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Dense and Green Building Typologies

Research, Policy and Practice Perspectives

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Foreword: Propagating Singapore's Alternative Modernity

It is 10 AM on Saturday 24 March 2018 in the 'pod' auditorium on the 16th floor of Singapore's National Library. A large and expectant audience of assorted architects, artists, poets, sociologists and intellectuals is gathering. They have come to hear William Lim give a lecture celebrating the bestowal of this year's Singapore Institute of Architects Gold Medal upon him.

The lecture title appears on the screen in large bold letters: 'The Future is Now!' it announces. The audience settles down as the Chair and Institute President, Seah Chee Huang, recounts the many inter-twined threads of Lim's career as architect, writer, activist and cultural impresario.

On stage, Lim adjusts his mic, consults his notes and begins in characteristic academic style. As his lecture gathers steam, he builds a compelling case for the role of architecture in grappling with the multifarious challenges of contemporary urbanisation in Asia. He patiently tabulates the negative symptoms—land-grabbing, real estate speculation, displacement of the urban poor, destruction of culture and environmental degradation—and challenges his audience to address them in their respective day-to-day professional lives. His own position clear: 'starchitecture' cannot help, and local built examples by Zaha Hadid and Daniel Libeskind are summarily dismissed.

Those in the audience expecting reflection on the back-catalogue of Lim's own built work are growing restless. As the clock ticks past the half-hour mark, it becomes clear that there will be no slides on the Golden Mile or People's Park complexes, those audacious and famed mixed-use megastructures of the 1970s that he designed with colleagues Tay Kheng Soon and Koh Seow Chuan. It is no surprise that the post-lecture discussion turns to those projects. One after another, audience members reflect on the built work of Lim and colleagues of his generation such as Tay and Koh, as well as Tan Cheng Siong and Ken Yeang. Projects such as Siong's Pearl Bank Apartments, Tay's Dairy Farm Estate, and his development guide plan for Kampung Bugis, and Yeang's more recent work (including the National Library building in which the event is taking place), feature strongly.

Discussants, sociologist Kwok Kian Woon and architect Richard Ho, join Lim on stage to sum up. They skilfully capture the mood of the auditorium, and try to square Lim's future-oriented rallying speech with the reflective atmosphere in the room. Lim, Tay, Koh, Tan and many others of that generation, Kwok suggests, gave shape to a unique legacy of tropical architecture and city-making. This legacy was based on a productive tension that embraced both modernisation's progressive drive, technological optimism and universalism, as well as a postcolonial spirit for self-determination, cultivating cultural identity, and appreciation of tropical environmental conditions. This heady mix—implicating science, technology, architecture, urbanism, poetry, art and cinema—shaped an alternative modernity that inspired a wholly new city vision. The relatively short history of postcolonial city-making at that time—Chandigarh, Brasilia, Canberra and Japan's metabolism—was instructive. But early projects like the Golden Mile and the Kampung Bugis development guide demonstrated, for the first time, the possibilities of a densely populated, global, mixed-use city that was at ease in the tropics.

The future may be now, Kwok and Ho seemed to be saying, but it draws upon a rich legacy of innovation, creative risk-taking and appreciation for the nuances of culture and situation that Singapore's early alternative modernists shaped.

What, then of the now and the future? The alternative modernity legacy continues to inspire new projects, such as initiatives to document built work of the postcolonial period, efforts to capture the oral history of architects, engineers and actors of that era, and student architectural design experiments at Singapore University of Technology and Design (SUTD) and National University of Singapore (NUS) on 3-dimensional, high-density and bioclimatic forms. It might also be argued that many of the mainstream policies and visions of government planning agencies—in their embrace of non-motorised transport options, landscaping for urban spaces and high-rises (LUSH) and water-sensitive urban design, for example—build upon the possibilities of an alternative modernity.

