechnology

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The Research Center for Bioscience and Biotechnology (BBRC) is a research center of ITB focused on strengthening research in the fields of bioscience and biotechnology on food, health, environment, energy, etc. The main strategic programs of BBRC is conducting excellent researches for the development of sciences, technologies and products that can be used for better life. As research outputs, BBRC through its researchers publishes scientific papers in international journals, conducts presentations at international and national seminars, applies for patents, develops products, etc. BBRC also organizes trainings, workshops, seminars, etc. in order to share knowledge and research findings. These events have been enthusiastically attended by researchers from different institutions around Indonesia, receiving positive feedbacks.

BBRC facilitates and supports lecturers as well as researchers who work in research groups from ITB faculties such as the School of Pharmacy, the School of Life Sciences and Technology, the Faculty of Mathematics and Natural Sciences, the Faculty of Industrial Engineering and the Faculty of Civil and Environmental Engineering.

The funding from ITB that granted through RU grant has been a stimulation for BBRC researchers to find other research funding from sources within ITB and other institutions in Indonesia, for example state industries, as well as from foreign institutions. In addition, BBRC has established and/or initiated collaborations with institutions in Indonesia and other countries.

In line with the new orientation of ITB as an entrepreneurial university, BBRC looks forward to be engaged in research for the development of products that can be useful for the community or can be commercialized. We are looking forward to ITB's continuous support, especially the revitalization of laboratory facilities, to enable the center to deliver excellent research, product development and community services.

Vision

To become a center of excellence in research and a national flagship in bioscience and biotechnology, developing applications for industries and communities.

Mission

Conducting excellent research in bioscience and biotechnology in order to develop products, scientific knowledge and strategic technologies, and to facilitate research training as well as technology support for industries and communities.

BBRC research is classified into 3 clusters:

A. Research on the basis of natural sources for health, food and other valuable products.
   Examples of past research topics:
   1. Development of standardized herbal medicines for lowering of uric acid content in blood.
   2. Encapsulation of mangosteen polymer nanofiber using rotary force spinning.
   3. Production of aflatoksin from Aspergilus flavus for quality and safety of herbal medicines.
   4. Develoment of post-harvesting management system with utilization of TiO2 nanomaterial on banana fruit as a model.
   5. Development of Indonesian herbal medicines for several indications of disease
   6. Development of marker compounds for quality control of herbal medicines
   7. Development of nutraceuticals

B. Research on enzyme, vaccine, adjuvant and protein therapeutics.
Examples of past research topics:

1. Creating a hybrid collection preliminary to the development of humanized monoclonal antibody for therapy of hepatitis B.
2. Development of diagnostic kits for hepatitis.

C. Research on biotechnology for health, food, energy, and environment.
Examples of past research topics:

1. Production of bioethanol from akar wangi (Vetiveria zizanioides) as phytoremediation plant in a former bauxite mining field.
2. Transformation of key genes in artemisinin biosynthesis, farnesyl phosphate synthase (FPS) and amorphadiene synthase (ADS) in Sacharomyces serevicae for production of antimalarial artemisinin.
3. Study on degradation of colorless compounds using laccase from Marasmielus palmivorus by high-throughput screening.

Research products (some are commercially available as well as in the final steps of researches, some are still on progress in researches)

1. Several herbal medicines for treatment of deseases such as antidiabetic, anti rheumatics, anticholesterol, etc
2. Natural products based-cosmetic products such as shampoo and cream for the skin whithening
3. Marker compounds for standardization of herbal medicines
4. Mushrooms
5. Diagnostic kit for hepatitis B
6. Instruments for nanofiber productions
7. Etc.

Figure 1. Research activities in BBRC.

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Research Center for Cultural and Environmental Products

Website: pbl.lppm.itb.ac.id

The Research Center for Cultural and Environmental Products (PP PBL) has a vision to create culture-based creativity for livelihood improvement.

Its mission is to develop knowledge and expertise on art and design based on natural, human and cultural resources; to increase the competitiveness of creative products and services by using national natural, human and cultural resources sustainably; to encourage the nurturing of the creative industry through the development of cultural activities; and to connect and develop research and development collaborations, both at national and international level.

The goals of PP PBL are to be inspirational, creative, high-quality and competitive; to make cultural links, to organize cultural activities, to raise social awareness, to nurture research culture, and conduct cultural knowledge management.

The research areas of PP PBL are: *Art and Artistic, Art and Aesthetic, Art and Curatorial, Design and Artifacts, Design and Materials, Design and Systems, Design and Visual Culture, Design and Environment, Design and Behaviour, and Design and Information*. The research is focused on: local materials such as bamboo, ratan, grasses, and others; appropriate technology; the cultural creative industry; public and cultural awareness as part of character building.

