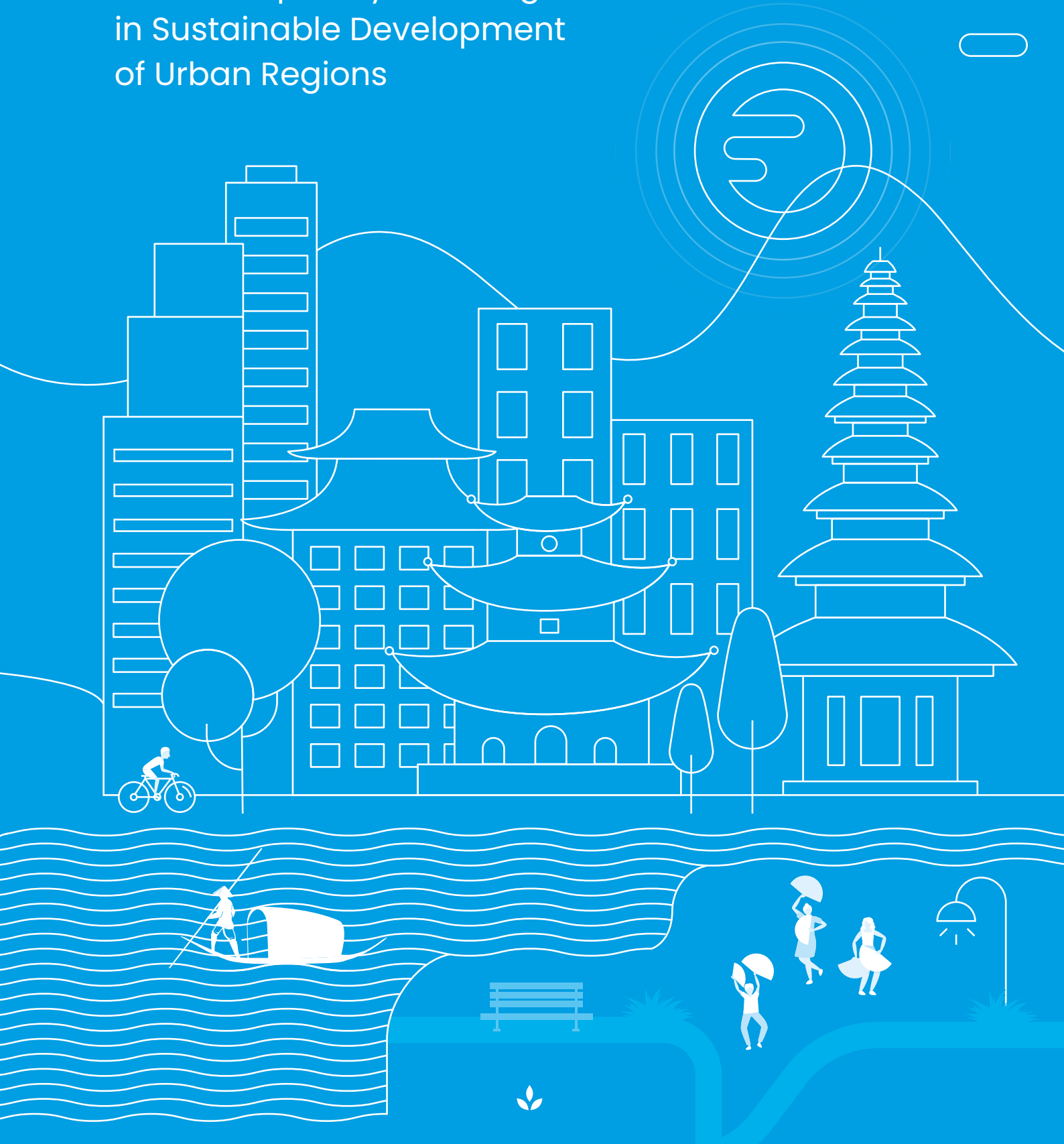


SURE Solutions

1st Volume · 2024

Transdisciplinary Challenges in Sustainable Development of Urban Regions



SURE Solutions is the science mag on transdisciplinary urban research

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SURE Solutions
1st Volume 2024

SURE Solutions

Transdisciplinary Challenges in Sustainable
Development of Urban Regions



From the Editors

High-level programs and strategies for sustainable urban and regional development fall short of grasping the complexities on the ground. They rarely take a synthetic and synergetic perspective leading to creative solutions. *Solutions* – the magazine outlet of the SURE funding priority – wants to address sustainable urban development in South East Asia and China by highlighting the specificity of places and sites, challenges and solutions. It puts into focus the individual projects as well as the individuals behind the projects. It showcases insights from the facilitation and synthesis research accompanying the funding priority and, before all, novel solutions in urban planning and development.



Deutsch
Hochrangige Programme und Strategien für nachhaltige urbane und regionale Entwicklung scheitern oft daran, die Komplexitäten vor Ort zu erfassen. Selten nehmen sie eine synthetische und synergetische Perspektive ein, die zu kreativen Lösungen führt. *Solutions* – das Magazin des SURE-Förderschwerpunktes – thematisiert nachhaltige urbane Entwicklung in Südostasien und China, indem es die Spezifität von Orten und Standorten, Herausforderungen und Lösungen hervorhebt. Es konzentriert sich auf die einzelnen Projekte sowie die Personen hinter den Projekten. Es präsentiert Erkenntnisse aus der Begleit- und Syntheseforschung, die den Förderschwerpunkt begleitet, und vor allem neuartige Lösungen in der Stadtplanung und Stadtentwicklung.

những giải pháp sáng tạo. *Solutions* – cơ quan truyền thông của ưu tiên tài trợ SURE – muốn đề cập đến phát triển đô thị bền vững tại Đông Nam Á và Trung Quốc bằng cách nhấn mạnh tính cụ thể của các địa điểm, thách thức và giải pháp. Nó tập trung vào các dự án cá nhân cũng như những người đứng sau các dự án. Nó trình bày các thông tin chi tiết từ nghiên cứu hỗ trợ và tổng hợp đi kèm với ưu tiên tài trợ và, trước hết, những giải pháp mới trong quy hoạch và phát triển đô thị.



Tiếng Việt
Các chương trình và chiến lược cấp cao cho phát triển đô thị và vùng miền bền vững thường không đủ hiểu rõ về sự phức tạp trên thực tế. Họ hiếm khi có quan điểm tổng hợp và tạo ra

แบบไทย
โปรแกรมและกลยุทธ์ระดับสูงสำหรับการพัฒนาเมืองและภูมิภาคที่ยั่งยืน มักขาดความเข้าใจในความซับซ้อนของสถานการณ์จริง และมักไม่มองในมุมมองทางการสังเคราะห์และการร่วมมือซึ่งส่งผลให้ขาดความคิดสร้างสรรค์ *Solutions* – นิตยสารของ SURE funding priority – ต้องการที่จะสนับสนุนการพัฒนาเมืองที่ยั่งยืนในภูมิภาคเอเชียตะวันออกเฉียงใต้และประเทศจีน โดยการเน้นที่ความเฉพาะของสถานที่และสถานการณ์ ความท้าทายและวิธีการแก้ไข มันยังเน้นไปที่โครงการแต่ละโครงการและบุคคลที่อยู่เบื้องหลัง มันสอดดูเรื่องราวจากงานวิจัยในการขอ facilitation และการสร้างสรรค์ที่ได้รับการสนับสนุน และก่อนที่มันจะเป็นที่ทุ่มเทในวิธีการในการวางแผนและพัฒนาเมืองใหม่

ພາສາລາວ

ໂຄງການສະຖານທີ່ການແລະຈົບຈຳເປັນ
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ວິທະຍາໄລ SURE - ຈະຕັ້ງການຕັ້ງການ
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ແຕ່ລະຄະແນນ ແລະບຸກຄົນຢູ່ພວກນັກຂ້າງທັງການ
ຂອງຂ້າງຂອງໂຄງການມີທີ່ມາດໃຫ້ສ່ວນຫົວ. ແຕ່
ມີການສະແດງຄວາມຮູ້ສຶກສາຈາກການການສະແດງ
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ຂອງການສະແດງຄວາມຮູ້ສຶກສາແລະການ
ພັດທະນາຂອງການປະຕິເສດທີ່ມີທົດລອງຂອງກາ.

Filipino

Ang mga programang pang-
mataas na antas at mga
estrategiya para sa mapanatiling
urban at rehiyonal na pag-unlad
ay hindi lubos na nauunawaan
ang kumplikasyon sa lupa.
Madalang silang kumuha ng
sintetiko at synerhistic na
pananaw na nagdadala sa
likhang mga solusyon. Ang
Solutions – ang outlet na
magasin ng SURE funding priority
– ay nais na tutukan ang
mapanatiling urban na pag-
unlad sa Timog Silangang Asya
at Tsina sa pamamagitan ng
pagbibigay-diin sa partikular na
mga lugar at site, mga hamon at
solusyon. Itinutok nito ang mga
indibidwal na proyekto pati na rin
ang mga indibidwal sa likod ng
mga proyekto. Ipinapakita nito
ang mga kaalaman mula sa
pagpapadali at pagsasaliksik na
kasama sa prayoridad ng pondo
at, higit sa lahat, ang mga bago
at likhang mga solusyon sa
urban planning at development.

Indonesia

Program-program dan strategi
tingkat tinggi untuk
pembangunan perkotaan dan
regional yang berkelanjutan
kurang memahami kompleksitas
di lapangan. Mereka jarang
mengambil perspektif sintetis
dan sinergis yang mengarah ke
solusi kreatif. Solutions – outlet
majalah dari prioritas pendanaan
SURE – ingin menangani
pembangunan perkotaan yang
berkelanjutan di Asia Tenggara
dan Cina dengan menyoroti
spesifik dari tempat dan lokasi,
tantangan, dan solusi. Hal ini
memusatkan perhatian pada
proyek-proyek individu serta
individu-individu di balik proyek-
proyek tersebut. Ini memamerkan
wawasan dari penelitian fasilitasi
dan sintesis yang menyertai
prioritas pendanaan, dan
terutama, solusi-solusi baru
dalam perencanaan dan
pengembangan perkotaan.

ខ្មែរ

កម្រិតខ្ពស់នៃកម្រិតកម្មវិធី និងយុវជនរស់នៃ
ការអភិវឌ្ឍន៍លើផែនទីដែលមានការបដិវត្តន៍
ក្រុមការងារមូលដ្ឋាន យ៉ាងវិញ្ញាសាកល្បង
ប្រទេសទីខាងកើត និងចិត្តមូលដ្ឋាននៅក្នុង
ការអភិវឌ្ឍន៍អំពីទីតាំង និងទំនាក់ទំនងដោយ
គ្មានសេចក្តីបញ្ចូលចិត្តច្រើន។ Solutions
- អំឡុងពេលបន្ទាប់របស់ជីវជាតិបងប្រាក់ SURE
- ចង់ស្រាវជ្រាវអំពីការអភិវឌ្ឍន៍អភិបាលលើ
ផែនទីមូលដ្ឋាន និងប្រទេសចម្ងាយនៅក្នុងអាស៊ី
អាមេរិកខាងកើតនិងចិត្តមូលដ្ឋាននៅក្នុងការដែល
មានការផ្លាស់ប្តូរ និងដំណើរការផលិតនៅក្នុង
ការអភិវឌ្ឍន៍អំពីផែនទី និងការគ្រប់គ្រងរបស់វា
នៅលើអំបូរខ្លួនរបស់កម្លាំងនិងការអភិវឌ្ឍន៍។

中文 (简体)

高级别的可持续城市和区域发展计划
和战略在把握基层情况的复杂性方面
存在不足。它们很少采取综合和协同的
视角来导向创造性解决方案。Solutions
– SURE资助优先级的杂志出口 – 希望

通过突出地点和场所的特定性、挑战和
解决方案,来解决东南亚和中国可持续
城市发展的问題。它聚焦于个别项目以
及项目背后的个人。它展示了伴随资助
优先级的促进和综合研究的见解,并首
先展示了城市规划和发展中的新颖解
决方案。

The narrative of the “urban age”
– that a majority of the global
population now lives in urbanized
areas, tendency still increasing –
is common knowledge. Cities
possess magnetic powers; they
attract ever more human,
material and financial resources
and expand more and more to
urban regions. For the larger part
of humankind, citizenship in its
literal meaning (being the
resident of a city) stands for
assets such as access to labor
and education, wellbeing and
social advance, participation in
culture and welfare services. It is
well known, too, that the
gravitational forces of
accelerated urbanization lead to
conditions highly unfavorable for
the wellbeing of natural
environment and humankind.
Spiraling downwards,
urbanization often amplifies
negative factors such as traffic,
pollution, crime, or waste
production.

The iconic table of the United
Nations 17 Sustainable
Development Goals (SDG)
reflects this load of challenges.
Beautifully colored and visualized,
backed by sophisticated
indicator systems, the icons
however are set apart from each
other like checkboxes – a
misleading representation.
Of course, the need for
measurement and

standardization brings along high levels of abstraction and schematic models that necessarily simplify the multiple facets of cities. But the numbers presented along with the narrative of the urban age, as well as the icons and indicators of the SDG table, fall short of grasping two key issues as it comes to urbanization.

Firstly, political and administrative decision makers – them being located in New York, Geneva, Hanoi or Beijing – have little insight into the urban complexities on the ground. Cities and urban regions are neither abstract numbers nor diagrams, but bundles of site-specific qualities: people's interactions in neighborhoods, local myths and habits, traditional styles and technologies, unique ways of constructing physical structures as well as social institutions. Cities are the places where all this comes together – often in a messy and irrational way. Under the heavy pressure of migration, climate, or labor market dynamics, urban agglomerations evolve rapidly and often without planning.

Secondly, there is the difficulty of creating planning solutions that are sufficiently comprehensive and integrated. Complex challenges cannot be tackled by solving individual problems one by one, as in a bureaucratic process. As complex systems of systems, cities and urban regions are full of diffuse interdependencies. Urbanism as well as systems science has sufficiently demonstrated the

wicked nature of complex problem solving – where one solution may easily generate new constellations of problems which may be even harder to solve. Reaching beyond departmental mindset, a highly synergetic approach is necessary to integrate the different perspectives and system layers into transdisciplinary scope, to converge the multiplicity of aspects into creative synthesis.



We will take an immediate view on the specific places and challenges – putting into focus the individual projects as well as the individuals behind the projects.

Acknowledging these challenges, the German Ministry of Education and Research (BMBF) has established the funding priority “Sustainable Development of Urban Regions” (SURE), supporting 10 research projects with a geographical focus on two global hotspots of urbanization – South East Asia and China.