This book can be counted among such projects too, expanding as it does the ecological and programmatic possibilities of high-density urbanism. The book emerges from research conducted by the 'Dense and Green Building Typologies' team at the Future Cities Laboratory (FCL). The team is composed of architects, academics, scientists and ecologists from ETH Zürich and SUTD, and in this book offers a precise demonstration of the FCL mission to conduct 'transformative research'.

The term 'transformative research' is most clearly articulated by the German Advisory Council on Global Change (WBGU) in its flagship report 'World in Transition: A Social Contract for Sustainability' (2011). In that report, the author team outlines what they call 'the great transformation' necessary to shift from the fossil fuel-based economic system towards a sustainable, low-carbon future. The great transformation is an ambitious enterprise, matched only, in the eyes of the WBGU, by two other events in world history for scale and impact: the neolithic revolution which saw the rise of agricultural society; and the industrial revolution that underpinned the rise of planetary urbanisation over the past two centuries (2011, 81). Other scholars agree. The Stockholm Resilience Centre team, for

example, has diagnosed what it calls 'the great acceleration' of almost all demographic and economic indicators matched by a sharp deterioration of indicators of environmental health since the beginning of the industrial revolution.

For the WBGU, the great transformation involves ushering in fundamentally new forms of production, consumption and lifestyle in order to 'reduce greenhouse gas emissions to a minimum in the coming decades (decarbonisation of the energy systems and establishment of low-carbon societies), to minimise the scarcity of essential resources (above all land, water, strategic mineral resources) through major resource efficiency increases, and to avoid abrupt changes within the Earth system (tipping points), through economic and development strategies which take the guard rails of the Earth system (planetary boundaries) into account' (WBGU 2011, 81).

Transformative research is one of the 'instruments of interdisciplinary research' (WBGU 2011, 351) that is necessary to address such challenges. It spans discipline- and system-based research and encourages a cross-fertilisation between the two. It emphasises engagement 'with society, the economy, and politics', while considering 'global usability', 'intercultural transferability' and potential 'rebound effects and 'path dependencies'. In short, transformative research aspires to actively steward, guide and curate the great transformation processes in responsible ways.

By gathering together this rich body of research material, the 'Dense and Green' team adopts a nuanced stance: on the one hand, sensitively building upon the possibilities that early Singaporean architects, artists and intellectuals articulated; and at the same time, engaging with regional and global debates concerning sustainability and urbanisation. In this sense, the book could well be an instrument of transformative research, that gives substance to Lim's call.

Singapore, Singapore Stephen Cairns

Preface

The following book chapters are based on the various contributors' presentations at the 'Dense and Green Building Typologies: Architecture as Urban Ecosystem' symposium that took place at the Singapore Urban Redevelopment Authority (URA) on 30 August 2017. The event was organised in the context of the Future Cities Laboratory Dense and Green Building Typologies research project. It brought together important stakeholders, including researchers, policy makers, planners, developers, architects and landscape architects, to discuss how dense and green buildings in Singapore and beyond can contribute to developing compact yet highly liveable future cities.

Dense and Green Building Typologies Project

Dense and Green Building Typologies is a 5-year research project of the Future Cities Laboratory (FCL), established by the Swiss Federal Institute of Technology Zurich (ETHZ) and the National Research Foundation Singapore in collaboration with key academic partners including the Singapore University of Technology and Design (SUTD). FCL studies sustainable future cities through science, by design and in place, with its High-Density Mixed-Use Cities Scenario developing new integrated planning paradigms, research methodologies and implementation processes to support higher population densities, higher standards of environmental sustainability and enhanced livability. As part of that scenario, Dense and Green Building Typologies investigates systematically the environmental, social, urban, architectural and economic benefits of large buildings with integrated green spaces in high-density contexts through a series of international in-depth case studies, including in Asia, Europe and the Americas.