Figure 7. The cover of Jurnal Inovasi Pertahanan dan Keamanan

Figure 4. Areca plate Hot Press Machine

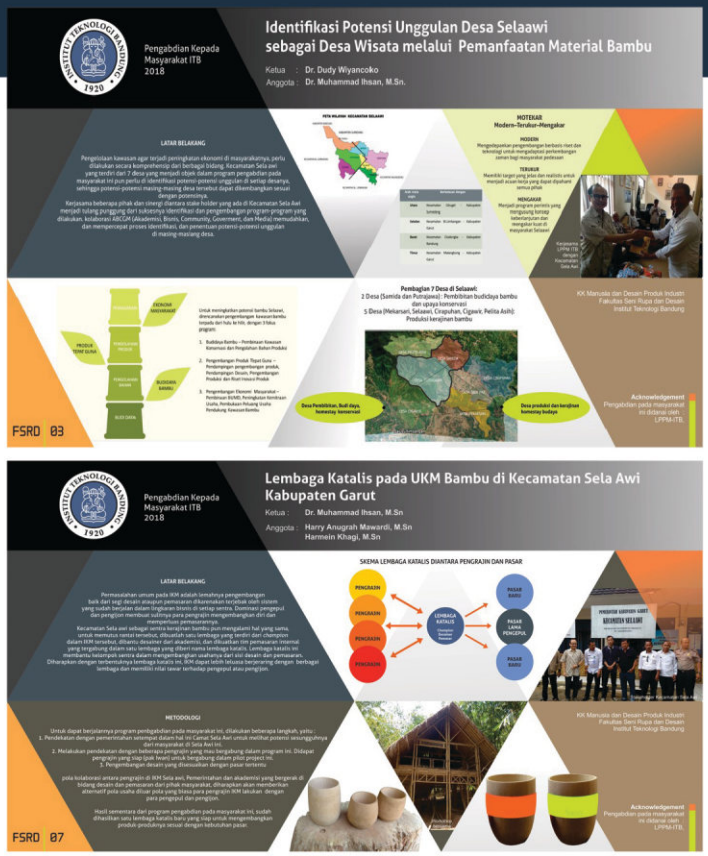

Figure 2. Sela Awi bamboo village

Figure 3. Product development from areca leaf, Tanjung Jabung Timur, Jambi Province

Figure 5. Joint product development with Viro Polymindo

Figure 5. Prostheticboo.

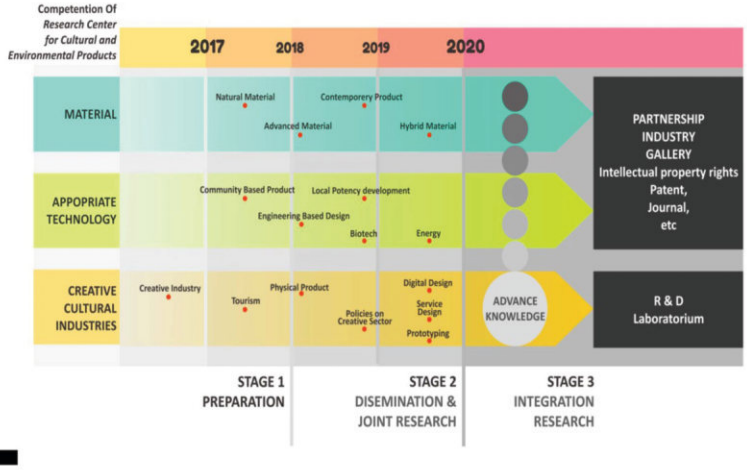

Figure 6. Roadmap of PP PBL.

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Research Center for Information and Communication Technology

Website: www.pptik.itb.ac.id

The Research Center for Information and Communication Technology (PPTIK ITB) has a mission to build a world-class research reputation. This requires the alignment of topics, research competencies, decent facilities, high activity and widespread global partnerships in the field of ICT research. In addition, PPTIK has a mission to encourage the development of commercial products, entrepreneurship and industries in the field of ICT.

Vision

Every Indonesian citizen must be able to utilize ICT for the advancement of his/her life. Every citizen can participate in the knowledge society and the knowledge economy, either benefiting from it or building it. Answering to the new challenges from ITB's entrepreneurial university era, PPTIK's activities in the period from 2015 to 2020 are focused on:

1. Strengthening the organizational capacity of PPTIK to collaborate with as many parties as possible from various sectors by utilizing its technology portfolio and solutions developed by all stakeholders of PPTIK.
2. Strengthening the role of PPTIK as a pioneer and consultant in the development and utilization of digital-learning technologies and solutions by deploying these to more and more diverse stakeholders, ensuring the emergence of technological-learning innovations and digital-learning start-ups and digital-learning solutions in the form of business models.
3. Increasing the role of PPTIK as a pioneer and consultant in ICT development and utilization and ICT-based solutions for application in various sectors by ensuring the emergence of related technological innovations that can be demonstrated in three forms: scientific publications, functional prototypes, pre-start-ups.

The technology and technological solutions developed by PPTIK will be modern interactive digital-media service systems.

To support this roadmap, the research developed by PPTIK will focus on the development of a smart community framework that will become the standard for realizing the smart city concept. The components of this smart community framework are:

1. Smart Mobility through the application of intelligent transportation system (ITS) research.
2. Smart Health Care through the development and implementation of the Detection of Patient Condition Data by Health Monitoring System (Detta Care).
3. Smart Government through the development of a project-based research called Indonesia United (Idun).
4. Smart Education from the development of e-learning research and educational game VidyaNusa, Final Project in the Network (TADJ), Open Online Data Course (OODC) to the development of an artificial-intelligence robot for human social education and interaction, called Lumen Social Robot.

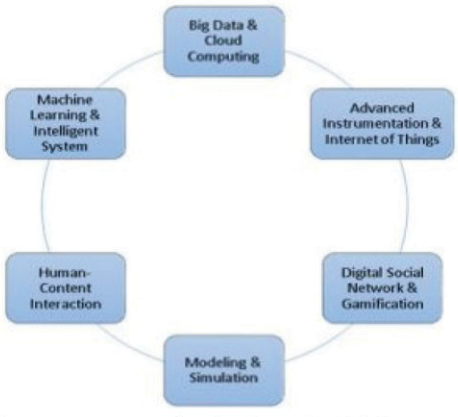

Figure 1. Components of modern interactive digital media services

Partnerships

In the process of developing its research, PPTIK has established collaborations with several parties, such as the Indonesian General Election Commission (KPU), Regional Election Commission (KPUD) West Java, Election Supervisory Board (Bawaslu), Zamrud Technology, Indonesian National Private Radio Broadcast Association (PRSSNI) in Bandung, Indonesian Telematics Research and Development Foundation (YPPTI), Microsoft Indonesia, NTT Data, Sampoerna Telekomunikasi Indonesia, PALU Central Sulawesi Health Agency, Meteorology, Climatology and Geophysics Agency (BMKG), Eon Reality Group, LIPI Geotechnology Research Center, MIT USA, Keio University, Telkom University and Universiti Teknologi Malaysia (UTM), Japan Smart Community Alliance, Indonesia Biodiversity Foundation (KEHATI), International Rhino Foundation (IRF), Anargya Technology, PT. Westpoint Security Indonesia, Bandung Regional Planning Agency (Bapeda), Department of Transportation Bandar Lampung, Department of Transportation Bandung, Bstart-up, Southeast Asian ministers of Education organization, Ministry of Education and Culture, Consortium of IoT, Komite Ekonomi dan Industri Nasional Republik Indonesia (KEIN), Badan Ekonomi Kreatif (BEKRAF) and others

Services

1. Research on ICT applications
2. Industrial collaboration
3. Consultation
4. Start-up incubation

Coaching Experience

The past few years PPTIK has gained experience in nurturing several start-up candidates, such as Lentera Nusantara, PT. Anargya, etc.