Being a central measure for the dissemination of SURE's results, we are glad to present to you our first edition of SURE's magazine outlet – Solutions. In view of the shortcomings described above, our magazine has two ambitions. (1) We will take an immediate view on the specific places and challenges – putting into focus the individual projects as well as the individuals behind the projects. We will zoom into the

very conditions on the ground and try to convey the full complexity, diversity and richness of each setting. (2) We will showcase insights from the ongoing facilitation and synthesis research that accompanies the overall funding priority and the individual projects. SURE Solutions is conceptualized as an easily accessible source for researchers and practitioners seeking actionable knowledge and applicable solutions for urban resilience and sustainability.

SURE Formats

We will publish SURE Solutions on an annual basis and present contributions from the SURE project community in a variety of formats. In SURE News we post fresh findings from the overall knowledge cosmos of SURE. The present issue, for example, introduces to you a toolbox for assessing water-related urban ecosystem services, created by the IMECOGIP project (p. 40). In the SURE Activity Reports we track the progress of the SURE projects and give you update on the projects' current achievements. This time you will find, among others, a report how the URA project managed to build up close ties to the Beiyang township in China (p. 58). SURE Research takes deep dives into scientific topics with relevance for the entire project community. We will outline cross-cutting challenges as well as emergent topics, and check for solutions that are transferrable to other application contexts. In this issue we feature six research papers, including the outline of a community-based tourism framework that is

potentially applicable in the entire Global South (p. 62). Finally, our SURE Snapshots appear in multiple places as informational intermezzi – short flashlights on people, events and tools worth to know. In this issue, for example, we like to bring to your attention OCTOBUS, the IIoT Platform for sustainable urban development deployed by the CHARMS project.

Cooperation medium

We believe that the formation of a community of knowledge and practice is key to respond adequately to the eminent urbanization challenges at hand. Solutions may become an effective instrument for such community-building, a low-threshold medium for the exchange between the SURE projects and beyond. The present edition shows that cities are not just massive problem statements but how urban communities can become powerful incubators of innovative solutions. Enjoy the reading – and reach out to us under: sure@hcu-hamburg.de

*Jörg Rainer Noennig,
Frank Schwartz &
Katharina M. Borgmann*



Photography by Katharina M. Borgmann,
Huangyan Hinterland in Taizhou, China

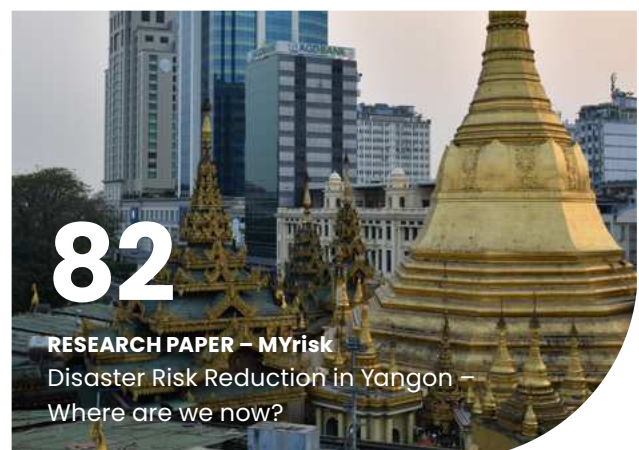
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ACTIVITY REPORT – URA

New Connections in Beiyang Township

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“

Concepts such as water sensitive cities may support sustainable urban developments, but must be framed in accordance with the specific characteristics and capacities of the cities.

50 ACTIVITY REPORT
PolyUrbanWaters



Build4People

Scientists and Practitioners in Creative Exchange on Sustainability Issues

Build4People's Round Table Workshop on Behaviour Change and Sustainability in Cambodia

Introduction

On 17 March 2022, the Build4People team of Work Package #1 "Behaviour Change" was hosting a half-day Round Table Workshop at the Royal University of Phnom Penh. While the overall transdisciplinary Build4people Project (www.build4people.org) aims at enhancing quality of life through sustainable urban transformation in the capital of Cambodia, Phnom Penh, Work Package #1 intends to (1) illuminate possible contradictions between individual lifestyle preferences and sustainable lifestyles, to (2) figure out the main drivers and barriers for sustainable behaviours in Phnom Penh, and to (3) implement and foster sustainable behaviours. Events like the Workshop "Behaviour Change" in addition to a representative household survey, online surveys, focus groups and the theory- and data-based development of interventions, complement the



Photography by the SURE Project Build4People

methodological portfolio of the Environmental Psychology work package.

Main Purpose: Exchange with Local Research Projects and Experts

The main purpose of the workshop was the exchange with local sustainability research projects and experts. Researchers and practitioners that deal with sustainability topics like waste management, urban climate, climate change adaptation and (pro-environmental) consumer behaviours in Phnom Penh/ Cambodia discussed manifold aspects of researching and supporting a sustainable future for Phnom Penh.

All participants had a strong connection to social and environmental sustainability topics: researchers at the Royal University of Phnom Penh (*Faculty of Development Studies, Faculty of Social Sciences and Humanities, Department of Psychology, and Department of Geography and Land Management*), researchers from other institutions like the *John Hopkins School of Advanced*

International Studies and Hong Kong Baptist University, and practitioners of the civil society (e.g., representatives from the Young Eco Ambassadors), and staff from governmental institutions like the *Ministry of Rural Development*.

Method: Interactive World-Café Session

Possible pathways of a sustainable urban transformation in Phnom Penh were discussed with respect to the participants work-related topics. The participants discussed problems, possible solutions, and relevant change agents as well as stakeholders for the improvement of pro-environmental behaviours in Phnom Penh in the light of the subject areas (1) *Waste Management*, (2) *Climate Change - Problem Awareness*, and (3) *Consumer Behaviour*. These topics were proposed by the participants in the first round of the workshop.

The World-Café method offers a structured but at the same time quite informal (hospitable coffeehouse setting) exchange and mutual learning. It aims at



getting all participants engaged in conversations about important and fundamental issues, making use of group intelligence, collecting thoughts in search of a common ground, and creating “harvest” by sharing the findings of the groups with all participants.

In three phases, the participants of the Build4People World-Café reflected on the problem analysis of a certain behaviour/subject area (1st round), discussed possible solutions and relevant change agents (2nd round) as well as practical implications, possible next steps, and the feasibility of implicated measures (3rd round). For every subject area there was a Café table with a tablecloth (with three guiding questions) to write on and scribble on (see figure 3). As a first step, the host of each table welcomed the participants and introduced the topic. Participants had some time to think about the questions and each group reflected jointly on ideas and connected them by using cards or by directly labelling the tablecloths. At the end of each round, participants switched groups and moved to the next table/topic. The host then presented the summary of the previous group to the new one and the cycle started again.

Insights: The Three Thematic Tables

Ideas discussed at the world-café table “Waste Management” included the need for guidelines and enforcement of waste management laws, the need for clear instructions for waste management and recycling, the

introduction of waste disposal fees, but also the provision of more bins in public spaces. The world-café table “Consumer Behaviour” focussed on the importance of social values for pro-environmental consumption patterns, the empowerment of eco-friendly groups and role-models as well as on behaviour constraints (poor public transport service) and the responsibility of local authorities to implement regulatory guidelines.

The main points of discussion at the world-café table “Problem Awareness of Climate Change” The main discussion points at the Third World Café table were improving formal and informal education on climate change (“knowing the impact”), strengthening digital knowledge transfer, providing information on climate change in Khmer, strengthening not only green role models but also local communities and environmental forums. The focus was on the need to implement regulatory policies that address the seriousness of global climate change.

Harvesting

The results of the World Café session were presented by participants of each table and the notes of all topics were summarized and clustered after the workshop.

The valuable ideas of this workshop will be integrated in different scientific and implementation activities of the Build4People project, to disseminate these collaborative

results to other relevant stakeholders of a sustainable urban transformation in Phnom Penh and to validate the projects’ research questions.

The method of the world café can be used for many contexts and is very promising when participants from different backgrounds are supposed to exchange ideas on an equal footing.

For a video clip of the event visit the Build4People YouTube Channel: www.youtube.com/watch?v=6OQwail6qBg&t=22s

Anke Blöbaum, Annalena Becker,
Op Vanna & Sok Serey

CHARMS

Evaluation of Heat Stress in Historic Wooden Houses in Chiang Mai

Residents of historic wooden buildings in the urban region of Chiang Mai suffer from uncomfortably high indoor temperatures and low indoor air quality during the hot season and high electricity bills in case of AC usage. The objective of CHARMS is to find suitable measures to optimize residents’ indoor comfort while conserving the “essence” of the historic nature of the buildings in an energy-efficient way.

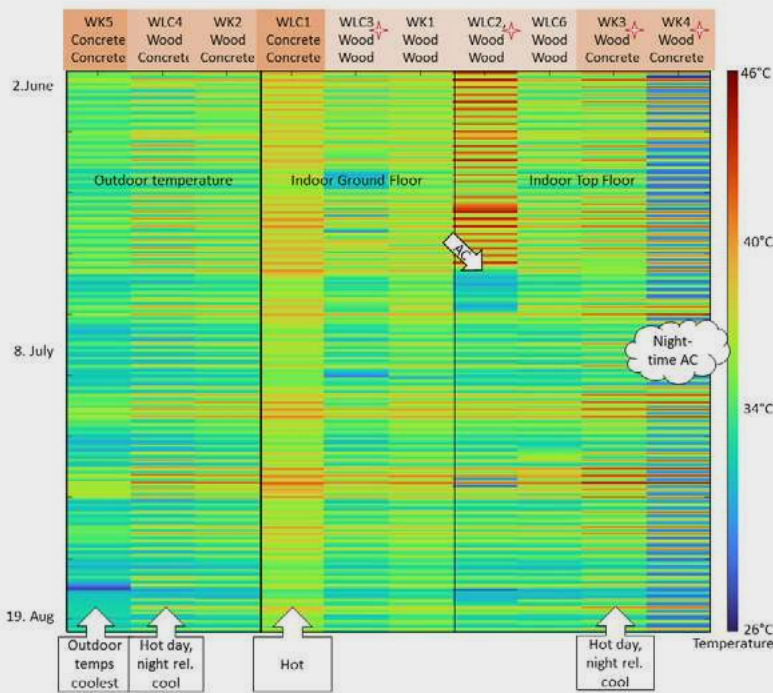


Figure 1: The measured temperatures of all ten sensors during the first six weeks of measurements

To evaluate the heat stress in historic wooden houses in downtown Chiang Mai, temperatures, air humidity and air quality (dust particles PM2.5 and PM1.0) shall be measured at 18 selected historic buildings in the Wat Ket and Wat Lam Chang districts over the course of one year. By today (August 2022), ten sensors have been recording data at ten historic buildings since June 2nd, 2022. The sensor locations can be categorized by outdoor/indoor, top floor/ground floor, concrete/wooden constructions, AC/non-AC, and Wat Ket (WK) and Wat Lam Chang (WLC).

Figure 1 illustrates the measured temperatures of all ten sensors during the first six weeks of measurements which fell into the monsoon season. In addition to the outdoor measurements at specific buildings, an urban heat map (UHM) was calculated

by INKEK GmbH as part of this project, to investigate the potential of night-time cooling effects to reduce the thermal stress on the houses. The UHM indicates that on the hottest days, Wat Lam Chang has a very low potential for influx of cool fresh air coming in from the Southwest. Wat Ket has a slightly higher potential of influx of fresh air during nighttime coming in from the Southeast. The measured outdoor temperatures during the monsoon season confirm the low influx leading to relatively low nighttime cooling in both districts. The outdoor temperatures range from a maximum of 43°C to a minimum of 27°C at night.

In all buildings, daytime temperatures of above 40°C have been measured. Besides the air-conditioned buildings, only one wooden building showed night temperatures

below 30°C, thus confirming the need for thermal control in the historic wooding buildings. The air-conditioned buildings achieve both highest daytime temperatures and coldest nighttime temperatures during AC-operation. The concrete building 1 in Wat Lam Chang has overall high temperatures (5°C higher on average), whereas the wooden building 3 in Wat Lam Chang is, on average, coolest, with nighttime temperatures near outdoor temperatures.

Since comfortably low nighttime temperatures are essential for human recovery, the data confirm the need for thermal control in the historic wooden buildings. Based on these first 2-3 months of measurements during monsoon season, in-depth investigations at WLC2, WLC3, WK3 and WK4 to investigate the options for improving the indoor comfort in the respective buildings, are in process. The in-depth investigations cover interviews with the residents of the respective buildings regarding following topics:

- Classification of the room, in which the DustBoy is installed, e.g. existence of glazed windows and external shading for windows
- Availability of AC and the operation scheme (time of operation, set temperature)
- Number of people living in the house, time of their presence in the house
- Availability and possible time of operation of fans, cooking place, hot water system, lighting, internet, TV.

- Typical cooling behavior (e.g. closing all windows and doors during daytime, open during night).
- Apart from doors and windows, are there special openings in the house to offer natural ventilation (open space underneath the building, openings in the roof space, internal walls and ceilings with or without openings).

*Maike Buddensiek &
Michael Krause*

CHARMS

Social Innovations in Practice: Enhancing Managerial Competences through Case-Based Learning for Sustainable Urban Heritage Management in Southeast Asia

The preservation of urban heritage sites is significantly influenced by the complexities of climate change, the

repercussions of COVID-19, and the ongoing Russian-Ukrainian conflict. An interdisciplinary skill set is crucial for navigating these challenges, suggesting that sustainable stewardship is about more than technical conservation—it is about holistic resilience in the face of global adversities. To specify the up- and reskilling needs of heritage practitioners in Southeast Asia, the UNESCO Bangkok analysed the existing conservation-related higher education programmes in relation to the capacity development needs expressed by heritage practitioners. The survey has revealed that a lot of heritage-related educational establishments and training programmes are still limited in their curriculum, predominantly fostering student learning in the core heritage disciplines such as archaeology, architecture, and museology which are insufficient to sustainably manage heritage sites (UNESCO, 2021, p. 25). The majority of academic institutions, specialising in heritage management in the Asia-Pacific region, are thus deficient in providing future heritage practitioners with courses that deliver critical managerial competences such as human capital management, financial and operations management and information management (UNESCO, 2021, p. 33).

To bridge the gap between existing academic offerings and the managerial competences needed on-site, UNESCO Bangkok has planned to organize a series of masterclasses on Innovative Models for Sustainable Heritage

Management. These classes aim to enable heritage practitioners from the Asia-Pacific region to acquire managerial knowledge and skills using the Harvard Business School case study method. This is a participatory learning approach where participants take on the role of a decision-maker to solve a real-life business dilemma through self-learning and discussions with the case protagonist, facilitators, and fellow students.

