About the 4th International Conference on Eco Engineering Development 2020

The International Conference on Eco Engineering Development (ICEED) is an annual conference conducted by the Faculty of Engineering, Bina Nusantara University since 2017. The previous conferences were conducted successfully, and all the accepted papers have been published in this IOP EES conference proceeding. This conference was essentially the media for our faculty members and the academician and researcher outside our university to publish their research.

This 4th International Conference on Eco Engineering Development was conducted virtually. It was finally decided since there were several restrictions in Indonesia and also around the globe due to the development of the Covid-19 pandemic: such as traveling, social distancing, and crowds. Therefore, the online seminar can ensure a safe environment for all the participants. The conference ought to be conducted sincerere search activities were still going in this pandemic situation even though several on site activity might not be conducted. Therefore, the 4th ICEED 2020 was held on the scheduled date virtually.

The online conference was held at 10th and 11th November 2021, and it was operated centrally from Binus Syahdan Campus, Kemanggisan, Jakarta. The Day 1 was an open public seminar that consists of the opening ceremony and opened by the Dean of the Faculty of Engineering, Bina Nusantara University, followed by the opening speech given by the Vice Rector of Research and Technology Transfer, the Director of South East Asian Ministry of Education Organization (SEAMEO) and the President of Indonesian Institute of Architects. Subsequently, there were 6 (six) keynotes speakers in this public seminar, and the Day 2 was a fully parallel session.

The online seminar used Zoom as the platform with the capacity of 1000 participants. In the Day 1, we used only the main room (without any breakout room). At the Day 2, there were 14 (fourteen) breakout rooms to facilitate the presentation from each author. Each breakout room was guided by a moderator and a co-host, so there are 14 moderators and 14 co-hosts to manage the breakout rooms and the presentation. Each author had maximum 10 minutes for a presentation, using a self-produced pre-recorded video. This was to avoid excessive time and any issues because of the internet connection. The Question & Answer (Q&A) session was held after the presentation. There were 3 (three) sessions in each breakout room and there were 5 (five) presentations at each session. The Q&A session was conducted after all the presenters finished their presentation. In addition, several questions can also be provided to the presenter via the chat feature of Zoom platform.

The two days conference participants were from Indonesia, such as Jakarta, West Java, and Central Java. The foreign participants were from Saudi Arabia, Malaysia, Vietnam, Singapore, Hongkong, Bangkok, Australia, and Philippines. The overall participants on day 1 were around 290 participants, and on Day 2 were about 140 participants. The participants on Day 2 were mostly the presenters and the authors.

In conclusion, The fourth International Conference on Eco Engineering Development was successfully conducted without any error. The schedule ran as planned.
PREFACE

The 4th International Conference on Eco Engineering Development (ICEED) 2020 was conducted at 10th and 11th November 2020 and held by Binus Faculty of Engineering. Since this conference was held in the middle of the Covid 19 Pandemic, therefore, the conference was conducted online. The conference went successfully.

The scientific program of this conference took the theme of “Eco engineering, technology, planning and design for sustainable built environment and living” as to respond to the challenge of the 20th century, particularly on the method, technology and the usage of natural resources for any kind of development. Sustainable in built environment is one of the sustainable goals that the United Nations (UN) appointed to be achieved, and sustainable living is the way to embark.

Sustainable living means an attempt to reduce the ecological footprint on the use of natural resources which can be carried out by ensuring the relation of living organisms to one another and to their physical surroundings. This relation is essentially necessary as the principle of thinking for the development of engineering and the improvement of technology in all fields, as well as planning and design for a built environment.

The parallel session contains the following topics:
- Sustainable Infrastructure and Transportation, Energy, Water and Renewable Energy
- Sustainable Industry and Green Manufacturing
- Sustainable Architecture
- Integrated of Smart Computing and Communication
- Green Food Technology

The conference was conducted in two days, the first day presented 6 (six) Keynote Speakers from local and International Universities and International Research Centers. The second day was full with 10 (ten) zoom rooms of parallel sessions that had about 261 papers that included the six topics. The participants came from 6 different countries.

I would like to express deep gratitude to all the authors that had contributed their papers in this conference, as well as all the keynote speakers, general participants, all reviewers for well contributions and supports. I would also like to thank the IOP Publishing for the support to the publication of our conference. I also would like to thank all the members of the organizing committee for the hard work and team work so that this conference could go successfully.

