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Challenges in aligning the architecture profession in Indonesia for climate change and sustainability

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Abstract

Increased energy use and attendant green house emissions are associated with increased urbanization. At the same time, climate change poses challenges for the built environment where there are tensions between rapid city building and low carbon growth. This paper develops and tests a method for the institutional development of built environment professions in emerging economies that are dealing with a range of issues, including rapid urbanization, and rapid building and construction. The built environment professions comprise a range of disciplines including architecture. Using the architecture profession as a case study, a 'deep-dive' is taken to understanding the role of architects as a central player in the move towards low carbon futures in Indonesia. The architecture profession and practitioners are analysed from the perspectives of curriculum development and governance in universities, private industry, peak industry bodies and other bodies driving low carbon growth such as green building councils. While the paper focuses on one discipline comprising the built environment profession, in reality, all disciplines comprising the built environment professions need to be considered to understand how they interact within the profession and between each other so as to maximize outcomes for low carbon approaches. An institutional approach is helpful in guiding the built professions in other transitioning economies. Generally, transitions to low carbon futures in academia have taken the approach of curriculum development in the various disciplines. While this approach is laudable, it is not enough. It is clear that curriculum development alone is insufficient to bring about broad scale and lasting changes to low carbon futures. Educational changes in universities represent only one institutional approach. In reality however, educational institutions need to work in tandem with several other institutional agencies to drive, complement and support changes for low carbon futures; including government, industry practitioners and peak industry bodies.

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1. Background

Current growth of greenhouse gas emissions in the buildings and construction sector needs to be arrested. This is particularly the case in developing countries where buildings are likely to consume half of the available raw materials and account for up to a third of final energy consumption[1]. The recent (2016) OECD report [2] focuses on the Association of South East Asian Nations (ASEAN) region due to the prospects that the region unfolds, "….the region should tap into its considerable potential in renewable energy to meet growing demand" (p.25). There are untapped opportunities to harness this in the built environment sector.

Natural resources of SE Asia need to be properly managed to ensure long term survival of key economic activities such as agriculture and forestry. As the region is undergoing rapid urbanisation, investing in low carbon infrastructure will assist in shaping cities that are energy efficient, pollution free and climate resilient. By adopting sustainable policy and economic models, SE Asia has an untapped opportunity to become a hub for green investment. Success in a green economic model may also bring with it new jobs and investment for the region. It is anticipated that by 2030, there would be more than 24 million jobs worldwide in the renewables arena[3].

It has been well documented that growth in Asia will continue and result in increased energy use and carbon dioxide emissions [4]. Key highlights are that:

- Asian GDP will expand from 27 per-cent in 2004 to 34 per-cent in 2030, the highest compared to other blocks including Europe and North America.
- Asian population is forecast to to increase by half the world population, with India and China being the largest by 2030.
- Primary energy demand and attendant CO_2 emissions are expected to rise by 9 per-cent in 2030 under a business as usual scenario.
- Primary energy demand in Asia is expected to grow to 6.2 billion tonnes of energy equivalent by 2030, a growth of 200 per-cent from 3.1 billion tonnes of energy equivalent in 2004.

Within Asian cities, it is anticipated that:

- Total energy consumption through building use is expected to rise 65 per-cent to 1150 million tonnes of energy equivalent by 2030[5].
- Building energy consumption is predicted to comprise 18.5 per-cent of total energy consumption in 2030.

An important note to consider is that in the transition to new economies cleaner jobs will require managing sustainability transitions well, including retraining where required. It is in this context that this paper is situated. The paper focuses on the architecture profession in Indonesia and the preparedness of students and graduates to meet the current and future demands on the built environment from a climate change and sustainability perspective.

It builds on previous work undertaken by the author [6] [7] [8]. The project *Integrating sustainability into engineering and built environment curriculum* (funded by United Nations University's (UNU) Promotion of Sustainability in Post Graduate Education and Research (ProSPER.Net) from 2012-14: Phase 1) found, amongst a range of other outcomes, that university academics sought assistance in extending curriculum change beyond single courses to whole professional programs. They sought assistance to change programs so that the capacity of built environment professionals to design and build low carbon cities was institutionalised. This institutional focus suggests that building-on from the first phase of the project, the focus currently should be on developing a means for understanding built environment professions, in particular engineers, architects and, construction and project managers, in relation to:

- Country specific conditions: industry, faculty, curriculum, pedagogy and organisation of the professions
- Government policy: urban planning, building code regulation and economic development strategies supporting low carbon urban development.