At this stage, Fraunhofer IMW, operating within the framework of the project CHARMS, whose objective is to improve the indoor comfort of historic wooden houses in Thailand, proposed to contribute to the development of the UNESCO's masterclasses. The high potential for this collaboration was attributed to the alignment of CHARMS's objective, which seeks to endow individuals working in heritage-related areas with managerial



Picture by the SURE project CHARMS



capabilities needed to design and implement integrated, economically sustainable solutions for built heritage conservation. Consequently, both Fraunhofer IMW and UNESCO Bangkok recognised the prospective synergies in their partnership, which could help accomplish a shared objective integral to both organisations: enhancing the capacity building of heritage practitioners in Southeast Asia to ensure the effectiveness of cultural heritage conservation and management practices in the face of twenty-first-century societal challenges.

To date, the cooperation between Fraunhofer IMW, UNESCO Bangkok and the local associate, Think City Institute, has resulted in the development of a case study on innovative models for heritage conservation, harnessing the Harvard Business School case study method. This case study provided the foundation for the inaugural two-month masterclass on Sustainable Heritage Management, conducted in February–March 2022. The masterclass delved into the successful endeavours of Penang-based heritage conservationists Laurence Loh and Lin Lee Loh-Lim in constructing a sustainable operating model for the adaptive reuse of the iconic Blue Mansion – the former residence of the Chinese merchant and politician Cheong Fatt Tze. The primary objective of the masterclass was to bolster the managerial competences of heritage practitioners and cultivate their

problem-solving, decision-making, and critical thinking capabilities in a heritage management context. In order to facilitate the masterclass, Think City Institute provided a web-based learning platform, and a series of videos exploring the operating models utilised for the conservation was produced. Complementing these resources, Fraunhofer IMW developed two supplementary videos that served as a primer on the subject of social innovation in the heritage conservation sector.

The present and forthcoming masterclasses aim to provide a conduit for heritage professionals to gain insights from benchmark cases in heritage management, engage in discourse on innovative approaches to heritage conservation with project executors, share international experiences with participants from different countries of the Asia-Pacific region and apply their newly acquired knowledge and skills to address diverse managerial problems.

Larisa Ryabtseva &
Henrik Beermann

SURE F&SR

Of Strategies and Synergies

Synergy Workshop Six with GreenCityLabHuế und FloodAdaptVN in Huế, Vietnam 1st of October 2022.

In the bustling city of Huế, Vietnam, a pivotal gathering unfolded on October 1, 2022. The sixth Synergy Workshop marked the convergence of two significant initiatives: the GreenCityLabHuế (GCLH) and FloodAdaptVN (FAVN) projects. Hosted by Binh Minh Hoang of the MienTrung Institute for Scientific Research, in collaboration with SURE Facilitation & Synthesis Research Team, this workshop was a meeting of minds aimed at addressing the city’s pressing challenges (DLR, n.d.).

Huế grapples with a spectrum of issues—from climate change impacts to urbanization strains. The GCLH consortium, propelled by the goal of fostering a sustainable, inclusive future for the city, stands as a response to these challenges ([Source: UfU e.V., n.d.]). This workshop was a strategic gathering to explore collaborative avenues between these projects.

Representatives from both GCLH and FAVN, including Dr. Nguyen Ngoc Tung and Prof. Dr. Nguyen Hoang Khanh Linh, convened to explore common ground and shared objectives. The focus was on transcending mere research boundaries to establish joint strategies for tackling Huế’s multifaceted problems.

The workshop kicked off with an overview of the SURE Funding Priority and the SURE Facilitation & Synthesis Research Project, shedding light on the communication tool—SURExChange—for internal discussions. Discussions then



Photography by the SURE Project GreenCityLabHuế

veered into the specifics of the GCLH and FAVN projects before exploring potential synergies (DLR, n.d.).

Participants brainstormed innovative communication approaches—utilizing platforms like SURExChange for seamless consortium communication, harnessing social media collectively, and considering local newspapers for wider dissemination of insights.

Beyond communication strategies, the conversation extended to collaborative events and exhibitions. The mobile nature of GCLH's exhibition emerged as an opportunity for cross-pollination—contemplating setups within FAVN spaces and mutual content integration, fostering a dynamic exchange of ideas (UfU e.V., n.d.).

In terms of content, a common thread was found in nature-based solutions (NBS), seen as pivotal in mitigating flood risks. Discussions revolved around shared topics such as air quality, heat, and the synergy of green-blue spaces,

prompting the exploration of each other's case studies for mutual benefit (DLR, n.d.).

The workshop concluded with a guided tour through the GCLH exhibition—a physical and digital amalgamation encapsulating Hué's climate change narrative, its verdant history, and the evolving nature-based solutions shaping the city's future (UfU e.V., n.d.). A space designed for discussion, scientific validation, and reaching diverse audiences.

Plans are underway to refine the exhibition's logistics for better impact, including strategic activity scheduling and multi-location setups, aiming to amplify outreach and awareness around the Lab's initiatives (UfU e.V., n.d.).

The workshop's impact resonates—a testament to the potential when collaborations align, visions synchronize, and actions converge toward a greener, more resilient Hué.

*Katharina M. Borgmann
& Anika Slawski*

Lirlap

LIRLAP Fieldwork in Metro Manila and Capacity Building

The focus of LIRLAP is on resilient solutions for both informal settlements and planned resettlement sites as well as capacity building on the local level to ensure a long-lasting impact of these approaches. Working package (WP) 2 of LIRLAP deals with on-site upgrading of informal settlements in high-risk urbanized areas. It aims at enhancing residents' livelihood opportunities, community coping capacity for natural and man-made disasters and developing on-site upgrading activities with the community. It follows a community-based approach while being counterbalanced with planning interventions. WP3 analyses different resettlement approaches and their effects and

investigates whether the planned relocation (retreat) can improve the resiliency of the people. An index-based evaluation and monitoring framework will be developed to reveal the cause and effects of the location, the participation processes, financing schemes and housing designs. Both WPs aim is to develop model-retreat and upgrading projects which reflect the best resilience options and likewise with a cost-benefit prospect. Results of WP2 and WP3 provide first-hand and up-to-date input for the WP5 on training and capacity building as well as a tailor-made PhD programme.

In March 2022, the extensive survey and analysis period took off after a short pandemic-related delay with a visit of project members from the University of the Philippines, TU Dortmund, University of Stuttgart and the engineering company KaiserIngenieure, Dortmund in 16 settlements in the National Capital Region and surrounding provinces. The focus was on ten resettlement sites and six informal settlements. An essential part of these visits were group discussions with the Homeowner Associations, the local elective politicians or settlement leaders, urban poor groups and NGOs. The visits were complemented by photographic documentation and transect walks through the settlements. This was the starting point for intensive fieldwork in these 16 settlements from March to June 2022 with household interviews and focus group discussions. In total 1383 household surveys

were achieved with the support of 12 professional enumerators. In both surveys of WP2 and WP3, the number of female respondents outnumbered the male by 80%. The interviewed respondents for both WPs have education attainment of high school graduate (ca. 38%).

In the ten resettlement sites, a total of 1167 residents were interviewed. The survey investigates differences between resettlement approaches and is intended to provide data for the development of a resilient retreat index. This index should be able to monitor resettlement activities and allow estimations on how resettlement contributed to or interrupted the process of resilience building. The focus is on different resilience dimensions: resilient settlements, the exposure and architectural component, resilient livelihoods, focussing on livelihood capitals and resilient processes, investigating governance and participation options. Preliminary findings are that resettlement was arranged mostly because the residents lived before in hazardous areas or so-called danger zones. 90% of the relocated residents take part in a long-term amortisation rent to ownership program while only 10 % are renting the house in the relocation areas. However, before the resettlement, they mostly owned the house (60%) and 22 % were renters in the informal settlement. At the same time, the number of households having a legal document for their home increased from 1% in the informal settlement to 70% now at the



WP3 household survey

relocation site. However, the employment rate decreased in the relocation area from two third before to 50% only. This is a crucial decrease since they have to pay now for the home in the long-term amortisation rent to ownership program questioning the sustainability of the resettlement scheme. More than half of the residents had to change their job due to the new relocation site. For half of the families, the income has decreased after relocation while for one-third it has increased.

In May 2022, WP2 has been conducting 12 focus group discussions (FGD). Per site, two FGDs, consisting of community residents and community leaders and representatives respectively. FGDs' major focus are 1) a joint community hazards and risks mapping, 2) coping mechanisms and disaster preparedness, 3) community livelihoods, 4) community development issues and 5) community resilience future. Following the FGDs, WP2



conducted its household survey in June, covering 216 households in total (per site, 36 households). The household survey aims to complement the data collected by the FGDs. Residents' livelihood and their perspectives of spatial and disaster resilience were investigated during the household survey. The studied communities' adaption capacity and development needs were explored, so to identify the resilience upgrading priorities and feasible on-ground measures. Notably, almost half of the WP2 surveyed families are living on rent-free plots without the consent of the owner, which represents high informality regarding their tenure status. Fieldwork results have been triangulated and validated by an expert workshop on October 4th, 2022, in Manila. By end of 2022, LIRLAP will prepare a resilience upgrading knowledge transfer to Vietnam and Thailand with all LIRLAP project partners.

For WP 5 which covers capacity building and the Dual PhD program, it is important to consider that resilient informal upgrading and retreat will only be successful and sustainable if accompanied by capacity building of stakeholders at the local and national levels as well as in the academia. Therefore, training courses for key stakeholders involved in disaster risk management and urban governance have been successfully conducted in 2022. The first one was the course "Integration of Community Resilience in Urban Shelter Planning and Management

(I-CORE). I-CORE was a six-week training course conducted from 17 January to 25 February 2022 by all LIRLAP Partners. 42 participants from both different government levels and NGOs and CBOs, successfully went through the various modules. The second training course was the four-week training on Smart Urban Governance for Settlements Development Planning and Management (I-SURGE) which was conducted in September and October 2022.

As the second part of capacity building, a Dual PhD between TUDO and SURP on topics of urban planning and resilience and disaster risk reduction and management with regular PhD workshops is under preparation. Students at the PhD level shall be intensively involved in all research activities of the various WPs. LMU and Stuttgart Universities will be involved in joint supervision as well.

Hannes Lauer &
Wolfgang Scholz

SURE F&SR

Ten Days of Chaos, Resilience, and Zeal. Or a Journey in Three Acts

It is slowly getting dark as the landing flight to Đà Nẵng starts.

The rural fields, suburban settlements, even the emerging urban areas are widely flooded. Twenty-four hours earlier, the city was busy preparing for Typhoon *Noru*, which made landfall over Vietnam – over Đà Nẵng – on September 27, 2022. One day on and hours of delay (due to suspended air traffic) later, one fact in particular can be observed: *the calm after the storm*. And then – another night later – the streets are largely tidied up, damage has (for now) been repaired, bits and pieces that have flown around have been swept up. Resignation? Routine? Resilience?

At the Đà Nẵng University of Architecture, the students of the summer school, organized as part of the SURE project *ement!*, are working again on their *community-based sustainable tourism concepts for the Cu De River Valley* – for the final presentation the following day. Natural disasters such as a typhoon, which are increasing as climate change progresses, highlight the urgency to act sustainably, and this is also – or especially – true for the sector that the city of Đà Nẵng has identified for itself as an important growth potential: Tourism. At the same time, it is mainly the valleys of the surrounding provinces that have realized their tourism potential as a recreational destination during the Corona pandemic and this is what the Summer School is all about: authentic and sustainable tourism, based on the understanding that communities can use their own capabilities to



achieve sustainability. One of the five topics, the summer school addresses, is therefore the issue of *sustainable forestry and agriculture*. Practiced deforestation and monoculture in the provinces threaten the loss of biodiversity and in this context, sustainable tourism can be used as a tool: if natural qualities – such as the forest – are recognized by the communities as tourism and financial potential and are carefully used for tourism purposes, there could be a chance to achieve sustainable behavior in regard of forestry and agriculture¹.

She's like the wind through my tree, Patrick Swayze's voice pours from the car's speakers as the green, the imperial, the city of Huế arises on the horizon. Two SURE projects are located here: GreenCityLabHuế and FloodAdaptVN.

The GreenCityLabHuế consortium aims to increase knowledge on the integration of nature-based solutions (nbs) and blue-green infrastructure into existing urban structures. On the one hand, the governance side is considered by adapting legal regulations and integrating nbs into existing urban planning and thus into strategic planning. On the other hand, the goal is to involve local people in processes of co-design through participation. Here, the

organized workshops and especially the exhibition of the GreenCityLabHuế support to make issues of climate change, nbs and green-blue infrastructure accessible and to sensitize for these very topics. The fact that people have a strong sense of community has been shown by *Noru* – Vietnamese people have a tradition of caring and supporting each other during natural disasters².

But it's not just typhoons that are increasing in Central Vietnam due to climate change, it's also heavy rainfall events that the FloodAdaptVN project is addressing and developing measures to reduce flood risk. Here, as well, a people-oriented approach represents a smart strategy that can be easily linked to, because, as we learned, Huế residents are proud of their tradition, of their culture, of their city, have a great understanding of local values and aim for protecting them. For the purpose of developing Huế sustainably through people's strong awareness, the *Green Sunday* was launched a few years ago, on which people collect garbage and plant flowers. So, Huế today is quite walkable, green and the river is sometimes even swum in, if it is not polluted by a typhoon and floods³. Three hours, an old propeller machine and a few sweats later, writer Wojciech

Czaja's words about Phnom Penh seem tangible reality: *The Khmer city has declared chaos to be the principle of order. Thus, one is no longer surprised when the Tuk Tuk driver proudly says: „Oh, Royal Palace, I know where that is.“* (Czaja 2018: 201).

Although not in the Royal Palace, but in the Phnom Penh City Hall, the consortium of the SURE project Build4People discusses



Photography by Katharina M. Borgmann, in Huế, Vietnam

1 Information from meetings with local partners of emplement!, especially: Dr. Chu Manh Trinh, Nguyễn Trần Lan Chi and Nguyen Thi Thu Thuy
 2 Information from an interview with Binh Minh Hoang and Long Nguyen Dac Hoang, MienTrung Institute for Scientific Research, partner of GreenCityLabHuế
 3 Information from an interview with Assoc. Prof. Dr. Nguyen Hoang Khanh Linh, Head of International School, Hue University, partner of FloodAdaptVN

in the context of a roundtable workshop with representatives of urban planning *design strategies and early stages criteria for sustainable neighbourhood development*. A sustainable development in Phnom Penh requires in the first step mainly structural interventions in the area of open space, roads and water supply. The reason is that three main problems dominate in the city: Waste management, traffic jams and floods. In addition to the mass of waste, which could not be managed, traffic jams in the city occurs on a daily basis and on an immense scale. Reducing the number of cars seems illusory from today's perspective, because there are no alternatives like a well working public transport system. City buses are stuck in traffic jams, do not arrive on time, making connections poor. But the biggest challenge is the water: Phnom Penh is bordered by the Mekong River to the east and water from the mountains flows into the city from the west. During the rainy season, the city must constantly pump and protect itself, so there is an urgent need for a resilient drainage system⁴. And here the circle closes, and here the journey ends: Faithful companions have been issues such as the typhoon, floods, and heavy rainfall – plus the threat of biodiversity loss through monoculture. But the good news is, there are approaches like community-based tourism, sustainable neighborhood concepts, nature-

based solutions, flood mitigation measures, and there are the makers, the initiators, the researchers, and – most importantly – the residents who care about their cities.