Lastly, I believe this proceeding would be beneficial for the development of eco engineering knowledge even though we are now in the pandemic Covid 19 situation.

Religiana Hendarti, Ph.D,IAI
Bina Nusantara University, Indonesia
ICEED 2020 Conference Chair
WELCOME SPEECH

First of all, on behalf of the organizing committee of ICEED 2017, I would like to welcome all the participants, authors, as well as the Keynote speakers at this online conference. The conference, unfortunately, should be conducted online since the pandemic of Covid 19. However, we are thankful that the conference finally can be conducted and received quite a lot papers from the academician include students and practitioners.

It is an honor for Engineering Faculty Bina Nusantara University to be the host and the organizer of this event and I also would like to thank all the co-host that has supported to this conference.

The topic of this ICEED 2020 is inline with the development of industry and the need of sustainable environment and living. Nowadays, this theme is actually become a challenges for the researchers, scientists as well as engineering professionals. The trend of Industry 4.0 such as the Internet of Things, big data until its manufacturing trend cannot be separated with the living of human. Sustainable living and environment may now have changes with this industry. Everything can be connected through internet and also can be monitored through sensors can be resulted in a new paradigm. Additionally, the natural resources and the human aspect will also be highlighted in this conference.

I would also like to give my appreciation the conference organizers, all of reviewers, as well as the authors for their contribution and making the event of ICEED 2020 successful. We also greatly acknowledge our publishing partner, IOP Publishing, for their collaborative support in publishing the conference proceedings.

Dr. Ir. John Fredy Bobby Saragih, M.Si
Bina Nusantara University, Indonesia
ICEED 2017 General Chair

WELCOME SPEECH

International Conference on Eco Engineering Development is one of our best achievement for Binus University, therefore, it is an honor for Engineering Faculty become the organizer of ICEED 2020. On behalf of our Rector, as Vice Rector of Research and Technolog Transfer, I underline that this conference is one our main conferences that has produced many best papers as the results of the growing awarenss and motiviation of the our faculty member to share knowledge with practitioners, researchers, and community towards that inline with the topics of the ICEED 2020. Also, I believe this event will be rich with the appreciation of the participants and hopefully this event will be held again next year and become an annual meeting for discussing and share the updated research, especially in this pandemic Covid 19 situation, the conference still conducted eventhough in online platform. Indeed, I hope all of you will enjoy the experience on an online conference.

Prof. Tirta Nugraha Mursitama, S.Sos., M.M., Ph.D.
Bina Nusantara University, Indonesia
Vice Rector Research & Technology Transfer, BINUS University
Opening Speech 1

Dr Ethel Agnes Pascua-Valenzuela
Director of Southeast Asian Ministers of Education Organization Secretariat (SEAMEO Secretariat)

To the officials and staff of the host Binus University, to the co-host department of civil engineering University of Indonesia, SEAMEOBiotrop, Association of Indonesia hydraulics engineers, Indonesia Institute of Architecture, International Building Performance Simulation Association of Singapore and to the participants a very good morning to all of us. It is an honor for me to be speaking in front of you today although virtual, at the 4th ICEED 2020 with the theme of echo engineering technology planning and design for sustainable living and environment. SEAMEO stands up with all of you in innovating to ensure that interventions are in place to achieve sustainable living environment and sustainable development goals. But this Covid-19 pandemic forced everyone to make a long and hard look and reflect on the way we do things. Keeping in mind the most efficient and effective way of protecting our environment. How do we design the future given the increasingly different environment that we are in. What engineering marvels shall we employ in designing building and structures given the most complex environment that we face especially during natural disaster. I am sure that speakers from all over the world in this ICEED 2020 will have appropriate solutions and I sincerely believe that we will all learn from them from all of us here in SEAMED headquarters in Bangkok and our 26 centers. I wish everyone a day full of learning. Thank you very much and have a good morning.

