Built Environment Curricula in the Asia-Pacific Region:

Responding to Climate Change

Project Report
Funded by ProSPER.Net

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Funded by ProSPER.Net
Authors: Tony Dalton and Usha Iyer-Raniga

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ProSPER.Net is an acronym for Promotion of Sustainability in Postgraduate Education and Research Network. It is an alliance of forty leading universities in the Asia-Pacific region committed to integrating sustainable development into postgraduate higher education and developing a new generation of leaders who can respond to global sustainability challenges in the face of rapid environmental degradation.

By changing the way higher education institutions teach students about sustainability, ProSPER.Net improves the ways in which future professionals manage sustainability issues across a wide variety of disciplines. ProSPER.Net is supported by a secretariat at the United Nations University Institute for the Advanced Study of Sustainability in Tokyo.

Project Team Members:

Associate Professor Usha Iyer-Raniga	School of Property, Construction and Project Management, RMIT University, Australia Co-Lead Sustainable Buildings and Construction (SBC) Programme, United Nations 10 Year Framework of Programmes (UN 10YFP)
Professor Tony Dalton	Centre for Urban Research, RMIT University, Australia
Dr Xin Wang	UNEP-Tongji Institute of Environment for Sustainable Development, University of Tongji, China
Ms Sun Jie	UNEP-Tongji Institute of Environment for Sustainable Development, University of Tongji, China
Dr Chaminda Bandara	Department of Civil Engineering, University of Peradeniya, Sri Lanka
Professor Ranjith Dissanyake	Department of Civil Engineering, University of Peradeniya, Sri Lanka
Dr Sohee Minsun Kim	School of Environment, Resources and Development, Asian Institute of Technology, Thailand
Dr Djoen San Santoso	School of Engineering and Technology, Asian Institute of Technology, Thailand
Associate Professor Karen Ann Jago-on	School of Urban and Regional Planning, University of the Philippines

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Executive summary

The aim of this project, *Built Environment Curricula in the Asia-Pacific: Responding to Climate Change*, was to consider how environmental, economic and social perspectives for sustainable development can be more systematically integrated into higher education institutions (HEI) built environment professional education in the Asia-Pacific region. Built environment professions in five countries – China, Sri Lanka, Indonesia, Thailand and the Philippines were considered. The focus was on five themes which provided a basis for comparison. They were (1) development and implementation of built environment regulations and their systems of administration used to govern urban development, (2) development of the professional association and engagement with urban sustainability issues in the case study country, (3) curriculum governance arrangements used for revising curriculum in HE built environment professional programs, (4) sustainability curriculum in case study undergraduate and postgraduate professional programs and (5) expectations of the profession in the context of climate change.

The study found that government in all countries had adopted a green building code but were experiencing significant difficulties in implementing the code. Also, the green building council in each country had made little headway in generating support for the rating of new buildings using their rating tool. Built environment professional associations and the government agencies that regulate entry of new members to the built environment professions think in terms of 'competent professionalism' which does not recognise the challenge of climate change. There is no systematic consideration of how best to equip built environment program graduates with the knowledge and skills needed to work in an industry increasingly required to decarbonise the built environment. Typically, built environment programs offering sustainability courses offer them only as electives, not as core requirements.

Changing the priorities of universities, professional associations, regulators of the professions and built environment regulators constitutes a large-scale change agenda. An agreed upon 'road map' for change is required. It is proposed that the United Nations University Institute for Advanced Study of Sustainability (UNU IAS) convene a workshop of stakeholders with a commitment to contribute to the development of a 'road map' which aims to make climate change mitigation and adaptation central to higher education built environment professional education in the Asia-Pacific region.
UNU IAS is well placed to provide leadership for this initiative because it has a history of supporting the study of sustainability in higher education in the Asia-Pacific through its support for ProSPER.Net and many other initiatives.

The nature of the road map can be illustrated by noting initial ideas for research, capacity building and network development projects.

The research could be extended by:

- Selecting one profession and researching all accredited programs as an action learning project for one country.
- Undertaking detailed case studies focusing on exemplar built environment professional programs that could guide further curriculum development.
- The capacity of universities to make climate change mitigation and adaptation issues more central to the curriculum could be supported by:
    - Supporting faculty who are already teaching in built environment professional courses to renew curriculum.
    - Reviewing the operations of licensing boards and councils used to regulate built environment professional membership and setting new expectations.
    - Establishing an Asia-Pacific PhD scholarship program which supports research aimed at creating a future network of expert built environment sustainability educators.
    - Continuing support for the development of built environment professional education could be achieved by developing a principles-based support network for the education of future and already qualified built environment professionals necessary for sustainable city building and governance.

Photo: Tony Dalton

Related papers published

- Iyer-Raniga, U. and Dalton, T. 2017. 'A holistic view for integrating sustainability education for the built environment professions in Indonesia'. In: *Handbook of theory and practice of Sustainable Development in Higher Education* (Volume 6), Walter Leal Filho (Ed).
- Iyer-Raniga, U. and Dalton, T. 2016. 'Challenges in aligning the architecture profession in Indonesia for Climate Change and Sustainability'. *International High-Performance Built Environments Conference 2016*, Sydney 17-18 November 2016.

Acronyms

APEC	Asia Pacific Economic Cooperation
APTARI	Association of Universities of Architecture, Indonesia
ASA	Association of Siamese Architects
ASC	Architectural Society of China
AUN	ASEAN University Network
BAE	Board of Architectural Education
BAN-PT	National Accreditation Board of Higher Education
BCA	Building Control Act
BEC	Building Energy Code
BEP	Board of Environment Planning
CDP	Comprehensive Development Plan
CHED	Commission on Higher Education
CIA	Ceylon Institute of Architects
CLUP	Comprehensive Land Use Plan
CPD	Continuing Professional Development
DEDE	Department of Alternative Energy Development and Efficiency
EEBC	Energy Efficient Building Code
ELOs	Expected Learning Outcomes
ESCOs	Energy service companies
ESD	Environmental Sustainable Development
GBC	Green Building Code
GBCSL	Green Building Council of Sri Lanka
GBDL	Green Building Design Label
GBEL	Green Building Energy Label
GBL	Green Building Label
GUPES	Global Universities Partnership on Environment and Sustainability

HEI	Higher education institutions
HLURB	Housing and Land Use Regulatory Board
HUDCC	Housing and Urban Development Coordinating Council
IAI	Indonesian Institute of Architects - Ikatan Arsitek Indonesia
ICTAD	Institute of Construction Training and Development
IESD	Institute of Environment for Sustainable Development
IESL	Institution of Engineers Sri Lanka
IFC	International Finance Corporation
LAM	Independent Accreditation Agencies
LDIP	Local Development Investment Plan
LGU	Local Government Units
LEED	Leadership in Energy and Environmental Design
MNRE	Ministry of Natural Resources and Environment
MOHURD	Ministry of Housing and Urban-Rural Development
MoPW	Ministry of Public Works
NBAA	National Board of Architectural Accreditation of China
NEDA	National Economic and Development Authority
NEEAP	National Environmental Education Action Plan
ONEP	Office of Natural Resources and Environmental Policy and Planning
PGBI	Philippines Green Building Initiative
PIEP	Philippine Institute of Environmental Planners
PRC	Professional Regulation Commission
ProSPER.Net	Promotion of Sustainability in Postgraduate Education and Research Network
RIBA	Royal Institute of British Architects
RICS	Royal Institute of Chartered Surveyors
SLSEA	Sri Lankan Sustainable Energy Authority
SURP	School of Urban and Regional Planning
TGO	Thailand Greenhouse Gas Management Organisation
TREES	Thailand Rating Energy and Environment System
UGC	University Grants Commission
UGM	Universitas Gadjah Mada
UNU IAS	United Nations University Institute for Advanced Study of Sustainability
UP	University of the Philippines
WGBC	World Green Building Council

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Photo: Greg Tavares.

1 Introduction

The aim of this project is to consider how environmental, economic and social perspectives for sustainable development can be more systematically integrated into higher education institution (HEI) built environment professional education in the Asia Pacific region. For the purposes of this paper, sustainability, climate change, adaptation and resilience are used interchangeably. They are all terms associated with the aim to lower carbon emissions in the built environment.

This project builds on work undertaken earlier in a Phase 1 project, *Integrating sustainability education in engineering and built environment curriculum*. During the 2012-13 period Phase 1 focused on the skills and knowledge required to lower energy consumption in buildings and help make the transition to low carbon societies. A workshop and follow-up consultation by nine ProSPER. NET universities and industry participants was led by RMIT University. A guide for integrating sustainability in curricula of built environment professional degree programs was a key outcome for this project (Iyer-Raniga and Andamon 2014, 2016).

Another finding was that university academics were seeking assistance in extending curriculum change beyond single courses to whole professional programs. In particular, they sought assistance in:

- developing a greater capacity to contribute to broader curriculum development processes within their universities
- relating their work on curriculum reform to broader built environment industry, professional and governmental interests
- integrating sustainability content into curriculum at the course and program levels for built environment professional education.

This Phase 2 project responds to the Phase 1 findings by adopting a top-down perspective which seeks to relate curriculum development within universities to broader built environment industry, professional and governmental interests.

The project is based on the following three assumptions about the current context:

- A high priority policy objective for all governments in this rapidly urbanising region is to meet global commitments to mitigate and adapt to climate change by decarbonising the built environment, making it more energy and water efficient, adapting to climate change and making it more resilient.
- The work of designing, procuring, financing, renewing and maintaining the built environment is undertaken by professionals who are being challenged to incorporate new knowledge and professional practices into the way they produce and renew less carbon and water intensive built environments.
- HEIs educating built environment professionals, such as in architecture, engineering, building, construction management, project management, and urban planning, are being challenged to renew their curriculum and research capacities so that their graduates can contribute more to urban sustainability.

The project, based on these starting points, included built environment case study professions in five countries – China, Sri Lanka, Indonesia, Thailand and the Philippines.

The objectives of Phase 2 are:

- To contribute to processes which institutionalise the capacity of future generations of built environment professionals to design and build low carbon cities in the Asia Pacific; and
- To increase the relevance of university curriculum to designing and building low carbon cities by faculty, professional associations, industry associations, government agencies and international agencies.

It was beyond the scope of this project to review built environment professional education and the formation of the professions across all countries in the Asia Pacific. Instead the focus was on developing a methodology for understanding the institutional development of built environment professions in case study countries. Broader survey research of built environment professional

Photo: James Preston.

education, formation and growth of the professions was beyond the scope of this project.

1.1 Project context

The context for the project is continuing rapid urbanisation in the developing world. In the Asia and Pacific region urbanisation is particularly rapid.

As the United Nations ESCAP and UN Habitat (2015:7) note:

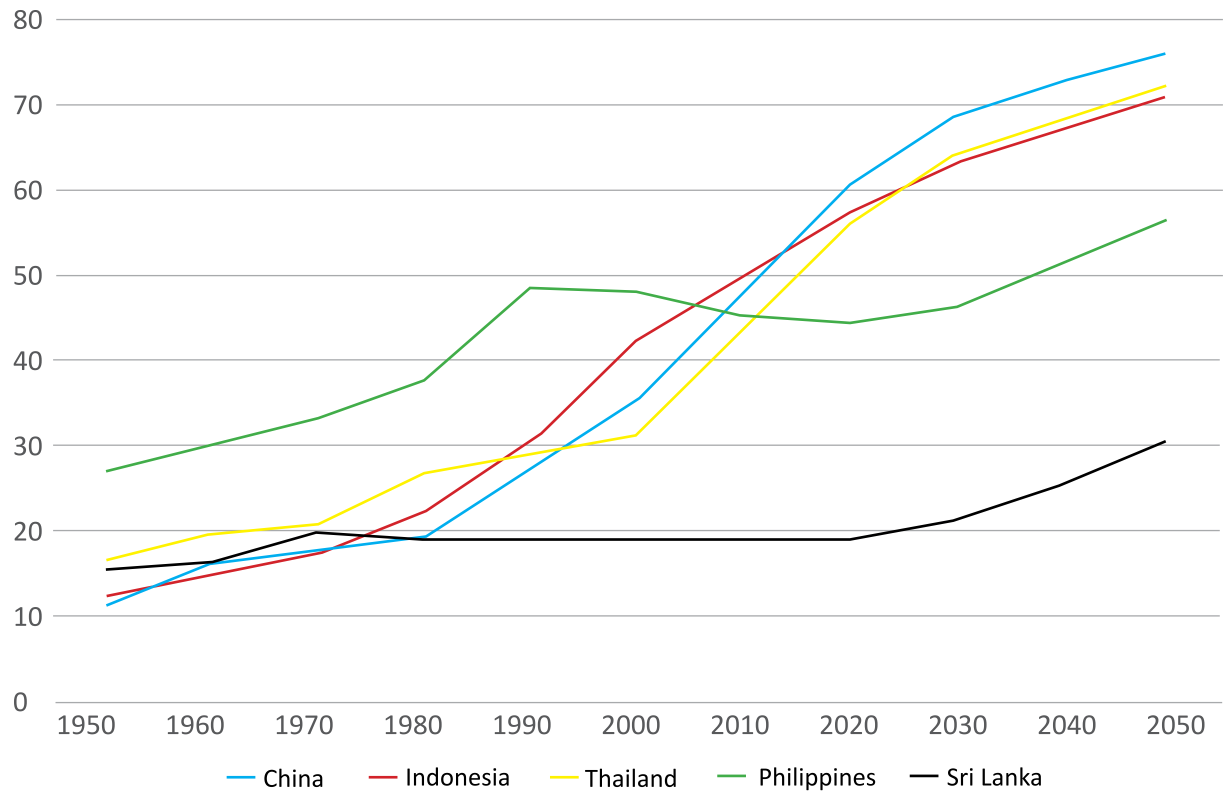
> The speed and scope of urbanisation in Asia and the Pacific is unprecedented. Between 1980 and 2010, the region's cities grew by around one billion people. United Nations projections show they will add another one billion by 2040.

The five countries which form the setting for the case studies of the built environment professions are part of this story of urban growth as shown in Figure 1.

Buildings in these growing urban areas are a major source of greenhouse gas emissions through the energy used to manufacture building materials, construct and operate buildings. These greenhouse gas emissions are projected to grow significantly as urban populations grow and as household incomes rise and support increased consumption in higher quality built environments. Further, much of this urban growth is occurring in peri-urban areas around large metropolitan cities. Typically, development in these peri-urban areas are subject to very weak regulation and guidance systems (Sajor 2016: 265).

One way in which the growth of greenhouse gas emissions can be moderated is to change the way

Figure 1: Case study countries: Percentage of population residing in urban areas 1950-2050



Source: United Nations ESCAP and UN Habitat (2015: 11)

cities are designed, built, retrofitted, and maintained by considering the role of the built environment professional workforces that design, build, retrofit and maintain cities. Built environment professionals may be trained and required to contribute to decarbonising the built environment and making water use more efficient. These professions include, among others, architects, engineers, planners, quantity surveyors and project managers. Simply regulating new requirements and exhorting professionals to change their day-to-day practice is an inadequate response.

Instead, it is important to focus on the institutional arrangements that encourage and constrain professionals to change their professional practices and approaches. Initially these professionals are educated within university departments and are taught an approved curriculum. Typically, the curriculum is developed by academics who have been drawn from the profession and guided by the requirements for professional association membership. Across HEI institutions there is evidence of 'bottom-up' initiatives providing built environment students with opportunities to learn about climate change, mitigation of greenhouse gas emissions and adapting cities to the effects of climate change. However, there is no evidence of any complementary 'top down' review of built environment education that could lead to all programs responding to the challenge of climate change through curriculum renewal.

It also appears that there are no broad expectations for system wide recognition of climate change by built environment professional education programs. This is evident in the lacunae in the research and policy reports supported by the international agencies and governments focusing on the challenges of rapid urbanisation and reducing carbon emissions in cities (see for example Bose 2010, Dobbs, Remes et al. 2012, World Bank 2012, APEC 2013, Hoornweg and Freire 2013, UNEP 2014, Ellis and Roberts 2016).

In these reports, no consideration has been given to the capacities of the professional workforces responsible for the design, build, retrofit and maintenance of cities. At best, there is a recognition of the need for skill development. For example, the World Bank (2012: 14) notes that 'skill shortages already appear to be impeding the greening of growth'. However, this finding is not connected to any appreciation of the institutional arrangements that educate built environment professionals. The connection between realising the objective of decarbonising urban development through educating future built environment professionals has not been recognised.

This disconnect is also evident in many developed countries. For example, Mummé (2017: 7) draws the following conclusion about postgraduate architectural education programs in Canada:

> A surprising and shocking finding is that not one of the eleven accredited M. Arch. programs in Canada has a course devoted to climate change. And only one of the accredited M. Arch. Programs in Canada has a required course devoted to the environment or sustainability in the broad sense.

There is however more urgency in making connections between the challenges of climate change and built environment professional education programs in developing countries. This is because, in addition to rapid urbanisation, built environment higher education programs are growing rapidly as a part of the broader expansion of higher education in the Asia-Pacific. As Ziguras (2016: 78) notes, higher education in the region is a story of continuing rapid growth:

> Mass higher education has become accepted by governments across the region as an unquestionable goal, and participation rates have increased very rapidly right across the region, despite very different levels of economic development and diverse ideological frames.

This growth is evident in the rapid increase in the number of public and private higher education institutions and extraordinary rates of growth in the participation of post-secondary school populations in higher education. Professional built environment programs are part of this massified higher education which produces graduates who move into positions in private firms and public sector agencies which aim to commission, procure, build and manage buildings in rapidly growing Asia-Pacific cities.

1.2 Project methodology

The methodology for this project is based on the core idea that the institutional arrangements that constitute the built environment professions and their continuing development are important. They are important because if we are to ensure climate change mitigation and adaptation is a feature of rapidly growing cities then those responsible for planning, designing and procuring buildings must have the necessary knowledge and skills.