*Katharina M. Borgmann &
Anika Slawski*

URA

Urban-Rural-Living Lab in Nordhausen: Findings for a Just and Sustainable future

The Nordhausen region, located in the state of Thuringia, Germany, is one of the three Urban-Rural-Living Labs of the Sino-German project „Urban-Rural Assembly“ (URA), funded by the BMBF. In 2022 the three Raumbild workshops in Nordhausen were conducted by scientists from the URA project along with representatives from politics, administration, and civil society from the Nordhausen region. These workshops were carried out in close cooperation with the Berlin-based planning office, Urban Catalyst GmbH, and IBA Thüringen GmbH. The workshops yielded tangible



Photography by the SURE Project Urban Rural Assembly (URA)

perspectives for a socio-ecologically sustainable and climate-friendly development within the region, serving as a template for further regional projects.

On March 3, 2022 the first workshop was held to identify potentials and challenges for the region. The second workshop, which took place on June 9, 2022, focused on exploring concrete spaces, actors, and their connections in order to shape a climate-neutral, socially just and cycle-oriented future in Nordhausen. Finally on September 29, 2022, the research

⁴ Information from an interview with Mr. Phanin Cheam, Vice-Head Urban Management Division of Phnom Penh Capital Hall, partner of Build4People



team presented future scenarios for three selected areas in the Nordhausen region during the third and final workshop. These future scenarios encompassed various approaches and strategies to address key issues and achieve the envisioned goals for the region's development.

The workshops were significant milestones as they provided a suitable framework for local actors to collaborate with the research team. Together, they exchanged their perspectives on the region, discussed goals for future spatial development, and, based on these discussions, formulated concrete development approaches. This collaborative process allowed for the exploration of innovative ideas and strategies, paving the way for a promising and impactful future for the region.

*Maria Frölich,
Hannes Langguth & Li Fan*

IMECOGIP

IMECOGIP Toolbox helps Assessing Water-Related Urban Ecosystem Services

Among the main challenges cities worldwide face today are those related to water. At first-hand, one might think of aggravated storm surges due

to climate change and sea level rise. Some of the SURE projects indeed have a planning perspective on the associated risks. Furthermore, flooding by overland flow is likely to increase because of continued surface sealing and climate change resulting in more torrential rainfall events. Beside these hazardous events, planners must also keep in mind the provision of water, especially groundwater for drinking, for industrial and other uses. Good planning considers risks for development and assesses the potential of the current environmental conditions in a spatially explicit way with the help of Geographical Information Systems (GIS). Planners must also know how to reduce risks and mitigate harmful consequences that derive from previous developments. It is necessary for them to estimate the impact of planned land cover changes on the services that natural processes, e.g. related to the water cycle, might cause. A key to foster sustainable water-sensitive urban development is Green Infrastructure.

It is common thinking that Green Infrastructure defined as a strategically planned network of green and blue elements has positive effects on the well-being of city-dwellers. In order to assess the benefits, planners and politicians are often bound to trust their own guts rather than being able to rationalize or even quantify existing or tentative contributions of Green Infrastructure for humans, also known as ecosystem services.

To alleviate this deficit, the IMECOGIP team develops a GIS-supported toolbox. It wishes to support the implementation of ecosystem services thinking into the planning of Green Infrastructure. Together with our partners, we are setting up this toolbox as a freely available and open-source program which we apply to real life planning situations. Cooperation partners are in Shanghai, Beijing and in the German Ruhr metropolis coming from academia, municipalities and companies. Among the more than twenty ecosystem services available through our toolbox, the following ones are related to water: flash flood regulation, temperature regulation, baseflow regulation and groundwater recharge. In the alpha-release of the toolbox, the first two services have recently been implemented. In the following, we introduce them and give a preview on how we tackle the third and fourth in the beta-release, which is in the testing phase.

Flash Flood Regulation

Estimating the discharge volume of a contributing area to overland flow is one of the most important and well-established indices in the so-called Rational Method. The key parameter is the discharge coefficient. It expresses the percentage of rainfall that will not infiltrate into the soils and percolate further into the underground. The percentage depends on the nature of the land cover. We assigned discharge coefficients to all types of urban land use/land cover, ready to be used. Hereby, users are able to display maps and get

an idea of the spatial arrangement of areas especially prone to overland flow.



The IMECOGIP Toolbox shows how Green Infrastructure is regulating all aspects of human relationship to water: cultural ecosystem services, as well as provisioning and regulating services. For latter causes, two services have recently been implemented: flash flood and temperature regulation.

You could go a step further and define a meaningful catchment

area and subsequently accumulate the discharge of this predefined catchment area. Introduce Green Infrastructure in your plan wherever possible and run the toolbox again to see the effect. Assuming the rainfall amount, you can estimate the water volume that is retained by the newly introduced Green Infrastructure. According to the sponge-city concept, planning green space and bio-swales contribute to lowering the discharge coefficient.

The Hydrological Cycle – Base Concept for Water-Related Services at different Time Scales

Atmosphere, plants, surfaces and fluid water interact permanently through hydrological processes. Via evaporation and

transpiration, the water budget is intricately linked to the energy budget of the ecosystems. In short, the more water is available for plant transpiration, the larger the cooling effect of the vegetation. IMECOGIP accounts for the water demand and water availability to assess the temperature regulation of urban and peri-urban green surfaces. There is evidence from Shanghai, that the Urban Heat Island can be mitigated by increasing Green Infrastructure (Wang & Shu 2020). Within the IMECOGIP Toolbox, we express transpirative cooling by a newly established index.

This way, planners can quantitatively estimate the effect of their Green Infrastructure interventions, i.e. the different grades of cooling due to plant



In urban areas, natural and restored creeks, their riparian zones as well as ponds provide multiple ecosystem services. Photography by IMECOGIP



transpiration. Besides plant transpiration, the soil influences most how much water is released to the groundwater that underlies each city, be it in form of porous aquifers or solid rock aquifers. That is why the users of the toolbox should input at least rough estimates of the water holding capacity of the soils in their area of interest. IMECOGIP takes into account that transpiration and groundwater recharge are high when the soil is wet. Both processes use up the water stored in the soil. For the groundwater recharge the time scale is one year, whereas for temperature regulation the time span of interest is usually less than half a month. All this is incorporated in the toolbox in a meaningful way. In many urban areas, groundwater is a prime resource for drinking water. Lowering groundwater tables due to increasing surface sealing is a threat for healthy communities. A steady groundwater recharge contributes to stabilize the amount of water in rivers and creeks during periods without rainfall.

This is of utmost importance for the aquatic communities. Humans profit from it through recreational activities enjoying walking along riverbeds that are not dried up and show attractive biotopes. These secondary aspects touch cultural ecosystem services, whereas the previous examples are commonly classified as provisioning and regulating services.

Harold Zepp

SURE F&SR

Fusion Cuisine Insights, aka SURE Status Seminar 2023

One of the main highlights in 2023 was the SURE Status Seminar in Bangkok, Thailand, from September 25 to September 28. It was a dynamic platform to foster dialogue and collaboration among 11 SURE collaborative projects with circa 100 participants from Germany, Thailand, Myanmar, Laos, Cambodia, Vietnam, Indonesia, and China. With the central theme, "Local and Cross-Cultural Settings and Cooperations," this conference emphasised the importance of effective collaboration in diverse contexts. This conference represented a significant milestone in the SURE community collective journey, halfway through the R&D phase. It provided a unique opportunity to showcase the progress made so far, share groundbreaking research findings, and gain invaluable feedback from peers. Here's a glimpse of some of the exciting events and discussions that took place:

Uncovering Bangkok's Flood Legacy (Side event)

Started with a captivating lecture by Mr. Sajjapongs from Landprocess on Bangkok's risk management and flood prevention. Followed by a guided tour of the Chulalongkorn

University Centenary Park, where we could see the flood management practices in action during heavy rainfall.

"Good Practices" Day at the Status Seminar

Day one burst with energy, hosting a vibrant mix of presentations, round table discussions, and world cafe sessions. We kicked off with keynote speakers Dr. Verena Hebbecker from the German Federal Ministry of Research and Education and Niramon Serisakul, the Director of the Urban Design and Development Center at Chulalongkorn University, who set the stage for an intellectually charged day. The round table discussions focused on critical themes such as Comparative Urban Transformation Approaches, the Social Significance of Sustainability, and the intricacies of Urban Planning and Decision-Making Towards Sustainability. Beyond just tables, these discussion hubs became dynamic platforms for the 11 SURE projects to share their unique insights, fostering an environment encouraging participants to contribute, reflect, and engage in meaningful dialogue about their experiences. Adding another layer to this rich tapestry, the WorldCafe session delved into the significance of reflection and its seamless integration into project activities. Discussions at different tables focused on specific dimensions of reflection—overarching, content-related, internal, or learning reflection. The day of intensive exchanges has concluded in a feast to settle and



Summary and Reflection on the SURE Status Seminar 2023, Bangkok, Thailand

fuel the minds for the following days.

"Building Alliances" Day at the Status Seminar

Day two was like stepping into a bustling marketplace of ideas. The Market Square session was a lively bazaar of knowledge, where project representatives showcased their best practices in risk management and disaster prevention, juggling topics like ecosystem services, eco-tourism, and the intriguing concept of a transition lab. In this vibrant exchange, we witnessed an orchestra of deep interactions—project representatives engaging with keynote speakers, panellists, and fellow participants. The grand finale of the day? A captivating panel discussion featuring luminaries like Frank D'hondt from UN-Habitat Vietnam, Joachim Bergerhoff of

GFA Consulting Group, Niramon Serisakul, the powerhouse from Chulalongkorn University, and Riccardo Maroso from UN-Habitat. The panellists discussed the role of actionable and localised knowledge in implementation. They pondered the intricate dance between science, acting as a neutral knowledge trader, and the SURE projects—coined "fusion cuisine" for their magical blend of planning and implementation in the complex, intercultural realm. It was a day where diverse perspectives converged, creating a tapestry of shared wisdom.

Cultural Finale: Visit to The Siam Society

The conference ended with a visit to The Siam Society, which promotes knowledge of Thailand's culture. Participants enjoyed a guided tour of the

house museum and library, adding a cultural touch to our experience.

Looking back on this extraordinary conference, I am inspired by the spirit of collaboration, innovation, and knowledge sharing that filled the event. The connections made, and insights gained will undoubtedly drive our collective mission toward sustainable urban development.

Ágota Barabás

Build4People

The Build4People's Sustainable Building Arena – An Example for an Urban Transition Lab in the Global South

Ravi Jayaweera & Michael Waibel



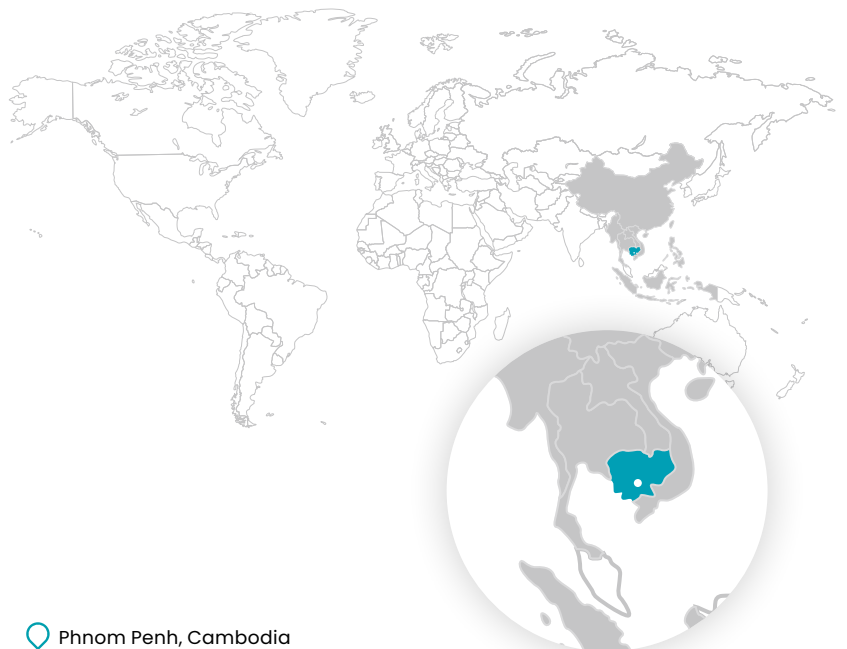
Photography by Katharina M. Borgmann,
Old Town in Phnom Penh, Cambodia



The way cities in Southeast Asia are currently being built and operated is considered as largely unsustainable. Transition Management is therefore suggested as an approach to influence development pathways towards more sustainable systems through the creation of collaborative platforms for change agents to co-create joint challenge framings, visions and transition strategies. This contribution to the SURE Solutions Report discusses preliminary experiences from the ongoing Build4People Sustainable Building Arena (SBA), a transition intervention that was adapted to the local context of Phnom Penh's building system. The first part of the SBA which mainly gathered relevant frontrunners in the field of sustainable building was implemented in the context of the Build4People Project in early 2022 saw positive reactions and outcomes.

Introduction

The aim of this activity report is to introduce about the first Build4People Sustainable Building Arena (SBA), held at Impact Hub Phnom Penh in March 2022. Hereby, the SBA serves as an example for a transition governance intervention that is adapted to a context outside Western democracies, which has been the predominant focus of transition studies, so far. The report firstly covers the project context and the SBA concept, it secondly presents the implementation process and its outcomes and finally concludes with some limitations of the approach.



Phnom Penh, Cambodia



Background: Build4People Project

The overall goal of the inter- and transdisciplinary Build4People project is to support a transformative shift of current development paths of the city of Phnom Penh towards more sustainability and a higher quality of life. To this end, the building sector is the starting point for Build4People’s research because of its profound sustainability effects, both directly through emissions, evictions or resource consumption, and indirectly, by affecting daily practices and lifestyles of users and urbanites in the long-term (Waibel et al., 2020).

Urban sustainability transitions are by no means just a technological challenge, but above all also a social, cultural, economic, and political challenge. At the same time, it has become increasingly clear that scholars can only develop implementation-oriented solutions for sustainable urban development together in a dialogue with urban society.

Based on this transdisciplinary understanding of the problem, the Build4People project tries to integrate various disciplines such as environmental psychology, civil engineering, urban planning, architecture, urban climatology, remote sensing and human geography in a cross-cutting manner using common participatory formats such as urban living labs or incubators for sustainable business models with local stakeholders from politics, business and civil society to jointly develop practical knowledge and interventions, which ultimately aim to support inclusive sustainable urban development processes.