The first phase of the project also showed that academics sought to bridge links with industry because academics

typically could not keep up with industry demands. A professional development program encompassing industry practitioners and academics is therefore required to meet this need.

This paper reports work undertaken in one country; Indonesia for setting up a programme of change for Indonesian built environment professionals. The paper commences with a background on why Indonesia is considered as a context for this study. The development of built environment regulation in Indonesia is explained, followed by a focus on one profession amongst the range of built environment professions considered. Architecture profession is the focus of this paper as architectural design fundamentally impacts on the final outcome of the building. The recognition of the need to "tread lightly" on the environment is not part of the culture or practice of the architecture profession in Indonesia from a curriculum perspective. The development of architecture as a profession, and how this impacts on other built environment professions is explored. This leads to the next section of the paper on governance of curriculum development in universities with a focus on the state of play with the universities that are reputed to have the best programmes in architecture. The changing expectations of the profession particularly in light of pressures on building sustainability and considering climate change impacts are next considered, followed by discussions and conclusions.

1.1. Indonesia

Indonesia as a country in the ASEAN region is undergoing rapid urbanisation. In 2012, Indonesia's GDP was 6.2 per-cent per annum on par with other countries in the ASEAN region, and share of world trade in the same year was 4.6 per-cent [9]. In the period 2006-14, Indonesia's population grew by 1.3 per-cent per annum and by 2014 it was 254.5 million. In the period 1971-2010 the proportion of Indonesia's population classified as urban increased from 17 per-cent to 50 per-cent [10]. However, more recently, the rate of urbanisation has declined from 3.0 per-cent in 2006 to 2.7 per-cent in 2014 [11]. This growth has concentrated in a few large cities with rapid growth on the fringes and slower growth in central city areas [12]. Economic growth measured by increases in GDP in the period 2006-14 has moved between a high of 6.3 and a low of 4.6 per-cent. It has been estimated that construction spending grew by 5.2 per-cent per annum for the period 2014-2019 [13].

Urbanisation and economic growth has been accompanied by increasing per-capita energy use and related growth in CO_2 emissions, which in the period 2006-2011 grew from 1.5 to 2.3 metric tons per-capita per annum [11]. Further, energy demand is projected to grow as population growth, urbanisation and rising incomes result in the increasing use of household appliances and cars. It is forecast that Indonesia's primary energy demand will grow at an average annual rate of 2.4 per-cent in the period 2007-2030 and that the share of fossil fuels in the energy mix underpinning this growth will rise from 69 per-cent to 72 per-cent [14]. In summary, Indonesia is a country experiencing growth in population, urbanisation, economic activity, energy use and attendant CO_2 emissions.

Specifically in the area of buildings there is considerable potential for energy efficiency. As the IEA [15] notes 'Indonesia has significant energy efficiency potential in both the residential and commercial sectors' (p.136). However, the legacy challenge is significant because the regulatory framework is only now being adopted and implemented and there are no reliable assessments of the sustainability performance of the existing building stock.

Indonesia is at an interesting juncture, similar to other countries in the Asia-Pacific and in the Latin American region. As already indicated, with high economic growth in the country and rapid urbanisation, Indonesia is facing high carbon emissions unless directed towards low carbon, low emission or net zero emissions path. It is critical therefore, that any approach to building and construction of the built environment and associated consumption is not business as usual, so as to avoid lock-in, and fast track developments away from the path that the Developed Countries have taken in the recent years. An important aspect when considering the built environment are building codes and attendant regulatory standards, as they provide minimum requirements for ensuring the safety, amenity and sustainability of the built environment.

2. Built environment regulation

Van der Heijden [16] identifies five ideal regimes of built environment regulation in Developed Countries: public,

prescribed, co-regulation, conditional co-regulation, substitute co-regulation, and private. Furthermore, it can be noted that most countries are now moving towards performance based building codes where performance rather than prescription is the focus. Therefore, it is not critical *how* performance is reached, rather that it *is* reached (p.1040). Such type of open regulation assist the regulator to also find a more cost effective approach to achieving compliance.