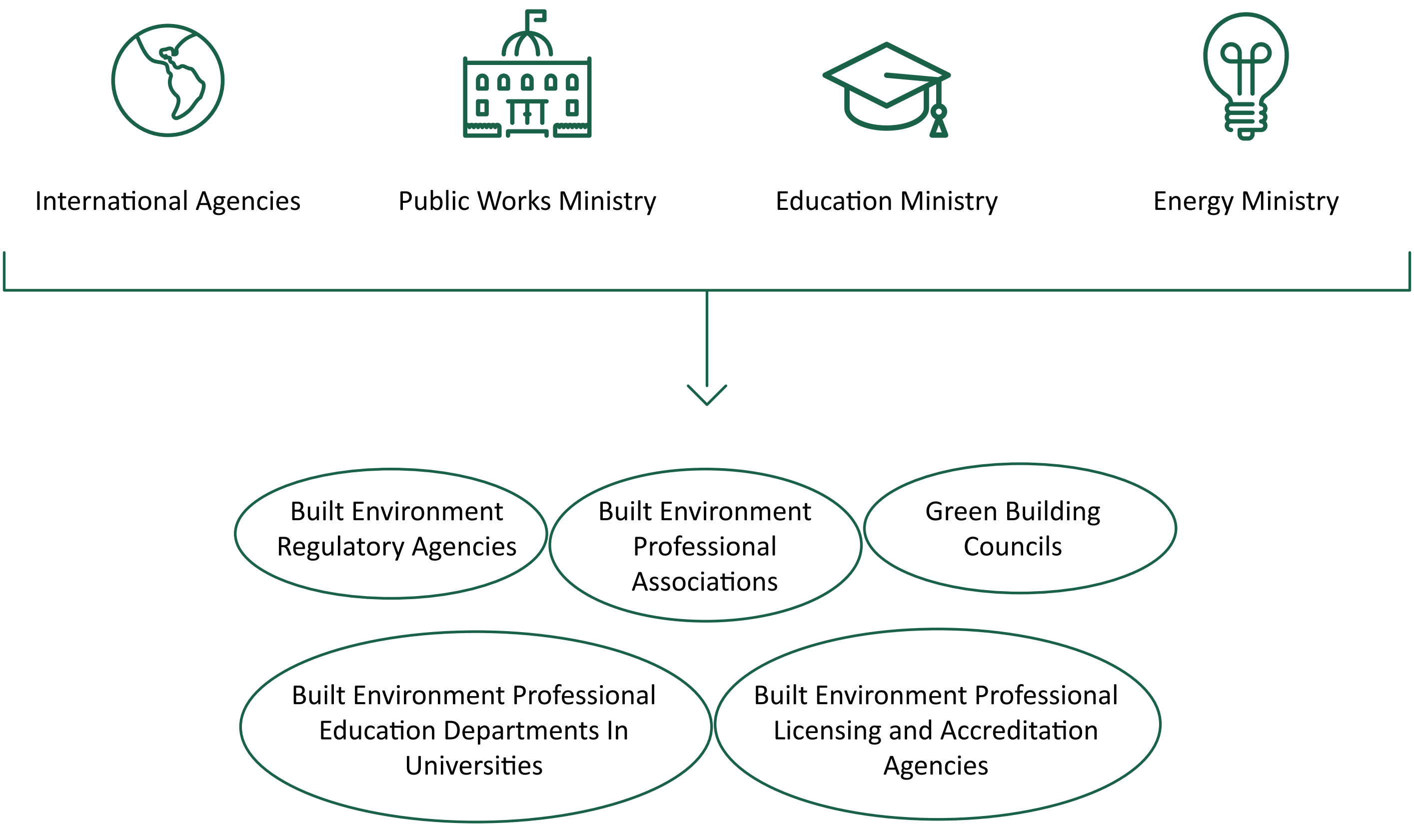
This means that it is important to recognise:

- government built environment agencies and systems that regulate the built environment
- associations that represent and support the built environment professionals
- government agencies that license and accredit the built environment professions
- departments and schools within universities that educate built environment professionals
- green building councils that accredit exemplar buildings and train sustainability professionals

Further, it is important to recognise other agencies with policy responsibilities for carbon reduction. In developing countries these are international agencies that assist public works ministries that develop and implement planning and building codes; education ministries that are leading higher education growth and development; and energy ministries that are leading the drive for built environment energy efficiency. Figure 2 illustrates these typical institutional arrangements.

The research approach based on this methodology was to undertake five case studies of built environment

Figure 2: Typical built environment institutional arrangements



professions and professional education in the Asia Pacific Region. Each profession was researched by examining five themes.

- Built environment regulation: the development and implementation of regulations and their systems of administration used to govern urban development.
- The profession: the development of the professional association and engagement with urban sustainability issues.
- Curriculum governance: arrangements used for revising curriculum in HE built environment professional programs.
- Built environment curriculum: sustainability curriculum and delivery in case study undergraduate and post-graduate professional programs in five countries (one case study per country).
- Expectations of the profession: evidence from stakeholder debate about contemporary challenges in the context of climate change.

These case studies and the universities responsible for preparing the case studies were:

- Architects in China – University of Tongji
- Civil engineers in Sri Lanka – University of Peradeniya
- Architects in Indonesia – RMIT University
- Architects and engineers in Thailand – Asian Institute of Technology
- Urban planners in the Philippines – University of the Philippines

These case studies were researched through document analysis and interviews with built environment professionals, academics, representatives of professional associations, and representatives of government and international agency officials. Each ProSPER.Net participant decided which built environment profession they would use for the case study. The project was developed based on the idea that the selection of the same built environment profession in each country was not so important. Rather, what was important was preparing case studies highlighting developments that supported the formation and development of a typical profession.

A one day workshop also formed an important element of the project methodology. This workshop, held on Wednesday 3rd of August 2016 in Jakarta, brought together 40 built environment and higher education professionals from universities, industry associations, professional associations and government agencies with responsibility for city planning, building and economic development that were committed to the development of low carbon cities.

The workshop was designed to enable participants to contribute ideas on how to systematically integrate environmental sustainable development thinking into university built environment professional education. While the workshop was held in Indonesia, with primarily local participants, it also had a regional orientation informed by the participation of representatives of the ProSPER.Net universities. The workshop confirmed that built environment curriculum change extending beyond bottom-up initiatives to a broader institutional and system wide change was critical for creating sustainable built environments.

1.3 The report

Section 2 presents an account of building code development in the five countries. The purpose of building codes is to regulate the built environment and improve the energy and water efficiency of the built environment. In all five countries, there has been a recent development and promulgation of building codes. These codes supported by administrative, assessment and approval processes can guide built environment professionals and building owners to produce and renew buildings that contain less embodied energy and can operate in ways which reduce energy and water use.

Section 3 presents an account of the development of the professions in each of these five countries. A profession in this context is understood as a workforce with defining features, in particular: a 'professional association, cognitive base, institutionalised training, licensing, work autonomy, colleague control, and code of ethics' (Larson 2012). It then considers the relationship between the professions and academic units that run built environment academic programs in the five countries and the broad arrangements governing university curriculum development. These arrangements have been changing as the higher education systems in these countries have been growing.

Section 4 examines in more detail the nature of built environment programs and curriculum in case study universities – one in each country. The progress made in embedding triple bottom line sustainable development in program aims, learning objectives, core and elective curriculum and staffing is of particular interest. One way of measuring progress is to assess the extent to which sustainable development learning opportunities have been embedded in core courses in programs, or have been made available in electives or specialist post-graduate degrees.

Section 5 presents the conclusion that much remains to be done. There has been progress in developing built environment regulatory systems requiring less carbon intensive built environments, though significant issues remain. The professional associations and their governance systems have not made sustainability central to built environment design, procurement and management. In universities, climate change has been acknowledged; however there has been no deep greening of built environment professional education.

Based on these findings it is proposed that a 'road map' for built environment professional education change is prepared. The United Nations University Institute for Advanced Study of Sustainability (UNU IAS) is well placed to convene this workshop of stakeholders committed to ensuring that climate change mitigation and adaptation is made central to higher education built environment professional education in the Asia-Pacific region. UNU IAS has a history of supporting the study of sustainability in higher education in the Asia-Pacific through support for ProSPER.Net and other initiatives.

The content of the 'road map' would be determined by workshop participants under three headings. First, the challenge facing built environment professional education requires further research. Second, there is a need to develop the capacity of existing faculty in built environment programs and create a network of expert built environment sustainability educators. Third, there is a need to create a global network that supports the education of built environment professionals and their contribution to the governance of cities that are increasingly sustainable.

Appendix 1 presents a report on the workshop held in Jakarta as a part of this project. It provided the venue to engage stakeholders in a discussion about the relationship between built environment higher education and the development of institutional capacities necessary for decarbonising the built environment.

1.4 Limitations of this project

This project examines the architecture, engineering and planning professions across the case study countries as described above. It is not a like-like comparison of just one profession across all countries. There are several reasons for this. First, built environment disciplines need to work together to reduce carbon emissions. Second, there are similarities in the way in which built environment professions have developed. Third, the project relied on the ProSPER.Net participants undertaking research in their own country.
Reviewing the built environment professional education and the formation of the professions more broadly in the Asia Pacific was not part of this study, largely due to time and budgetary considerations. Broader survey research of built environment professional education and an in-depth study of the formation and growth of the professions in each of the case study countries was not possible. The emphasis in this project was on developing a methodology for understanding the institutional development of built environment professions.

Photo: Flickr/roaming-the-planet

2 Built environment regulation

Knowledge of building regulations and broader urban development planning regulations and using them to guide the design and procurement of buildings is an important requirement for built environment professionals. These are the regulations that governments have developed which seek to control how buildings are built and located in cities. The long-term objectives underpinning these regulations have been fire prevention and safety, health and user access. Others relate to urban design and city functioning.

Recently, governments have added sustainability objectives which have led to further regulatory measures, such as those aimed at reducing building waste, increasing building envelope thermal performance and efficiencies in operating water and energy use. In developed countries, there has been progress in implementing these regulations for new buildings and their effectiveness has been demonstrated (IEA and UNDP 2013: 39). The big challenge in developed countries is regulating for the upgrading of existing buildings but as yet little attention has been given to this challenge. The EU is the most advanced jurisdiction where member states are required to regulate for the systematic upgrading of the existing building stock (European Union 2012).

The situation is different in developing countries where the rate of growth of new buildings associated with rapid urbanisation is high. This means that the yet-to-be-built stock will form a larger proportion of the total stock in future years than in developed countries. For example, it has been estimated that in China only 40 per cent of the building stock of 2020 exists today (Managan, Layke et al. 2012: 9). The challenge is to ensure that the best possible sustainability measures are incorporated in buildings so that the large yet-to-be-built building stock does not 'lock in' the poor building performance currently widespread in cities in developed countries. This is more so the case for developing countries. In developing countries, the development and promulgation of building codes based on sustainability principles is recent (Nathan Associates Inc 2013). Also, these countries are challenged by weaknesses in governance, technical and institutional capacities compared to developed countries (IEA and UNDP 2013: 39).

This is the nature of the challenge faced by leaders of built environment regulation initiatives in the case study countries in this project. They are faced with implementing systems for built environment regulation that go beyond promulgating principles, rules and sanctions for non-observance. Instead they are faced with building participation in the regulatory system by the very many actor groups engaged in designing and procuring buildings. Some of these have a commitment to regulation and decarbonising the built environment but many do not. This can lead to a fragmented approach, where some bottom¬-up initiatives are supported but there is inadequate top-down coordination and enforcement. Ultimately, what has to be achieved is a system, or a regime, involving actor groups in processes of collaboration and contestation within an accepted framework. Regulation is more than the application of rules by government. Black (2002: 26) sums up this idea of regulation:

> Regulation is an activity that extends beyond the state, thus regulation may on the basis of such a conceptualisation embrace a variety of forms of relationship between state, law and society. It thus enables the identification, creation and analysis of regulatory arrangements that involve complex interactions between state and non-state actors, and enables each to be identified as both regulators and regulatees.

Built environment regulation in any country involves complex interactions between state and non-actors because of the nature of the building sector. Buildings are designed, financed and procured by bringing together multiple actors through multiple contracting arrangements. Businesses in these supply chains typically range from the very large and well-resourced to the very small and unincorporated individual contractor. Also, it is a sector where multiple government agencies, often from different levels of government, have contiguous and overlapping regulatory responsibilities. There are agencies with responsibility for regulating building design and construction and there are others that regulate the broader urban arrangements within which buildings are located. Beyond the actors engaged in the designing, financing and procuring of buildings there are the associations representing building owners, professionals and trade and labour interests. Also, there are NGOs that advocate solutions to built environment issues, such as energy use, disability access, innovation, and affordability.

Built environment regulation also requires agencies with the capacity to lead the development and implementation of regulation. The problem is that in developing countries there are regulatory capacity constraints across many areas of social and economic activity, including the built environment. Liu, Myer et al. (2010: xxi) in their publication for the World Bank, Mainstreaming Building Energy Efficiency Codes, sum up the problem in these terms:

> Many developing countries began to introduce BEECs [building energy efficiency codes] in the 1990s. With a few exceptions, the enforcement practices are still lacking, hindered by major institutional and economic barriers and limited by underdeveloped technical capacity.

An important technical capacity constraint is the under-supply of people with the qualifications and skills required to act as regulators. In the context of rapidly urbanising countries with large scale building activity, ensuring the supply of a sufficiently trained workforce is a challenge. Meeting the challenge is difficult because of the extent of specialisation required to regulate different types of building, multiple construction processes and building systems. Therefore, addressing regulatory capacity constraints requires assessment of: existing capacities; the benefits and costs of existing and new regulations; the mix of public and private regulatory responsibilities; and anticipated future challenges. In this context using a regulatory impact assessment (RIA) methodology can be useful (Kirkpatrick and Parkers 2004).

Built environment regulation linked to sustainability goals can also be supported by the voluntary initiatives of actor groups who pursue public good or market advantage goals by developing and adhering to agreed-upon standards. This is what van der Heijden (2014: 94) calls 'best-of-class benchmarking'. It is a system where certification of 'a building plan or construction work is assessed against a series of predefined regulations'. This results in a score being awarded on an easily comprehended scale. These schemes receive their support from developers, building owners, investors NGOs and built environment professional associations. Also, they are often supported by government as agencies seek to encourage the property industry to voluntarily move beyond government construction codes and regulation. This best-of-class-benchmarking movement began in the UK in the early 1990s and has subsequently spread through developed countries and, more recently, developing countries. Evidence of this movement is found in national green building councils and their regional and global networks.

At a broader level, the advice from the World Bank, based on a review of the developing country experience in institutionalising building energy efficiency codes, is that country strategies with four elements is required (Liu, Myer et al. 2010). The first is strengthening governance capacity by expanding and strengthening political support for energy efficiency. The second is improving the regulatory and enforcement capacity of government agencies responsible for supervising the building construction sector. The third is developing the technical and engineering capacity of key groups in building construction supply chains. The fourth is developing the means for financing the additional costs incurred in procuring buildings that are more energy efficient than those that are normally provided.

Each case study country is examined below by describing the development of the building code for China, Sri Lanka, Indonesia and Thailand. In the case of the Philippines the focus is expanded to include the development of the urban planning regulatory system. Particular attention is given to the institutional context for the development of regulation and the administrative and compliance constraints that have been acknowledged. The development of voluntary green building assessment and accreditation systems supported by green building councils or institutes are also described.

2.1 China

The Chinese government has developed a two-part strategy to increase the energy efficiency of buildings and reduce carbon emissions related to buildings. The first are the requirements included in building codes introduced in the mid 1980s. The second is the development of the Green Building Evaluation Standard. This standard is equivalent to the US LEED system and was established in 2006.

In China, building codes requiring building energy conservation were first introduced in the mid 1980s. They have been revised regularly and energy conservation requirements have increased. Key legislative steps have been the 1997 Energy Conservation Law, which specifically supported the development of building energy conservation codes, and the 2007 revision of this law. The revision contained seven articles that established priorities for the further development of codes: code administration, compliance and enforcement, energy use mandatory disclosure by real estate companies, indoor temperature control systems in public buildings, household heat metering, power conservation management of landscape lighting in public facilities and large buildings, building materials and solar and renewable energy.

Chinese government agencies, supported by this legislation, have gone on to develop a comprehensive set of energy conservation codes for residential and commercial buildings that respond to the very different conditions across five climatic zones which range from tropical to severe cold. For residential buildings, there are three residential building design standards applying to new construction, building additions and retrofits. Each standard has been developed based on a target for the reduction in the use of energy. Similar design standards have been established for commercial buildings. More specific standards have been developed for building systems, including lighting design, heating, cooling and solar energy technologies and building materials. Further, central government has gone on to develop standards for monitoring energy use including the inspection of buildings.

There is also a local government dimension in this history of central government code and standards development. Broadly, the situation in China is that national government develops and sets the regulations and local government authorities implement them. However, local government can choose whether to comply with the national codes and standards or go beyond the national requirements. Shui, Evans et al. (2009: 3) report that in 2005 there were approximately one hundred local design codes based on national codes. More recently Khanna, Romankiewicz et al. (2014: 44) report that there has been an ‘increasing level of activity by local city governments that goes beyond national requirements, especially as interest grows in low-carbon cities and eco-cities’.

The Green Building Energy Label (GBEL) is similar to the US LEED in the way it evaluates, labels and symbolically rewards companies and agencies that design and build green buildings. The standard covers land conservation; energy conservation; water conservation; material conservation; indoor environmental quality; and building operation and management throughout the life cycle (Shui, Evans et al. 2009: 20). The GBEL is supported by other supplementary and technical standards that contain requirements, recommendations and preferred items.

The Chinese GBEL system is also different to the US LEED scheme because the GBEL is developed and run by the Chinese government, not a non-government organisation supported by industry associations and professional associations. Unlike the US and other countries it is ‘reliant upon bureaucratic hierarchies and apparatuses for implementation’ (Zhou 2015: 11). At the centre there is the Green Buildings Research Centre hosted by the Chinese Society for Urban Studies and the Science and Technology Promotion Center of the Ministry of Housing and Urban-Rural Development (MOHURD).

Companies and agencies applying for GBEL recognition apply both for a Green Building Design Label (GBDL) and the operational Green Building Label (GBL). Both labels have three ranks: one-star, two-star and three-star, with three-star being the highest rank. These companies and agencies are also able to apply for subsidies from central and local government. The level and the structure of subsidies vary across the country. For example, in

Beijing 2 star buildings attract a 40 RMB/m2 from central government and 22.5 RMB/m2 from local government and 3 star buildings attract 80 RMB/m2 from central government and 40 RMB/m2 from local government.

The overarching policy framework for the building energy reduction targets are included in China's rolling five year plans. The targets in the two most recent plans (11th Five Year Plan 2006-2010 and the 12th Five Year Plan 2011-2015) demonstrate an increasing commitment to building energy efficiency (Khanna, Romankiewicz et al. 2014: 44-45). In the 12th Five Year Plan commitments are made for substantially increasing the energy efficiency of all new buildings; retrofitting existing residential buildings; retrofitting and developing energy management plans for large public buildings; including renewable energy applications in new construction; promotion of 'green building' through demonstration projects, investment in government buildings and regulation of new construction in selected cities; and promotion of energy efficient building materials.

The development and growth of the Chinese green building program is driven by the state through a coordinated set of agencies. However, questions remain about how well embedded green building thinking and practice is within the systems producing new buildings in China's rapidly growing cities (Zhou 2015). An indication of this is found in the extent to which members of the architecture profession have engaged with the green building. Zhou (2015: 10), based on her survey of senior architects found that 'capacity building is only at a nascent stage' based on limited involvement in green building projects and that professional education and knowledge networks are yet to emerge. In part, this absence of capacity building relates to the accreditation system, administered entirely by MOHURD central and local government offices, which does not offer the broader professional development programs offered by green building councils in other countries (Khanna, Romankiewicz et al. 2014).

Photo: Flickr/mrhayata

2.2 Sri Lanka

The Sri Lankan government has a three-part strategy to increase the energy efficiency of buildings and reduce carbon emissions related to buildings. The first initiative is the development of the building code. The second initiative is the development of the green rating system first established in 2009 based on the US LEED system guided by the World Green Building Council. The third initiative involves programs developed by the Sri Lankan Sustainable Energy Authority (SLSEA) established in 2007, which aims to increase the supply of renewable energy and energy efficiency through policy and regulation, development, energy service support for all sectors, awareness and education, and financing.

The first building code initiative was the adoption of the Energy Efficient Building Code (EEBC) in 2000. It was prepared by consultants and funded by the World Bank. It covered the main areas of lighting, ventilation and air conditioning, building envelope, electric power and distribution, and water heating. Its purpose was to encourage energy efficient building designs and to guide building retrofits to achieve high energy efficiency standards for larger commercial multi storey buildings that used air conditioning for cooling. Residential and industrial buildings were not included, however, and implementation of the code failed. As Wickramasinghe (2009: 51) notes, the industry regarded the code as a guideline. It 'failed to interest the dominant stakeholder group of architects. As a result, the building code was never practiced … and went into disuse'.