Singapore, Singapore — Thomas Schröpfer
Zürich, Switzerland — Sacha Menz

Acknowledgements: Dense and Green Building Typologies Research Team

Prof. Dr. Thomas Schröpfer is Professor of Architecture and Sustainable Design (ASD) at the Singapore University of Technology and Design (SUTD) and Principal Investigator of the Dense and Green Building Typologies project at the Singapore-ETH Centre Future Cities Laboratory (SEC-FCL). He began his academic career at Harvard University, where he was appointed Assistant Professor of Architecture in 2004 and Associate Professor of Architecture in 2008. He was named Full Professor after joining SUTD in 2011, where he became Associate Head of Pillar of ASD, Co-Director of the SUTD-JTC I^3 Centre and Director of the University's award-winning Advanced Architecture Laboratory. He held visiting professorships at the Massachusetts Institute of Technology, the Swiss Federal Institute of Technology and the National University of Singapore. In 2015, he was appointed member of the SEC-FCL Steering Committee. His book publications have been translated into several languages and include *Dense + Green: Innovative Building Types for Sustainable Urban Architecture* (2016), *Ecological Urban Architecture: Qualitative Approaches to Sustainability* (2012) and *Material Design: Informing Architecture by Materiality* (2011). He is the recipient of prestigious awards and recognitions, including the Singapore President's Design Award, the German Design Award the and the Asia Education Leadership Award. His research and design projects have been exhibited at important international venues, including the Venice Architecture Biennale and the World Congress of Architecture.

Prof. Sacha Menz is Professor of Architecture and Building Process at the Swiss Federal Institute of Technology (ETH) Zürich. He has served as the Dean of the Department of Architecture, and has been leading the Institute of Technology in Architecture (ITA) for over 10 years, where he designed and coordinated the building process of the Arch_Tec_Lab. He also established the Master of Advanced Studies (MAS) Programme in Architecture, Real Estate and Construction, as well as several CAS (Certificate of Advanced Studies) courses at ETH. He held the position of Deputy Director at NCCR (National Centre of Competence in Research) in Digital Fabrication and was a guest professor at South-Eastern University in Nanjing, China. Trained in Architecture at ETH with a master's degree, Sacha

co-established sam Architects and Partners (SAM) in Zürich/Switzerland. SAM designed the award-winning»Vorderer Sternen« Building in Zürich. He is member of several boards such as the Architectural Board of Consultants for the City of Ostfildern, Germany; Board of Directors of Swiss Engineers and Architects Association (SIA), Reviewing Board for Clusters of Excellence of the DFG (German Research Foundation). He has authored academic publications including *Three Books on the Subject of Building Process* and *Public Space Evolution in High-Density Living in Singapore* and actively contributes in international conferences and architectural juries.

Dr. Michelle Yingying Jiang is a postdoctoral researcher and the Project Coordinator of the Dense and Green Building Typologies project. She investigates the post-occupancy performance of dense and green buildings in terms of social benefits, including user perception and preference, as well as dense and green buildings' influence on health and comfort. Her research interests include architectural history, space design and the interrelations between the physical quality of space and human behaviour. Prior to her current position, Michelle was part of Module X: Housing at the Future Cities Laboratory as a postdoctoral researcher, analysing socio-spatial qualities of elevated public spaces in public housing in Singapore. She also participated in the Smart Living Lab at the École Polytechnique Fédérale de Lausanne (EPFL), where she drafted the programme on building space flexibility and usability. Michelle graduated from Zhejiang University of Technology in 2004 with an Engineering Bachelor Degree in Architecture Design. She obtained an Master's Degree Engineering in Architecture, History and Theory from Shenzhen University in China in 2008. In 2012, she completed her PhD thesis on building flexibility and adaptability at the Architecture Department of The University of Hong Kong.

Richard Belcher's role at the Future Cities Laboratory is quantifying the environmental and economic value of greenery in dense and green building typologies using post-occupancy data. He holds a Master of Science in Environmental Management from the National University of Singapore (NUS), where he quantified how neighbourhood green space influences the selling price of public housing. He also has a BSc (hons.) in Forestry from Bangor University, Wales. Prior to his role at FCL, Richard worked as an environmental consultant in Singapore, conducting pollution control studies, Environmental Impact Assessments (EIAs) and emissions inventory studies.