In Indonesia, a new commitment to extending and deepening the system of built environment regulation was signalled when the *Law on Buildings*, Law No 28 was passed by the Indonesian parliament in 2002. It provided a framework for regulating the built environment where buildings would be based on their 'utilization, safety, balanced and harmonious principles with their environment' [17]. The main provisions of the law covered building functions; requirements for building administration, use, layout, form, architecture, environmental impact, reliability, health, safety, convenience and accessibility; building management; peoples' participation through third party rights; government assistance; and sanctions. The regulations that accompany the law reference standards from Standards Indonesia (SNI) in more than fifty codes.

Subsequently, the Indonesian government through its ministries has developed its regime of built environment regulation by passing further legislation and regulations. Key additions include: Regulation No. 36/2005 Buildings and Government; Ministry of Public Works Regulation No. 29/PRT/M/2006 on Guidance of Building Technical Requirement; Law No. 30/2007 on Energy; Government Regulation on Energy Conservation No. 70/2009; Law No. 32/2009 on Environmental Protection and Management; Regulation of the Minister of Public Works No. 02/PRT/M/2014 on Guidelines for Land Use Planning; Law No. 32/2009 on Environmental Protection and Management; Regulation of the State Minister of Living Environment of RI No. 15/2010 on requirements and procedures for obtaining license for analysis appraiser commission on living environmental impact; Regulation of Minister Public Works No 06/PRT/M/2011, 28 March 2011, Utilisation Guidelines of Water Resources. The most significant measure in terms of the environmental performance of building was the passing of Ministry of Environment Regulation No.8 of 2010 on 'Criteria and Certification of Environmentally Friendly Building Certification'. In Jakarta, the passing of the Regulation Number 38/2012 on Green Building complemented this Indonesian government regulation. It is compulsory for developers of large buildings to consider energy conservation measures based on SNI codes relating to energy covering building envelope, air conditioning, lighting and building energy auditing.

At a national level the built environment regulation and regulatory capacity development has been led by the Indonesian government agency, the Ministry of Public Works (MPoW). It is responsible for the National Guidelines on Green Buildings, which sets out objectives for energy and water efficiency in buildings and building waste reduction. It also sets targets for implementation of the national guidelines by supporting the local government authorities responsible for governing the seven largest cities to prepare their green building codes and increase their regulatory capacities by supporting their management information systems, baseline data collection, consultation systems, application assessment processes, and certification and audit procedures [18]. Further work in accelerating the pace of the green building movement in Indonesia has been spurred by the International Finance Corporation (IFC). As an agency of the World Bank, IFC supports much of this work through the MPoW. It plays a pivotal role in supporting the development of building regulation in a number of Developing Countries (other than Indonesia) and aims at increasing the energy efficiency of buildings. It recognises that climate change is a serious global challenge and that climate-related impacts can undermine economic and social well-being and development efforts. In this context it has engaged in investments, and because of the 'importance of the private sector's role in the reduction of greenhouse gas (GHG) emissions, IFC engages in innovative investments and advisory services to support climate-friendly solutions and opportunities for business' [19]. IFC responds to the extra challenges evident in developing countries where technical and institutional capacities tend to be weaker than in developed countries and where there is a lack of data on energy use across different types of buildings and building uses [20]. Therefore, the role played by the IFC cannot be underestimated particularly in the current landscape in Indonesia. The next section examines architectural education in Indonesia.

3. Architecture education

Architectural education in Indonesia is spread across 159 institutions, including colleges and universities, teaching architecture at an undergraduate level. In addition there are 16 universities with masters programs and 6 universities with a doctoral program. In the ASEAN region this compares to 83 programs in the Philippines, 22 in Vietnam and 20 in Thailand [21] [22] [23].

The state of play of the architecture profession in Indonesia is strongly linked to the educational platform for the profession. Most Indonesian universities have adopted a four-year bachelor degree for architecture with a one year Masters degree where students can specialise in a particular area such as tourism, urban design and urban planning. However, this is now being transitioned as explained further in this section. There may be individual specialisations within universities, such as forms of Indonesian architecture. Also, there may be more "environmental" focus, particularly in the use of specialized soft ware packages.