The second initiative was the Code of Practice for Energy Efficient Buildings in Sri Lanka, 2008. This code was broader in scope and applied to smaller buildings including industrial buildings with one or more features listed in Section 1.3.3 of the code. Also, the energy performance of existing buildings that are being extended or remodeled are expected to conform to the code regulations. Further, the code is supported by an ISO system of standards for materials and products.

The three main purposes of the 2008 code are to:

- Introduce energy efficient design and/or retrofits to commercial buildings, industrial facilities and housing schemes to enable design, construction and maintenance to reduce energy consumption without compromising the building's function, and/or occupant comfort and health.
- Set criteria and minimum standards for energy efficiency in design and/or retrofits in commercial buildings and provide criteria for determining compliance.
- Encourage energy efficiency designs exceeding minimum standards.

The code was also framed to reflect a new implementation objective that required building owners and developers to comply with regulations by ensuring that applicants applied for permits within an administrative system. At the centre of this system is the Urban Development Authority (UDA) that operates in partnership with provincial councils and local government authorities that have responsibility for enforcement at the provincial and local levels.

The code is currently being revised along with a new building energy rating system by an engineering firm specialising in design, research and consulting on green buildings (SLSEA 2017). Its brief is to produce a new code based on revised performance parameters reflecting new technologies along with global and local industry practices (Devcoe 2015). Completion and promulgation of the new code was scheduled for 2016 but has been delayed.

The formation of the Green Building Council of Sri Lanka (GBCSL) in 2009 and development of the green rating system for buildings has followed a similar path to green building councils in other countries. It was formed by built environment professional associations including architects, engineers, structural engineers, town planners and quantity surveyors. University academics, construction industry leaders, environmentalists and business leaders were also involved. Further, the Sri Lankan government provided support through the Institute for Construction Training and Development (ICTAD).

This agency, within the Ministry of Housing and Construction, has a remit for assisting the development of the construction industry through processes such as supporting the development of skills and expertise of people and professional bodies, registering contractors and supporting the development of industry quality assurance systems. Support for the GBCSL has been an element in this broader program of industry development. Currently there are seven buildings on the GBCSL register of accredited buildings.

The GBCSL has introduced two rating schemes, the GREENSL® Rating System for rating buildings and GREENSL® Labelling System for rating products. The GBCSL also conducts an Associate Professional Training Course that trains industry professionals who can then work as Green Professionals with a knowledge of green building practices.

The SLSEA policy and program work is aimed at ensuring the future energy security of Sri Lanka in a context of rapidly rising economic growth and energy consumption linked to the importation of high cost oil, coal and gas. The SLSEA plan is organised around regulations, energy services, awareness and financing.

In addition to the building code other regulations cover: energy labelling of appliances, including light emitting technologies, accreditation of energy managers and auditors, and mandatory energy auditing and management. The mandatory energy auditing and management is focused on the largest 1600 consumers who account for 80 per cent of electricity consumption and requires them to measure and manage their energy consumption. Energy services includes a regional lighting centre, establishing energy service companies (ESCOs), and energy auditing and technical support. Awareness programs include training for professionals in the construction sector, and award and recognition programs. Financing assistance includes a guaranteed facility and a soft loan scheme.

Although progress has been made in developing the institutional arrangements required for increasing built environment energy efficiency, major barriers remain. They have been lack of financing, lack of end user awareness and commitment, lack of technical capacity amongst end users and the underdevelopment of regulations (GSA 2012: 104). The problem of awareness and commitment to energy efficiency has been identified as an issue in the construction sector. As the SLSEA (2017) notes, they have run awareness programs to encourage and motivate professionals employed in the construction sector to adhere to the building code. They have done this because although people are aware of the energy crisis and realise the need for solutions, implementing the regulations remains a challenge in the construction sector. This is made all the more difficult because of the limited availability of people with technical skills and knowledge (Sugathapala 2014).

2.3 Indonesia

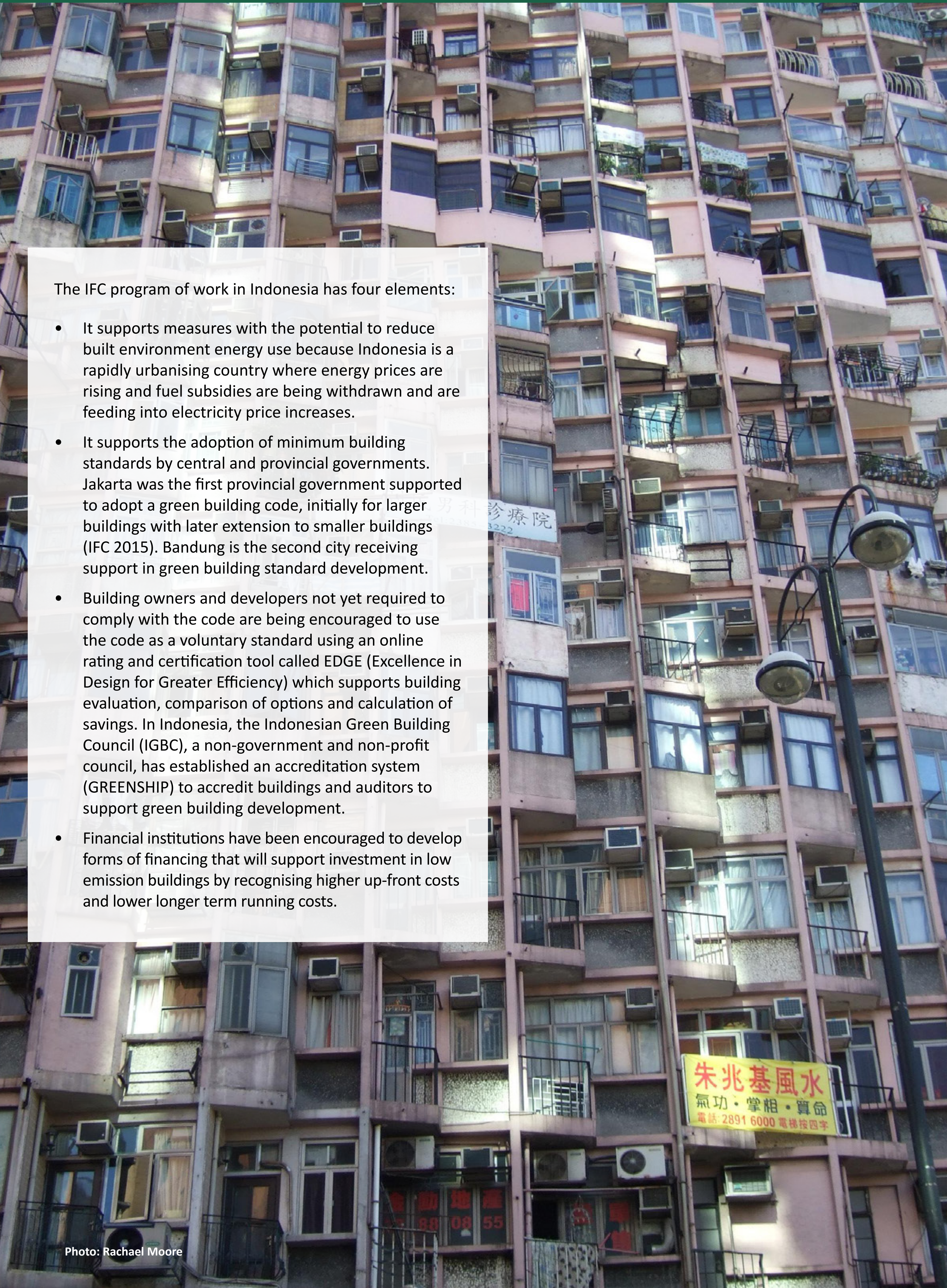
In Indonesia regulation of the built environment was primarily a local government responsibility until the late 1990s. Some local authorities developed regulations through collaborative arrangements. Subsequently the national system of built environment regulation has been developed through two processes. First, in the mid 1990s the Ministry of Public Works built on the work undertaken by local government and prepared and adopted an initial building code. Second, global pressures, particularly through the World Trade Organisation, sought to reduce trade barriers applying to building materials by harmonising built environment regulation. Within the Asia Pacific region APEC became an important forum for discussing these reforms. In this context Australia became an active participant based on its mid 1990s revision of its building regulatory system, which included the formation of the Australian Building Codes Board in 1994 based on an intergovernmental agreement between the states and territories (ACLN 1996).

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 'utilisation, safety, balanced and harmonious principles with their environment' (The House of Representatives of the Republic of Indonesia 2002). The main provisions covered building functions; requirements for building administration, use, layout, form, architecture, environmental impact, reliability, health, safety, convenience and accessibility; building management; people 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. 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 made it 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 Ministry of Public Works (MoPW). 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 the 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 (IPEEC 2015).

The International Finance Corporation (IFC), a World Bank agency, supports much of this work by the MPoW. It supports the development of building regulation in a number of developing countries aimed 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 due to the 'importance of the private sector's role in the reduction of greenhouse gas (GHG) emissions, IFC will engage in innovative investments and advisory services to support climate-friendly solutions and opportunities for business' (IFC 2012). It is responding 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 (IEA and UNDP 2013).



The IFC program of work in Indonesia has four elements:

- It supports measures with the potential to reduce built environment energy use because Indonesia is a rapidly urbanising country where energy prices are rising and fuel subsidies are being withdrawn and are feeding into electricity price increases.
- It supports the adoption of minimum building standards by central and provincial governments. Jakarta was the first provincial government supported to adopt a green building code, initially for larger buildings with later extension to smaller buildings (IFC 2015). Bandung is the second city receiving support in green building standard development.
- Building owners and developers not yet required to comply with the code are being encouraged to use the code as a voluntary standard using an online rating and certification tool called EDGE (Excellence in Design for Greater Efficiency) which supports building evaluation, comparison of options and calculation of savings. In Indonesia, the Indonesian Green Building Council (IGBC), a non-government and non-profit council, has established an accreditation system (GREENSHIP) to accredit buildings and auditors to support green building development.
- Financial institutions have been encouraged to develop forms of financing that will support investment in low emission buildings by recognising higher up-front costs and lower longer term running costs.

Photo: Rachael Moore

2.4 Thailand

In Thailand, legislation and the regulations governing buildings both in terms of the number of laws and the regulations and their administration are extensive. However, two pieces of legislation used to control building design and construction stand out. They are the Building Control Act (BCA), first enacted in 1975 and revised a number of times, and the Energy Conservation Promotion Act enacted in 1995.

The BCA provides a framework for the administration of more than 200 ministerial regulations covering areas such as design and construction, fire, sanitation, lighting, ventilation, water, waste and mechanical design (Nathan Associates Inc 2013). The committee responsible for the BCA and regulations, the Building Control Committee, is chaired by the Director General of the Department of Public works and Town & Country Planning and has a membership drawn from ministries, such as health, industry, highways, provincial administration and environment; the engineering and architecture professions; Bangkok local government; and senior experts.

The Energy Conservation Promotion Act, through the mandatory Building Energy Code (BEC), prescribes standards for designated buildings. The BEC scope covers the building envelope; electrical lighting; water heating and air-conditioning; energy consumption; and renewable energy deployment within the building. Designated buildings are those that will have a gross floor area of 2,000 square meters or more, or buildings to be modified that have a gross floor area of 2,000 meters or more. Within these parameters nine building types have been designated: health-care centres such as hospitals; educational institutions; office buildings; condominiums; buildings where more than 500 people can gather such as sports stadiums or convention centres; theatres; hotels; certain entertainment establishments; and shopping centres and department stores.

The BEC is the responsibility of the Department of Alternative Energy Development and Efficiency (DEDE) within the Ministry of Energy, and assesses its performance in terms of estimated tonnes of CO2 reduction. This work by DEDE is undertaken in collaboration with the Office of Natural Resources and Environmental Policy and Planning (ONEP) and Thailand Greenhouse Gas Management Organisation (TGO) within the Ministry of Natural Resources and Environment (MNRE). The commitment to increasing the efficiency of building energy stems from the draft Thai Climate Change Policy and the National Agenda that responds to COP21. The framework for improving building energy efficiency, within this cluster of government agencies, is outlined in the Thailand: 20-Year Energy Efficiency Development Plan (2011 - 2030) led by the Ministry of Energy (2011b) and specified in the Thailand Energy Efficiency Development Plan 2015-2036 (Ministry of Energy 2011a).

In addition to the regulatory system Thailand also has a voluntary green buildings sector led by the Thai Green Building Institute (TGBI) formed in 2009 with the support of the Association of Siamese Architects and the Engineering Institute of Thailand. Its objectives are to promote professional standards for the design, construction and building management of green building; facilitate architectural and engineering practices associated with green building development; and support green building activities such as training, workshops, seminars or conferences. The TGBI uses the Thailand Rating Energy and Environment System (TREES) to assess and certify building environmental performance. It is based on the BEC, similar to the US LEED system, developed with support from the Ministry of Energy in conjunction with Chulalongkorn University. Building owners seeking certification of their building can either use the LEED or TREES. As of early 2014 less than 30 buildings in Thailand had been certified and notably none of these buildings were residential buildings (Mitchell, Souche et al. 2014).

The barriers to improving built environment energy efficiency in Thailand were reviewed by an APEC peer review team in 2010 (PREE Team 2010) and there has been follow up strategic planning aimed at increasing energy efficiency including in the built environment (Ministry of Energy 2011b, 2011a). Two significant issues have undermined efforts to improve the energy efficiency of buildings being planned and constructed in Thailand.

Photo: Chris Price.

First, there is a shortage of people with the qualifications and skills necessary for designing and procuring green buildings and others who are able to assess applications for new buildings and apply the regulations. For example, the major consulting company Solidiance (2014) working in the area of green buildings and cities notes the 'lack of know-how from local architects, contractors and consultants is an issue to develop green buildings' and PREE Team (2010) notes that there is a problem with 'compliance enforcement to verify that the code was in fact followed during, and after, the building completion'. Government agencies assess permit applications. However, during construction, unless there is a problem, such as an accident or a complaint from neighbours, buildings are not inspected during construction.

The skill capacity issue is being addressed by a UNDP program 'Promoting energy efficiency in commercial buildings'. Its objective has been to strengthen national capacity in promoting environmental management in the building sector. This has been undertaken through a program of enhancing the awareness of government agencies and local authorities, the building sector, and financial institutes on designs and implementations of energy efficiency technologies and practices that are applicable in the Thai context. The program has been organised principally around eleven demonstration projects comprised of one educational institute, five office buildings, three hotels and two hospitals. Also, the Ministry of Energy has made substantial commitments to training of built environment professionals in the Thailand Energy Efficiency Development Plan 2015-2036 (Ministry of Energy 2011a).

Second, regulations are not enforced. Mitchell, Souche et al. (2014) note that there 'are no penalties for non-compliance with the Green Building Code [the BEC]'. Similarly, the Asia Pacific Economic Cooperation (APEC) peer review of Thai energy efficiency concluded that although there has been progress, two critical items are missing from the overall program: a process for improving the codes and compliance enforcement to verify that the code was in fact followed during, and after, the building completion. Further, there is evidence of corruption. As Gan Integrity (2017) note 'most infrastructure projects and other public works projects such as government sponsored housing construction have major problems with corruption resulting in delays, poor performance and higher cost'. Corruption is also recognised and opposed by construction industry organisations 'with fighting corruption at the top of the government's agenda, the property industry believes it is also time for the state to address irregularities that occur when developers apply for construction permits (Katharangsiporn 2014)'.

At the senior government level the need for enforcement has been recognised in the Thailand Energy Efficiency Development Plan 2015-2036 (Ministry of Energy 2011a). In the plan commitments are made for adopting 'Mandatory Requirements via Rules, Regulations and Standards' for larger commercial buildings, which includes government buildings. However, in the area of smaller commercial buildings and residential housing, the commitment to improving energy efficiency is weaker. The plan only makes a commitment to Energy Conservation Promotion and Support. Corruption also appears to be an area where there has been little progress. In 2016 Thailand declined from 76th to 101st in the Transparency International rankings of 176 countries (Bangkok Post 2017).

2.5 Philippines

The Philippines government has well-developed laws and regulations aimed at protecting the environment and reducing carbon emissions. In the mid 1990s a leading figure in environmental law and law enforcement attested to this when he stated that legal framework governing the Philippine environment, consisting of about 118 environment and related laws, was 'sufficient in substance and in form, even superfluous' (Dodman, McGranahan et al. 2013: 66). Further, the Philippines local government legislation confers considerable local autonomy and enforcement powers to Local Government Units (LGUs), including powers to enforce environmental laws and the national building code, and to approve plans for land subdivision (Yilmaz and Venugopal 2013: 235). However, notwithstanding the legislation, there is a consensus that progress on environmental protection and reducing built environment greenhouse gas emissions is limited by systemic weaknesses in Philippine institutional arrangements and governance capacities.

Minimum building standards are set by the National Building Code of the Philippines and Presidential Decree 1096 (PD 1096). Up until 2015 the National Building Code, although mandatory, contained only voluntary standards on energy efficiency for the building envelope, lighting, heating ventilation and air conditioning, and water heating. The Philippines until this time relied solely on encouraging businesses and residents to adopt energy efficiency measures. The government also provided some training to professionals in the design and construction industries on the voluntary standards. However, in mid 2015 the Green Building Code (GBC), a Referral Code of the National Building Code (Presidential Decree No. 1096), was launched by the Department of Public Works and Highways (DPWH).

The development and introduction of the GBC, similar to the introduction of the Indonesian green building code, has been supported by the IFC. Like Indonesia, the code applies to larger residential, accommodation, educational, health, office, retail and mixed occupancy buildings (Department of Public Works and Highways 2015). It has six main performance standards: energy efficiency; water efficiency; material sustainability; solid waste management; site sustainability; and indoor environmental quality. Further, the IFC has supported the formation of the Philippines Green Building Initiative (PGBI), established in 2010, as a way of promoting the green building sector. Its members are drawn from built environment professional associations who support green building sector growth. Similar to the other countries discussed above the PGBI has adopted the IFC supported EDGE green building certification system as their system for measuring building performance (PGBI 2017).

Progress on improving the energy efficiency of buildings in the Philippines is limited for three reasons. First, the commitment to minimum standards through the adoption of the GBC is recent and has not been accompanied by an implementation plan. Second, there is a shortage of suitably qualified people in the industry with knowledge about green buildings. As the Oxford Business Group (2015) has noted at the time of the adoption of the GBC 'there is a lack of expertise in green project design and engineering among local developers, as well as a scarcity of green building material supplies'. They also note that government will struggle to implement the code because there 'is a shortage of qualified building inspectors' and understaffing of LGUs with responsibility for regulating new buildings. Third, public sector energy efficient exemplars that illustrate the potential of energy efficient buildings are absent. For example in the city of Cebu, the second largest city in the Philippines, Ostojic, Bose et al. (2013: 135), note that 'there is no formalised refurbishment cycle for government buildings, which poses a significant challenge to achieving energy efficient performance in the existing building stock'. At the time, the Cebu LGU was initiating its first pilot project for improving the energy efficiency of City Hall through a retrofit for a central air conditioning system.