Opening Speech 2

Ketut Rana Wiarcha, IAI
President of Indonesian Indonesian Institute of Architects

Thank you for all moderators. Good morning to the Mr. and Mrs. who had the opportunity to attend this morning. What I honor Mr. Counselor of Binus University, Professor Tirtanugraha Muritama Phd, what I respect Mr. Dean of the Faculty of Engineering, Dr. Bob Saragih master of science, what I respect Mrs. Chairman Religiana Hendarti Phd, IAI as well as attendance whom I respect all. What an extraordinary event that was held at the international conference on eco engineering development ICEED 2020 to coincide 2020. Hari Pahlawan means National Heroes Day in Indonesia, in order to welcome future development it is also necessary to prepare professional readiness especiallt in the field of the architecture considering that scientific competence as a basic profession has been mastered and equals to all the universities in the Asian region then how can we compete and synergize in professional practice on the Asian single market as one of the commitment between countries as outlined in the Asian MLA mutual recognition arrangement the most crucial point to the realm of the single Asian market is the problem of mobility cross-border practice which is called the registered foreign architect this is our homework for all of the Asian member states, so we have to prepare that to increase our profession and appose to increase our economic growth around Asia. Thank you very much and have a good day.
Executive summary Keynote 1

Dr. Imam Santoso, MSc.
Chairman of The Association of Indonesian Hydraulics Engineers or Himpunan Ahli Teknik Hidraulik Indonesia

Green Infrastructure for Sustainable Development

Infrastructure development and economic growth have a reciprocal relationship. The infrastructure development will contribute an economic expansion through multiplier effect. Strong platform of infrastructure may accelerate the economic development to a certain level, while the rapid economic growth will demand the enlargement of infrastructure to support the greater flow of people and goods. According to the World Economic Forum (WEF)’s Global Competitiveness Report 2019, Indonesia ranks 50th out of 141 economies in terms of infrastructure development, increased significantly from the 62nd position in year of 2016. However, to enhance the infrastructure development is a very challenging work since the connectivity is not well set yet. The issue becomes even more complex to enable sufficient infrastructure for the whole country. By end of 2019, Indonesia was ranked in 72nd position in infrastructure development among 141 countries. It is also clearly identified that Indonesia’s main strengths are its market size (7th position) and macroeconomic stability (90.0, 54th position). In fact, there is still considerable room for further improvement and sustainable development. Unfortunately, the pandemic of COVID-19, as we all know, has put a strong impact to the global economy of many countries including Indonesia.

Looking at into the current situation of water resources potential, Indonesia belongs to the third richest country in the world in terms of total renewable water resources. The total available fresh water for the country reaches about 3.906 km³. While if we focus more on the fresh water per capita, Indonesia is ranked 42nd worldwide. It means if the government is able to well manage this great resource, it offers a huge opportunity to enhance the sustainable development.

Green infrastructure is defined as an approach to water management that protects, restores, or mimics the natural water cycle. Green infrastructure is also defined as an interconnected network of green space that conserves natural ecosystem values and functions and provides associated benefits to human population. There are some reasons why green infrastructure is important.

First, it reins in storm water runoff. Second, green infrastructure may reduce risk of water related disasters. By conserving the watershed, we can reduce the risk of flood, drought, erosion, and landslides. Third, green infrastructure also offers lower cost and quality of life improvement

Sustainability principle must be applied in an environment undergoing multiple changes, changes that are occurring over different temporal and spatial scales. Water resource systems that are managed to satisfy the changing demands placed on them, now and on into the future, without system degradation, can be called “sustainable.” To gain the sustainability we may need to include few things: attainable goals, operable principles, technology adaptation, institutional capacity, and adaptive management.
Executive summary Keynote 2

Prof. Stephen SY Lau,
Professor of the Beijing University of Civil Engineering & Architecture, and
Honorary Professor of Hong Kong University.

"How do we design buildings to change user behaviors -- speaking from the case of the zero energy building from the School of Design & Environment, National University of Singapore"

This paper will introduce the NUS Campus Building located in Singapore. This is the first Net Zero Energy Building for a campus. The mechanism of natural light, how to harvest rain in order to be used as the alternative water source, the ventilation system and the energy harvesting from sun are discussed here. Aside from all the building services, the form of the building is essentially design through a careful analysis such as the sun orientation and the wind direction. The resulted building form also accommodate the concept of wellness and provide several area for greenery. Indeed, this new concept of net zero energy building had change our behavior to be more aware on using energy efficiently and effectively. Also, the students are expected more healthy.