Achievements

The start-up candidates coached by PPTIK ITB received several awards at national and international level, such as INAICTA, APICTA, Indonesia Innovations and Innovators Expo (I3E), Kemenristekdikti, and others.

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Research Center for Infrastructure and Regional Development

Website: www.ppiw.itb.ac.id

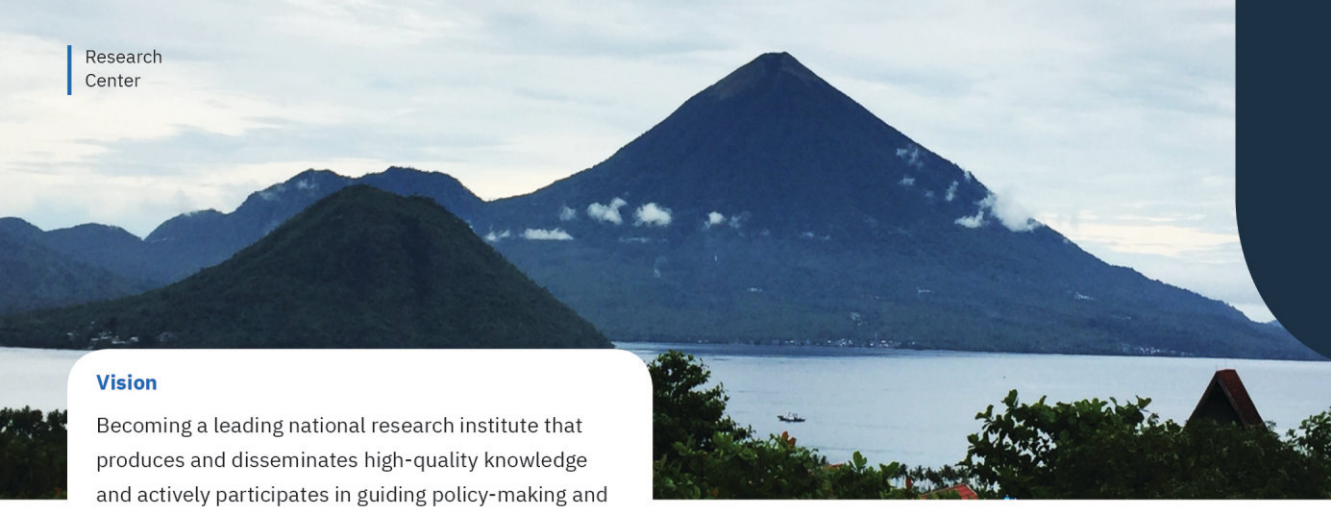
The Research Center for Infrastructure and Regional Development (PPIK) is coordinated by the Institute for Research and Community Services of ITB. PPIK was established to address national challenges on infrastructure and regional development and to contribute to knowledge-building by integrating infrastructure and regional development in order to meet the challenges of Indonesia's centennial independence celebration in 2045.

As a research center, PPIK attempts to bring together researchers by eliminating institutional barriers to enable cross-institutional and interdisciplinary collaboration in the fields of infrastructure and regional development. PPIK is home to nearly 30 lecturers and researchers with diverse skills, interests, and experience. The members come from various backgrounds related to the built environment, such as civil and environmental engineering, regional and city planning, and architecture. In 2018, the members are involved in integrated research and projects on smart river management in the Citarum watershed. Other ongoing research projects include large-scale land development, megaproject planning, transit-oriented development, smart cities, and creative cities.

There are three research clusters in PPIK. The first cluster, Mega-urban Infrastructure, focuses on mega-urbanization and infrastructure development, integrated urban transportation management, metropolitan management, and new-town development. The second cluster, Rural and Coastal Development, concentrates on creative groups, agrarian reform, local capacity and productivity, and basic services. The third cluster, Watershed management, focuses on water engineering, physical change, spatial restructuring, and institutional development.

PPIK consistently produces and disseminates knowledge through various media such as journals and seminars both at national and global level. PPIK is involved in formulating regional and infrastructure development policies for both central and local governments. PPIK has established collaborations with a number of selected international and national institutions, as well as local governments in Indonesia. PPIK is also committed to strengthening the capacity of practitioners and government officers by conducting trainings on subjects such as zoning regulations, metropolitan management and environmental planning.



Vision

Becoming a leading national research institute that produces and disseminates high-quality knowledge and actively participates in guiding policy-making and promotes integrated and sustainable regional and infrastructure development.

Mission

1. To conduct basic, applied and action research on infrastructure and regional development, and to communicate the results to various interested parties.
2. To contribute to addressing national and regional issues through research-based infrastructure and regional development technology and policies.
3. To strengthen the capacity of governments and communities in infrastructure and regional development planning.

"PPIK is a catalyst for Indonesia's development, especially in celebrating the centenary of Indonesia's independence in 2045."

Programs

1. **Innovative and Synergetic Research:** We have a long tradition of research in most aspects of infrastructure and regional development. The interests and contributions of the group are quite diverse with researches over the previous years in management of mega-urban and urban infrastructure; development of rural and coastal areas; and watershed management. Currently, there is a strong focus on Smart River Management.
2. **Informative Reference Data and Information:** We recognize that the role of data is increasingly important in promoting the development of the nation. In addition, we are also aware that data and information in Indonesia, especially related to infrastructure and regional development have not been available in an integrated manner. We are committed to provide data and information on infrastructure and regional development that are not only up-to-date but also complete and informative.
3. **Community Services:** We attempt to apply our research results and our knowledge to solve the problems of infrastructure and regional development in Indonesia, so our hard work will give real benefits to people's lives. Related to this matter, PPIK is involved in formulating regional and infrastructure development policies for both central and local governments.
4. **Training for Practitioners, Local Government, and Society:** We feel obligated to diffuse our knowledge to relevant stakeholders so that the achievement of Indonesia's glory in 2045 will be supported by adequate human resources. We are committed to strengthen the capacity of practitioners and government officers by conducting trainings.