Architectural Association of Higher Education in Indonesia (Asosiasi Pendidikan Tinggi Arsitektur Indonesia APTARI) APTARI is also working with universities, to carry out a Program of Revitalization Field Studies on the Preparation of Achievement Learning, Curriculum and Standards Architects Professional Education from 2015. The program is an effort to improve the quality of higher education architecture in Indonesia in general and education of the architectural profession in particular. This program includes the preparation of achievement learning (learning outcomes), curriculum and educational standards. Workshops were held with key industry and academic experts, and higher education government officials in 2015, leading to the development of working groups that ultimately lead to the development of the learning outcomes for professional architects. As required, by the working group, the National Board of the Indonesian Architects Association (Ikatan Arsitek Indonesia IAI) consists of the Board of Education, Professional Board, Board of Education Architects and Architect Profession Council, and the Executive Board and representatives from APTARI.

The IAI current legal foundation for curriculum of higher education in Indonesia (KPT) [22] is built on the following regulations:

- Republic Act no. 14 of 2005 on Teachers and Lecturers.
- Republic Act no. 12 of 2012 on Higher Education.
- Presidential Decree No. 8 of 2012 on the National Qualifications Framework Indonesia (KKNI)
- Regulation No. 49 of 2014 on National Education Standards High (SNPT).
- Ministerial Decree No. 154 of 2014 on Clumps of Science and Technology and Graduate Degree College.

Thus, the key pieces of regulation to be considered are; KKNI, SNPT and the ministerial Regulation No. 154 of 2014. Where required, references for the architectural studies program may refer to [22], p. 5:

- "Book-Based Curriculum Development Guide for Higher Education in 2008
- UNESCO-UIA Charter (2005) "Design, Knowledge, Skills"
- Item 13 Competence IAI
- ASEAN MRA for Architectural Services
- Architectural Education Charter Declaration Indonesia 2010
- Naab 2009 Conditions for Substantial Equivalency for Professional Degree Programs in Architecture
- Ka'b-2014 Conditions & Procedures for Professional Degree Programs in Architecture
- Law no: 18 of 1999 on Construction Services
- Director General of Higher Education Decree No.43 / Dikti / Kep / 2006 on Signs Implementation Group
- Courses Personality Development in Higher Education"

Graduates in Indonesia are expected to meet the following qualifications in accordance with the ministerial Regulation No. 154 of 2014 on 'Divisions of Sciences and Technology and Degree Graduates of Higher Education' (Table 1) recommended nomenclature. The competencies for a person with the Diploma of Architecture is considered to be an associate expert who is able to represent ideas technically with drawings, models and building information modelling of construction and architecture; both manual and digital. A person with a Bachelor's degree is able to design and master architecture at a basic level. A person qualified at a Masters level controls the state of the art design and science of architecture and a person with a Doctoral qualification is capable of developing the state of

the art and science of architecture. An architect professional is a graduate ready to develop as one with proscribed competencies. For practicing architecture, an architect professional holds the reins, and this is explained in further detail.

A graduate architect (Bachelor of Architecture) is expected to have basic knowledge of the ability to design, have basic knowledge of matters that are practitioner related such as knowledge, role and understanding of building contractor/builder, developer, project manger, policy makers; undertake basic education and research, ability to undertake critiques, and curate art/designs. The ability to undertake banking, marketing, business management are also considered to be an important part of this basic knowledge. Therefore, the education competencies are the ability to imagine, think creatively, innovate and undertake design; gather information, formulate design problems and undertake analysis; ability to think in three-dimensional; and, the ability to reconcile, negotiate, integrate knowledge and apply skills in the creation of design solutions.

Table 1. Recommendations of the degree programme in Indonesia by the IAI (Source: [22]).