Executive summary Keynote 3

Dr Mohammed Ali Berawi
Director, Center for Sustainable Infrastructure Development (CSID), Universitas Indonesia

Director, ASEAN University Network – Sustainable City and Urban Development (AUN – SCUD)

Creating Value-Added and Stimulating Innovation in Mega Infrastructure Projects: Increasing Projects Feasibility

Infrastructure development is arguably one of the main drivers of economic growth. Infrastructure systems create the backbone of an economy, as they provide social, as well as economic, benefits to society. The development of modern infrastructure thus becomes a way to enable competitive advantage in a highly competitive global environment. Technological innovation must contribute to the development of new models of sustainable social, economic, and environmental growth in order to make the system more sustainable for the well-being of society.
A key success factor for infrastructure Public Private Partnerships (PPP) is the quality of project feasibility, assessed through Value for Money (VfM). PPP plays an important role in the success of infrastructure development by producing optimum benefits for stakeholders. The government must play a role in providing public infrastructure, reasonable community pricing for accessing infrastructure services, and generating revenue for the private sector. Furthermore, in order to create optimum benefits and increase project feasibility, innovation and value-added infrastructure projects must be a focus of the early project planning stage. Efforts at cost effectiveness and the creation of value-added projects form the basis for accelerating infrastructure development when there are financial constraints. Value-added projects will directly affect financing and partnership schemes.

Some case studies on the use of value engineering application, and followed by financial analysis and partnership model in megaproject planning are presented. The findings show that value-added infrastructure projects and effective infrastructure financing schemes is able to enhance project feasibility and thus boost strategic alliances between government and the private sector.

Executive summary Keynote 4

Prof. Rajendran Parthiban,
Professor Engineering and IT
Monash University Malaysia

Role of Industry 4.0 on the Development of Sustainable Environment and Living

The paper discuss the role of Industry 4.0 for the development of sustainable environment and living. The history of industry started at the era of steam usage, and then follow with the invention of electricity, computing and now the cyber physics systems. In general the current industry have several pilars, namely: autonomous robots, simulation, big data, system integration, augmented reality, additive manufacturing, Internot of Things (IoT), cloud computing and cyber security.

Some examples of how the Industry 4.0 can be applied in daily life are presented. The application of IoT can be used for monitoring an urban farming. The usage can be for the sensing system. Moreover, the paper also presents the role of this industry to achieve the goals of Sustainable Development issued by the UN. The real cases provided in the presentation are the lighting lab, the drone delivery and the IR4.0 Smart Surveillance, health care, smart home, manufacturing as well as aquaculture.

Conclusion:

• Industry 4.0 focuses on cyber-physical systems
• UN has defined sustainable development goals
• Industry 4.0 can be used to improve sustainable living
• Research works are carried out both within and outside Monash to combine Industry 4.0 and sustainable living
Application domains vary from education and communication to agriculture and manufacturing.

**Executive summary Keynote 5**

Okky Setyawati Dharmaputra, Santi Ambarwati, Ina Retnowati, Nijma Nurfadila
SEAMEO BIOTROP, Southeast Asian Regional Centre for Tropical Biology, Bogor 16134, Indonesia

**Good Postharvest Handling Practice to Minimize Mycotoxicogenic Fungal Infection in Foodstuff**

Mycotoxins are secondary metabolites produced by certain fungal species that can affect human and animal health. Foodstuff can be infected by mycotoxin producing fungi during pre- as well as postharvest stages of production. Good postharvest handling practice is a key issue for minimizing the risk of mycotoxin accumulation. It is important to prevent mycotoxinogenic fungal infection and develop practical and effective postharvest procedures to minimize mycotoxin production in the food supply chains. A review is given on good postharvest handling practice on nutmeg and Arabica coffee beans to minimize mycotoxicogenic fungal infection.