SBA Concept

How to support processes of transformational change towards urban sustainability has been widely discussed for more than a decade (Rotmans et al., 2001; Smith et al., 2005; Loorbach, 2010). While many transition challenges are located in the Global South, sustainability transitions studies has been criticized as being euro-centric, with most applications and case studies being located there (Silvestri et al., 2018; Pant et al., 2015). Since transitions are not only connected to technology, but equally to politics, institutions and governance, transition governance interventions need to be contextualized to their socio-institutional contexts



Figure 1 (top): Team Purple Flowers collects challenges and looks at the challenge cards. Figure 2 (bottom): Group "Hearts" discusses the transition challenges.

(Newton, 2017; Noboa and Upham, 2018). Consequently, we have conceptualized an adapted transition governance framework for the case of Cambodia’s building and urban development system, the Sustainable Building Arena (SBA).

The objective of the SBA has been the co-development of visions and strategies with local sustainability frontrunners from the building sector in Phnom Penh. Previous research showed that no institutionalized platform of exchange exists for local frontrunners. Bringing these individuals together in a co-creation process to strengthen their networks and collaborative potential was thus considered as a promising entry point for the SBA. Following an adapted form of transition management that was specifically developed by the Build4People Project for the context of Phnom Penh (Jayaweera et al., 2023; Jayaweera et al., 2022), the SBA followed a three step approach that focussed on the following questions:

1. What is wrong with the current building and urban development sector in Phnom Penh?
2. How do we want buildings and neighbourhoods to be designed, built and operated in Phnom Penh by 2040?
3. How can we get to our desired future(s)?

The SBA itself was preceded by a design process, which included the formation of a Transition Team, i.e., a core-team of dedicated individuals that are stakeholders in the building sector in Phnom Penh, and Build4People team members. Together with the transition team, the workshop design was finalised and after a joint actor mapping workshop, a list of SBA participants was put together. The transition team selected participants that were driven by sustainability and that have been engaging with sustainability solutions within the building sector of Phnom Penh in the past.

The design of the SBA itself addressed several contextual factors, including hierarchical societal relations, practices of information hoarding, neo-patrimonialism, etc. These increase the need for a "safe space" where change agents can exchange freely and protected from dominant positions with interests in the status quo. Furthermore, the concept highlights the need of the temporal reduction of the effects of hierarchical relationships, and calls for a careful choreography of group constellations and actor involvement, including frontrunners, connectors, system toppers and informants (Jayaweera et al., 2022).

In this way, the SBA provided the framework for the constitution of a co-creative and protected space

where knowledge and transformative approaches for the urban built environment could be co-developed. As a multi-actor dialogue and co-creation platform, the SBA aimed to support the co-development of transformative capacities and knowledge, alternative discourses, as well as processes of coalition building and networking. The SBA and its prior design phase were part of a longer process with multiple iterations of SBA workshops and the operationalization of developed transition strategies in local experiments (Figure 3).

Implementation of the SBA

In regard of the implementation of the SBA workshop in March 2022, the Build4People team, led by Work Package #6 "Sustainable Urban Transformation" and Work Package #2 "Sustainable Building", joined forces with Impact Hub Phnom Penh (IHPP), a local but globally connected community builder. IHPP provided facilities, and facilitation support. The organizers created four breakout groups that aimed for an intimate discussion setting and a mix of perspectives, including institutional field (architect, consultant, developer, academia, civil society, building material producers, youth organisation, etc.), gender, local/ expat, etc. Furthermore, each group had a facilitator and a participant observer, usually an urban youth activist, or a student that were briefed accordingly.

Christina Karagianni and Ravi Jayaweera started the workshop with a presentation covering the plan for the day, the motivation behind the different phases, the long term ambition of the SBA and the scientific background of the arena, i.e. transition

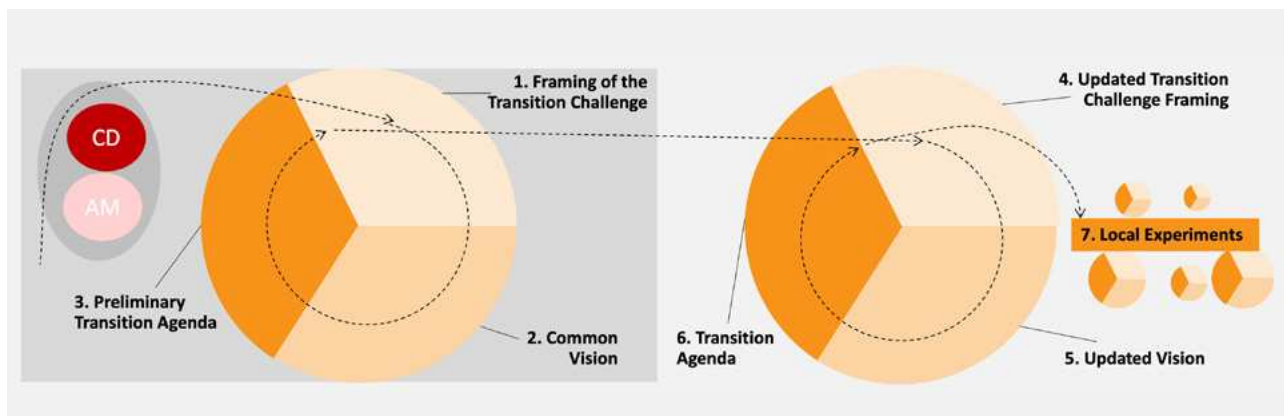


Figure 3: Sequence of a SBA Process (Source: Jayaweera et al., 2022)



studies, transition management and transdisciplinary research (Noboa and Upham, 2018; Frantzeskaki et al., 2018). Additionally, Mélanie Mossard, the Director of IHPP, who co-facilitated the workshop, addressed the participants and shared brainstorming guidelines for the subsequent sessions, while Michael Waibel, Build4People consortium leader, generally introduced the project.

SBA Workshop Phase 1: Transition Challenge/Problem Framing

The first phase of the SBA aimed at the co-development of a framing of the transition challenge. The guiding question of this phase thus asked: What is wrong with the current building and urban development sector in Phnom Penh? The framing of the transition challenge involved the identification, articulation, hierarchization and integration of problems in thematic groups. In the small teams, participants brainstormed individually, before sharing their ideas with the small group. Ideas were organised as chosen by the team together with their facilitator.

To integrate Build4People research into the process and combine it with the knowledge held by the participating stakeholders in a transdisciplinary dialogue process, participants could optionally draw on additional input in the form of "Challenge Cards" (Noboa et al., 2018). These cards highlighted individual transition challenges from the system analysis. The disciplinary work packages of the B4P project had developed these under the guidance of Christina Karagianni and Ravi Jayaweera beforehand. The collaborative framing of the transition challenge supported the participants to familiarize themselves with the different positions and values in the group and to overcome institutional perspectives (Roorda et al., 2014). After discussing, integrating and clustering within the small group, each group presented to the plenary.

Key challenges that were raised by the participants dealt with aspects of governance, regulation, and regulatory enforcement. Participants primarily noted the absence of relevant regulatory frameworks like a building code, or in the case of existing rules (such as the Phnom Penh Masterplan), that these have not been sufficiently enforced.

Participants voiced the need for more integrated and decentralised planning schemes, enforced regulation and connected this to the theme of (lacking) administrative capacities. While the need for more awareness of sustainability and knowledge about sustainable forms of urban development construction was mentioned for various actor groups, including developers and households, participants specifically highlighted the need for more capacity of subnational administrations.

Other key challenges related to a lack of public and green spaces, mobility issues (limited walkability, unattractive public transportation, etc.), resilience and water management (flash floods, wastewater treatment, etc.), urban sprawl and the increasing fragmentation of Phnom Penh into so called boreys (local name for gated compounds). In connection to the latter, some stakeholders stated challenges related to the themes of affordability, segregation and inclusivity of housing and urban development processes. These were closely linked to challenges that were clustered under "markets": Participants raised the challenges of speculative investment and profit-maximising real estate actors that implement luxury-oriented units instead of more affordable ones. In this vein, the dominant role of private developers vis-à-vis the state and of the civil society was mentioned. Lastly, more challenges were raised within the fields of building design and building materials (e.g. low quality, lack of context sensitive design with high AC-reliance), buildings and energy as well as lack of green finance and incentives.

The first workshop phase revealed the diversity and interconnectedness of challenges. Furthermore, high levels of agreement and like-mindedness between participating stakeholders became evident. The participants saw that many others share their critical evaluation of the current building and urban development processes in Phnom Penh.

SBA Workshop Phase 2: Collaborative Visioning

In the second phase, the participants co-developed and expressed their key priorities and principles for their envisioned futures of the local building and urban development system as well as images and



Figure 4: Participants developing transition strategies

narratives of desirable futures in a common vision. The guiding question for this phase was thus: How do we want buildings and neighbourhoods to be designed, built and operated in Phnom Penh by 2040? As in the previous phase, the participants brainstormed individually, before discussing their ideas within their breakout groups, and lastly in the plenary. Participants were free to choose from various methods of expressing their visions, including drawings, the use of Lego, post-its, etc.

Key elements of the visions brought forward related to the inclusivity and sustainability of building and urban development processes, integrated planning and a strong regulatory framework. Key terms mentioned were among others “people-centred”, “contextually adapted”, “green”, “healthy”, “long lasting”, “liveable”, or overall: “A Green Phnom Penh for All”. Other foci of the visions included urban green spaces, the protection of urban lakes, walkability, attractive public transport, and technological aspects such as clean energy sources and electric mobility. Phase 2 of the Arena showed that the participating stakeholders were able to develop a far reaching and widely encompassing set of visionary elements. The results showed high consistencies between groups and individual participants and relatively low levels of contradictions in regard of the developed visions. It became also clear that the participants equally

considered social (affordability, inclusiveness, etc.) and environmental aspects (resource consumption, circularity, renewable energy use) of sustainability in their visions.

SBA Workshop Phase 3: Development of a Transition Agenda

In the third phase, back-casting methodologies were used to connect future scenarios and narratives to the problematized present, in order to develop concrete transition pathways and strategies. Hereby, a first sketch of a “Transition Agenda” was created. The guiding questions for this step were: “How can we get to our desired future(s)? What steps must be taken in the short-, medium-, and long-term?”. Participants identified short-term, medium and long-term actions to define, prioritize and further elaborate transition pathways (Roorda et al., 2014). The individual groups came up with a wide set of necessary steps for the realization of their visions. Some connected these closer to particular transition pathways than others. For example, groups followed a pathway towards an inclusive or a green city. Others clustered their short, medium and long-term steps into a set of themes, including education and awareness, regulation and governance, urban planning, design and construction, building materials.



Suggestions for necessary actions included the creation of online databases of sustainable design practices and sustainable building experts, the integration of sustainable building knowledge into university curricula, awareness raising campaigns for the general public and capacity building for (subnational) administrations and industry, together with sustainability incentives and pilot projects. The transition agenda thus involved visionary images, pathways, and ideas for short-term action, with the actors seeing themselves and their networks as an essential part of both the future and the pathways towards the envisioned future.

The local artist Penkuro visually summarized the main points of all three SBA phase as shown in Figure 5. In the aftermath of the SBA these aesthetically pleasing designs were also shown on large-format posters during several other Build4People events to disseminate low-accessible information on sustainable urban transformation in Phnom Penh.

Conclusion

Overall, it can be said that the first Build4People SBA was a successful urban transition lab in the Global South. It brought together a wide range of frontrunners and change agents from the fields of sustainable building and urban development. As an informal institution and co-creative and protected space, the SBA supported the establishment of new links between individuals, strengthened networks and initiated fruitful discussions at the science-policy-business-civil society interface.

Several key aspects that were targeted by the SBA design could be realized. The selection of participants through the actor mapping process can be considered successful: A survey of participants showed that all participants said that the group constellation was “very good” or “good”, while feeling “very safe” or “safe” to share views, even when questioning the status quo. Whereas participants widely agreed that a transition towards urban sustainability is necessary, and that the SBA can generate meaningful impact, it also became clear that this can only be achieved in a longer engagement process. Based on the ongoing evaluation, the SBA process will be consequently

adjusted for subsequent workshops. A larger group of participants will update, specify, and expand the preliminary transition agenda at the second SBA scheduled for March 2023. The next cycle will then also focus more on the operationalization of the transition agenda in local experiments. Meanwhile the degree of safe space shielding will diminish over time, as knowledge co-production, narratives, network formation, trust-building, etc. are advanced, and the focus moves from innovative power to transformative power (Avelino, 2017). A future challenge will be the implementation of developed ideas and strategies. The project team will follow up with participants to study and support experiments to further realize the transformative potential.

While the SBA aims at the empowerment of change agents, social innovation and supporting an urban sustainability transition in Phnom Penh's building sector, the Build4People team is fully aware of the limits and challenges of attempts of influencing transition processes. Instead of following an understanding of “cock-pitism” of transition managers who can steer systems according to their instruments, we consider transition researchers to be in more modest roles of setting the stage, as boundary makers and policy entrepreneurs that collaborate with stakeholders on the co-production of knowledge and the building of coalitions (Hajer et al., 2015; Stirling, 2019).