In the Philippines, all LGUs are required to prepare a Comprehensive Land Use Plan (CLUP) and a Comprehensive Development Plan (CDP). CLUPs are implemented through the zoning ordinances that enforce land use or locational policies and performance standards (DILG 2008). The CLUP distinguishes four types of land use: settlement, infrastructure, protected, and production. The CDP is broader and covers the five development sectors: social, economic, physical, environmental and institutional. LGUs are also responsible for other multisector development plans and public investment programs, including the local development investment plan (LDIP). Planners are the professionals that support the development of both the CLUP and CDP planning processes within the broader political process, which is the responsibility of elected officials, industry representatives and civil society interests. The development plans are enacted by the Local Legislative Councils (Sangguniang Bayan or Sangguniang Panglungsod), and are reviewed and ratified by the Provincial Land Use Committees (PLUC) and/or the Housing and Land Use Regulatory Boards (HLURB).

These planning arrangements led by LGUs establish the layout of urban areas with their town centres and other land uses, rural settlements and in some regions the settlement of ethnic groups and indigenous people. Other national laws and codes govern development within these areas with a particular focus on infrastructure, linking different land uses to the provision of services and regulations that regulate land used for different types of production. LGUs work within a framework that assigns functions and supports their operations through revenue sharing between local and central government and supports LGU resource generation. In addition to these laws and codes, other legislation such as the National Integrated Protected Areas System (NIPAS) Act of 1992 provides for the protection of areas using eight land use categories: strict nature reserve, natural park, natural monument, wildlife sanctuary, protected landscapes and seascapes, resource reserve and natural biotic areas.

National government also has a role in planning for urban development. At the apex, there is the National Economic and Development Authority (NEDA) with responsibility for setting the National Framework Plan. In addition, there is the Senate Committee on Urban Planning, Housing and Resettlement, the House Committee on Housing and Urban Development, the Housing and Urban Development Coordinating Council (HUDCC) and the Human Settlements Regulatory Commission. The Housing and Land Use Regulatory Board (HLURB) formulates land use planning guidelines and standards for use by LGUs.

Reviews of these arrangements have found significant weaknesses. First, the assignment of responsibilities is unclear resulting in overlaps and inefficient administration. The Asian Development Bank found that the devolution of land use planning to LGUs has resulted in arrangements where 'data on urban land use is maintained by several agencies, leading to fragmented responsibilities in land management and administration (Singru and Lindfield 2014). The European Commission (2009: 8) similarly observes that agencies and laws overlap and that there is a 'critical problem of an inefficient and ineffective land use administration system which discourages sustainable management of resources'. Second, built environment and land use governance in the Philippines is beset by the problem of continuing corruption (ECAP, ICLEI SEA et al. 2008, Antonio, Bass et al. 2012, Singru and Lindfield 2014). Third, the agencies responsible for urban development are constrained by human resource shortages. The Asian Development Bank finds that 'the pool of skilled human resources for urban management needs in the Philippines is critically low, largely due to the limited educational opportunities in the area of urban planning and management' (Singru and Lindfield 2014: 50).

2.6 Summary

The countries discussed in the case studies began greening their building regulation systems at different times: China mid 1980s, Sri Lanka 2000, Indonesia 2010, Thailand 1995, and the Philippines 2015. The reasons for including energy efficiency objectives as part of the building code can be attributed to two main pressures. First, all these countries are struggling to meet the increasing demand for energy associated with economic growth, urbanisation and rising household incomes. Buildings built to higher standards provide opportunities for building users to reduce the energy they use to provide thermal comfort, lighting and run appliances and equipment. Potentially this can slow down growth in the demand for energy and investment in costly energy infrastructure. However, an issue in all countries is that actual energy use is not assessed and the effect of the codes on energy demand is unknown. Second, all these countries are experiencing the effects of climate change and have become signatories to a succession of global agreements aimed at reducing greenhouse gas emissions. The introduction of building codes requiring improved building energy efficiency is now a common response across all signatory nations.

The development of voluntary rating schemes has accompanied the development of regulations in all case study countries. This has been done through the establishment of green building councils in all the countries, with the exception of China. These green building councils have followed the form of the green building councils established in developed countries and promoted through the World Green Building Council. These councils have been led by professionals drawn from the architecture and engineering professions and supported by government public works and regulatory agencies. The IFC has been an important supporter in Indonesia and the Philippines. These councils have been seen as a means for engaging and training built environment professionals through the provision of accredited training. They also promote green building by assessing and certifying high profile prestigious buildings. The number of certified buildings in all countries is small but they are nevertheless symbolically important. In China, this process of building certification is the responsibility of government and broader engagement with built environment professions is absent.

The difficulties in implementing and administering the building codes is a common issue. First, there is, to varying degrees, corruption which leads to limited or no checking by officials of building work done against approved plans and specifications. Second, agencies with responsibility for assessing building plans and specifications have limited capacity to regulate. Simply put, they do not have sufficient staff with the necessary training and qualifications to do the regulatory work. Third, these capacity problems are compounded, in some countries, by overlapping responsibilities and arrangements between agencies at central and local government, resulting in unclear assignment of responsibilities. Fourth, within the finance, design and construct parts of the development industry there are few professionals with the knowledge and training required to respond to the new and higher expectations for building performance embedded in the regulations.

Photo: iStock.

3 Built environment professions and university curriculum

This section provides a framework for considering the relationships between the built environment professions and the universities that educate future members of the professions. If the built environment professions are to become better equipped to contribute to decarbonising the built environment, it is important to focus more on the connection between what is taught in universities and the way the professions function. This includes understanding the formation of the professions; the type of work undertaken by professionals; the organisation of professional associations; university-professional association relationships; and whether professional associations are responding to climate change challenges.

The built environment professions include architects, engineers, planners, project managers, quantity surveyors, facilities managers, and property analysts and managers. Also within architecture and engineering disciplines there are sub-categories such as interior and landscape in architecture and mechanical, electrical, hydraulic and civil engineering. The origins of these modern professions lie, along with many other professions, in the rise of industrial capitalism in the UK and other western industrialising societies towards the end of the nineteenth century (Larson 1993: 6, Freidson 2001). This is the time when the contemporary characteristics of the professions were being established, such as arrangements for training and education, the formation of professional associations, licensing, codes of ethics, and government recognition and regulation.

The professions, Freidson (2001: 125) argues, can be understood by recognising five ‘interdependent elements’ or categories and using them to guide analysis of contemporary arrangements for particular professions in particular countries. He nominates specialist knowledge and skill; a recognised and controlled division of labour; a privileged labour market position based on qualifications; a training program associated with higher education controlled by the profession; and a set of ideas that emphasises altruism and quality rather than economic return and efficiency. Freidson stresses that these elements do not portray any ‘real occupation’ but provide a means to ‘appraise and analyse historic occupations whose characteristics vary in time and place’. In other words, the way in which particular professions form and develop is contingent on particular social, economic and political contexts.

In the built environment, this contingency plays out around the way that capital is made available for the procurement of buildings and the organisation of the labour market that produces buildings. All buildings, apart from buildings that make up informal squatter and traditional village settlements, require the use of finance capital. This means that the way built environment professional work is created and organised depends on those with access to capital and through this access have the power to commission and procure buildings. Those with this access are corporations, unincorporated businesses, government agencies or households. Increasingly, given the distribution of wealth and contemporary patterns of urban development, the built environment professionals depend for their work on those that have access to investment capital.

There are two main roles for built environment professionals in the production of new buildings. First, there are the professionals that combine to design, specify, estimate, manage and supervise the production of new buildings. They do this as staff in multiple consulting firms who form complex interdependent working relationships over defined periods of time. These professions, such as architects, engineers, estimators and project managers, have specific roles in guiding supply chains that produce buildings. When a building is finished, these working relationships dissolve and reform around new projects. Second, some professionals become expert regulators who work for government. These professionals assess, approve or reject applications for planning, building and occupancy permits, using criteria set out in planning and building legislation and codes. In some countries, some of this regulatory work is undertaken by self-employed professionals. In sum, professionals operate within systems where they experience levels of autonomy and discretion but within constraints.

A third role for built environment professionals is teaching and researching in universities. Some of these professionals return to the university as career academics, increasingly following the completion of a master's or doctorate degree. However, many built environment professionals working in universities do so on a part-time basis. Their primary job is in the industry that produces new building and/or renews existing buildings. Their work in the university, particularly in architecture, is typically on a semester by semester basis with responsibility for teaching specialist or studio courses.

The built environment professions have, like many other professions, formed associations that seek to represent their interests. In many countries, there are institutes and associations with the name of the profession embedded in the name of the association or institute. Each institute or association has its own distinct history. In the Asia Pacific, many associations have an early 20th century origin when local built environment professionals began to use models of organisation and representation borrowed from the west. In some countries, the model was passed on by professionals employed by colonial powers before decolonisation.

A way of understanding the development of associations and programs of work can be understood by considering three key features. First, professional associations represent the interests of members through advocacy and supporting association members to participate in consultative processes. Associations typically establish member categories with different statuses and rights. Second, professional associations constantly interact with government and government agencies that recognise, direct and assist associations. This can range from passing profession specific legislation governing membership eligibility through to regulations protecting the interests of consumers of professional services. Third, professional associations have relationships with the higher education institutions that educate future members. Associations will often seek to influence curriculum that ranges from giving advice through to program accreditation.

The relationship between professional associations and universities is a two-way process. It is based on the strategy and capacity of associations to develop and maintain relationships with universities. If this is to be a meaningful relationship this will have to be with particular academic units, departments or schools that are responsible for academic program development and the periodic review of these programs. It will also be based on the capacity of the academic unit to maintain external relationships with the associations and have agreed processes for consultation and perhaps accreditation.

In developed countries, the idea and the practice of regular and ongoing relationships between professional associations and universities is well established. Professional associations are extensively involved in consulting with academic units in universities about academic programs. Many have a role that extends to program accreditation, often through independent statutory accreditation bodies. This means that graduates are eligible to become members of the association and the university is able to promote these academic programs to prospective students with the promise that successful completion of the program will make them eligible to become a member of the professional association.

In developing countries, the challenge of creating structured relationships between professional associations and universities is considerable and progress is limited. First, the professional associations have limited memberships, constrained resources and small secretariats. In this context, their capacity to work with various stakeholders in specifying the competencies that should be included in professional programs is limited. Second, as the university system in developing countries has grown rapidly into a mass education system, this means that the number of professional programs across the university system that a professional association can potentially relate to is large. Third, successful relationships between professional associations and universities also depend on the capacity of university academic units to establish and nurture relationships with the association and other industry groups. In the context of a rapidly growing higher education system, universities have unequal access to resources, particularly the recruitment of well qualified senior faculty with the capacity to lead curriculum development within academic units and develop lasting collaborative external relations.

In the country case studies that follow, accounts are presented of the development of the professional association and the way in which the association relates to universities in each country. Of particular interest is the extent and nature of exchanges between universities and professional associations that focus on climate change and initiatives that might follow. A key finding from this examination is that the relationships between the professional associations and academic unit responsible for built environment programs are not well developed. Instead the guidance that universities receive about the structure and content of the curriculum often comes from a framework prepared by a government agency.

An examination of the professions chosen by the ProSPER.Net participants in the case study countries is presented: architecture in China and Indonesia; engineering in Sri Lanka; architecture and engineering in Thailand; and planning in the Philippines.

3.1 China (architects)

The Architectural Society of China (ASC) is the national professional institute for architects working in the architectural science and technology field in China. It was formed initially in the Shanghai International Settlement in the early 20th century and by 1927 it became the Chinese Society of Architects following the rise of the Nationalist government. It was reconstituted as the ASC in 1952 following WWII and the formation of the Peoples Republic of China (Rowe and Wang 2011). The objectives of the ASC are to: promote the development and prosperity of the Chinese architectural culture; invigorate the country through science, technology and education as well as the strategy of sustainable development; unite and organise all professional architects in China; promote professional architectural skills and knowledge; and serve national urban and rural construction development programs.

Throughout its history, the ASC has maintained a strong international orientation and developed strong exchange relations with institutes of architecture in other countries. Through these relationships the ASC has borrowed ideas about how to organise the profession. As Rowe and Wang (2011: 274) note, during the formation and reformation of the architecture profession in China, foreign ideas about how to define the profession, modes of practice and architectural education have been borrowed. The first formal development of international relations was in 1955 when the ASC joined in the International Union of Architects as a national section. In 1989, the ASC joined in the Architects Regional Council of Asia. Recently the ASC led China's engagement in the 2008 Canberra Accord process that facilitates the portability of educational credentials between countries whose accreditation agencies have signed the accord (Canberra Accord Secretariat 2011). In 2012 the ASC established an Architectural Education Evaluation Branch after approval by MOHURD. Its principal function is to set out the views of the association on professional architectural education.

Defining the model architecture degree began in 1992 led by the National Board of Architectural Accreditation of China (NBAA), following the 11th conference of the Chinese State Council Academic Degrees Committee. The NBAA did this by assessing the undergraduate architecture courses taught in four prestigious universities: Tsinghua University, Tongji University, Southeast China University and Tianjin University. This led to a decision to confirm the five-year degree, including 18 weeks of professional practice in design institutes, as the requirement for registration of graduates as architects. Graduates of programs with less than five years would be required to gain specified years of project design experience. The requirements are summarised in Table 1. Overall, this table shows an increasing reliance on five years of university degree education as a prerequisite for registration as an architect. Subsequently, in 1995 a process commenced to divide five years of degree education into three years of undergraduate and two years of post-graduate master's level education.

Graduates with project design practice can take the registration examination. However, the required years of career practice differ for different types of degrees. Graduates with a bachelor of architecture degree must have at least 3 years of professional practice, while those with a master of architecture degree must have at least 2 years of professional practice. However, graduates with a bachelor of engineering degree must have between five and seven years of professional practice depending on whether they completed a four- or five-year undergraduate degree. However, it is also the case that professionals working in the industry do not necessarily have to be registered as an architect to pursue an architectural career. However, without registration professionals do not have the authority to sign off on design projects.

Accreditation of all programs continues to be the responsibility of the NBAA. The NBAA is a statutory agency entrusted by the Academic Degree Committee of the State Council, the Ministry of Education and the Ministry of Housing and Urban-Rural Development to govern the requirements for architectural education

Table 1: China: Years of project design experience required for the registered architect exam

Major subject		Education background	Minimum period of project design experience required before eligibility for registered architect exam	The latest year of graduation for eligibility to sit registered architect exam
Bachelor or above	Architecture	Bachelor (or above) degree	2 years	2014
	Related major	Bachelor (or above) degree	3 years	2013
Junior college	Architecture (Architectural design)	Graduation	3 years	2013
	Related major	Graduation	4 years	2012
Technical secondary school (vocational schools are not included)	Architecture (Architectural design skill)	Graduation of a four-year educational system (three-year including the starting point of high school)	5 years	2011
	Architecture (Architectural design skill)	Graduation of a three-year educational system (two-year including the starting point of high school)	7 years	2009
	Related major	Graduation of a four-year educational system (three-year including the starting point of high school)	8 years	2008
	Related major	Graduation of a three-year educational system (two-year including the starting point of high school)	10 years	2007
	Architecture (Architectural design skill)	Graduation of a three-year adult secondary education	8 years	2006
	Related major	Graduation of a three-year adult secondary education	10 years	2006

accreditation. Since the NBAA commenced its work in the early 1990s, 66 programs at 45 universities have been accredited: 44 B. Arch programs and 22 M. Arch programs (Canberra Accord on Architectural Education 2011). In addition to program accreditation there is a continuing process of curriculum review and renewal overseen by the NBAA.

Environmental sustainable development has received limited attention within the institutional arrangements for accreditation and the growth of the ASC. Three forms of evidence support this statement. First, within the architecture profession itself there is an absence of a broad base of sustainability expertise. As Zhou (2015: 10) notes, within the architecture institutes, which are state owned architectural practices that undertake commissioned project designs, professional architects have little experience of green building. This means that students, who must undertake a total of eighteen weeks of professional practice in the institutes, have little chance of exposure to green architectural practice. Second, the NBAA has been slow to set expectations for university architecture departments to recognise sustainable development goals in their programs. A review of the NBAA noted the need for ‘leadership by the NBAA on contemporary issues’ when it recommended that ‘NBAA documents should be revised to integrate standard terms, and replenish new concepts and requirements for issues such as urban design, energy-saving, and environmental protection’ (Canberra Accord on Architectural Education 2011: 17). Third, there is evidence, based on comparative case study research, that Chinese universities have the smallest amount of sustainability education in their architecture programs, compared to other universities in other Asian countries (Álvarez, Lee et al. 2016: 24)

3.2 Sri Lanka (engineers and architects)

The Institution of Engineers Sri Lanka (IESL), established in 1956, succeeded the Engineering Association of Ceylon founded in 1906. In 1968, the Institution of Engineers Sri Lanka became an incorporated body following the passing of an act of parliament with objectives to: advance the science and practice of engineering across the disciplines including civil, electrical, mechanical and chemical engineering; promote engineering learning and research; set conditions of institute membership; set professional standards; present the views of engineers; and establish relations with engineering institutes in other countries. The IESL currently has a membership of approximately 13,000 across all engineering disciplines.

One of the key roles of the IESL is to monitor and maintain the professional standards of practicing engineers. It does this by setting criteria for the different membership categories. Associate members must have a four-year degree from a recognised university. Faculties of engineering at four Sri Lankan universities are recognised: Moratuwa, Peradeniya, Ruhuna and the Open University of Sri Lanka. Overseas universities are recognised through Sri Lankan participation in the Washington Accord and the International Professional Engineers Agreement. Applications for membership from applicants with degrees from universities not accredited or recognised by the IESL are evaluated on a case-by-case basis for acceptance for membership. The institute also assesses members for the status of 'Chartered Engineer' and 'International Professional Engineer' through a professional review process. The IESL also runs a continuing professional development (CPD) program of seminars, lectures and orations. Accredited CPD can also be provided by other organisations as long as the offerings meet the standard required by the IESL.

The governing body of IESL is the Council, elected by the general membership annually, and led by the President. The headquarters of the IESL is located in Colombo with a secretariat, with centres established in provincial areas. The business of the IESL is carried out through the sectional committees, standing committees, forums, boards and ad hoc committees, supported by the secretariat (IESL 2017).

The Ceylon Institute of Architects (CIA) was established in 1956 by twelve overseas qualified architects who were also members of the Royal Institute of British Architects (RIBA). When the membership of the CIA had risen to 30 in 1960 they adopted a constitution, modelled on the RIBA, with the intention to make the CIA a RIBA allied institute. By 1961 the CIA had led the formation of a School of Architecture within the Institute of Practical Technology, Katubedda. The CIA became the Sri Lanka Institute of Architects (SLIA) in 1976 following the passing of Sri Lanka Institute of Architects Law. After incorporation, the SLIA developed the same education roles as the IESL by establishing a Board of Architectural Education (BAE) responsible for accrediting programs of architecture in universities, administering the exam for registration of architects and a continuing CPD program.

The institutional arrangements for both the engineering profession and architecture in Sri Lanka are further complemented through their presence within the deliberations of the University Grants Commission (UGC), which is the central government agency with responsibility for higher education. It has responsibility for higher education planning, resource allocation, academic standards, admission and administration. It is guided by an extensive system of 21 standing committees. A number of these are broad discipline committees, including the Standing Committee on Engineering and Architecture. This committee, largely comprised of university deans of architecture and engineering, representatives of the associations and other industry representatives provides advice to the UGC on built environment education, including policy guidance, requirements for degree programs and curriculum.