Pathway	Study programme	International equivalent terminology	Degree	Abbreviation and interpretation	Outline of competency	Code
Diploma (D3)	Pictures Architecture	Architectural Drafting	Associate Expert	A.Md.Ars Picture Architecture	Associate expert	52.602.01.0
Bachelor (S1)	Architecture	Architecture	Bachelor Architecture	S.Ars Architecture	Design and master architecture at a basic level	61.602.01
Profession	Architecture	Architecture	Architect	Ar Architecture	Architecture professional	73.602.01
Masters (S2)	Architecture	Architecture	Magister Architecture	Mars Architecture	Masters, influencing art, design and science of architecture	81.602.01
Doctoral (S3)	Architecture	Architecture	Doctor Architecture	Ar Ars Architecture	Doctoral, developing state of art and science of architecture	91.602.01

In addition, the ability to understand and apply knowledge of the theory and design methods, understand procedure and the design process, ability to explain the design decisions armed with theory and design methods; ability to review the knowledge of historical and cultural precedents in local and world architecture, knowledge of art and its influence on the quality of architectural design, awareness of the relevant regulations, technical guidelines and standards for planning, design, construction, health, safety and the use of the built environment; technical knowledge of structure, materials and construction; understanding the process of technical design and integration structure, construction technology and system utilities to be effectively functional are all considered critical. The ability to communicate ideas through collaboration verbally, numeracy skills, writing, drawing, modelling and evaluation are all important.

Table 2. Recommendations of the degree programme in Indonesia by the IAI (Source: [22]).

Level	Work ability in KKNI	Qualification
9	Deepening expansion of new science and technology through research, complete with problem solving, and multi or trans disciplinary approaches to problem solving	Doctor
8	Developing science and technology through research, innovation and proven ability to resolve problems with inter/multi-disciplinary approaches	Masters (*Magister*)
7	Manage resources, evaluate comprehensively for developing strategic organisation, complete problems with mono disciplinary approaches	Profession
6	Applying, assessing, designing, use of science and technology in resolving procedural issues	Bachelor
5	*Beringkup* extensive finishing work, choosing various methods, formulating procedural problem solving	3 year Diploma

This includes the ability to create manual models, electronically, and graphically to define and communicate design proposals. In accordance with Presidential Decree No. 8 of 2012 on Qualifications framework National Indonesia (KKNI) and Regulation No. 49 of 2014 on Standards National Higher Education (SNPT), the competency or capability levels of graduates are summarized in Table 2.

Based on data provided by APTARI (2013- Accountability Report Higher Education Association Management Architecture Indonesia (APTARI) Period 2010 - 2013) there is a disparity in quality between architectural education in Java and outside Java. Java Island, comprising the three main universities in Indonesia still occupies the highest number of courses in architecture by as much as 37 per-cent, followed by Sulawesi, Sumatra as much as 19 per-cent based on data accreditation of BAN-PT (Data of the National Accreditation Board of Higher Education (BAN-PT)) in October 2015. Of the 103 courses S1 Architecture in Java and Sumatra, there were 19 per-cent accredited A, 48 per-cent are accredited B, and 33 per-cent are accredited C. While from 38 courses S1 Architecture outside Java and Sumatra, there are 5 per-cent accredited and those accredited B are 34 per-cent, while 61 per-cent are accredited C. A refers to the top tier, with C being at the bottom. The formulation of educational standards of the profession consists of eight (8) standards that refer to the National Standard of Higher Education, consists of competency standards, content standards, process standards, assessment standards, educator standard, the standard of facilities and infrastructure, as well as financing standards.

A teacher needs to have at least level S2 for teaching, that is, a Masters qualification to be considered an educator. The three main universities have qualified staff with doctoral qualifications, however, as indicated, universities in the far flung regions of Indonesia struggle with recruiting staff that have or possess suitable post graduate qualification.

The next section looks at the governance of curriculum development.

4. Changes in the governance of curriculum

Globally, the peak industry body, the International Union of Architect (UIA) presented an important concept of Sustainable Architectural Design on 7th December 2009 in Copenhagen, outlining the importance of sustainability in the curriculum [24]. The UIA supports a five year undergraduate program, which has also been supported within Indonesia, thereby moving the four year program to a five year program. This of course, presents challenges currently. The standards of the competencies developed for the architecture profession is based on standards for higher education in Indonesia as indicated in the previous section, and the details for KKNI are still being developed. KKNI has worked on developing Higher Education into the proposed details of learning outcomes to pick up 13 competencies identified by the IAI. Some of these exist as part of the UIA, but some do not (especially the attitude of architects).