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Research Center for New and Renewable Energy

Website : www.ppebt.lppm.itb.ac.id

The Research Center for New and Renewable Energy (PPEBT-ITB) is an organization under the Institute for Research and Community Services (LPPM) ITB, which aims to play an active role in complying with new and renewable energy (NRE) challenges in Indonesia. PPEBT-ITB hopes to become the leading NRE research center in Indonesia by synergizing all ITB research potential in producing NRE technology, providing direction for EBT technology development, and producing and providing real NRE technologies for the nation's benefit,

Research Focus

PPEBT-ITB research covers all NRE technology and its applications, including the utilization of water energy, wind energy, biomass energy, coal upgrading, solar photo voltaic, biofuels, geothermal energy production, organic Rankine cycles, smart grids, etc.

Vision

PPEBT-ITB's vision has the ambition to become the leading new and renewable energy research center in Indonesia.

Mission

PPEBT-ITB's mission is to synergize all ITB researches in the new and renewable energy field; to prepare research directions for developing new and renewable energy technologies in Indonesia; to produce and prepare new and sustainable energy technologies that can be utilized in Indonesia.

Research Roadmap

Various researches on alternative energy sources such as hydro, wind, solar, biomass and biofuel, have been done in the PPEBT-ITB laboratory, such as laboratory scale experiments, prototypes for fuel production, and produced energy that can enter the electrical grid. In 2017, PPEBT intends to combine several research results to create an energy-independent place that is sourced from various renewable energy sources and has the potential to be developed into a small-grid prototype that can be connected to the national electricity grid (see figure 1).

The small-grid scheme for various renewable energy sources (sun, wind, biomass, gasification, hydro) is expected to increase energy resistance and has low CO2 emissions. This model needs to be further developed considering Indonesia has various renewable energy potentials.

Figure 1 Small grid from various new and renewable energy sources with on/off grid system

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Research Center for Disaster Mitigation

Website : www.ppmb.itb.ac.id

At Glance

The Research Center for Disaster Mitigation (RCDM), established in 2011, is a research center under the scheme of the Institute for Research and Community Services ITB. RCDM aims to play a significant role in disaster mitigation at national, regional and international levels by conducting and promoting fundamental and applied researches on disaster management and mitigation as well as other relevant mitigation initiatives with the support of national and international organizations. The center has the obligation to respond to the national need in reducing disaster impact and to institutionalize and sustain the research activities related to disaster mitigation done by ITB over the past twenty years.

ITB's original Research Group on Disaster Mitigation was established in January 2003. In 2005, the research group was transformed into the Center for Disaster Mitigation. Due to the nationwide increase of the disaster mitigation problem, in 2011, the center was expanded into the Research Center for Disaster Mitigation with a wider authority and responsibility under the policy of ITB in response to the nationwide challenges in disaster mitigation.

RCDM is expected to conduct fundamental and applied researches in disaster mitigation and to overcome challenges in urban, rural, regional and national development by supporting the development of strategic policies and legal mechanisms, to identify and analyze disaster impacts, to disseminate and transfer knowledge and skills through trainings, workshops, seminars and community-based action research activities.

Vision

To become an excellent and highly respected research center that enhances innovation in disaster mitigation at local, national, regional and international levels, as well as contributing significantly to delivering safer communities in Indonesia by reducing disaster risks.

Mission

1. To deliver a safer community and stakeholders who are aware, responsive and able to overcome potential natural and man-made disasters.
2. To enhance fundamental and applied research activities that are able to anticipate, respond to and mitigate disaster risks.
3. To promote fundamental and applied research results that can strengthen policy development in disaster management in order to achieve sustainable development.
4. To support the formation of disaster-mitigation expert communities in Indonesia through education.

Scope of Work

1. Education – Enhancing the expertise of disaster mitigation through research-based post-graduate programs, collaboration with Graduate Research on Earthquake and Active Tectonics ITB, ASEAN Alliance universities, Kyoto University, and Indonesian government agencies (National Disaster Management Agency, Agency of Meteorology, Climatology and Geophysics, Ministry of Public Works, Ministry of Energy and Natural Resources, Ministry of Research and Technology, National Planning Agency, and Indonesian Research Institute).
2. Research – Promoting and strengthening innovative, fundamental and applied research activities in disaster mitigation.
3. Community services – Serving the community through stimulating, educating, and facilitating related institutions and communities at national and regional levels in order to achieve comprehensive disaster-risk mitigation, information dissemination, and transferring knowledge and technical skills.

Basis Capital

- ITB senior researchers
- Relevant track record and networks
- Research agenda of research group ITB
- In line with disaster management program
- Laboratory/software/library

Network and Collaboration

Network

RCDM is part of several networks with private and government institutions at local, national and international levels. The list of institutions is as follows:

Local and national institutions

- Kementrian Riset dan Teknologi
- Kementrian Energi dan Sumber Daya Mineral, PVMBG (Pusat Vulkanologi dan Mitigasi Bencana Geologi-Badan Geologi)
- Kementrian Pekerjaan Umum dan Perumahan Rakyat, Puskim (Pusat Penelitian dan Pengembangan Teknologi Pemukiman)