Practicing professionals belong to professional associations that clearly specify and control entry requirements. They are also responsible for CPD programs that are provided through short courses, lectures and conferences. Further, the associations review and accredit university programs. This program of accreditation is conducted in a context where the associations are members of broader international associations and Sri Lankan requirements are benchmarked against requirements in other countries.

In both professions, there has been a growing recognition of the importance of climate change and sustainability issues. This is particularly evident in the support that both associations gave to the formation of the GBSL. It is also evident in the inclusion of sustainability issues in the CPD programs. However, the associations have not made environment and sustainability a central feature of their CPD programs and deliberations.

An indication of how little understanding and commitment there was to sustainability became evident during the failed implementation of the Energy Efficiency Building Code from 2000. As Wickramasinghe (2009: 52) has observed:

> The initial attempt and its failure to implement a voluntary regime draw the attention to the importance of understanding the different expectations of stakeholders. Architects, the dominant group in new building design, treated the code as a limiting factor in creativity. It should have been projected as a driver of sustainability [rather] than a constraint of creativity.

This experience suggests that relying on professional associations alone to champion sustainability within the regular procurement of new buildings and their construction is not realistic.

Photo: Tony Dalton.

3.3 Indonesia (architects)

The early development of the architecture profession in Indonesia was associated with two initiatives of the Dutch colonial administrators. First, in the late 19th century they initiated a program of civic infrastructure provision, including post offices, telegraph offices, lighthouses, markets, hospitals and government offices overseen by a central government public works agency. Second, in the early 20th century they created a provincial system of civil administration with considerable autonomy based in cities and confirmed these arrangements in the Decentralisation Act in 1903. This provided opportunities for the establishment of architectural practices largely led by Dutch expatriate architects (Arsitiana and Murtiyoso 1996). During the 1920s and 1930s practicing architects with others involved in the public works program began to form an association.

It was not until after WWII, with the end of colonialism and the establishment of the Republic of Indonesia in 1949, that architects again began to establish a professional association. An early initiative was a program of higher education in architecture beginning in 1950 within the Faculty of Engineering Science at ITB in the city of Bandung. In 1958 the first 'architectural engineers' graduated from this program. Then in 1959 the Ministry of Public Works began to consider how best to organise building and design construction professionals. This prompted the early ITB architecture graduates and other architects to organise and form the Indonesian Institute of Architects (Ikatan Arsitek Indonesia – IAI) in late 1959. The subsequent development of the IAI was slow as it struggled to develop a code of professional practice within the context of a rapidly expanding building industry where the 'regulatory atmosphere and the actual construction process itself were far from optimal' (Arsitiana and Murtiyoso 1996: 42). By 1974 membership increased to 95.

Subsequent growth was rapid and by 1975 membership reached 500. Steps that accompanied this membership growth were: establishing chapters in major cities beyond Bandung and Jakarta, holding regular congresses, establishing a system of architectural awards, forging a network of international connections with institutes in other countries and international bodies, publishing a journal, and publishing guidelines for the conduct of architectural practice and fee setting. An important achievement in 1993 was government recognition of the professional title of arsitek/architect along with seven other professional titles.

The IAI is now a fully functioning professional organisation. In 2014, it had a membership of approximately 15,000 architects distributed across three categories of 'basic', 'medium' and 'advanced' based on years of professional experience and completed professional development. Approximately half of the members were located in Jakarta in 2014, which reflects the dominance of this city in the growth pattern of Indonesian urbanisation. Beyond Jakarta there are 50 IAI chapters distributed across the country reflecting the decentralised Indonesian settlement pattern. A staff of eight support the organisation in the Jakarta head office with further staff support spread across the 50 chapters. In addition, the ASEAN system of mutual recognition, seeking to increase the trade in professional services, including architectural services, now includes architects. Although as Nikomborirak and Jitdumrong (2013) note, the trade in architectural services has been small.

In summary, the development of the architecture profession in Indonesia followed a similar path to that followed in developed countries evident in the earlier period of industrialisation, urbanisation and formation of labour market specialisations. In these countries it led to the formation of occupations that could be distinguished by what Larson (2012) refers to as the 'visible characteristics of the professional phenomenon'. This is evident in: an association, the IAI; a record of defining and describing Indonesian architecture; academic programs in more than 80 higher education institutions; licensing through a government sponsored Architects Council (Dewan Keprofesian Arsitek); collegiate control through the IAI over registration; symbolic control through awards and recognition; a compulsory CPD program; and a code of ethics.

The CPD program is the main way in which the IAI provides an opportunity for its members to become familiar with broader urban and environmental sustainability issues. It is comprised of six modules and the code of practice and continuing registration requires that members participate in the program covering: land development; built environment regulation; architects and social and political issues; architect – client relationships; architects as project coordinators; and managing architectural firms. Typically, these modules consist of presentations and workshops that are hosted by the IAI Jakarta office and chapter offices.

Architectural education in Indonesia is provided through 159 HEIs that teach architecture at an undergraduate level. In addition, there are 16 universities with master's 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. Indonesian universities have adopted a four-year bachelor degree for architecture with a one-year master's degree where students can specialise in a particular area such as tourism, urban design and urban planning.

A National Qualifications Framework for Indonesia has been adopted and the National Accreditation Board of Higher Education (BAN-PT) has responsibility for accrediting all academic programs within HEIs. Since the early 2000s it has progressively developed systems and frameworks for the accreditation of professional programs in HEIs. Architecture programs have been assessed within this system and the accreditation agency (BAN-PT) system records 128 accreditations. The development of this system reflects the broader quality assurance processes used in other countries. In addition, architectural educators within the elite universities have sought recognition of their programs through the ASEAN University Network (AUN) and the Commonwealth Association of Architects established through the Canberra Accord (Canberra Accord Secretariat 2011).

This system of accreditation however is changing by moving towards a more discipline-specific accreditation and quality assurance process. This is being done through Indonesian government moves to establish new independent and self-financed accreditation boards aimed at enhancing credibility and recognition of programs on a national and regional level. These boards will be known as Lembaga Akreditasi Mandiri (LAM, Independent Accreditation Agencies) and become accreditation agencies specialising in specific disciplines or professions. A LAM was established in the health sector in 2014 and others are planned (Niedermeier and Pohlenz 2016: 26).

Within this emerging framework, the IAI and the Indonesian Association of Schools of Architecture (APTARI; Asosiasi Pendidikan Tinggi Arsitektur Indonesia) have been leading the review process that is expected to result in the establishment of an architecture LAM. The main focus in this review has been on specifying competencies for architecture and recommending a review and accreditation system for architecture programs. The consultation documents informing the discussion of this institutional development indicate that sustainability will be a focus within the new accreditation arrangements (AIA 2015b, 2015a).

3.4 Thailand (architects and engineers)

The development of the architecture and engineering professional associations in Thailand, the Association of Siamese Architects and the Engineering Institute of Thailand, have followed a similar path to those in other countries. The Association of Siamese Architects (ASA) was established in 1934 and the Engineering Institute of Thailand was established in 1943. Both associations were formed by small groups of professionals undertaking similar work and possessing similar qualifications. Both associations now have a similar set of objectives which include: to represent the profession; uphold standards; promote research; support compliance with codes of professional ethics; collaborate with similar professional associations internationally; and promote continuing education and training. Further, both institutes represent the different discipline groups within each profession. Within architecture these are architect, landscape architect, interior design, and urban planning. Within engineering it includes automotive, civil, chemical, computer, electrical, environmental, industrial, mechanical, mining, metallurgy and petroleum engineering.

Both professions are supported by government legislation, the Architecture Act (2000) and the Engineer Act (1999). Previously both the architecture and engineering professions were regulated by a government unit in the Ministry of Interior, the Regulation Board of Engineering Profession and Architecture Profession. Both acts led to the formation of councils: The Architect Council of Thailand and The Council of Engineers, which are required to register and regulate the members of their professions. Council members are the professionals that have been admitted with; a degree qualification approved by the council; a proven period of professional practice; and satisfactory completion of an entrance examination. Both councils have membership categories – associate, professional and senior professional. The boards of both councils are comprised of elected ordinary members in two categories: practicing professionals; and academics teaching and researching in a university professional program. The government also appoints members to both boards.

Both councils are involved in education and training in two ways. First, they are responsible for accrediting degree, diploma and certificate qualifications. Accreditation of an academic program means that graduates become eligible to apply for registration as council members. HEIs apply for accreditation by preparing a report presenting the curriculum and an evaluation. These applications are assessed by council audit teams and are approved (subject to conditions) or rejected. Second, the councils have a role in CPD by specifying the range of activities that constitute recognised continuing professional development. For example, the Engineers Council sets out eight categories of learning activities, each with multiple sub categories, that are awarded weighted points (Council of Engineers of Thailand 2010). The councils, who specify which organisations are eligible to provide CPD and HEIs, are prominent amongst these accredited organisations. Sustainability themes are present in the CPD programs but neither council has developed a broad-based approach to climate change adaptation and mitigation in their CPD programs.

The centrality of the councils in the institutional arrangements of the architecture and engineering professions supports the status quo in the development of curriculum in academic programs. Broadly, the current processes privilege the criteria used by the councils to assess graduates for professional registration. They start with the current model of professional services and the way industry representatives frame their demand for them. In the absence of other advice about likely future changes, particularly related energy and water efficiency in the built environment, this system reinforces the status quo. As noted in section 2.1.4 the shortage of people with the qualifications and skills necessary for designing and procuring green buildings and others who are able to assess applications for new buildings and apply the regulations has already been identified (PREE Team 2010, Solidiance 2014). However, the councils do not conduct this type of analysis resulting in little consideration of the possibilities for broader curriculum change. Academics within programs who support curriculum change therefore have little scope for achieving substantive change.

This conservative approach to curriculum development and approval in these two built environment professions is at variance with the significant change in the Thai higher education system. Within this system policy and governance systems have been redesigned to transfer governance and administrative authority from the Office of the Higher Education Commission to HEIs. The idea of the 'autonomous university' has been a feature of Thai higher education policy. Accompanying this shift in university governance, new methods of accountability have come in the form of establishing national standards and quality assurance within a national qualifications framework (Lauhathiansind and Chunbundit 2016). This change is based on government recognition of key societal issues confronting Thai HEI development. Energy and environment are issues that have been explicitly recognised in this policy reformulation.

Although the institutional arrangements for architectural and engineering education, with the councils at their centre, appear to narrow the scope for curriculum development, there are nevertheless universities that have broken the mold. A stand out in this context is the University of Chulalongkorn in Bangkok, the oldest in Thailand, founded in 1917, with a Department of Architecture established in 1930. Álvarez, Lee et al. (2016), in their comparative study of sustainability in 20 architecture programs in Asia, found that the Chulalongkorn program of architecture is 'the most remarkable example of a well-organised sequence of seven design studios along with other related courses in a five-year program'. They also found that quantitatively, with 17 sustainability related courses, Chulalongkorn had the largest number of sustainability related courses of all the 20 universities reviewed across eight countries.

As for the future, as already noted in section 2.1.4, Thailand has a strategy for improving energy efficiency set out in the Thailand Energy Efficiency Development Plan (2015-2036) (Ministry of Energy 2011a). It sets out measures and targets and identifies the organisations that must be involved in plan implementation. As the plans say 'to achieve the specified target by 2030, effective mechanisms for mobilisation are required' (Ministry of Energy 2011a: 6-2). This has led the ministry to identify agencies and organisations that should be involved in the implementation of strategic measures specified in the plan. This includes the Council of Architects and Council of Engineers, which are identified as important contributors to six strategic commitments.

Perhaps the most important is the strategic commitment to 'human resources and institutional capability development'. In this context, they have been identified as key contributors to 'supporting the development of professionals in the field of energy efficiency' and 'supporting the development of institutional capability of agencies/organisations in both public and private sectors'. This presents a significant challenge to both the councils and the universities with engineering and architecture programs.

3.5 Philippines (planning)

Growth in environmental planning work in the Philippines began in the 1960s and started to be recognised as a profession through the formation of the Philippine Institute of Environmental Planners (PIEP) in 1969. Environmental planners in the Philippines are professionals that work in the areas of land use planning, social planning, economic planning and planning law and administration. The factors that led to the growth of professionals working in these different forms of planning and the formation of PIEP were: rapid economic growth and urbanisation, particularly in Manila; development of a planning system directed by central government through the National Planning Commission established in 1950; establishment of a rudimentary local government land use planning system in the 1960s; and aspirations for better resourced and devolved local governance civil society organisation and local government leaders.

Also, international agencies in the 1960s, in particular the UNDP, were encouraging the Philippines government to establish a planning system and expand the professional planning workforce that could staff this system (Faithfull 1969). These agencies also worked with the University of the Philippines (UP) to form the profession at a time when there was no HE planning education in the Philippines. UP responded by establishing an academic unit, the Institute of Planning, that began recruiting, supporting and training the professionals who became the academics who taught planning and assisted the formation of PIEP. Subsequently there have been two further major steps in the growth and institutionalisation of the environmental planning profession: the development of accredited planning degree programs, through the UP school of School of Urban and Regional Planning (SURP) postgraduate programs and undergraduate programs in other universities; and the inclusion of planners in the broader regulation of the professions by the Professional Regulation Commission and the Board of Environmental Planning.

PIEP is now the professional organisation that promotes the professional status of environmental planners. Its objectives are: to guide development; promote the study and practice of planning; raise the professional status of planners and protect their interests; and promote professional relationships with other professions. The PIEP goes about meeting these objectives through a program of symposia, round-table discussions and consultations, seminars, workshops, conferences and refresher courses. It also engages in policy research, strategy formulation, socio-economic studies, impact analysis, evaluative research and writing fellowships. Information is disseminated through publications that include environmental planning databases, directories, newsletters and convening of e-groups. PIEP is also a major training provider to national and local government agencies, private companies and NGOs. It also is accredited to provide CPD to registered environmental planners.

The first UP degree program started in 1968 with the establishment of a one year Master in Environmental Planning program and the first two professional planners graduated in 1969. The current suite of SURP programs in urban and regional planning are a graduate diploma, MA and PhD. UP SURP through this history and current suite of postgraduate offerings has become the senior institution for the provision of planning education. This standing is supported by the granting of autonomous HEI status awarded to the University of the Philippines within the national system regulated by the Commission on Higher Education (CHED). This means that UP designs its own curricula and offers new programs which are approved by the Board of Regents (BOR) of the university. Subsequently other universities and colleges in the Philippines have entered the planning field and now offer planning programs. However, they are subject to regulation by CHED and are a part of the Philippine higher education system that has experienced enormous growth, but is poorly resourced, compared to other higher education systems in Asia Pacific developing countries (Ngohayon and Nangphuhan II 2016).

The Philippines government began a process for regulating the professions in 1973 by establishing the Professional Regulation Commission (PRC) with a mandate to regulate and supervise the professions and to play a strategic role in planning for the development of the professional workforce for industry, commerce, government and the economy. However, it was not until 1993, following a false start in 1978, that the Board of Environment Planning (BEP) was established by the

PRC and given responsibility for supervising, examining and registering environmental planners; regulating the practice of environmental planning; developing, upgrading and updating environmental planning curriculum; and improving professional competence through professional development (Congress of the Philippines 2013).

A central function of the BEP is to register environmental planners. These are professionals with a degree in planning, professional experience and pass the 'professional licensure examination'. This examination is based on a specified curriculum under the five headings of physical planning; social planning, economic planning; planning law and administration; and planning and special planning studies (Board of Environmental Planning 2000). This system of licensing has grown significantly. In 2016, 1010 applicants sat the licensure examination and 542 passed. Licensed environment planners must also meet annual CPD requirements by engaging in seminars and workshops, postgraduate education or self-directed learning and by providing evidence of satisfactory completion.

There is little evidence available on the knowledge and the capacity of registered environmental planners to contribute to measures that could decarbonise the built environment and respond more broadly to the challenges of climate change. However, the following three points can be made about the work of planning professionals.

First, as discussed in section 2.5, environmental planners in the Philippines work in institutional arrangements with systemic weaknesses, including a weak system of land administration, endemic corruption and professional human resource shortages. These arrangements undermine planners who seek to implement measures aimed at mitigating and adapting to climate change (Singru and Lindfield 2014). Second, although there is a plan to embed environmental education for sustainable development in all Filipino higher education programs, through the National Environmental Education Action Plan (NEEAP), progress is slow. The lack of resources and reliance on voluntarism has limited progress in most universities (Galang 2010). Third, broader leadership has not been provided by the PRC or the BEP through revision of environmental planner registration requirements. The licensure examination syllabus does not refer to climate change and its implications for environmental planning. Further, the literature recommended to applicants preparing for the qualifying examinations does not include references presenting a substantive analysis of climate change and its implications for environmental planning (Professional Regulation Commission 2012).

3.6 Conclusion

The formation and development of the professions in the case study countries have largely followed the pattern of development evident in developed countries. The associations have typically been formed by small numbers of professionals who have been keen to lay claim to their shared area of specialist knowledge and skill and recruit members with similar knowledge and skill; control who is able to undertake this type of work in the future; assert a position in the labour market based on academic qualifications; influence or control the higher education programs that educate future members of the profession; and emphasise the altruism and quality of the contribution that the profession makes to society. However, there have also been variations in the way in which the professions have developed the institutional arrangements that support and promote their professions.

It is noticeable that in none of the case study countries is there evidence that the built environment professions have recognised the challenge that climate change presents to cities and continued urbanisation. There is, in other words, no evidence of substantial progress towards greening the built environment professions. The professional associations have not developed policy commitments that make climate change and built environment decarbonisation a central concern. Nor have the professional associations or the professional licensing and registration bodies supported making climate change and built environment decarbonisation a central theme in built environment higher professional education. This conclusion is based on the evidence presented on two institutional processes discussed in the case studies.

First, within the professional associations there is some recognition of the importance of a changing climate and the implications this has for the way people live and work in cities. This has led associations to support the idea of mitigating greenhouse gas emissions and adapting cities to the effects of climate change. However, none of the associations have developed a set of commitments that could result in a program aimed at adapting and mitigating the effects of climate change. In relation to universities, this is evident in the way that none of the associations have developed systematic relations with the academic units in universities that run the professional programs that educate the future members of the profession. The only exception is in Indonesia where the AIA is engaged in specifying a set of competencies that could better equip future architecture graduates to contribute to designing and procuring more sustainable buildings (AIA 2015b, 2015a). This is being undertaken as a part of the reworking of the Indonesian higher education quality assurance system that will apply to a small number of professional academic programs.

The main expression of a commitment by the professional associations to sustainability is found in the support that the professional associations have given to the formation and development of green building councils. These are the councils that have developed voluntary rating and certification schemes used to rate the environmental performance of large prestige private and public buildings. These councils also provide training to built environment professionals on how to assess buildings against environmental performance criteria. However, in all countries the number of buildings assessed by green building institutes are small in number and represent a small proportion of the number of new buildings built each year in these countries where there is rapid urbanisation. They do provide exemplars of what is possible and, as van der Heijden (2014: 119) suggests, they may have important 'diffusion effects' when others in design, construction and building management work learn about the rating and certification schemes and begin to apply them to their projects.