The UIA stated its commitment for implementing “Sustainable by Design Strategy” where a participating country’s Sustainable Architectural Design Strategy included the socio-economic and environmental context for the design. Starting with this, the framework of Sustainable Architectural Design in Indonesia was prescribed, which included main considerations of the UIA [25]:

- Sustainable by Design should begin with the earliest stages of a project and needs commitments between all the stakeholders: clients, designers, engineers, authorities, contractors, owners, users and the community.
- Sustainable by Design needs to incorporate all aspects of construction and future use based on full Life Cycle Analysis and Management
- Sustainable by Design could optimise efficiency through design. Renewable energies, high performance and environmentally benign technologies could be integrated to the greatest practical extent in the project conception.
- Sustainable by Design recognized that all architecture and planning projects were part of a complex interactive system, linked to their wider natural surroundings, and reflect the heritage, culture, and social values of the daily life of the community.
- Sustainable by Design would seek healthy materials for healthy buildings, ecologically and socially respectful land-use, and an aesthetic sensitivity that inspires, affirms and ennobles.
- Sustainable by Design aims to significantly reduce carbon imprints, hazardous materials and technologies and all other adverse human effects of the built environment on the natural environment.

- Sustainable by Design endeavours to improving the quality of life, promoting equity both locally and globally, advancing economic well-being and providing opportunities for community engagement and empowerment.
- Sustainable by Design recognises the local and planetary interdependence of all people. It acknowledges that urban populations depend on an integrated, interdependent, and sustainable rural-urban system for their life support systems (clean water and air, food, shelter, work, education, health, cultural opportunity, and the like).
- Sustainable by Design endorsed UNESCO's statement that cultural diversity, as a source of exchange, innovation and creativity, was very important for humankind.

The EDUCATE (Environmental Design in University Curricula and Architectural Training in Europe) white paper [26] also provides a global appraisal of the state of the art environmental sustainability in professional practice where building practitioners were surveyed to seek their views on academic curricula, continuing professional development, and regulations and clients' demands. Most of the respondents agreed that designing for sustainability entailed specialist skills and felt that it needed to be an important part of professional qualifications. What is significant however, is that, over 95 per-cent of the respondents felt that higher education curricula should be the main vehicle for imparting these skills, and on-going skill development should be offered through CPD activities promoted by regulatory bodies. Regulatory bodies, were in fact, considered to not support sustainable practices and there was significant room for improvement here. Furthermore, minimum regulatory standards were seen to impose a ceiling on aspirations.

Further developments in the ASEAN landscape also need to be considered into this mix. The ASEAN treaty signed in 2007 has spurred the Provisions on National Standards of Higher Education, Institute of Education and profession Independent accreditation, which has not been undertaken by BAN-PT, the qualifications framework in Indonesia [22]. The Institute of Architects Indonesia (IAI) document in 2015 [21] has prepared a document on the preparation of education, curriculum achievements and learning outcomes for the education of professional architects in Indonesia. It recognises that architectural education in Indonesia is currently experiencing changes, demanding the creation of models of learning that are more dynamic, multidisciplinary and focused on producing graduates who meet the standards of competence that are recognised nationally and internationally. There is also the growing recognition that graduates increasingly require education that is global so that they can compete with foreign architects. The free market ASEAN Free Market Mutual recognition of architectural services in 2007 has been a catalyst for architects in Indonesia to be globally competitive.

While the architecture disciplines and associated peak industry bodies have been working on competencies, it is not surprising that they are operating on their own. There is limited evidence of collaboration with faculty from other built environment programs such as engineering.

5. Discussions

Architecture programs have mostly initially developed within engineering faculties of the universities and as they grew, they have split off and formed their own departments and expanded to include broader disciplines such as architecture, regional and urban planning. There is continuing discourse in Indonesia about Indonesian identity and how architecture contributes to this identity formation in a region within the tropical climate zone that couples built environment culture to sustainability. The formation of specialisation within the various schools or faculties in Indonesian universities is still maturing. Considerable effort has been put into upgrading the qualifications of faculty through supporting academics to undertake research degrees in other countries, predominantly Japan, USA, UK and Australia. In turn these elite universities are providing post graduate programs; Masters and PhD programs for academic staff from other more junior universities and colleges to upgrade their qualifications. This is important for the overall quality of education in Indonesia, as these leading universities pass on know-how to the universities for support and follow up. The discourse to mainstream sustainability as part of the curriculum though has yet to occur. Opportunities for students to study built environment sustainability issues in architecture programs has largely been provided through a limited number of electives or through the individual initiatives of faculty who introduce sustainability issues into core courses. Therefore, the approach is rather fragmented.