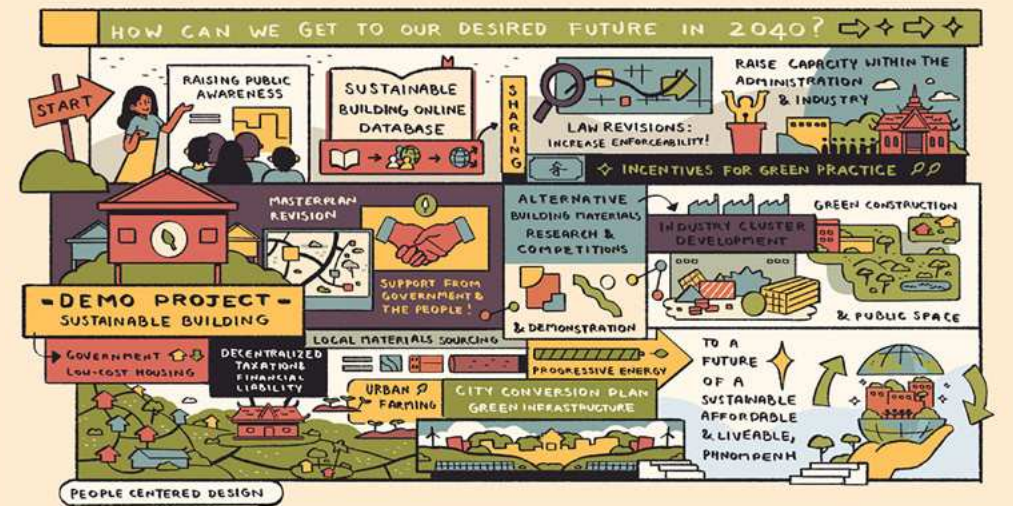



Figure 5: Results from all three SBA phases illustrated by Penkuro



CHARMS

Energy-Efficient Retrofit of Wooden Heritage Buildings in Chiang Mai by Nature-Based Interior Insulation on the Basis of Typha

*Jakob Richtmann, Henrik Beermann,
Martin Krus, Stefan Bichlmair,
Ralf Kilian*

The traditional wooden Thai house, which also can be found in Chiang Mai, represents local and sustainable climate adapted building tradition with an open construction designed for high natural air exchange rates to achieve a more convenient thermal comfort, maintain good air quality, and remove moisture. However, due to urbanization and climate change induced rising temperatures, tolerable indoor temperatures are no longer ensured to a sufficient extent by natural ventilation. Moreover, the unhealthy air pollution in Chiang Mai also affects the indoor air quality negatively. Thus, today many wooden houses are retrofitted with air conditioners, which lead to high energy consumption and contribute to the amplification of the urban heat island effect, or are even demolished. These circumstances have led to a sharp decline of traditional wooden houses in Chiang Mai and thus to the loss of cultural identity. Many houses have been replaced by concrete buildings, which also means a significant decline in terms of ecologic building design. Thus, it is important to preserve traditional wooden houses by retrofitting them with new sustainable, climate-friendly technologies and materials. This report presents possible solutions to address these

challenges. Workshops were held at Chiang Mai University, where several solutions developed at Fraunhofer IBP were presented and discussed with local stakeholders. Especially the Typha board, an innovative construction and insulation material made of cattail (Typha), was considered as particularly interesting.

Typha as a raw material combines numerous structural, building-physical as well as ecological and economic advantages like low thermal-conductivity, mechanical strength, and biological resistance. Moreover, the plant is widespread throughout the world, can be established very fast and is characterized by an enormous productivity. It also can be used for the creation of ecologically valuable wetlands with important functions like a long-term bondage of CO₂, water retention, and purification of nutrient polluted surface water. In addition, the magnesite bonded Typha board is hardly flammable and completely compostable. Due to its insulating and stabilizing properties, it could be used as interior insulation and for reinforcement of load-bearing structures or stiffening of the buildings. Additionally, the Typha board could be used to seal the countless joints of



Photography by David Gardiner, from unsplash

the walls to substantially reduce the infiltration of polluted air. Furthermore, a reduced air exchange rate combined with thermal insulating properties of Typha increases the effectiveness of air conditioners and decreases the energy consumption of electricity significantly. The next step for the CHARMS-team will be to assess the transferability of the Typha board in wooden houses in Chiang Mai with the aim of retrofitting them in an energy-efficient and sustainable way.

For this purpose, it is planned to conduct comparative simulations and modeling and thus to investigate its performance regarding climatic boundary conditions in Thailand. At the same time, the options to produce Typha in the urban hinterland are assessed considering questions of energy efficiency, water retention and purification, and food security from a nexus perspective.



 Chiang Mai, Thailand



บทความภาษาไทย

อาคารบ้านไม้โบราณที่พบได้จังหวัดเชียงใหม่แสดงถึงภูมิปัญญาและองค์ความรู้ท้องถิ่นของการสร้างบ้านเรือนที่ปรับให้เข้ากับภูมิอากาศท้องถิ่น ด้วยการออกแบบโครงสร้างของบ้านที่เปิดโล่งเพื่อให้อากาศสามารถถ่ายเทได้สูง ทำให้บ้านไม้โบราณมีความสบายในเชิงอุณหภูมิเพื่อการอยู่อาศัย มีคุณภาพอากาศที่ดี และสามารถกำจัดความชื้นภายในบ้านได้ อย่างไรก็ตามในปัจจุบันประเด็นของการขยายเมือง (Urbanization) และการเปลี่ยนแปลงสภาพภูมิอากาศ (Climate Change) ส่งผลให้อุณหภูมิเพิ่มสูงขึ้น ระบบระบายอากาศตามธรรมชาติไม่สามารถตอบสนองของความสบายในเชิงอุณหภูมิภายในอาคารได้ ยิ่งไปกว่านั้นปัญหามลพิษทางอากาศในจังหวัดเชียงใหม่ส่งผลกระทบต่อเป็นอย่างมากกับคุณภาพอากาศภายในอาคาร ด้วยเหตุนี้ทำให้เจ้าของบ้านไม้โบราณเลือกที่จะปรับปรุงบ้านโดยการติดตั้งเครื่องปรับอากาศภายในบ้าน ซึ่งทำให้อัตรการใช้ไฟฟ้าในครัวเรือนสูงขึ้นและก่อให้เกิดเกาะความร้อนในเมือง (Urban heat island) ที่เพิ่มมากขึ้น รวมถึงการที่เจ้าของบ้านไม้โบราณเลือกที่จะรื้อถอนบ้านและแทนที่ด้วยการสร้างบ้านคอนกรีต ทำให้จำนวนบ้านไม้ในจังหวัดเชียงใหม่มีจำนวนลดลงอย่างรวดเร็ว นอกจากการรื้อถอนจะทำให้ท้องถิ่นสูญเสียความเป็นอัตลักษณ์แล้ว ยังส่งผลถึงการลดลงของอาคารที่ออกแบบอิงต่อนิเวศวิทยา (Ecologic Building Design) อีกด้วย ด้วยเหตุดังกล่าวทำให้นักวิจัยเห็นถึงความสำคัญในการอนุรักษ์และปรับปรุงอาคารไม้โบราณด้วยเทคโนโลยีหรือวัสดุที่มีความยั่งยืนและเป็นมิตรต่อสิ่งแวดล้อม

รายงานฉบับนี้มีจุดประสงค์ในการนำเสนอนวัตกรรมต่างๆ เพื่อแก้ไขปัญหาของบ้านไม้โบราณซึ่งคิดค้นและพัฒนาโดย Fraunhofer IBP ผ่านการอบรมเชิงปฏิบัติการ (Workshop) ที่จัดขึ้น ณ มหาวิทยาลัยเชียงใหม่ โดยการอบรมดังกล่าวได้มีการนำเสนอนวัตกรรมและหารือกับผู้มีส่วนได้ส่วนเสียในท้องถิ่น โดยเฉพาะประเด็นของการนำนวัตกรรมแผงรูปทรงแท่ง (Typha board) มาใช้ในการก่อสร้างและฉนวนกันความร้อนภายในอาคารบ้านไม้โบราณ

ต้นรูปทรงแท่ง (Typha) เป็นวัสดุจากธรรมชาติที่ปลูกกันอย่างแพร่หลายในทวีปต่างๆทั่วโลก ด้วยโครงสร้างที่ซับซ้อนของเส้นใย ลักษณะทางกายภาพ การนำความร้อนต่ำ มีความแข็งแรงเชิงกล มีความทนทานทางชีวภาพ สามารถเจริญเติบโตได้อย่างรวดเร็ว และมีผลผลิตสูง จึงเป็นข้อได้เปรียบทั้งในเชิงนิเวศวิทยาและเศรษฐกิจ นอกจากนี้บริเวณเพาะปลูกรูปทรงแท่งยังสามารถเป็นบริเวณพื้นที่ชุ่มน้ำ (Wetland) ที่เป็นประโยชน์ในเชิงนิเวศวิทยาในการกักเก็บก๊าซคาร์บอนไดออกไซด์ (CO₂) สามารถพื้นที่กักเก็บน้ำ รวมถึงบำบัดแร่ธาตุบนผิวน้ำได้ด้วย ในกรรมวิธีผลิตแผงรูปทรงแท่งนั้นเน้นใช้ถูกประสานกันด้วยแมกนีเซียมซึ่งมีคุณสมบัติติดไฟยากและสามารถย่อยสลายได้ตามธรรมชาติ ทำให้แผงรูปทรงแท่งสามารถนำมาใช้เป็นฉนวนกันความร้อนภายในอาคารและเป็นวัสดุเสริมโครงสร้างรับน้ำหนักเพื่อเพิ่มความแข็งแรงของอาคารได้ รวมถึงใช้ในการปิดช่องไม้เพื่อลดปริมาณมลพิษอากาศที่เข้าภายในบ้าน นอกจากนี้ยังช่วยเพิ่มอัตราการถ่ายเทของอากาศภายในอาคารส่งผลให้การใช้พลังงานไฟฟ้าในบ้านที่มีประสิทธิภาพมากขึ้น

ขั้นตอนต่อไปในการดำเนินงานวิจัยคือการประเมินความเป็นไปได้ในการติดตั้งแผงรูปทรงแท่งภายในบ้านไม้จังหวัดเชียงใหม่ ด้วยวิธีการวิเคราะห์เชิงเปรียบเทียบ (Comparative Simulation) และการสร้างแบบจำลอง (Modeling) ซึ่งเงื่อนไขของการทดลองดังกล่าวมีจุดประสงค์เพื่อวัดประสิทธิภาพการใช้งานของนวัตกรรมกับสภาพภูมิอากาศของจังหวัดเชียงใหม่ โดยมีเป้าหมายเพื่อให้บ้านไม้โบราณสามารถใช้พลังงานได้อย่างมีประสิทธิภาพและยั่งยืน ในขณะเดียวกันประเด็นของการเพาะปลูกรูปทรงแท่งในพื้นที่ชนบทจะถูกนำมาอภิปรายในแง่ของผลกระทบต่ออนุรักษ์พลังงาน การกรองและกักเก็บน้ำ รวมถึงการเชื่อมโยงกับประเด็นของความมั่นคงทางอาหารอีกด้วย

Background and Problem Definition – Situation of Wooden Heritage Residential Buildings in Chiang Mai:

Thailand has a very rich cultural heritage. In architecture, the traditional wooden Thai house represents local and sustainable climate adapted building tradition which is more and more lost today. Traditional wooden residential buildings in Chiang Mai were usually built with wooden planks and boards fixed on a wooden frame or beams. Since the joints between the planks are not sealed there are smaller or bigger air gaps in the outer walls, which allow continuous ventilation in order to cool the interior, help to maintain good air quality and remove moisture from residential use in a natural and passive way. The leaking joints lead to higher air exchange rates and increased air velocity indoors and thus to a more convenient thermal comfort for inhabitants.

However, the cooling effect for indoor air temperature by high air exchange rates is limited to the level of the outdoor temperature. In the past this was one possibility to sustain a more or less acceptable indoor climate. Due to new and different comfort demand of residents in recent times, changing outdoor climate by urbanization (urban heat island) on the one hand and rising temperatures as a result of climate change on the other hand, the traditional function of natural ventilation is no longer given to a sufficient extent in these traditional buildings. This circumstance not only causes an unsatisfactory thermal indoor comfort for the inhabitants, moreover, in many cases these buildings are retrofitted with air conditioners to cool the interiors. This leads to high energy consumption due to the high ventilation rate



of the building and, on the other hand, contributes to the amplification of the urban heat island effect.

Finally, Chiang Mai City is notorious for its unhealthy level of air pollution, particularly during the dry season between January and May, the so-called haze season, when rice straw is burned in the surrounding countryside. In March 2019, Chiang Mai was ranked as the city with the worst air quality index (AQI) score worldwide (Wipatayotin, 2019). Due to the open wooden construction, the indoor comfort is thus also affected negatively by the entry of contaminated air leading to unhealthy air quality inside these buildings.

In the recent past, these circumstances have led to a sharp and in some places even to a very sharp decline in the proportion of traditional wooden houses in Chiang Mai City. The two pilot communities of the CHARMS project are good examples for this loss: Between 2019 and 2021, the Lam Chang community located in the historic city center lost 19 percent of its wooden, residential building stock in only two years. With a total loss of 34 percent, the loss in the second pilot community Wat Ket is even higher.

In many cases these houses have been replaced by modern apartment buildings made of concrete. This trend towards more concrete buildings leads to further negative consequences: Firstly, the loss of wooden building stock, whose existence and future use are of importance to many local residents, is accompanied by the loss of cultural identity. Secondly, the building material cement, which is required for the construction of concrete buildings, is characterized by extremely energy-intensive production and thus associated with very high CO₂ emissions. The raw material wood, on the other hand, is considered a long-term carbon sink in the construction sector (Churkina et al., 2020), which means that the trend towards concrete can be evaluated as a completely wrong direction and significant decline in terms of sustainability and ecologic building design.

Thus, for reasons of building culture and sustainability, as well as for climate change impact adaption of the city of Chiang Mai, it is important to

preserve the traditional houses made out of wood and retrofit them with sustainable and climate-friendly technologies and materials. This report presents possible solutions to address the aforementioned challenges related to the use of these traditional buildings.

Field Visits and Workshops in Chiang Mai in April 2022:

As a part of the CHARMS project, researchers of the Fraunhofer Institute for Building Physics IBP visited Chiang Mai in April 2022 to assess the site-specific boundary conditions from a building physics perspective. During the stay in Chiang Mai, the two pilot districts Lam Chang and Wat Ket were investigated. There, interviews were conducted with the inhabitants of traditional wooden houses in order to understand their experiences, problems



Figure 1: Wooden houses in the CHARMS pilot districts Lam Chang and Wat Ket in Chiang Mai.
Image sources: School of Public Policy, Chiang Mai University (SPP).



and needs resulting from living in this type of building. Two of the houses visited are depicted in figure 1.

The residents' reports on barriers and drivers of indoor comfort are consistent with previously conducted research and surveys. The main identified problems of the wooden houses from the point of view of building physics are:

- Lack of thermal indoor comfort, which for example was improved a little in one building via subsequently implemented natural ventilation in the form of a hole in the ceiling between the first and second floor (Fig. 2, photo 1), but is still far from comfortable.
- High energy consumption through the use of air conditioning, which is further increased by the fact that the wall constructions are not air tight (Fig. 2, photo 2), lack of sufficient heat insulation of wall components and have single-layer glazing (Fig. 2, photo 3). However, despite the high energy consumption of these systems and their contribution to the heat island effect, the workshops (and also unpublished existing results from a survey conducted in 2019) indicate that air conditioning systems are considered the most effective means for cooling indoor space.
- Unhealthy indoor air quality, which is caused by pollutants being transmitted from the outside air through the leakages in the wall structure (high air exchange rate).
- Additionally, lack of sound insulation and occasional damages in the building structures caused by insects (mainly by termites) (Fig. 2, photo 4) were also mentioned as further problems. In addition to these field visits, workshops were also held at Chiang Mai University, to which

representatives of construction companies, municipalities and academics were invited. These workshops aimed to present several solutions developed at Fraunhofer IBP and to discuss their applicability in Thailand with the local stakeholders. All of the presented materials and technologies aim at improving the energy, comfort and ecological performance of buildings. The discussions showed that especially the innovative construction and insulation material made of cattail (Typha) was met with very high interest. Therefore, the next sections focus on a short presentation of this product.