Roadmap

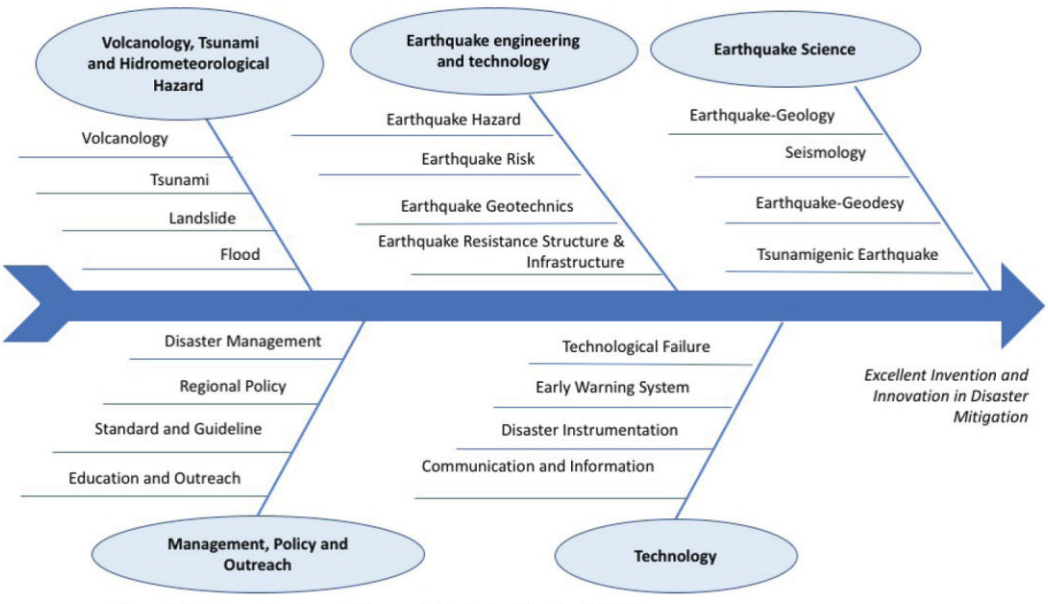

Figure 1. Fishbone Roadmap of Research Center for Disaster Mitigation.

- Kementrian Pekerjaan Umum dan Perumahan Rakyat, Puslitbang Sumber Daya Air
- Kementrian Pekerjaan Umum dan Perumahan Rakyat, Puslitbang Jalan dan Jembatan
- Kementrian Pekerjaan Umum dan Perumahan Rakyat, PUSGEN (Pusat Studi Gempa Nasional)
- Kementrian Koordinator Bidang Pemberdayaan Masyarakat dan Kebudayaan
- Kementrian Pendidikan dan Kebudayaan
- Kementrian Agraria dan Tata Ruang
- Kementrian Koordinator Bidang Perekonomian
- Kementrian Keuangan
- Kementrian Desa, Transmigrasi dan Daerah Tertinggal
- Kementrian Koordinator Maritim
- BAPPENAS (Badan Perencanaan dan Pembangunan Nasional)
- BNPB (Badan Nasional Penanggulangan Bencana)
- BMKG (Badan Meteorologi, Klimatologi dan Geofisika)
- BIG (Badan Informasi Geospasial)
- BPPT (Badan Pengkajian dan Penerapan Teknologi)
- Puslit Geotek LIPI
- IABI (Ikatan Ahli Bencana Indonesia)
- HATTI (Himpunan Ahli Teknik Tanah Indonesia)
- HAKI (Himpunan Ahli Konstruksi Indonesia)
- U-INSPIRE (Youth and Young Professionals on Innovation in Science and Technology
- FPT-PRB (Forum Perguruan Tinggi Pengurangan Risiko Bencana)
- BAPPEDA (Badan Perencanaan Pembangunan Daerah) Jabar dan Kota Bandung
- F-PRB Provinsi Jawa Barat (Forum Pengurangan Risiko Bencana Jabar)
- BPBD Provinsi Jawa Barat, Jawa Tengah, Jawa Timur, Sulawesi Tenggata, Maluku, Maluku Utara, Papua, Papua Barat, Sumatera Barat
- BPBD Kabupaten Bandung Barat, Kabupaten Bandung
- Dinas Kebakaran dan Penanggulangan Bencana Kota Bandung
- Dinas Pekerjaan Umum Provinsi DKI Jakarta
- Etc.

Overseas institutions

- United Nations Development Programme (UNDP)
- United Nations Volunteers (UNV)
- United Nations Educational, Scientific, and Culture Organization (UNESCO)
- Global Earthquake Model (GEM)
- USGS (United States Geological Survey)
- IAEA (International Atomic Energy Agency), Vienna
- IAEE (International Association for Earthquake Engineering)
- US Agency for International Development (USAID)
- IO-TEWS (Indian Ocean Tsunami Early Warning System)
- Mercy Corps
- ASEAN Secretariat
- ASEAN Coordinating Centre for Humanitarian Assistance on Disaster Management (AHA Center)
- ASEAN Safe School Initiative (ASSI)
- Asia Pacific Alliance for Disaster Management (APADM)
- Asia Pacific Rim University (APRU)
- International Federation of Red Cross and Red Crescent Societies (IFRC)
- Southeast Asia Disaster Prevention Research Institute (SEADRI- UKM)
- Australia National University (ANU)
- Massachusetts Institute of Technology (MIT)
- Tokyo University, Japan
- Kyoto University, Japan
- Nagoya University, Japan
- Tohoku University, Japan
- Kagawa University, Japan
- Ministry of Youth and Sports Malaysia (KBS)
- Universiti Kebangsaan Malaysia (UKM)
- Etc.