Second, in all the case study countries there are agencies established by government statutes, such as the NBAA in China, the BAE in Sri Lanka, the Architects Council in Indonesia, the Architect Council and the Council of Engineers in Thailand, and the BEP in the Philippines, that regulate the professions through licensing of new members and the accreditation of university professional programs. However, the evidence is that these bodies largely reflect the status quo in the way they formulate their licensing requirements and reflect them in membership examinations and criteria they use to accredit university programs. Prima facie there is scope for these agencies to become proactive in formulating strategies that require knowledge and skills about climate change and built environment decarbonisation in curriculum, as well as testing for this knowledge in registration examinations.

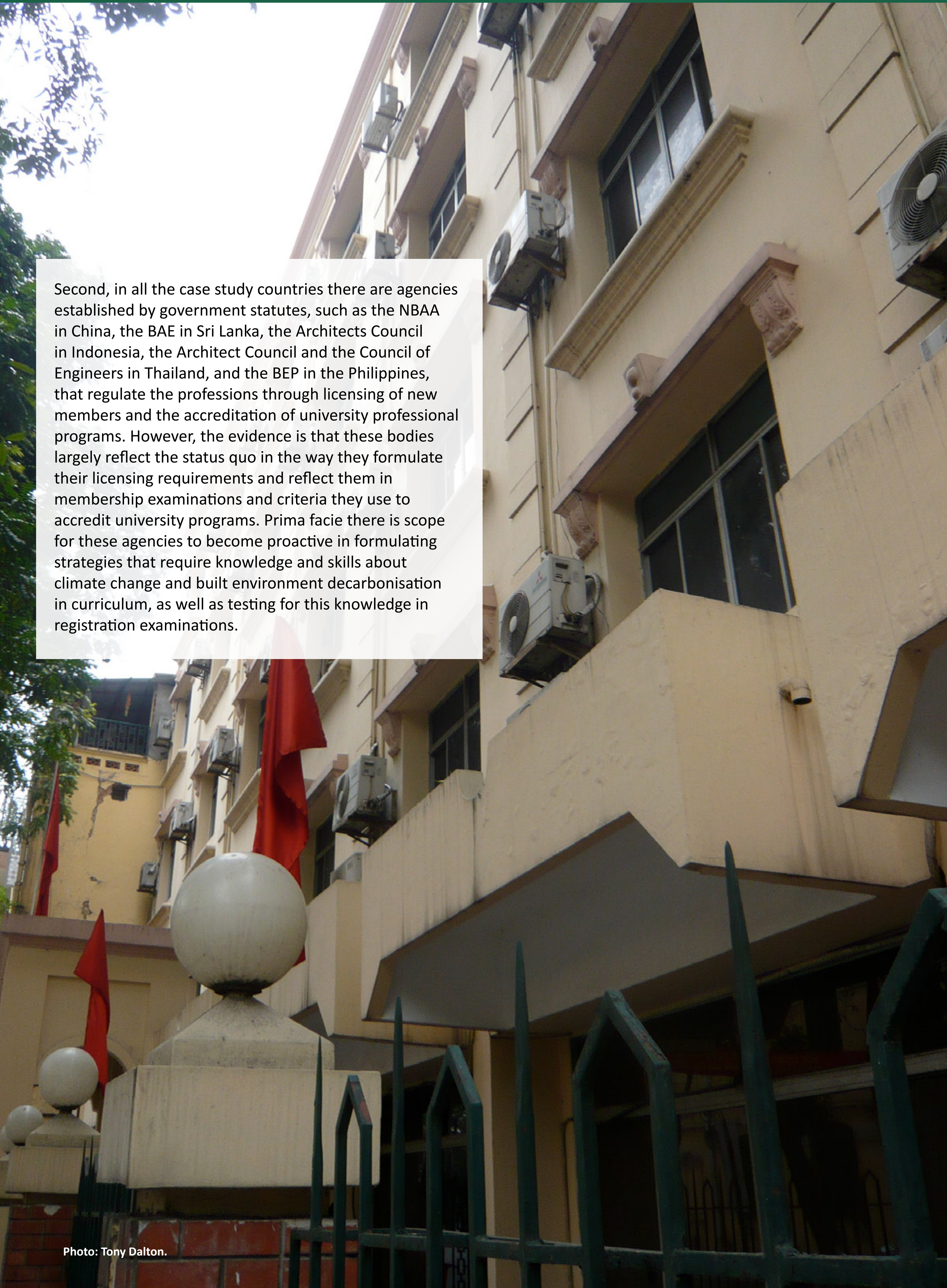


Photo: Tony Dalton.

4 ESD in the built environment curriculum

This section examines the nature of built environment programs and curriculum in five case study universities – one university in each country. The focus is on the extent to which environmental sustainable development has become a part of the curriculum. Examination of three aspects of academic programs at both the undergraduate and postgraduate levels in these case study universities provides insight into the nature and the extent of ESD in the curriculum. They are:

- Program descriptions and statements of objectives and reference to the environmental challenges facing future built environment.
- Core courses in programs that all students must complete and the presence or absence of courses in these programs focusing on environmental issues.
- The suite of electives that students choose from and the presence or absence of electives with an environmental focus.

In addition, some faculties have established a specialist degree where environmental issues are central to the program and students develop specialist expertise. These degrees at a postgraduate level typically follow a completed undergraduate professional education such as in engineering and architecture.

All these programs have histories, and understanding these histories helps to understand the nature and extent of ESD in the curriculum. The four main factors that can shape the nature and extent of ESD in the curriculum are the following:

- The ideas and professional orientation of the program founders who responded to their contemporary challenges and imperatives for training professionals with design, theoretical and technical knowledge and practical skills necessary for meeting the demand for new buildings.
- Employing faculty with ESD expertise. This might be achieved by supporting academics to extend their knowledge and experience in ESD; arranging for sessional teachers from other parts of the university to teach ESD; and engaging sessional teachers from industry with ESD expertise.
- Establishing connections between faculty and industry professionals, firms and government agencies with ESD experience in built environment design, procurement and building that can contribute by providing advice, sessional teaching and work experience for students.
- Having leaders or champions of ESD in positions amongst faculty who have the influence within faculty governance processes necessary for identifying areas of the curriculum that are ready for revision and supporting faculty to revise and teach ESD materials and develop industry connections.

The five case study universities described in this section are: the architecture program at Tongji University in China; engineering programs at Peradeniya University; architecture at Gadjah Mada University in Indonesia; architecture programs at Thammasat University in Thailand; and urban planning at the University of Philippines in the Philippines.

4.1 University of Tongji in China and architecture

Architectural education in China has developed a capacity for the high-volume supply of architects that support building booms associated with rapid urbanisation. In this context, the focus of graduate attributes in the architecture curriculum has been on design supplemented by technology, theory and practical courses (Rowe and Wang 2011). Also, as discussed in section 3.1, limited expectations have been placed on universities for curriculum development that increases ESD knowledge and skills (Canberra Accord on Architectural Education 2011: 17). Álvarez, Lee et al. (2016: 24) concur with this finding based on their review of four Chinese universities and conclude that they had less sustainability education in their programs compared to universities in other Asian countries.

The University of Tongji undergraduate architecture program is a five-year program, like most architecture programs in China. The University of Tongji, located in Shanghai, is recognised as an outstanding university based on the results of the QS ranking system. The architecture program was established in 1952 with a focus on modernity and innovation, but also recognises the Chinese cultural heritage and the unique position of Shanghai as a city with a history of international engagement and collaboration.

The courses comprising the curriculum are in three categories. Basic Public Courses are general courses undertaken during the first two years of study that are not directly related to the study of architecture. They include courses on Chinese history and politics, military theory, English, mathematics and art. Professional Basic Courses are the twenty-one compulsory courses that must be completed by all students in the first four years of the program. Professional Required Courses are the sixteen compulsory courses undertaken in years four and five of the program. Professional Elective Courses are courses chosen by students from an extensive and changing list and are undertaken mainly in the later years of the program. In addition, students also complete study requirements during the summer holidays and undertake Practice Courses.

A summary of the five-year program is as follows:

- First year students are introduced to architecture through six Professional Basic Courses: Introduction to Design, Introduction to Architecture, Basics of Design and Basics of Architectural Design and introductory courses in Art and Architectural History. Students at the end of their first year undertake three Practice Courses: Military Training, Architectural Cognition and Art Modelling 1.
- Second year students undertake a further seven Professional Basic Courses: City Reading, Principle of Building Generation, Architectural Design Principles, Building Generation Design, Architectural Design, Digital Design Method, Building Construction, Architectural Physics (acoustics, lighting and heating and cooling), and Architectural Mechanics 1 and 2. Students also undertake their first Professional Required Course, Construction Technology Applications. Students at the end of their second year undertake two practice courses: Art Modelling 2 and Design Week 1.
- Third year students undertake four Professional Basic Courses: Building Systems (Energy, Heating and Plumbing), Ergonomics, and Building Structures 1 and 2. Students also undertake eight Professional Required Courses in year three: Building Codes, Building Special Structures, Building Disaster Prevention, Architectural Theory and History 1 and 2, Principals of Environment and Architectural Design, Architectural Design Principles of Urban Complexes, Environment and Architectural Design and Urban Complexes and Urban Design. Students at the end of third year undertake two practice courses: Design Week 2 and Historical Analysis.
- Fourth year students undertake just one Professional Basic Course: Environmental Cybernetics. Students also undertake six Professional Required Courses: Architectural Review, Principles of Urban and Residential Design, Principles of Interior Design, Urban and Residential Design, Interior Design and Special Architectural Design.

- Fifth and final year students have no Professional Basic Course or Professional Required Course requirements. Instead they choose from the list of Professional Elective Courses. These final year students complete two substantive Practice Courses, Design Institute Internship and Graduation project, along with a smaller Innovative Ability Development Project.

The number of courses in the program with explicit ESD content have grown in recent years. A summary of the courses, by course category, with ESD content is presented in Table 2.

Table 2: University of Tongji: Courses with ESD content in the Architecture program

Course Category	Coures Names	Per-cent of ESD related courses in category
Professional Basic Courses	• City Reading • Architectural Physics • Building Systems • Environmental Cybernetics	16 per cent of Professional Basic courses
Professional Required Courses	• Building Disaster Prevention • Principles of Environment and Architectural Design • Architectural Design Principles of Urban Complexes • Environment and Architectural Design • Urban and Residential Design	24 per cent of Professional Required Courses
Professional Elective Courses	• Indoor Environment Performance • Principles of Landscape Planning and Design • Landscape Plants and Applications • Introduction to Climate Responsive Design • Forms of Built Environment • Discussions on Contemporary Urban Planning and Design in China • Modern Residential Design	21 per cent of Professional Elective Courses

Note: The percentages have been calculated using the program credit point system.

An important feature of sustainability courses in the Tongji architecture program is the sequencing of some of the sustainability courses. As Álvarez, Lee et al. (2016: 24) note, the level of integration is a feature of curriculum design at Tongji where the environmental technology courses are sequenced with the design studios and social and historical analysis courses.

Integrating ESD into the architecture curriculum reflects the broader strategic commitment to sustainability at Tongji University. This is expressed in the first university strategic goal which is to ‘become a world-class sustainability-oriented university’. Two initiatives stand out.

The university hosts the UN Environment-Tongji Institute of Environment for Sustainable Development (IESD) which has as its first objective to ‘mainstream environment and sustainable development into higher education’. The institute is supported by all the colleges and schools within the university, including the College of Architecture and Urban Planning. Further, Tongji is a lead institution in the Global Universities Partnership on Environment and Sustainability (GUPES). It provides a platform for more than 800 universities that collaborate on mainstreaming environment and sustainable concepts and practices in higher education, as well as the training of technical and management personnel. However, there is the continuing challenge of how to link these initiatives to departments so students get considerable access to sustainability knowledge in their core educational programs.

Photo: Flickr/Ceetap.

4.2 University of Peradeniya in Sri Lanka and civil engineering

Civil Engineering at the University of Peradeniya is taught at both the undergraduate and postgraduate levels within the Department of Civil Engineering (Faculty of Engineering 2015). The undergraduate program leads to the degree of Bachelor of Science of Engineering with a specialisation in civil engineering. At the post-graduate level the department offers master's and graduate diploma programs that respond to new professional labour market demands for advanced knowledge in specialist areas of engineering. At both the undergraduate and post-graduate programs the Department of Civil Engineering has recognised the need to provide students with the opportunity to acquire sustainability concepts and knowledge. However, the extent to which sustainability knowledge has been included in the curriculum varies considerably across programs.

All undergraduate students within the Faculty of Engineering undertake a common first-year general program. At the end of the first year students choose to specialise in a branch of engineering across six offerings: civil engineering; chemical and process engineering; computer engineering; electrical and electronic engineering; mechanical engineering; and production engineering. Each three-year specialisation is taught within a separate department and has core courses, technical electives and industrial training which all students must complete. In addition, students undertake a small number of general elective courses which are non-technical courses offered to all students across the six engineering disciplines contributed by the six departments into an electives pool.

At the undergraduate level the greatest opportunity for civil engineering students to learn about sustainability is through general electives. The most significant is the 'Sustainable Development' general elective which is a three-credit point course. Another two-credit point elective, 'The Engineer in Society', also provides an opportunity for students to consider sustainability issues. Others are 'Technology and Economic Development' (three credit points) and 'Rural Economic Development and Technology' (two credit points). These courses are all within the civil engineering program that requires students to complete 75 credit points through core courses and 21 credit points through general electives. It is possible for civil engineering students to select electives so that they do not undertake any sustainability elective courses.

Core courses focused on technical knowledge also provide limited opportunities for undergraduate students to acquire sustainability knowledge. For example, civil engineering students undertake an 'Environmental Engineering' core course focused on water quality, water management, waste disposal and water pollution control. Similarly, students must complete 'Introduction to Electrical Engineering I', which introduces them to the basics of electrical energy use.

In sum, sustainability concepts and knowledge have not been systematically embedded in the Bachelor of Science of Engineering degree specialising in civil engineering. Students can learn about sustainability at an introductory level by completing a small number of electives. They can also acquire technical knowledge through their core technical courses that could assist them in understanding broader sustainability issues. However, engineering graduates are not systematically introduced to the sustainability challenges and innovations in civil engineering that are required to mitigate carbon emissions and adapt the built environment to the effects of climate change.

The Department of Civil Engineering offers five postgraduate programs where students can graduate at either a Graduate Diploma or Master of Science level. These programs are Geotechnical Engineering and Engineering Geology; Highway and Traffic Engineering; Structural Engineering; Sustainable Built Environment; and Environment and Water Engineering (Department of Civil Engineering 2014a, 2014b, 2015b, 2015c, 2015a).

As the program names suggest the Sustainable Built Environment program has a distinctive sustainability focus. Entry into the Sustainable Built Environment program is open to graduates from built environment undergraduate programs including engineering, architecture, town planning and building economics along with one year of industrial experience. The program focuses on 'introducing the concepts and methods of reducing the environmental burden of activities related to the built environment' and aims to build capacity 'in the area of sustainable built environment'. The environmental sustainability learning objectives are reflected in the concepts and knowledge presented in all 10 courses that make up the Master of Science program and the reduced version of seven courses in the Graduate Diploma. The Green Building Council of Sri Lanka is an industry partner that contributes to the program and recruits Green Building Certified Professional members from amongst the graduates.

Sustainability concepts and knowledge are, however, largely missing from the other four postgraduate programs. The Structural Engineering program aims to extend and deepen the civil engineering knowledge of structures for graduates of undergraduate civil engineering programs. Both the core and the elective courses in this program do not contain any sustainability content. The Environment and Water Engineering program has been designed to increase the capabilities of the students in analysing, planning, construction, operation and management of water and sanitary engineering works. The program has been developed using current water and sanitary engineering frameworks and does not reflect the emergence of new paradigms for water and sanitary waste management that respond to sustainability challenges in urban water use and waste disposal. Students enrolled in the Highway and Traffic Engineering program specialise in either highway or traffic engineering and both streams reflect traditional approaches to traffic and highway engineering. The design of the degree does not recognise broader sustainability issues associated with current approaches to road design and management.

4.3 Universitas Gadjah Mada in Indonesia and architecture

Like China, Indonesia has developed a capacity for the high-volume production of professional architects as a part of its very rapid expansion of higher education. In 2016, architectural education in Indonesia was provided through 159 HEIs that taught architecture at an undergraduate level. In addition, there were 16 universities with a master's program and six universities with a doctoral program. The University of Gadjah Mada (UGM) was very early in this history of growth in architectural education when the first program began in the early 1960s as a specialisation within engineering education.

The motto of the Department of Architecture and Planning at UGM is 'better space, better living', and the vision is to produce graduates able to thrive and become professional architects, be creative and responsive to the environment and be competitive at an international level (UGM 2015). It provides a four-year program that closely follows the competencies set by the UIA - Union of International Architects, and APTARI (Association of Universities of Architecture, Indonesia). Also, the engineering origins of the program remain evident. The Department of Architecture and Planning remains in the Faculty of Engineering and the name of the architecture degree is Sarjana Teknik (Bachelor of Engineering). UGM, acknowledged as one of the elite Indonesian universities, also provides a master's program and a doctoral program.

The architecture program at UGM has been framed within an explicit set of Expected Learning Outcomes (ELOs). There are five headline ELOs: Design Abilities, Architecture-Related Issues, Building Technologies, Supporting Skills and Ethics and Professionalism. These headline ELOs are further defined through 16 Main Competencies, 22 Specialised Competencies and 13 Unique Competencies (Department of Architecture and Planning 2015).

A summary of the four-year program is as follows

- First year courses introduce students to architectural design, aesthetics, building and construction, the history of architecture, analysing sites and mechanical systems.
- Second year courses deepen student knowledge of design, building and construction and introduce them to building materials science and project management.
- Third year courses continue to extend student knowledge of design, building and construction and introduce students to urban planning, housing design and ethics.
- Fourth year courses focus largely on the final year project and introduce students to architectural criticism and community service

There are four features common to each of the four years. First, students in each of the eight semesters complete an Architecture Design Studio which provides them with an opportunity to integrate the knowledge they gain from other courses into their design learning. Second, students complete eight electives which they undertake from their fourth semester through to their seventh semester. Third, the main method of learning used throughout the program is project-based learning. Fourth, students are required to learn about ESD specified in a set of competencies.

ESD features in six of the 22 Specialised Competencies but is not included in the Main Competencies or Unique Competencies. The Specialised Competencies with an ESD focus require students to become competent in:

- KP 7: Understanding the social context of the built environment and the ergonomic requirements that provide for access and equity.
- KP8: Knowledge of natural systems and built environments.
- KP9: Understanding the issues of conservation and waste management.
- KP10: Understanding the materials cycle and issues of ecological sustainability, environmental impact and design that reduces the use of energy, use of passive systems and energy management.
- KP11: Awareness of the history and practice of landscape architecture, urban design, regional and national planning, and their relationship to local and global demography and resources.

- KP12: Awareness of the management of natural systems at the risk of natural disasters.

These competencies are linked to the following courses.