Emek Erdolu's research at the Future Cities Laboratory examines the variations in quantum and design configurations of green components on and around the high-density buildings as patterns of provision and connectivity within larger urban green systems. His broader research interest is the relationship between digital technology and design thinking in the context of emerging computational tools and its implications for architecture and urban design. Prior to FCL, Emek has worked for 7 years in the US, China and Singapore on various architecture, landscape and urban design projects and he has taught as a studio instructor at Bilkent

University in Turkey. He holds a Master of Urban Design with Distinction from University of Michigan, Ann Arbor and a Diploma in Landscape Architecture and Urban Design from Bilkent University.

Mayank Kaushal is an architect, urban designer, researcher and an avid writer with sustainable design expertise. He has worked on diverse types in the public and private sector, spanning various cultural and climatic regions across Asia. Over the years, he was involved in a number of award-winning projects that celebrate sustainability by qualitatively and quantitatively sculpting environmental resilience. He is constantly working on combining research with practical applications. He has contributed to the Masters programme as a juror for studio presentations at the National University of Singapore and through his recent editorial work on 'SG3—Decoding Sustainable Urbanism, Singapore'. He is an advocate rethink his current role as a researcher at Future Cities Laboratory focuses on understanding qualitative and quantifiable design benefits of dense and green building typologies.

Prashanth Raju is a researcher at the Future Cities Laboratory of the Singapore-ETH Centre. As part of the Dense and Green Building Typologies project, his research examines the variations in design configurations of green components on high-density buildings and analyses their design benefits in architecture and urban scale. His broader research is on the integration of landscape infrastructure within the built environment using design strategies that strengthen the negotiation and interaction between them. Prior to FCL, he has worked as an architect for two years in India where he was involved in residential, commercial and master planning projects. Prashanth holds a dual Master of Urban Planning and Master of Urban Design degree from the University of Michigan, Ann Arbor, where he was awarded for his work on accessibility and affordability of design. He also holds a Bachelor of Architecture from MEASI Academy of Architecture, India.

Thibault Pilsudski's role at the Future Cities Laboratory (FCL) is investigating maintenance aspects of greenery in high-rise buildings as well as analysing them in terms of Green Plot Ratio (GNPR) as an indicator for density of greenery. Within the larger urban context, he also examines the impact of dense and green buildings in relation to urban density and accessibility to landscape spaces. Prior to FCL, he has worked at the Ministry of National Development Centre for Liveable Cities in Singapore on various urban projects such as the pedestrianisation of Orchard Road. Thibault holds a Master of Urban Studies and Public Policy degree from Sciences Po Paris and a Master of Urban Planning degree from the National University of Singapore.

Jonathan Koon Ngee Tan is a researcher currently working on quantifying the thermal benefits of urban greenery using infrared thermography, image classification and statistical modelling. During his time with the Botany Laboratory at the National University of Singapore, he surveyed secondary forests to detail the population dynamics of exotic tree species and their native ecological analogues and conducted nursery experiments to investigate the responses of exotic tree

species along a nutrient gradient. His larger research interest is the functional benefits and conservation of nature. He holds a Bachelor of Science in Environmental Studies (Biology Specialisation) degree from the National University of Singapore.

Ester Suen's work aims to understand the benefits of greenery on buildings in Singapore with regards to biodiversity and microclimate. Her broad interests include urban ecology, sustainability and conservation. Specifically, she is interested in understanding the socioecological relationships between plants, animals and people in urban areas. She has previously worked in a forest ecology and restoration laboratory at Yale-NUS, where she studied the functional traits of plants in relation to their environment. She holds a Bachelor of Science in Wildlife Biology and Conservation from the University of Guelph in Canada.