Prominent collaborative researches

Collaborative researches condected by RCDM among others are:

a. **Center of Excellence program from Ministry of Research and Higher Education: Center of Excellence for Earthquake in Science and Technology**
RCDM is designated as the host for the national center of excellence (PUI-PT) for Earthquake Science and Technology by the Indonesian Ministry of Research, Technology, and Higher Education. This grant has been awarded from March 2019.

b. **National Center for Earthquake Studies (PuSGeN), Ministry of Public Work and Housing**
RCDM is one of the initiators as well as the lead research coordinator for the National Center for Earthquake Studies (Pusat Studi Gempa Nasional / PuSGeN), establish in 2016 under the Ministry of Public Works and Housing. PuSGeN consists of prominent earthquake scientists, researchers and engineers in Indonesia of about 70 members, with 3 primary focus: continuous updating on National Earthquake Sources and Hazard Map, assessment on significant damaging earthquakes in Indonesia, and dissemination on recent earthquake knowledge and mitigation effort.

c. **University Forum for Disaster Risk Reduction (UF-DRR)**
RCDM actively involved since its initiation in UF-DRR. The forum serves as a leading organization on DRR reduction efforts among universities in Indonesia. UF-DRR was formed on November 11th, 2008 in Jakarta with support from UNDP and BNPB, with the first head from RCDM ITB. It works on 3 focus area: (1) Capacity building, (2) Academic excellence, and (3) Advocacy. UF-DRR has recently launched Disaster Resilience University. UF-DRR together with Ministry of Higher Education and BNPB has launch Disaster Resilience University (DRU) Program on 25 January 2019 to be implemented widely in Indonesia. RCDM is currently assigned in the structure organization as partnership and networking division. RCDM also becomes a leading institution for UF-DRR in running the TATTs program that strengthening local universities in 8 (eight) provinces. Many products have been developed through this program.

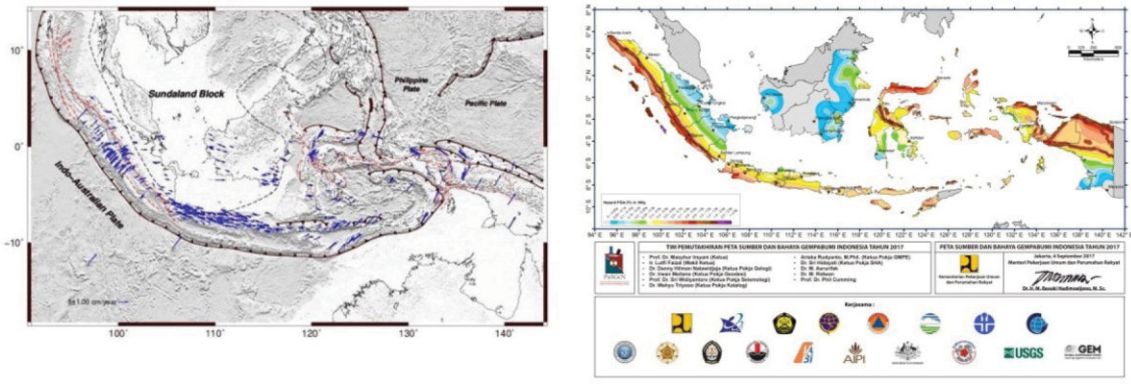

Figure 2. New updated Indonesian tectonic map (left) and New Updated Earthquake Hazard Map Indonesia (Right) (PuSGeN, 2018)

Figure 3. Published book on the Earthquake Source and Hazard Map 2017 and assessment on recent significant earthquake in Indonesia in collaboration with PuSGeN.

Output/Products and Achievement

RCDM has produced many products and achieved several outcomes. The products of RCDM were in the form of hazard maps, vulnerability maps, risk maps, technical guideline, policy brief and many others. The current products of RCDM ITB was Earthquake Zoning Map Indonesia (figure 2), which become input for defining standard of building code in Indonesia. RCDM has also collaborated with several organizations and produced scientific publications in journals and conference/seminar proceedings. RCDM's output and products are achievement for RCDM and support in increasing credibility of RCDM and obtaining trust from various institutions in both national and international level. RDCM also actively conduct outreach, research dissemination, education and training, such as DRC program (Disaster Resilient Country) and the ASEAN Youth Volunteer Program (AYVP) 2017. These achievements would be expected to make RCDM sustain and obtain more supports from ITB and various national and international institutions/ organizations.

Figure 4. Development of National Standard on Design Codes for Geotechnique and Earthquake, and National Standard on Earthquake Resistant Structure and Infrastructure.

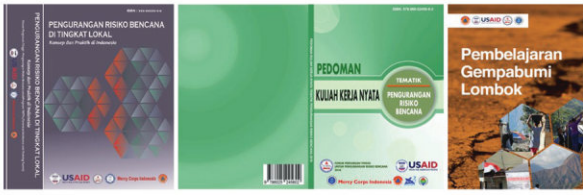

Figure 5. Product collaboration with UF-DRR during TATTs Program.

Figure 6. Product on outreach and education material.

Several products for Policy and planning development include:

a. Development of Earthquake Mitigation Masterplan (2012)
b. Establishing the National Center for Earthquake Studies (2016)
c. Development of National Movement for Di saster Risk Reduction Model (2017)
d. Developing National Design Codes for Geo-technique and Earthquake (2016)
e. Developing updating of National Earthquake Source and Hazard Map (2010 & 2017)
f. Revision and Updating of seismic resistance design codes for Buildings (2012), for Bridges (2015), for Dams (2016), and others
g. Contribution on the National Masterplan for Disaster Management (RIPB) 2045 for Earthquake chapter (2018)
h. Development of Blue Print West Java Resilience Culture Province 2019-2024
i. Development of Guideline on Disaster Mitigation for Special Economic Zone of Indonesia

Figure 7. International Collaboration.

Figure 8. Education and outreach programs.

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Laboratories

Enhanced Oil Recovery (EOR) Laboratory

Enhanced Oil Recovery (EOR) Laboratory is part of Faculty of Mining and Petroleum Engineering (Fakultas Teknik Pertambangan dan Perminyakan), Institute Technology Bandung that focused on research and study in Enhanced Oil Recovery topics, specifically chemical injection. Founded in 2012 by Prof. Taufan Marhaendrajana, the laboratory has accommodated various studies to respond the growing interest of the application of chemical products in upstream petroleum industry, especially for enhanced oil recovery. EOR Laboratory has collaborated with numerous other parties including Pertamina EP for surfactant and polymer flooding, Elnusa Petrofin and PT SEPP for surfactant huff-and-puff stimulation, MEDCO and OPPINET ITB for flow assurance, polymer water blocking and water shut-off as well as various research topics about EOR with OGRINDO ITB.

Figure 1. Laboratory Activity (Rheology).