Typha as a Possible Solution to Improve Indoor Comfort:

As shown in projects funded by the DBU (Theuerkorn et al.), the use of Typha as a raw material for the production of building materials combines numerous structural, building-physical as well as ecological and economic advantages. The Typha leaves are particularly suitable because of their special properties of the plant, that include following benefits (Krus et al., 2021):

- Low thermal conductivity caused by the sponge-like tissue, which enables good insulating properties for the building material (Fig. 3, middle),
- Low specific weight due to this sponge fabric filling the leaf chambers,
- Mechanical strength of the product caused by a complex and stable fabric with high compressive and tensile strength of the leaves in the direction of their axes,
- High flexibility and elastic deformability perpendicular to the leaf axes allowing the addition of the inexpensive mineral binder magnesite.



Figure 2: Hole in the ceiling in order to facilitate natural ventilation (1st); Leaking construction (2nd); Installed air conditioning system and single layer glazing (3rd); Termite damage to the construction (4th)
Image Sources: Fraunhofer Institute for Building Physics IBP (Fraunhofer IBP)

Furthermore, the Typha plant (Fig. 3, left) is characterized by a biological resistance to fungal and insect attack due to its natural equipment with tanning agents (polyphenols), which makes the application of chemical additives obsolete. With regard to the production of a building material, the raw material also has the advantage that it is easy and quick to process with common tools. Additionally, the cutting process is low energy-intensive, since Typha, unlike other renewable raw materials, does not contain SiO₂-components, which therefore makes it easily and permanently to cut with sharp knives.

To harvest the huge potential Typha offers to the development of sustainable building materials, the Fraunhofer IBP and the company typha technik Naturbaustoffe developed a load-bearing and insulating magnesite-bonded typha panel called Typha board (Fig. 3, right). In addition to the above-mentioned advantages specific to the raw material,

the finished panel is hardly flammable (building material class B1, fire resistance class F60 to F120 depending on the thickness) and shows neither glowing and particular smoke development nor burn-dripping. Another benefit of the Typha board is its easy dismantling and complete compostability, which fully complies with the idea of minimizing negative environmental construction impacts through qualitative transformation coupled with the closure and deceleration of material cycles (cradle to cradle).

Moreover, the cultivation of Typha has several beneficial aspects. Firstly, the plant is widespread throughout the world and can be established very fast. Secondly, it is characterized by an enormous productivity of about 15 to 20 tons of dry matter per hectare and year, which can be used for approximately 150 to 250 m³ of building material. Thirdly, it thrives well in humid locations with medium to very high nutrient supply and a good



Figure 3: Typha plant; Leaf bundle cross-section; Load-bearing and insulating magnesite-bonded Typha board.
Image Source: Left – Petr Filippov, Wikimedia Commons; middle – Fraunhofer IBP; right – Fraunhofer IBP.



toleration of nutrient oversupply. On the one hand Typha cultivations can therefore be used for the creation of ecologically valuable wetlands with important functions like a long-term bondage of CO₂, which even exceeds the potential of wood cultivation by far, as well as water retention and additional habitat for animals (Fig. 4). On the other hand a purification of nutrient polluted surface water is enabled by cattail cultivations.

A Nexus Perspective of the Cultivation of Typha in the Urban Hinterland of Chiang Mai City

Bio-based construction materials with a high technology readiness level such as the Typha board can contribute to the decarbonization of the construction sector and cater to the rapid urbanization of secondary cities in Southeast Asia. Given that radical emission cuts of urban environments are urgently needed, realistic solutions such as the Typha board allow both the adaptation to environmental changes that house-owners face already while mitigating operational and embodied emissions of urban living. At the same time, the relatively high technological maturity of the solution allows its adoption and diffusion in the Asian construction market within a short time frame.

To validate and realize the potential of the Typha board to improve the indoor comfort in wooden, residential buildings in the context of Thailand, the CHARMS-team approaches the next steps in the development and diffusion of Typha-based construction materials from a nexus perspective. Some of the guiding questions are:

1. Energy: Is it possible that a Typha board produced in the urban hinterland improves the indoor comfort while reducing the operational and embodied emissions of urban living in wooden, residential buildings in Chiang Mai City?
2. Water: In which way can Typha be produced that the co-benefits of Typha to create ecologically valuable wetlands, water retention and purification of nutrient polluted surface water are optimized?
3. Food Security: What are the consequences of the promotion of Typha cultivation in the urban hinterland of Chiang Mai City in terms of availability and access of sufficient quantities of food in an

appropriate quality?

Thailand's agricultural sector is the second largest emitter of greenhouse gas emissions. About 60 percent of these emissions come from rice production (International Rice Research Institute [IRRI]). At the same time, rice farming is of high economic relevance in the urban hinterland of Chiang Mai. For these reasons, the supply-side activities related to the Typha board will focus on barriers and drivers for a sustainable, coupled production of Typha and rice in the hinterland of Chiang Mai City.

To prepare the ground for a potential market take-up, the CHARMS-team seeks feedback on the Typha board from the Thai construction industry. A first pitch of the Typha board to representatives of Southeast Asia's largest and oldest cement and building material company took place in July 2022 and it is currently planned to extend the engagement with other private sector actors in the next months.

Conclusion and Next Steps:

For the reasons mentioned above and also based on the results of the interviews and workshops, the raw material Typha itself as well as the Typha board as a sustainable construction and insulation material holds an enormous theoretical potential for application in Thailand. Due to its insulating and stabilizing properties, it could be used not only as interior insulation of the traditional wooden houses, but also for reinforcement of load-bearing structures. Renewable materials in general also offer the possibility for long-term storing CO₂ in buildings. In addition, the insulation of the interior walls also significantly increases the effectiveness of already existing air conditioning systems, which leads to a saving of the required energy. Furthermore, by applying the Typha board, a sealing of the walls could be achieved, resulting in a substantial reduction of pollutants entering from the outside.

Therefore, the next step will be to assess the transferability of the Typha board in wooden houses in Chiang Mai with the aim of retrofitting them in an energy-efficient and sustainable way. For this purpose, it is planned to conduct comparative

simulations and modeling of traditional wooden houses and thus to investigate the performance of the building material with regard to climatic boundary conditions in Thailand. At the same time, the options or the production of Typha in the urban hinterland are assessed. As soon as the theoretical feasibility and the analysis of the potential for energy saving has been proven in this way, it is also intended to define a real laboratory in the pilot districts of Chiang Mai, in which the Typha board

will be used in a real environment in order to survey the behavior of the building materials, energy consumption and its influence on the indoor comfort conditions.



Figure 4: Typha cultivation. Image Source: Technische Universität München (TUM)

A photograph of a lush green park with a stream in the foreground. The stream is surrounded by rocks and green plants. In the background, there are many trees and modern buildings under a clear blue sky. The text is overlaid on the left side of the image.

IMECOGIP

Interdisciplinary Assessment of Ecosystem Services to Foster Sustainable Development in Shanghai¹

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¹ This article is based on excerpts of the extended journal article, authored by Zepp et al. (2021):
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Photography by Katharina M. Borgmann, in Shanghai

Ecosystem services (ES) are a fundamental component of well-being and sustainable urban development with tremendous potential to enhance urban planning. In this activity report from the IMECOGIP project, we focused on the Shanghai Baoshan district Master Plan as a case study, and analyzed it under the lenses of ES supply using the matrix approach. We ascertained the supply of ES as delineated in the ecological network plan for 2035, and developed an evaluation framework based on CICES v5.1 and two expert workshops. Our approach used an integrated preliminary ES-assessment, and evaluated the consequences for the supply of ES in Baoshan district, which is adaptable to varying urban geographies. The results of our assessment show that, if realized as planned, the district will increase the overall supply of ES, especially regulating and cultural services that play an important role within GI on the urban level. In general, the land use plans should include fine-grained information within building blocks to allow for even better assessing of the spatial structure of ES supply.

中文(简体)

生态系统服务(ES)是福祉和城市可持续发展的基本组成部分,在提升城市规划工作方面具有巨大潜力。在IMECOGIP项目工作报告中,我们以上海宝山区总体规划为研究案例,在生态系统服务供给视角下对其进行了矩阵分析。我们根据当地2035年生态网络规划确定了生态系统服务的供给内容,并在CICES v5.1和两次专家研讨会的基础上建立了评估框架。我们的方法综合了基础性的生态系统评估,并对宝山区生态系统供给水平的实施影响进行了评估,该方法适用于变化中的城市地理特点。我们的评估结果表明,如果按规划实施,宝山区生态系统服务总供给量得到提升,尤其是在城市层面的绿色基础设施中发挥重要的调节服务和文化服务功能。总体而言,土地利用规划应包括建筑区块内的细粒度信息数据,以便更好地评估生态系统服务供给下的空间结构。





1. Introduction

However sustainable development may be defined, constitutive parts touch on the ecological, economical and social dimensions. Ecosystem services (ES) build on the interaction between people and ecological systems. In times of ecological crises, the value of the ecological base for societies and their economies striving to follow sustainable development paths receive more and more attention. Ecosystem services, understood as the benefits humans gain from nature, are sometimes expressed in terms of monetary values, which expresses their relation to economic considerations. The challenges of economic valuation are immense because the priorities in rating the benefits are diverse among individuals, social groups and more so between cultural spheres. The project “Implementation of the ecosystem services framework in Green Infrastructure Planning for resilient urban development in the Ruhr and in Chinese megacities” (IMECOGIP) therefore aims at assessing and quantification of ecosystem services on a non-monetary base in two different societal contexts, in Shanghai, China, and in the Ruhr Metropolis, Germany.

The broad approach to ecosystem services implies that knowledge from different disciplines is needed. In a series of Sino-German workshops, the IMECOGIP project gathered specialists from ecology, social sciences, and planning as well as from planning practice to exercise a matrix-based assessment of ecosystem services in Shanghai and the Ruhr Metropolis. In this contribution, we present the method and its application to the present and tentative, anticipated future as laid out in the Master Plan for the Baoshan District.

2. Study Area and Methods

2.1. Study Area and Planning Framework

Shanghai’s Baoshan district is situated in northern Shanghai (Fig. 1). It is one of sixteen districts in Shanghai, covering an area of 425 km² and is home for roughly 2.2 million people (Shanghai Municipal People’s Government 2022). Being a part of the Yangtze delta, flat terrain and high groundwater table prevail. The Huangpu River forms the southeastern border of the district, which is well known for its steel industries along the Changjiang (Yangtze) River in the north and the southeast. Small-scale industrial plots locate alongside and

south of the Shanghai outer ring road as well as in central Baoshan, whereas the large industrial plots of state-owned enterprises, notably the Baosteel Group, are in the eastern and northeastern parts. Peri-urban land use with scattered village structures dominate in the northwestern parts of Baoshan. However, urban tissue occupies two-thirds of the district. Baoshan is in the process of urban transformation. The retreat of heavy industries offers chances for a comprehensive spatial reorganisation of land uses.

The Shanghai Master Plan (Shanghai Urban Planning and Land Resource Administration Bureau 2018) represents the mandatory planning framework, which the district government of Baoshan must implement accordingly. The ‘Comprehensive Plan and General Land-Use Plan of Baoshan District 2017–2035’ was issued in March 2019 (Baoshan District People’s Government 2019). It zones ecological spaces as well as permanent cropland areas and delineates urban development boundaries. Baoshan intends to cut the share of industrial land by half, from 34.4% to 17.2%. At the same time, the proportion of residential land shall

increase from 21.4% to 25.3%, green space from 9.2% to 16.8%, and public facilities from 6.2% to 9.2% (Baoshan District People’s Government 2019, 43).

2.2. Methods

2.2.1. Present and Future Land Use and Land Cover
Our assessment of ES provision is based on present and prospective land use/land cover (LULC) patches, for which a matching classification for both points in time was elaborated. As part of project activities, we mapped the LULC of Baoshan district in the year 2017 using a three-step approach combining visual interpretation, spatial overlay analysis and object based-classification (Antrop and Eetvelde 2000; Cadenasso et al. 2007; Shao and Wu 2008; Zhou et al. 2014). We overlaid Planet and Pleiades multispectral satellite images with a spatial resolution of 3 m and 0.5 m respectively, from August and September 2017. To cross-check and verify urban street networks, waterways, and public facilities, we used Open Street Map (© OpenStreetMap-contributors). We distinguished 18 LULC-classes (Table 1, Column 1), including areas that could not be classified adequately.

Baoshan LULC 2017	Baoshan LULC 2035	Workshop LULC assessment
residential urban > 80% sealed		residential urban > 80% sealed
residential urban 80–30% sealed	residential area	residential urban 80–30% sealed
residential urban < 30% sealed		residential urban < 30% sealed
residential rural		residential rural
green area	green area	urban green areas (parks)
basic farmland	basic farmland protection area	agricultural land
greenhouses		greenhouses
agroforestry area	agroforestry area	agroforestry
		forest
water bodies	water bodies	water bodies
water bodies (river)	water bodies (river)	water bodies (river)



Baoshan LULC 2017	Baoshan LULC 2035	Workshop LULC assessment
commercial area	commercial area	commercial area
industrial area and warehouses	industrial area and warehouses	industrial area and warehouses
	industrial R&D area	
sports & recreational area	sports and recreational area	sports and recreational area
educational, cultural and welfare area	educational, cultural and welfare are	educational, cultural and welfare are
municipal infrastructure	municipal infrastructure	municipal infrastructure
transportation facilities	transportation facilities	transportation facilities
unclear	strategic empty space	
under construction	land reserved for development	land reserved for development or under construction
	construction area for other land use	

Table 1: Land use/land cover (LULC) classifications used in Master Plans and harmonized for ES assessments. (1) Baoshan LULC 2017 is the classification we used in our own analysis of the present state. It is more detailed than (2) Baoshan LULC (General Land-Use Plan). To be able to assess and compare ES for both years, we prepared the (3) Workshop LULC assessment.

The ‘Comprehensive Plan and General Land-Use Plan of Baoshan District 2017–2035’ establishes only 16 LULC classes, (Column 2 in Table 1). The Plan does not allow for subdivisions of residential areas. To resolve the mismatch between class designations of Column 1 and 2, we aggregated the 2017 categories (‘unclear’, ‘under construction’) and 2035 categories (‘strategic empty space’, ‘land reserved for development’ and ‘construction area for other land use’) to ‘land reserved for development or under construction’ (Column 3). Industrial R&D area was subsumed in the category ‘industrial area and warehouses’ and greenhouses in ‘agricultural land’. Ultimately, we performed a spatial overlay for 2017 and 2035 LULC patches to calculate the LULC change in GIS (©ArcGIS 10.5.1).