Table 3: University of Gadjah Mada architecture: courses with ESD competency requirements

Course, credit points and year	Course description	ESD competencies included in course competency requirement
History and Development of Archipelago Architecture 2CP, yr1	Knowing and understanding the history of the development and diversity of Indonesian national architecture.	KP11
Site Analysis, 2 CP, yr 1	Knowing how to analyse the building footprint on the site and the broader impact of the building.	KP 7, 8, 10, 12
Architectural Aesthetics, 2 CP, yr 1	Know, understand and master the theory of 2-dimensional and 3-dimension composition and apply it to architectural objects.	KP 7, 8, 10, 12
History of Western and Eastern Architecture, 2CP, yr 2	Knowing and understanding the history and development of world architecture in particular eastern and western architecture.	KP 11, 12
Architecture Design Studio, 6CP, yr 2	Design a two-storey building with careful consideration of the internal and external factors and provide a logical explanation for the design.	KP 11
Structure and Construction 3, 2 CP, yr 2	Know and understand the structure of buildings up to four floors and be able to choose an appropriate structure and construction system for the type of buildings.	KP 10
Materials Technology, 2 CP, yr 2	Know and understand the types and characteristics of building materials (wood, concrete, and metal) and their use in architecture.	KP 10
Building Physics, 2 CP, yr 2	Know and understand the standards, requirements and building design techniques required to create high quality thermal performance, lighting and acoustics	KP 10
Architectural Design Studio 4, 6 CP, yr 2	Skilled design of buildings up to four floors with an emphasis on structural systems and utilities and be able to give a logical explanation for the choices.	KP 10, 12
Structure & Construction 4, 2CP, yr2	Understand high-rise buildings including structural systems, ground conditions, standards, regulations and materials and be able to present communicate proposals for high rise buildings.	KP 12
Utilities, 2CP, yr 2	Know and understand network systems in building design that creates comfortable, safe, secure and healthy buildings.	KP 9, 10
Practical work, 2CP, yr 3	Know the world of work in the sphere of architectural work in design, construction management and execution.	KP 8

The following observations can be made about the way ESD competencies are specified within the University of Gadjah Mada architecture program:

- Six ESD competencies are included in the list of 22 Specialised Competencies. There are no ESD competencies included in the 16 Generic Competencies, nor in the 13 Unique Competencies. This way of including ESD competencies indicates that ESD learning is understood to relate to particular courses and not to the program as a whole. ESD learning is not systematically imbricated into the program.
- In the core courses a total of 12 out of the 32 core courses, or 24 per cent of core courses, are linked to one or more ESD Specialised Competencies. The way in which they are linked is set out in Table 3.
- Only two of the seven design studios in the core program are linked to ESD Specialised Competencies. The central position of design studios is indicated by their six-credit point weighting. They are courses where students are expected to integrate knowledge from other specialist courses into their design work, and all other courses are two and three credit point courses. It seems that commitment to ESD has not been made central to design learning in the program.
- Students who are seeking to extend their knowledge of ESD beyond what is presented in the core have the opportunity to do this through their choice of electives. 17 out of 56, or 30 per cent, of elective courses have a clear ESD focus. They are all two credit point courses and include courses such as Tropical Building Design, Planning and Design for Urban Thermal Comfort and Sustainable Habitat Engineering. Students are required to complete six electives.

In sum, students undertaking the undergraduate architecture program at UGM are introduced to ESD concepts. However, ESD has not been embedded in all the design studios that form the program core. Opportunities for ESD learning are largely through the specialist core courses and the electives program.

Photo: Simon Diebstahl.

4.4 Thammasat University in Thailand and architecture

Thammasat University, founded in 1934, is one of the older highly ranked universities in Thailand that developed a significant program in educating students who became leaders in government, the public services and the military. A program in architecture was first offered by Thammasat University in 2000. The undergraduate and postgraduate programs in architecture are now offered by the Faculty of Architecture and Planning. It also offers bachelor programs in Interior Architecture, Urban Environmental Planning and Development, Landscape Architecture, Architecture for Real Estate Development, Urban Design and Development and master's programs in Architecture, Urban Environmental Planning and Development and Innovative Real Estate Development.

The undergraduate architecture program leads to a Bachelor of Science (Architecture) after four years of full-time study (Department of Architecture 2016). Graduates can then apply to undertake the two-year master's program leading to the Master of Architecture degree which qualifies them to sit the professional license examination and practice as an architect. The Thammasat University also offers a Doctor of Philosophy (Integrated Science of Built Environment) degree. Both the undergraduate and postgraduate architecture programs aim to assist students to become practicing architects. At the undergraduate level an overriding objective is to produce graduates who are capable of continuing on to study at a master's level.

The undergraduate curriculum has been designed using three main categories: general basic courses; architectural program courses; and elective courses (Department of Architecture 2016). The program is weighted towards architectural program courses with 108 credits, whereas the general basic courses have 31 credits and the elective courses only 6 credits. In other words, the program requires students to follow a core set of requirements and provides little choice through electives. The first-year basic courses are preliminary and general humanities, social science, science and mathematics and English courses. The undergraduate architecture program courses are organised into six categories: the fundamental courses that focus on presentation, communication and technical terms; the principle and technology courses that focus on architectural design and theory; materials and construction; building structure; environmental technology; and courses that present the contributions of other disciplines to architecture including landscape architecture, urban planning, psychology, management, interior design, art appreciation and business management.

The postgraduate architecture program is organised around four specialised areas: architectural design and theory; building technology; information technology in architecture; and architectural management. Students undertake a common first year where they learn about architecture but are also required to develop their research skills. In the Architectural design and theory program students undertake four three-credit point courses in the first semester: Method of Research in Architecture; Advanced Seminar in Architecture; Architectural Project Management; and Architectural Design – Research 1. In the second semester they undertake a further four courses: Professional Practices, Ethics and Leadership Development; Research Proposal and Publication; Architectural Design – Research 2; and an elective. In the third semester students undertake a further two courses: Thesis; and Architectural Design – Research.

The undergraduate and postgraduate program documents do not indicate a strong commitment to embedding ESD in the curriculum. In the program objectives, environment and sustainability is only referred to at the master's level where the aim is to produce graduates eligible to register as architects with the skills to be able to 'create environmentally concerned architecture in the modern Thai context and to contribute to a sustainable development'. However, within the program the course descriptions indicate that students are not systematically introduced to sustainability in architecture concepts (Faculty of Architecture and Town Planning 2016). Within the undergraduate program there are three environmental technology courses that focus on subject matter relevant to built environment sustainability. They are courses in tropical design with a particular focus on passive approaches to tropical architectural design; lighting and acoustical systems design; and building systems including air conditioning, waste disposal and treatment, electrical systems and fire.

Beyond the formal curriculum there is evidence of a broader commitment to ESD within the faculty. First, this is evident in publications by faculty such as Horayangkura (2012), Horayangkura, Jamieson et al. (2012) and Rittironk (2015), (Rittironk nd) Seingsuttivong (2013) that explore important ESD topics and themes. Second, the faculty supports the publication of two journals which include articles on sustainability. JARS (Journal of Architectural/Planning Research and Studies) is a journal that publishes articles on three areas, one of which focuses on building and green construction technology. BUILT: An International Journal of Building, Urban, Interior and Landscape Technology publishes articles on sustainability technologies and their application. Third, students focus on sustainability topics through their master's thesis research. For example, recent theses include: Reduction of Heat Transfer Using Roof Garden Hydroponics Root Soak; Green Space Design to Enhance Living Quality in Urban Condominiums: The META Sathon Study Area; Design Guidelines for Building Wooden Buildings for Energy Conservation: a case study of Chiang Khan community in Chiang Khan district; and Influence of Cellulose Fibre on Mechanical and Thermal Properties of Fibre Cement Roof Sheets in Hot-Humid Climate.

Photo: iStock.

4.5 University of the Philippines and planning

The School of Urban and Regional Planning (SURP) at the University of the Philippines is the only graduate school in urban and regional planning in the Philippines. It has a broad four-fold mandate to provide graduate education; to undertake research; to develop and provide training programs to practitioners; and provide extension services through agencies. Postgraduate education has been developed around the two main areas of urban and regional planning and regional development planning. The study of urban and regional planning can be undertaken at the graduate diploma, master of arts and PhD level (School of Urban and Regional Planning 2016). The study of regional development planning is undertaken as a Master of Science in Regional Development Planning and is jointly offered by SURP and Technische Universität Dortmund in Germany (The Spring UniversIty Network 2016). This section focuses on the urban and regional planning programs.

Approximately 500 students are enrolled in the urban and regional planning programs at any one time. The majority of these students are drawn from national government agencies and local government reflecting the initial mission of SURP, which is to provide the means for strengthening the planning capabilities of government. All students undertake six core planning courses:

- Theory and practice of planning with a focus on human settlement development and planning history
- Research methods and concepts used in planning
- Land use planning, resource use, development and infrastructure
- Planning analysis, techniques, models, and methods used in spatial planning
- Planning processes and plan implementation
- Practical workshop using planning processes and plan implementation

These courses form the core of three programs. Graduate Diploma students undertake two further three-credit point courses as electives before graduation. Master's students undertake further courses but undertake them within one of four areas of specialisation. These areas of specialisation are estate planning, public works planning, transportation planning and environment and natural resource planning. Students choose courses within their area of specialisation offered by SURP and other academic units such as the College of Engineering, College of Science, College of Social Sciences and Philosophy, College of Social Work and Community Development, National College of Public Administration and Governance and School of Economics. Master's students undertaking the thesis option complete three three-credit point courses within an area of specialisation. Master's students undertaking the non-thesis option undertake five three-credit point courses within an area of specialisation. In addition, the non-thesis students undertake two three-credit point cognate minor courses.

The core course curriculum provides students with limited opportunities to study climate change and built environment issues. The core course that has provided most opportunity is the land use planning course which deals with the concept of urban land, the social meaning of land use and the rationale of land use planning by government as a way of promoting social justice and community welfare. Other opportunities for students to learn about built environment sustainability issues in the core program come largely through faculty choosing to address sustainability issues in their teaching. Beyond the core courses, students (other than the master's students undertaking the environment and resource specialisation courses) have had the opportunity to study ESD only through electives.

This limited opportunity for the study of ESD by SURP students will change. This is because change in the regulatory system now requires that decisions by the Housing and Land Use Regulatory Board (HLURB) require the proponents of land use plans to anticipate disasters and future climate change. This commitment has been incorporated into the Philippine Development Plan 2017 – 2022 (NEDA 2017: 12-18). It states:

> The physical infrastructure of housing and location of human settlements must also ensure compliance with disaster risk reduction and management (DRRM) and climate change adaptation (CCA) requirements to mitigate risks and address vulnerability.

These new land use planning requirements present a challenge to the planning profession. Professionals will increasingly be required to be competent in undertaking or commissioning research that considers risks from such events as typhoons, floods and how urban development should respond to changes in climate, such as increasing temperatures and patterns of rainfall. In this context, SURP is reviewing its curriculum and the contribution it can make to increasing the capacity of their future graduates and professional planners to assess the risks of natural disasters and respond to climate change.

SURP has access to the resources required for ensuring that disaster risk management and climate change adaptation is made more central to the curriculum through collaborations. One collaboration with the Seoul National University for Science and Technology has led to the development of a practical road map for achieving the 'Vision of Mindanao'. This has involved: an analysis of natural disasters related to climate change; integration of climate change projections in disaster risk reduction and management plans; preparation of a guide to climate and disaster risk-responsive urban planning; preparation of development plans; preparation of plans for urban renewal; and capacity building for research and planning in partner institutions. Another has been a project initiated by the Department of Science and Technology, Build Back Better: The Science and Technology of Designing and Planning Disaster-Resilient Communities, Sites, and Buildings. This has involved collaboration with the UP College of Architecture and Institute of Civil Engineering. Other continuing collaborations are with the: University of Dortmund through the jointly offered M.Sc. program in Regional Development Planning and Management; University of Newcastle in the development of a Master of Arts in Disaster Preparedness and Reconstruction; and Australian National University in the development of two master's degrees: Master of Science in Environmental Management and Development and Master of Science in Climate Change.

4.6 Conclusion

This section has examined built environment academic programs in five universities: the architecture program at Tongji University in China; engineering programs at Peradeniya University; architecture at Gadjah Mada University in Indonesia; architecture programs at Thammasat University in Thailand; and urban planning at the University of Philippines in the Philippines. The purpose of this examination was to assess the extent to which programs of study have developed and the opportunities that students have to learn about climate change and how cities might respond. This was done by examining documents, such as course descriptions and program structures and assessing the extent to which environmental knowledge is included in core courses and electives.

The main findings that can be drawn from this limited examination of built environment case study programs are the following:

- Built environmental sustainability has not become a central frame of reference for any of the mainstream programs that were examined. The dominant frame of reference for these programs is what might be termed 'competent professionalism'. The courses are aimed at producing professional graduates with competencies in design, procurement and planning suited to times that pre-date the recognition of the climate change problem.
- The climate change problem has been recognised and has led to some program change. The principle change has been the development of electives which provide students with the opportunity to learn about some aspects of the challenge of climate change and how built environments might be designed and built differently. Another response, but less prevalent, is to establish specialist post-graduate degrees which enables graduates to become expert in developing less carbon intensive built environments.
- There are academics in many built environment schools who have developed considerable expertise in some aspects of built environment sustainability. This is evident in their research and publications, community and industry engagements, the development of elective courses and collaborations with other universities. This interest and commitment by some faculty in built environmental sustainability programs has not resulted in broader curriculum change, but perhaps provides some basis for future change.

Photo: Jayne Andd.

5 Conclusion

This project commenced with the following propositions:

- Decarbonising the rapidly expanding built environment and adapting to climate change is a high priority for governments in the Asia Pacific region so that their societies are more resilient.
- Built environment professionals are being challenged to incorporate new knowledge and professional practices into the way they work so that they produce less carbon intensive built environments.
- HEIs with built environment programs are being challenged to renew their curriculum so that their graduates have knowledge that will enable them to increase their contribution to future urban sustainability.

Five countries were studied: China, Sri Lanka, Indonesia, Thailand and the Philippines. The professions considered were architecture, engineering and planning. ProSPER.Net participants researched a built environment profession supported by the project leads in Australia. The project leads undertook the study of architecture in Indonesia. As the project progressed, the ProSPER.Net participants discussed their research with the project team. ProSPER.Net participants used common questions to ensure consistency across different professions in different countries.

This research is based on the idea that university built environment professional education programs are shaped by larger societal processes. They include the development and implementation of government built environment regulatory agencies and systems requiring improved building energy efficiency; formation and development of professional associations; the regulation of the professions by licensing and accreditation agencies; growth in built environment programs within universities; and voluntary green building councils that train assessors and accredit exemplar buildings.

Currently, these institutional arrangements are being reshaped by external agencies that are seeking to make built environment carbon reduction a shared goal. In developing countries these agencies are international agencies that assist public works ministries in code development and implementation; education ministries that support improvement through the development of university quality assurance processes; and energy ministries that regulate for increased built environment energy efficiency. Figure 2 illustrates these typical institutional arrangements.

This approach to understanding built environment higher education programs and the challenge of climate change was tested and validated at a workshop in Jakarta in August 2016. It was further tested and validated in a workshop at the 7th International Conference on Sustainable Built Environment 2016 (ICSBE) in Kandy, Sri Lanka in December 2016. A report on the Jakarta workshop is presented in Appendix 1.

The conclusions drawn from the project are the following:

5.1 Built environment regulation

Governments in recent years have put considerable resources into the development of built environment regulatory systems. International agencies, especially the International Finance Corporation, a World Bank agency, have provided considerable assistance to governments that have been developing these regulatory systems. The forms of assistance have included support for experts, consultations, training and evaluations of regulatory systems. In particular, this international support has sought to ensure that these countries not only develop built environment regulatory systems but also contribute to built environment decarbonisation. Considerable progress has been made. However, it is clear that significant issues remain. In summary, these issues are:

- Built environment regulatory capacity is limited by the shortage of qualified regulators and their limited knowledge about how buildings can be designed, procured and built in ways that reduce their carbon emissions.

- The efficacy of built environment regulatory systems is limited by the overlapping responsibilities of central and local government agencies.
- Underdeveloped administrative systems and continuing corruption provides the conditions for considerable non-observance and flouting of building regulations.
- Limited knowledge of sustainability and opposition to new requirements by built environment professionals working for building owners slows the implementation of new regulations.

5.2 Built environment professional associations

The development of the professions largely followed the earlier pattern of development in developed countries. The associations were formed by small numbers of professionals who laid claim to an area of specialist knowledge and skill; controlled the future membership; influenced or controlled the higher education programs related to the profession; and emphasised the altruism and quality of the contribution that the profession makes to society. The formation of the professional associations has also been closely associated with the development of entities, such as councils and boards, through which the membership of the profession is regulated. Of course, there are variations in the ways in which the associations have formed and developed. Similarly, there is variation in the way governments have developed systems for regulating the professions.

Within this context, the following broad conclusions can be made about the recognition of built environment sustainability issues in the governance of the professional associations and the related regulation of the professions by councils and boards.

- Most professional associations and accompanying councils and boards have not developed and promulgated comprehensive built environment sustainability policy positions.
- Professional associations require their members to undertake regular professional development and built environment sustainability can be an element within the offerings.
- Relationships between professional associations and universities are limited to conveying information about the formal requirements for membership of the professions.
- Professional associations support members who are enthusiasts for energy and water efficient buildings who have formed green building councils that assess and accredit large exemplar buildings.
- The built environment licensing boards and councils do not specify ESD knowledge as a requirement for membership of the professions.

5.3 University built environment professional education

Built environment professional education includes programs in architecture, engineering, town planning, urban design and project management. They are programs that provide graduates with the opportunity to become members of their chosen profession. Throughout the Asia-Pacific region the number of built environment professional programs have grown enormously as a part of what has been called the massification of higher education in this region. A key driver of the growth of built programs has been rapid urbanisation in the region as shown in Figure 1. This urbanisation has resulted in sustained growth in demand for professionals with the skills to design and build new buildings and urban infrastructure. Further, forecast rapid urbanisation will continue in the decades to come and that the demand for new professionals will continue. A key finding of this research is that there is no widespread deep greening of built environment professional education. Typically, there has been some acknowledgement of climate change and the case for more energy efficient buildings and other initiatives that could reduce built environment related carbon emissions. However, the following features of built environment professional education indicate that departments and schools within universities face considerable challenges. They include:

- The dominant paradigm guiding built environment education is ‘competent professionalism’, which reflects the type of professionalism sought by public agencies and firms that pre-date the recognition that carbon intensive cities form part of the climate change problem.
- Built environment sustainability courses tend to be offered either as electives or as specialist post-graduate degrees which result in most graduates having little or no knowledge of built environment sustainability issues and how they can be addressed.
- Although faculty in some departments are built environment sustainability experts, evident in their publications and industry engagement, their commitments have not resulted in broader curriculum change within their departments and schools.

5.4 Future action

The problem of climate change mitigation and adaptation needs to be made central to higher education built environment professional education. Of course, making this problem more central to the constellation of actor groups identified and discussed in this report presents a significant challenge. Changing the priorities of universities, professional associations, regulators of the professions and built environment regulators takes time and resources. It requires a consensus that there is a problem with built environment professional education and an agreed ‘road map’ about courses of action.

5.4.1 A road map for built environment curriculum change

It is proposed that the UNU IAS convene a workshop of stakeholders with a commitment to contribute to the development of a ‘road map’ that aims to make climate change mitigation and adaptation central to higher education built environment professional education in the Asia-Pacific region. Most Asia-Pacific countries have adopted building codes that form the basis for future decarbonisation of the built environment. However, the industry and the regulatory systems in these countries do not have the capacity to support the ‘rule of law’ that full implementation of codes requires.