Architecture faculty, along with other faculties in Indonesian universities are being required to increase their

research effort and publish in international journals. The international research profile of Indonesian universities is generally regarded as weak. Practicing architects are part of the faculty in many universities and there is often a tension between the 'practice of architecture' and 'research and scholarship of architecture'. This is no different from other emerging economies globally. Formalised consultative and advisory links through course advisory committees or similar with the built environment industry firms and associations and government agencies are not well developed. This is not to say, however, that there is a complete lack of industry engagement in the programmes of architecture. Program review and quality assurance have until now been largely organised internally within universities. This will change through the development of formal accreditation processes that are now being put in train by the IAI. Evaluation and accreditation of schools of architecture is in transition. It is moving from a system where the Ministry of Education reviews program administration but not the content of programs. The goal is toward a system that accredits programs on the basis of program quality that will be led by the IAI.

A review process is underway involving the IAI and APTARI in specifying competencies for architecture and recommending a system for the review and accreditation of architecture programs to the Indonesian government. Architectural education is being holistically reviewed in line with the 2008 National Qualifications Framework for Indonesia and Competency-Based Curriculum for Higher Education. The development of this system is following a similar path for reviewing post secondary schooling in other countries and has it origins in broader globalisation processes.

Globalisation processes that architecture educators are responding to match developments in the trade in architectural services that follow an ASEAN mutual recognition arrangement; initiatives by elite Indonesian programs that have sought recognition through the ASEAN University Network and the Commonwealth Association of Architects. Not keeping up with global trends leads to significant downsides; the most important one being, architectural services increasingly traded within the region and internationally, and there is growing awareness that Indonesian trained architects will be a part of this broader market. There are growing concerns by the architecture profession in Indonesia that they are losing jobs to architecture professionals from other countries in the region, such as Singapore. Singapore graduates training and competencies are considered to be globally competitive.

The regulatory regime that aims to increase the sustainability of Indonesian cities is in a very early stage of development and it is important that architects and other built environment professionals contribute to the further development of an effective regulatory regime. Architects must work with other built environment professionals in the design, building and commissioning of new buildings and the retrofitting of existing buildings. Yet there is a lack of clarity about the forms of collaboration that lead to the best sustainability outcomes. Again, this is not fully matured in many parts of the world in the education of architecture; however, the practice of architecture in Developing Countries has embraced interdisciplinary collaboration to realize favourable outcomes for the users. Even a cursory examination of some of the iconic green buildings around the world lately has demonstrated that shared ownership of outcomes through integrated design teams supports the realization of low carbon outcomes from a holistic life cycle perspective for buildings.

6. Conclusions

There are some key issues arising from this research that are critical for Indonesia to progress. There is evidence of an increased focus on sustainability within the current review of architectural education in Indonesia aligned with a more globalized training for architecture practitioners. A phased, long term vision with respect to built environment sustainability for the country is required. Practitioners, current and future, will need to blend technical and creative abilities to find innovative and creative solutions for the country.

With regard to knowledge and education, there is evidence for a need for further training, both within the curriculum and the professional accrediting bodies. A careful approach to this is required, as there is a danger that if evidence of sustainability outcomes are not provided, the response will result in green wash, leading to lack of support and engagement; not to mention 'locking in' emissions 80-100 years into the future. As noted from the experience of other countries who have traversed a similar path, multi and interdisciplinary insights are required for best practice. Capacity building for both academics and practitioners are required. Aligned with this are the need for

accreditation requirements to support a process that enables the realization of practitioners that are armed with expertise and the nous to deal with solutions that are not merely prescriptive, but support the challenges of climate change and sustainability in the present and into the future. Legislative and regulatory standards for driving sustainability need to be developed and enforced, in harmony with curricular content.

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