Laboratory study for surfactant-polymer flooding focused more on surfactant-polymer characterization using methodology that consists of step-by-step approach where, starting from hundreds of possible formulations from commercial market, it progressively delivers the best solutions for oil recovery in terms of technical compatibility and economic efficiency. Various instruments are involved including Brookfield DV3T rheometer, TX 5000D spinning drop tensiometer, attension contact angle, and densitometer to identify the best formulation. The most promising formulation is then evaluated using coreflood experiment at reservoir conditions, as well as additional experiments to assess the sensitivity of uncertain parameters and data collection for numerical simulation inputs. Integrated study using numerical simulation for both core-scale and reservoir model are also conducted to further assist the design of a successful field trial (or pilot) injection.

With access to broad range of raw materials and commercial surfactant suppliers which have developed a large set of proprietary industrially scalable product for EOR application, EOR Laboratory collaborating with PT LAPI ITB launched MENOR surfactant and commercially produced to adapt to the targeted reservoir. In 2017, a MENOR surfactant field trial in a sandstone reservoir bearing light waxy oil was implemented in Indonesia. The field trial has exceeded its expectation and large scale commercial deployment is currently under study.

Continuously researching new surfactants and expanding its portfolio, EOR Laboratory has also developed and synthesized new MENOR surfactant family, an amphoteric sulfonate alkyl ester (SAE) surfactant, a non-ionic surfactant FE-18, and their various combinations. With promising surfactant characteristics and oil recovery obtained in laboratory scale, road map to industrial scalability is currently under study prior to any field implementations.

In addition to research and study focused on industrial applications mentioned above, EOR Laboratory also assist on academic researches (i.e bachelor, master and doctoral thesis), especially but not limited to enhanced oil recovery topics in Petroleum Engineering environments. Numerous researches in EOR topics has been published in international journals and presented in conferences at national and international scale.

Figure 2. MENOR Product (Field).

Figure 3. MENOR Product (Lab)

Bukalapak – ITB Innovation Center

Established on 1 February 2019. The center consists of two laboratories: Artificial Intelligence Laboratory and Cloud Computing Lab.

The laboratories facilitate research on the following topics: Big Data Analytics, Computer Vision, Image Processing, Natural Language Processing, Product Recommendation, User Scoring, Data Mining, Grid Computation, Virtualization, Distributed Computation, NoSQL Databases, and Internet of Things.

Honeywell Control Laboratory Profile (Electrical Engineering Basic Laboratory 05)

Honeywell Control Laboratory was inaugurated on December 1st, 2016 by the President of Honeywell Indonesia, Allex Pollack, the President of Bandung Institute of Technology (ITB) Prof. Dr. Ir. Kadarsyah Suryadi, and the Dean of School of Electrical Engineering and Informatics (SEEI ITB) Dr. Ir. Jaka Sembiring. This laboratory is intended for students to learn industrial process control and other related fields that support Industry 4.0. Various facility available in this lab are a full set of Mini Refinery Plant (provided by Honeywell) and a Process Instrumentation Trainer that has belonged to Control System and Computer Laboratory since 2010. Both are currently equipped with an Experion Process Knowledge System - a Distributed Control System which employs a C300 controller as its main controller.

Figure 1. Exchange Students Activity (GIFU College Japan)

Ever since the beginning of its operation, this laboratory has become a residency laboratory for undergraduate students in senior year who are doing their Final Project (Capstone Design) and graduate students who are doing their Thesis research or other research activities related to Cyber-Physical System. Since 2017, there have been 4 graduate students who have published their papers to various international seminar/symposium, 11 undergraduate students who have completed their Capstone Design Final Project, and currently, there are 4 graduate students who are doing research for their thesis in Honeywell Control Laboratory. Common topics for research held in this laboratory are Cyber Security, Sensor and Instrumentation, Virtual Reality, and Advanced Control method for Industrial Process. Besides research activities, there are also laboratory experiment activities for undergraduate students, as a part of the compulsory subject EL3015 Control System. The laboratory experiment is intended to familiarize students with industrial process control. Until April 2019, 5 laboratory experimental period have conducted, with 60-150 students participated in each period. Furthermore, in 2017 and 2018 there has been additional residents in this laboratory, 7 exchange students from GIFU College Japan and KMUTT Thailand. Activities for exchange students included learning and doing research about sensors, instrumentations, and process control.

For future plans, besides all the research and laboratory experiment activities that already proceed, a program to allow general public access to Honeywell Control Laboratory facilities, so more academician and students will be benefited from this laboratory, has already been initiated this year. A training program for young professionals and students from other universities to learn more about Advanced Control Method is being arranged to cover both fundamental concepts and its practical implementation. The program is expected to bring a significant contribution to improving the national quality of human resources in the control system and industrial process field.

Figure 2. Undergraduate Students Laboratory Activities.

Figure 3. Instrument Calibration for Cyber-Physical System Research and Thesis (Graduate Student Activities).

The "Selaawi" Field Laboratory

Kawasan Industri Bambu Kreatif, PP PBL-LPPM ITB and Yayasan Selaawi Raksa Mandiri

The Selaawi Sub-district of Garut regency is considerably a unique area, along with the abundance of bamboo plants; Selaawi is a toponymic name stands for the in-between bamboo clumps. The sub-district consisted of seven villages with various potential of bamboo product development. There are two villages are specialized as bamboo raw material suppliers, and the other five villages are set up for bamboo material preparation and final production purpose. This framework is specially designed by local community to promote the vision of Garut regency towards Selaawi as a Creative Bamboo Industrial Zone.

The bamboo products produced by Selaawi crafts people are quite diverse, ranging from kitchenware woven products to home décor, and for the most iconic and commercialized one is the bird cage (Sangkar Burung) that receive popularity for its technique and its fine work. The bird cage of Selaawi becomes the most favorable craft product that have spread throughout Indonesia.

Currently, it has been about 10 years that Selaawi craftspeople have collaborated with students and lecturers of the Product Design ITB. This partnership appears has created a learning environment as an academic bridge between university and village in applying lecture assignments or studies that utilize bamboo material as the central point. From this collaboration, there have been a number of researches and product development carried out and gives benefit for students from undergraduate to doctoral levels.