Fragrant nutmeg (Myristica fragrans) is an important commodity that has been used in food and pharmaceutical industries, hence its quality should be monitored. Indonesia and Grenada dominate nutmeg production and export to European countries with world market shares of 75 and 20%, respectively. Appropriate postharvest handling methods of nutmeg is important to ensure their good quality among others in terms of aflatoxin contamination, i.e., nutmeg should be harvested directly from the tree, dried using smoke-drying method and stored with its shell. Nutmeg harvested using fruit picker pole method should not be mixed with fallen nutmeg fruits which have been in contact with the soil. Another good postharvest handling practice can be conducted as follows: 1) harvesting method that prevents nutmeg fruits from being in direct contact with the soil and harvesting ripe fruits; 2) nutmeg should be immediately dried using smoke- or oven-drying method, after mace is shelled; and 3) nutmeg should be stored with its shell.

Indonesia is the world’s fourth-largest coffee producers after Brazil, Vietnam and Columbia, in which one of its well-known coffee originates from the Toraja region, South Sulawesi. Consequently, Indonesia has to compete with these countries in producing good quality of coffee beans. To assess the quality of Arabica coffee (Coffea arabica) beans, in terms of ochratoxigenic fungal infection, three processing methods (dry, wet and semi-wet methods) and two types of packaging materials (polyethylene hermetic and polypropylene bags) can be used to maintain the quality of coffee beans during storage.
Executive summary Keynote 6

KANG Chang Wei
Deputy Director, Fluid Dynamics Department
Senior Scientist
A*STAR IHPC

Dispersion of Evaporating Cough Droplets in Tropical Environment

Respiratory infections happened through the transmission of virus laden droplets (>5 to 10 µm) and aerosols (≤5 µm) breathed out from infected individuals during sneezing, coughing, talking and breathing. To better understand the droplet transmission, researchers at A*STAR’s Institute of High Performance Computing built upon existing fluid dynamic capabilities and developed a airflow and droplet dispersion model from a respiratory event, in this case, a cough. Utilising this modelling and simulation capability, the risk of the transmission and infection can be better understood.

Key factors taken into consideration:
1. Time dependent air flow rate (expulsion force and fluid volume)
2. Droplet size distribution
3. Cough angle
4. Mouth opening area (expulsion force)
5. Normal breathing
6. Evaporation (heat transfer)
7. Non-volatile particle
8. Only physical science is considered (biological effect i.e., viral load in the droplet is taken into consideration during analysis)

Other vocalising activities: Talking and Singing

Strengths and Limitations of Study
• Strength of methodology is in coupling experimentation with computer simulation, which enables cross validation of findings.
• Study is analysed for 1 coughing action only directed to the front. Human subject is assumed to be static.
• Still numerous unknowns with regards to droplets transmission, e.g. viability of virus in droplets under various environmental conditions and duration, viral load needed for infection, etc.
• Aside from droplets transmission, there are other routes of infection, e.g. fomite, or infection that occurred outside of scenarios being studied.
• Droplets (being light) are easily affected by changes in the environmental air flow (speed and direction), site layout and location of fans / aircon / windows / etc, hence results will change when environmental conditions change.
• This study can only do experiment and simulation on a representative scenario, and generalise the broad findings.
• Hence, risk-based analysis is used; NB: low risk doesn’t mean no risk.
**Organizing Committees 4th ICEED 2020**

| Role                          | Name                                                  |
|-------------------------------|-------------------------------------------------------|
| General Chair                 | Dr Ir. John Fredy Bobby Saragih, MSc                  |
| Conference Chair              | Religiana Hendarti, ST MT PhD                         |
| Chief Editor                  | Dave Mangindaan, PhD, MRSC, AMIChemE, IPM             |
| Secretary                     | Dr. Dwiyantari Widyaningrum                           |
| Treasury                      | Meilani, ST MT                                        |
| Scientific and Proceeding     | Tota Pirdo Kasih, PhD                                 |
|                               | Dave Mangindaan PhD, MRSC, AMIChemE, IPM             |
|                               | Dr. Nina Nurdiani                                     |
|                               | Safarudin Gazali PhD                                  |
| Sponsorship, Collaboration and Exhibition | Dr Oki Setiyandito                                   |
|                               | Ir Juliastuti, MT                                     |
| Registration and Documentation| Jimmy Linggarjati, ST, MT                             |
| Website, IT, Local Arrangement| Johannes, ST, MT                                      |
| Event Program and Schedules   | Dr. Rienna Oktarina                                   |
|                               | Vivien Himmayani, ST, MT                              |