UNU IAS is well placed to provide leadership for this initiative because of its history of support for advancing the study of sustainability in higher education in the Asia-Pacific through its support for ProSPER.Net and many other initiatives. The scope of this workshop can be described in the following terms:

- **Aim:** Sponsor a workshop of committed stakeholders that produces a ‘road map’ for making climate change mitigation and adaptation central to built environment professional education and continuing professional development in the Asia-Pacific region
- **Participants:** Draw participants for this workshop from government, including national education and public works ministries; built environment professional bodies, including international bodies such as the Royal Institute of Chartered Surveyors (RICS) and the World Green Building Council (WGBC); building industry peak associations; associations of universities; NGOs in the higher education field such as SHARE (2017); and international donor organisations with built environment commitments, such as the World Bank International Finance Corporation (IFC) and UNESCO.
- **Outcome:** Charge the workshop with producing a ‘road map’ for a multi-year multi-project program for presentation to national governments and international donor organisations for revision and endorsement.

The nature of the road map can be envisaged by noting initial ideas for projects set out below under the headings of further research, capacity building and network development.

5.4.2 Research

The research presented through this project could be extended. It has focussed on five programs in five countries. There is scope to extend the research to cover more countries and more universities. There are two ways this could be done:

- Select one profession in one country and research all accredited programs as an action learning project where the results are used to assess capacity development requirements and guide the development of a change program.
- Undertake detailed case studies that focus on exemplar built environment professional programs that have made climate change mitigation and adaptation central to curriculum design and teaching and use this research to guide further curriculum development.

It is crucial that this type of research is sponsored by the main stakeholders in built environment professional education. If the time and effort is put into gaining the commitment of universities, professional associations, regulators of the professions and built environment regulators to sponsor further research the results are more likely to encourage future change.

5.4.3 Capacity building

Second, there is scope to develop the capacity of faculty within universities who are committed to making climate change mitigation and adaptation issues more central to the curriculum. This can be done in three principle ways:

- Support faculty who are already teaching in built environment professional courses to renew curriculum. This can be done through professional development programs for faculty supported by teaching load reductions and engaging experts, resulting in the preparation of new curriculum.
- Initiate a project reviewing the operations of licensing boards and councils used to regulate built environment professional membership with the objective of including sustainability knowledge and skills requirements in admission to professional membership regulations.
- Establish an Asia-Pacific PhD scholarship program that supports research aimed at creating a future network of built environment sustainability educators with the capacity to lead continuous improvement in professional built environment sustainability education.

5.4.4 Network development

Third, develop a regional network that supports the education of future and already qualified built environment professionals to develop the skills necessary for sustainable city building and governance.
A model for this type of network organisation is found in PRME – Principles for Responsible Management Education. It supports organised relationships between the United Nations and management-related academic institutions, business schools, and universities. PRME's work is based on principles which lay the foundation for a global platform for responsible management education. It was established in 2007 by an international task force of 60 deans, university presidents and representatives of leading business schools and academic institutions.

There is scope for developing a similar principles-based network with the capacity to support the development of built environment professional education able to produce graduates who can contribute to improving the sustainability of cities.

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Appendix 1: Report on project workshop held in Indonesia

Built Environment Curricula in the Asia-Pacific Region: Responding to Climate Change

Wednesday August 3rd, 2016
World Bank Board Room (Mahakam), Indonesia Stock Exchange (IDX) Tower 2

1. Background

This ProSPER.Net project, *Built Environment Curricula in the Asia-Pacific Region: Responding to Climate Change*, presents a framework and an argument for a systemic greening of the built environment curriculum in higher education institutions in the Asia-Pacific. This argument is presented through case study institutional analysis of built environment professions in five countries. An element of the project was to test the case study methodology through a workshop that considered 'architects in Indonesia' as a case study.

This workshop, held on Wednesday 3rd of August 2016, brought together 40 built environment and higher education professionals from universities, industry associations, professional associations and government agencies with responsibility for city planning, building and economic development that were committed to the development of low carbon cities.

The principal goal of the project is to propose ways for increasing the capacity of future built environment professionals to design and build low carbon cities in the Asia-Pacific which complement the bottom-up initiatives of some leaders in some higher education institutions that have initiated reviews and greened the curriculum. The specific objectives of the project are to:

1. Develop a methodology for analysing the institutional development of built environment professions and their relationship to higher education in the context of new expectations that these professions contribute more to climate change mitigation and adaptation.
2. Develop commitment from industry bodies, professional associations, universities and key urban development and economic policy government agencies to align policy objectives for low carbon growth with university built environment curricula.
3. Canvass commitment from international donor agencies for a program of support for institutionalising additional capacity within universities to enable them to green their curriculum in support of a low carbon urban future.
4. Consider ways in which university faculty can have access to professional development opportunities that will provide them with the knowledge and skills to develop new curriculum and teach it effectively to students.

2. The August 3rd workshop

The workshop was designed to seek ideas from participants on how to systematically integrate environmental sustainable development thinking into university built environment professional education in the rapidly urbanising Asia-Pacific region, with a focus on Indonesia.

Participants in the workshop were drawn from:

- Indonesian government agencies with built environment, environment and education responsibilities.
- Professional and industry associations including the Indonesian Institute of Architects, Indonesian Association of Schools of Architecture and the Indonesian Green Building Council.
- Academics from architecture and engineering departments in Indonesian universities.
- ProSPER.Net member universities undertaking case studies on built environment professions.
- International agencies including the International Finance Corporation.

During the workshop participants worked in small groups to consider:

- Built environment professional education stakeholders, opportunities and constraints.
- Possible actions in BE professional education.
- Prioritising possibilities for action that could maintain support for developing a collaborative change program.
- While the workshop was held in Indonesia, and while most of its participants were locally based, the workshop also had a regional orientation informed by the participation of representatives of the ProSPER.Net universities.

3. Workshop design

Three assumptions about the current context for built environment professions in the Asia-Pacific region provided a starting point for the workshop.

- A priority policy objective for all governments in this rapidly urbanising region is to meet global commitments to mitigate and adapt to climate change by decarbonising the built environment, making it more energy and water efficient, and more resilient for changes due to the climate.
- Professionals who design, procure, finance, renew and maintain the built environment are being challenged to incorporate new knowledge and practices into the way they produce fewer carbon and water intensive built environments.
- Universities that educate professionals, such as architects, engineers, project managers and planners, are being challenged to renew their curriculum so that graduates can produce fewer carbon and water intensive built environments.

The workshop was facilitated by Associate Prof Usha Iyer-Raniga.

The workshop commenced with four short presentations

1. *Reshaping higher education: Responses to 21st century challenges and demands* – Professor Philipp Pohlenz from the University of Potsdam
2. *Built environment curricula in the Asia Pacific: Responding to Climate Change* – Professor Tony Dalton, RMIT University
3. *Architects and architecture education in China* – Dr Wang Xin, University of Tongji
4. *Engineers and engineering education in Sri Lanka* – Dr Cheminda Bandara, University of Peradeniya

These presentations were followed by three facilitated sessions of round table discussion. Each table was briefed beforehand on their role by the workshop facilitator to maximise interaction and exchange of ideas in each group. As government organisation representatives were included in the workshop, representatives of two government organisations – the Ministry of Environment and Forestry and the Ministry of Public Works and Housing ¬– formally 'opened' the workshop.

Five discussion groups were formed out of the 40 participants with approximately 8 participants in each group. Care was taken to ensure there was a balance of industry, government and academic stakeholders in each group. Group membership was adjusted across the three rounds of discussion so that groupthink was avoided and interactions between the participants was maximised.

Professor Philipp Pohlenz is a key contributor to an important ASEAN project on higher education development and quality assurance (Niedermeier, F. & Pohlenz, P. (2016). State of Play and Development Needs: Higher Education Quality Assurance in the ASEAN Region, DAAD: SHARE Jakarta). SHARE is the European Union Support to Higher Education in the ASEAN Region, and is a four-year EU and ASEAN initiative. SHARE is supported by a consortium of the British Council (leader), Campus France, DAAD, EP-Nuffic, ENQA, and EUA. SHARE aims to support ASEAN in harmonising regional higher education by sharing European expertise. It does this through strengthening regional cooperation, enhancing the quality, competitiveness, and internationalisation of ASEAN higher education for institutions and students, and thereby contributing to a closer ASEAN Community in 2015 and beyond.

The workshop began with an introduction to higher education and the development of quality assurance processes in the Asia-Pacific region. The ASEAN region in particular is characterised by rapid growth in higher education that is responding to rapid urbanisation, economic development and the education needs of young people. The presentation explored the possibilities for integrating the science of climate change and sustainability knowledge into teaching and learning in the educational institutions. The key question underpinning the presentation was the future of higher education in the region in relation to competencies, balanced with or against technical knowledge, co-production in teaching and learning, study programs, thinking and learning, and development of curricula in a way that is qualifying students to understand and practice in ways that contribute to future sustainability.

Broader issues and challenges of the built environment professions and professional education in the Asia Pacific Region were then presented with a specific focus on Indonesia, followed by the state of the profession and education in Sri Lanka and China. The key themes guiding the development of each of these presentations were:

- *Built environment regulation:* the development and implementation of regulations and their systems of administration.
- *The profession:* the development of the association and engagement with urban sustainability issues.
- *Curriculum governance:* arrangements used for the revising curriculum in higher education (HE) built environment professional programs.
- *ESD in the curriculum:* sustainability in case study undergraduate and postgraduate professional programs.
- *Expectations of the profession:* evidence from stakeholder debate about challenges in the context of climate change.

Prof Tony Dalton, co-lead of this project, presented an overview of the challenges facing the built environment professionals in the Asia-Pacific region with a particular focus on the architecture profession in Indonesia. Dr Xin Wang from the University of Tongji and Dr Chaminda Bandara from the University of Peradeniya each presented case study accounts of the challenges facing built environment professionals, architecture in China and engineering in Sri Lanka respectively.

The three main themes of the workshop were discussed in the groups over three main sessions, each lasting about 1.5 hours. Prior to each round, the facilitator posed questions to the workshop participants to be further discussed in each group, concluding with three-minute-long report presentations from each group.

The following questions were posed for the Round 1 discussions:

- Who are the stakeholders that need to be considered for built environment higher education?
- What are the opportunities?
- What are the constraints?

Participants moved for Round 2 discussions, while table facilitators remained the same. For the second round of table discussions the following questions were posed:

- What bridges can be established between the stakeholders?
- What actions can be taken?
- What is realistic?

In Round 3 participants were requested to note any personal reflections they wanted to share before commencing their group discussion. The guiding question for this last activity was:

- What are the possibilities for action?

Participants had to come up with three action items, which they then discussed within their groups.

4 Workshop outcomes

The anticipated outcomes of the discussions were:

- Commitment for built environment curriculum change that extends beyond current bottom-up approaches to a system wide change.
- Commitment from an agency or agencies for leading initiatives promoting system wide change.
- A modest list of feasible initiatives with the potential to inform and develop system wide change in built environment professional education.
- Review of the methodology being used in the ProSPER.Net project to research and analyse built environment professional education.

For Round 1, where participants established a list of stakeholders, with opportunities and constraints, the groups identified a similar set of stakeholders. Not surprisingly, the stakeholders identified included the stakeholders present at the workshop. Other stakeholders that participants felt needed to be included were:

- Building owners and the community
- Ministry of Energy, Ministry of Higher Education and Ministry of Manpower
- Professional bodies such as IAP (Institute of Planners), IABHI (Institute of Green Building Professionals) and APTARI
- NGOs and development institutions such as BISA, LPJK (Professional Regulatory Authority), WALHI (Environmental organisations)
- Manufacturing industry supply chain participants
- Experts
- Consultant/contractor organisations such as INKINDO (consultant companies), GAPENSI (Contracting companies) and GAPENRI (EPC Companies)

Opportunities identified were:

- Better access to global knowledge
- Development of locally customised curricula
- Cooperation with other stakeholders and professionals in developing curricula
- Collaboration with local and international universities
- Dissemination of case studies and best practice
- Involvement of practicing professionals to create interest and awareness among students

Constraints identified were:

- Lack of alignment of codes and regulation
- Outdated standards
- Lack of specialists
- Lack of harmonisation of professional standards and qualifications

- Resistance to curricular change within universities
- Lack of lecturers with sustainability expertise
- Lack of elective courses
- Local wisdom and traditional knowledge not incorporated
- Fragmented decision making
- Fragmentation/siloed approach to building design and construction

In Round 2, where connections with stakeholders were considered, a summary of the outcomes were:

- Clearly defined learning outcomes for specific courses and programmes
- Strengthening licensing procedures
- Providing incentives for uptake of green buildings where possible
- Balance between theory and practice in university education
- Developing quality through ESD competencies and curricular development
- Create and maintain knowledge materials from specific industries
- Form partnerships with industry on research projects
- Create a repository of knowledge materials on green buildings (to be shared within, and between universities nationally and globally)
- Encourage and support interdisciplinary and multidisciplinary thinking and practice in the university programs
- Capacity building for professional development/ online training for continuing education
- Building research capacities in universities
- Capacity building for academics and government officers with respect to standards and certifications
- Capacity building for the construction workforce
- Setting up campaigns where appropriate to bring awareness and support for green buildings
- Knowledge sharing through benchmarking/ demonstration/pilot projects and technology transfer
- Aligning construction companies and their work force, government agencies at national and regional levels (and also local levels), NGOs, academe, and goods and services industries
- Investment in design and performance evaluation, with learning by doing and demonstration activities

The final round of discussion on priorities produced the following list of possibilities:

- Need to identify funding agencies/resources
- Undertake a mapping exercise to determine gaps and plan capacity building
- Prepare a roadmap involving all the relevant stakeholders
- Enforce regulation
- Capacity building/continuing education for all stakeholders
- Support the development of private projects for benchmarking/showcasing/awareness
- Develop a knowledge platform
- Industry and government engagement in curriculum development with incentives where appropriate

5. Workshop Evaluation

An evaluation form was provided to the participants to seek feedback on all stages of the workshop. All the speakers were considered to be good. The participants supported the workshop outcomes. Improvements for workshop included; ‘excellent job’, ‘keep up the good work’, ‘keep contact and share knowledge, information’, and ‘include life [sic] streaming and audience from various universities network, e.g. UN Sustainable Development and Solutions Network Indonesia (26 universities)’.

6. Conclusions

The aim of the workshop was to consider how to integrate sustainability in built environment higher education programs, with a particular focus on Indonesia. It was anticipated that there would be a common focus on building a commitment for built environment curriculum change extending beyond bottom-up approaches in programs to a system wide change. The result was agreement amongst participants on the importance of stakeholders including universities, government agencies and industry building a common program. It was also acknowledged that commitment from international agencies is required. The International Finance Corporation (IFC), which has a considerable track record in supporting countries in the region to revise their building codes, is keen to re-engage with key industry participants.

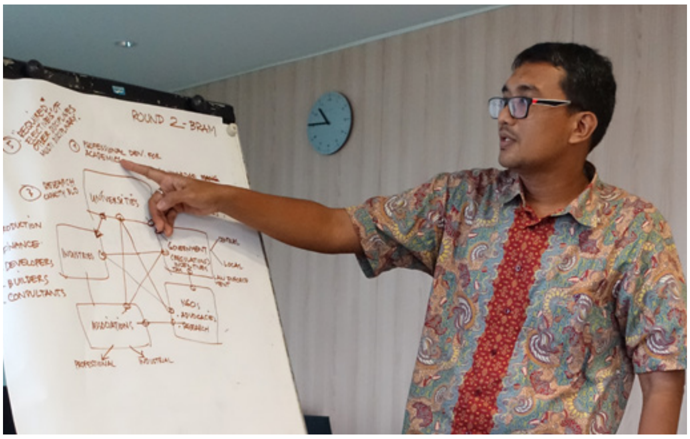
Engaging with government departments; in particular, the Ministry of Housing and Public Works and the Ministry of Environment and Forestry supported the idea of bringing government, industry and universities together. Further discussions with other government departments – the Ministry of Higher Education and the Ministry of Energy – are required.

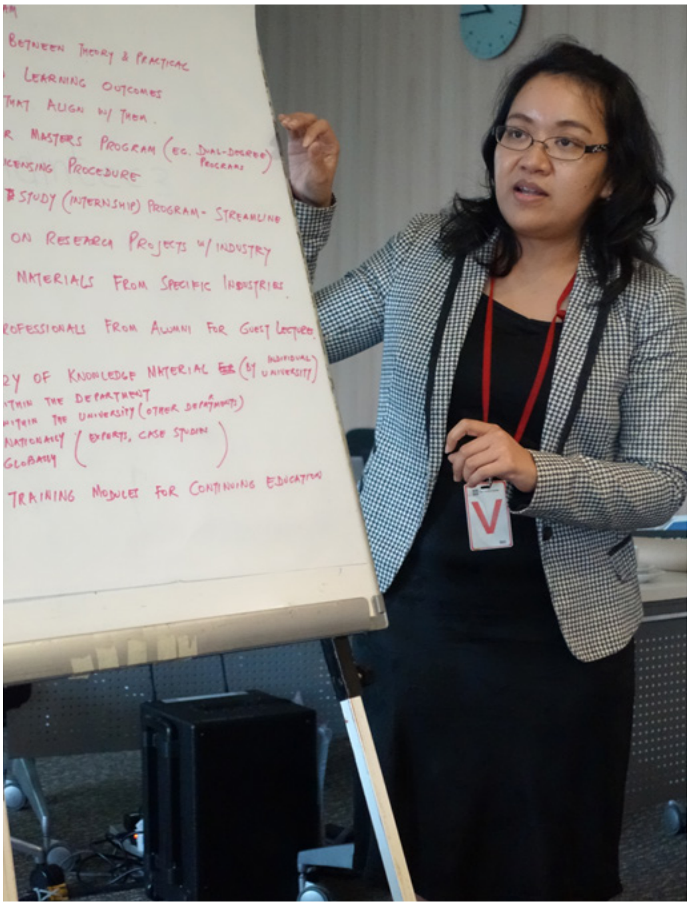
Overall, the discussions amongst the workshop participants presented a priority for the following:

- Capacity building
- Knowledge sharing platform
- Aligning government and industry with academia in curriculum development

The workshop established a basis for institutional engagement for sustainability in higher education. It confirmed the importance of engaging with stakeholders committed to improving sustainability and climate change thinking and practice in built environment higher education programs.

Photos from workshop held in Indonesia in August, 2016.




BETWEEN THEORY & PRACTICAL
LEARNING OUTCOMES
THAT ALIGN W/ THEM.
R MASTERS PROGRAM (EG. DUAL-DEGREE PROGRAM)
ICENSING PROCEDURE
STUDY (INTERNSHIP) PROGRAM - STREAMLINE
ON RESEARCH PROJECTS W/ INDUSTRY
MATERIALS FROM SPECIFIC INDUSTRIES
ROFESSIONALS FROM ALUMNI FOR GUEST LECTURE
RY OF KNOWLEDGE MATERIAL (BY INDIVIDUAL UNIVERSITY)
WITHIN THE DEPARTMENT
WITHIN THE UNIVERSITY (OTHER DEPARTMENTS)
NATIONALLY (EXPERTS, CASE STUDIES)
GLOBALLY
TRAINING MODULES FOR CONTINUING EDUCATION