Bamboo is a future material, known for its rapid growth, various species, and its beauty character. The diversity and potential of bamboo utilization is an opportunity for students, lecturers or researchers to possibly developing more creative products or further conducting research on bamboo design. This opportunity was realized by the local government (sub-district) where they finally made an agreement with ITB to set up a Field Laboratory as an academic research facility for those who interested in bamboo design development.

The "Selaawi" field laboratory is collaboration between the Sela Awi Raksa Mandiri Foundation, LPPM ITB and the local government of Selaawi.

Figure 1. Crafts made from Bamboo.

Figure 2. Lab activities.

Resources, Directory of Research, Innovation and Partnership

Research Groups

No.	Units
1	Geodesy
2	Geodinamic and Sedimentology
3	Apllied Geology
4	Remote Sensing & Geographical Information Sciences
5	Oceanography
6	Paleontology and Quaternary Geology
7	Petrology, Volcanology, and Geochemistry
8	Coastal, Marine and Maritime Engineering
9	Atmospheric Sciences
10	Surveying and Cadastre
11	Algebra
12	Analysis and Geometry
13	Astronomy
14	Biochemistry
15	Physics of Complex System
16	Physics of Magneticsm and Photonics
17	Physics of Electronic Materials
18	Nuclear Physics and Biophysics
19	Theoretical High Energy Physics and Instrumentation
20	Analytical Chemistry
21	Inorganic and Physical Chemistry
22	Organic Chemistry
23	Industrial and Financial Mathematics
24	Combinatorial Mathematics
25	Statistics
26	Aesthetics and The Science of Art
27	Design Science and Visual Culture Sciences
28	Humanity Science
29	Visual Communication and Multimedia
30	Craft and Tradition
31	Industrial Design
32	Human and Interior
33	Visual Art
34	Energy and Chemical Engineering Processing System
35	Ergonomics, Work Engineering and Work Safety
36	Building Physics
37	Instrumentation and Control
38	Industrial Management
39	Advanced Functional Material
40	Chemical Engineering Product Design and Development
41	Chemical Engineering Process Design and Development
42	Industrial System and Techno-Economics
43	Information and Decision Systems
44	Manufacturing Systems
45	Engineering Physics
46	Biomass and Food Processing Technology
47	Chemical Reaction Technology and Catalysts
48	Design, Operation and Maintenance of Aircraft
49	Flight Physics
50	Materials Science and Engineering
51	Energy Conversion
52	Mechanical Design
53	Lightweight Structure
54	Mechanical Engineering and Production
55	Construction Engineering and Management

No.	Units
56	Air And Waste Management
57	Water & Wastewater Engineering
58	Geotechnical Engineering
59	Structural Engineering
60	Transportation Engineering
61	Offshore Engineering
62	Coastal Engineering
63	Water Resources Engineering
64	Environmental Management Technology
65	Earth Resources Exploration
66	Global Geophysical
67	Applied Geophysics and Exploration
68	Geothermal
69	Exploration and Engineering Seismology
70	Metallurgy Engineering
71	Drilling Engineering, Production, Oil & Gas Man
72	Mining Engineering
73	Reservoir Engineering
74	Policy Planning and Development Management
75	Architectural Design
76	Urban Planning and Design
77	Regional and Rural Planning
78	Housing and Human Settlement
79	Architectural History, Theory and Criticism
80	Economic Systems and Modeling
81	Regional and Urban Infrastructure System
82	Building Technology
83	Entrepreneurship and Technology Management
84	Human and Knowledge Management
85	Operations and Performance Management
86	Decision Making and Strategic Negotiations
87	Business and Financial Risks
88	Business and Marketing Strategy
89	Biology Pharmacy
90	Pharmacochemistry
91	Pharmacology-Clinical Pharmacy
92	Pharmaceutics
93	Sports Science
94	Agrotechnology and Bioproduct Engineering
95	Microbial Biotechnology
96	Ecology
97	Animal Physiology and Developmental Biology and Biomedical Sciences
98	Genetics and Molecular Biotechnology
99	Biological Resources Management
100	Plant Sciences and Biotechnology
101	Forestry Technology
102	Electronics Engineering
103	Informatics
104	Software Engineering and Data
105	**Control System and Computer**
106	Biomedical Engineering
107	Power Engineering
108	Computer Engineering
109	Telecommunication Engineering
110	Information Technology

Faculty and School

No.	Units
1	*Faculty of Earth Sciences and Technology*
2	*Faculty of Mathematics and Natural Sciences*
3	*Faculty of Art and Design*
4	*Faculty of Mechanical and Aerospace Engineering*
5	*Faculty of Mining and Petroleum Engineering*
6	*Faculty of Civil and Environmental Engineering*
7	*Faculty of Industrial Technology*
8	*School of Architecture, Planning, and Policy Development*
9	*School of Business and Management*
10	*School of Pharmacy*
11	*School of Life Sciences and Technology*
12	*School of Electrical Engineering and Informatics*
13	*Graduate School*

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*

Center

No.	Units
1	*Center for Industrial Engineering*
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 Develoment*
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 Agrarian Studies*
20	*Center for Sustainable Transportation Technology Development*
21	*Center for Defense and Security Technology*
22	*ITB Halal Center*
23	*Center for Catalysis Engineering (CaRE)*
24	*Smart City and Community Innovation Center*
25	*Artificial Intelligence Center*

National Center of Excellence in Science and Technology

No.	Units
1	*National Center of Excellence for Broadband Wireless Access*
2	*National Center of Excellence for Defence and Security Technology*
3	*National Center of Excellence for Sustainable Transportation Technology*
4	*National Center of Excellence for Nanoscience and Nanotechnology*
5	*National Center of Excellence for Carbon Capture Storage*

WRRIM-ITB

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Innovation and Partnership
http://wrrim.itb.ac.id

LPPM-ITB

Institute for Research and
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LPIK-ITB

Institute of Innovation and
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DKHI-ITB

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