2.2.2. Assessment of (Prospective) Ecosystem Services

We applied the ‘Common International Classification of Ecosystem Services’ v5.1 (CICES) in our assessment (Haines-Young and Potschin 2018). The CICES framework represents a sophisticated

and peer-reviewed classification system used in recent European (Zepp et al. 2016; Tammi et al. 2017; Sutherland et al. 2018; Zepp 2018; Elliot et al. 2019) and Chinese (Yang et al. 2015; Cheng et al. 2019; Liu et al. 2020) ES studies. During an initial workshop held in October 2019, out of 90 ES listed in CICES v5.1, the principal investigators and Chinese partners, supported by their respective team, preselected the most relevant ES for large metropolitan areas. Thereafter, we invited experts from regional planning, municipalities, and universities to an assessment workshop. Seventeen scientists and professionals from practice assessed the ES significance of each LULC class listed in Table 1, Column 3. All experts who finally contributed to the assessment held academic degrees in urban or environmental planning (n = 5), landscape architecture (n = 3), environmental science (n = 7), economics (n = 1), and social science (n = 1), and were already familiar with the concept of ES. In the workshop, we explained in detail the different LULC classes, both orally and using supporting photos, to prepare the individual work phase. The organizers



asked the participants to rate the potential ES provision of each LULC in numbers from zero (no contribution) to five (maximum contribution), as done by Montoya-Tangarife et al. (2017) and Mukul et al. (2017). The assessment took place on-site during the afternoon of the same day. We calculated means, and to express the degree of consensus between the participants, we looked at the variability of ratings. The procedure is adapted to the matrix approach, originally suggested by Burkhard et al. (2012). Additionally, Jacobs et al. (2015) performed a knowledge-based survey among experts. Data are fuzzy in the case of LULC in general land use plans. With the matrix approach, we covered all major LULC classes ($n = 18$) presently found in the Baoshan District, approximating China's system of current land use classification (Chen and Zhou 2007; Guo et al. 2018). We included different degrees of imperviousness for urban residential areas to better explore ES by type of urban-dwelling structure. For the expected LULC 2035, we estimated the building density for new residential areas based on recently built neighbourhoods.

Prior to estimating the effect of land use changes on ES provision, we performed a minimum-maximum standardisation according to Mouchet et al. (2017). For each mean rating of ESSs, we subtracted the minimum mean rating of ESSs occurring in any LULC and then divided by the difference between the maximum and the minimum values, i.e., the range of mean ES ratings in any LULC

$$(1) \quad ESS_s = \frac{ES - MIN(ES)}{MAX(ES) - MIN(ES)}$$

with ESS standardised ES
ES mean rating of ES
MIN(ES), MAX(ES) minimum and maximum of mean ratings of ESSs occurring in any LULC

For each combination of LULC and ES, the result is a dimensionless and comparable indicator, ranging from zero to one (Mouchet et al. 2017).

The standardisation attributes equal importance to all ES and are area-specific.

For each ES, we calculated an area-weighted ES significance ESS_w (Equation 1) for both 2017 and 2035. The change in area-weighted significance is ESS_c according to Equation (2). To express the relative change of area weighted ES significance, we calculated a handy $ESS_c-Index$ (Equation 3). We subtract the value of 100 to accentuate differences between the 2017 and 2035 results. An increase in ES significance results in a positive index, while negative values indicate a deterioration of the situation.

$$(2) \quad ESS_w = \sum_{LULC=1}^n \left(ESS_{LULC} \times \frac{A_{LULC}}{A_t} \right)$$

$$(3) \quad ESS_c = ESS_{w, 2035} - ESS_{w, 2017}$$

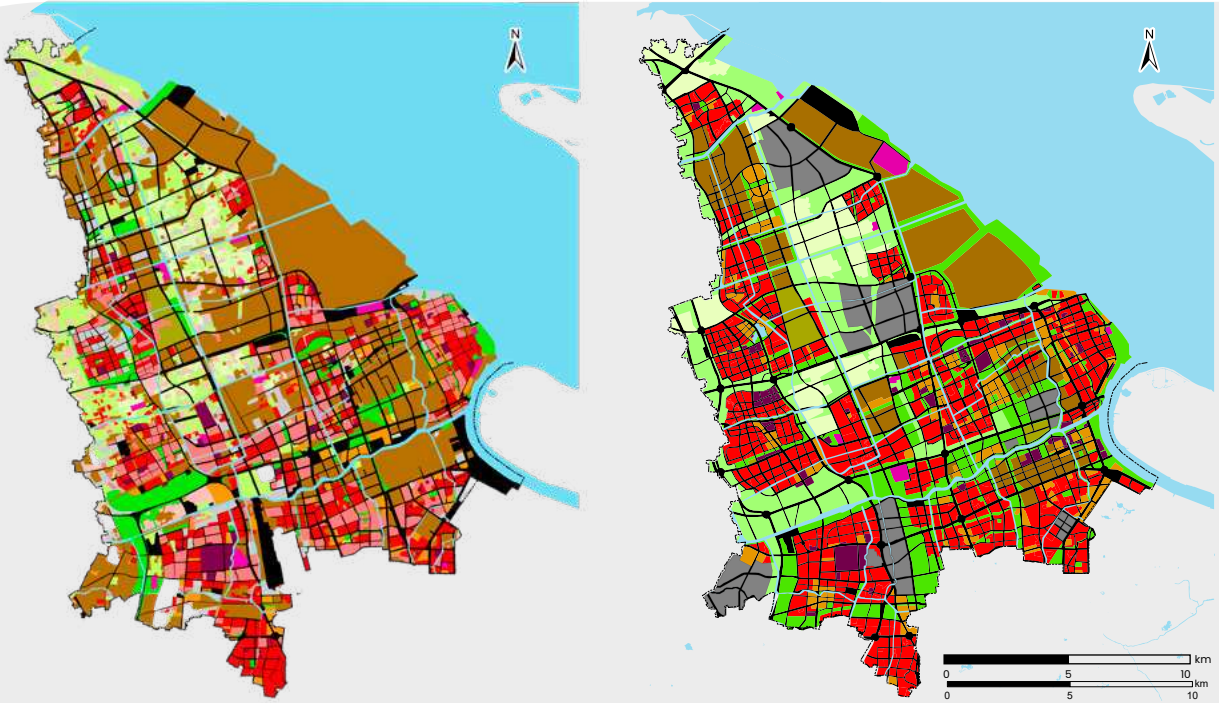
$$(4) \quad ESS_c-Index = (ESS_c \times 100) - 100$$

with ESS_w area weighted ES significance
 n number of LULC
 ESS_{LULC} ES significance of LULC class
 A_{LULC} area covered by LULC class
 A_t total area (Baoshan district)
 ESS_c change of area weighted significance
 $ESS_c-Index$ Index expressing relative ESC

3. Results

3.1. Land Use/Land Cover Change

The maps of Figure 2 formed the base to assess the supply of ES in 2017 and 2035, the anticipated state. The largest LULCC (change between Columns 1 and 2 of Table 1) is attributed to the transformation of industrial land. According to the plan, a total of 198 industrial plots are in need of consolidation and rehabilitation (Baoshan District People's Government 2019, 56). Our calculations show (Fig. 3) that the share of industrial land in the Baoshan District would decrease from 30.7% in 2017 to approximately 11.7% in 2035, of which 3.2% would be transformed into "industrial R&D areas". Although the amount of residential area showed a marginal increase from 20.8% to 21.1%, our analysis showed that this change would also imply an increase from 18.6% to 21.1% in urban residential area, presumably



Land Use Land Cover 2017

- agroforestry area
- basic farmland
- commercial area
- educational, cultural and welfare area
- green area
- industrial area and warehouses
- municipal infrastructure
- residential rural area
- residential urban < 30% sealed
- residential urban > 80% sealed
- residential urban 80-30% sealed
- sports & recreational area
- transportation facilities
- under construction
- water bodies

Land Use Land Cover 2035

- agroforestry area
- basic farmland protection area
- commercial area
- educational, cultural and welfare area
- green area
- industrial area and warehouses
- municipal infrastructure
- residential area
- sports & recreational area
- transportation facilities landuse
- land reserved for development
- water bodies

Figure 2: Land use land cover in 2017 (based on satellite interpretation and existing maps) and for 2035 according to the 'Comprehensive Plan and General Land-Use Plan of Baoshan District 2017-2035' (Baoshan District People's Government 2019).

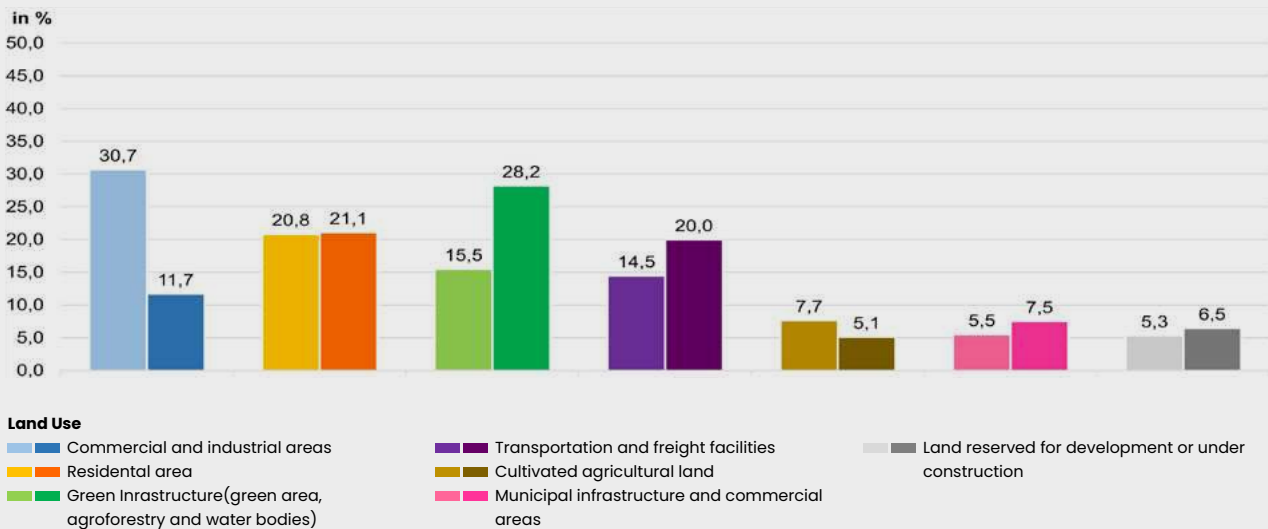


Figure 3: Prospective land use change between 2017 and 2035 for the Baoshan District, Shanghai. Calculation based on Figure 2.



multistoried buildings, at the expense of rural residential land (villages). Green Infrastructure (GI) would represent the largest net gain (from 15.5% to 28.2%). LULC for transportation and freight facilities is also foreseen to increase by approximately one-third, primarily due to the widening of narrow, rural streets to multilane streets for cars and motorbikes. Cultivated agricultural land is planned to shrink from 7.7% to 5.1%.

Though LULCC would include the conversion of rural residential area (10%) and agricultural land (7.5%) to create the ecological corridors, the intended LULCC implies a substantial conversion of formerly sealed land to GI accounting for more than 52 km². We evaluate the implications for the supply of ES in the following section.

3.2 ES Assessment Matrix

Table 2 shows the significance of ES on a scale from zero to five, expressed as the arithmetic mean of the experts' evaluation. The LULC classes are according

to Column 3 in Table 1. Urban green areas, forests, and bodies of water exhibit the highest scores. Regulating services reveal the highest significance for most of the LULC classes

In a metropolitan context, cultural ES can play, a more important role than provisioning and regulating ES according to the experts' opinions. This is especially the case for 'educational', "sports and recreational" LULC and for "urban green areas". With a view of provisioning ES, we noticed that almost all LULC-based maximum values stem from the section of abiotic ES (surface and groundwater used as a material), while biotic ES (aquatic and reared animals for nutritional purpose) delivered almost no significant levels (close to one) or were even rated as irrelevant (close to zero). The lowest mean ratings were assigned to transportation (0.67), commercial areas (0.80), and industrial areas and warehouses (0.86). Forests, urban green areas, and sports and recreational areas exhibit the highest contrasts between ES. There is a strong

Land Use / Land Cover	Residential / Urban / >80 scaled	Residential / Urban / 30-80 scaled	Residential / Urban / <30 scaled	Residential / Rural	Urban Green Areas (parks)	Agricultural Land	Greenhouses	Agroforestry	Forest	Water Bodies (river)	Water Bodies	Commercial Area	Industrial Area and Warehouses	Sport and Recreational Area	Educational, Cultural and Welfare Area	Transportation Facilities	Municipal Infrastructure	Land reserved for Development / Under Construction
Ecosystem Service																		
Animals reared for nutritional purposes	0.2	0.2	0.6	1.5	1.1	1.8	1.6	1.9	1.3	2.1	1.1	0.3	0.3	0.2	0.5	0.2	0.3	0.1
Animals reared by in-situ aquaculture for nutritional purposes	0.2	0.3	0.4	0.9	0.9	0.6	0.4	1.1	0.8	3.8	3.0	0.5	0.5	0.2	0.4	0.1	0.3	0.3
Surface water used as a material (non-drinking purposes)	1.9	2.7	2.7	2.9	2.9	2.4	2.3	3.0	3.2	3.3	3.1	1.7	1.6	1.3	2.0	0.8	1.9	2.6
Ground water (and subsurface) used as a material (non-drinking purposes)	1.6	2.1	2.5	2.6	2.9	2.9	2.6	3.0	4.7	2.5	1.9	1.2	1.1	1.5	1.5	0.7	1.4	2.2
Hydrological cycle and water flow regulation (including flood control)	1.4	1.6	2.1	2.3	3.8	3.1	2.5	3.8	4.5	3.8	2.8	0.8	0.8	1.0	1.3	0.8	1.1	1.4
Pollination (or 'gamete' dispersal in a marine context)	1.3	1.7	2.1	2.5	3.8	3.3	2.8	4.2	4.5	2.3	1.7	0.6	0.7	1.1	1.2	0.7	0.9	1.5
Maintaining nursery populations and habitats (including gene pool protection)	0.8	1.1	1.6	2.0	3.6	2.7	2.6	3.7	4.3	3.4	2.1	0.5	0.5	0.8	1.1	0.4	0.7	1.2
Decomposition and fixing processes and their effect on soil quality	0.8	0.9	1.5	2.1	3.9	3.1	3.1	3.5	4.8	1.9	1.2	0.3	0.4	0.9	0.8	0.3	0.5	0.9
Regulation of the chemical condition of freshwaters by living processes	1.0	1.1	1.3	1.6	2.5	2.3	1.9	2.5	4.0	4.5	3.2	0.6	0.9	0.7	0.8	0.5	1.3	1.0
Regulation of temperature and humidity, including ventilation and transpiration	2.1	2.2	2.5	2.5	3.8	2.9	2.6	3.5	3.5	3.8	3.0	1.4	1.8	1.9	1.7	1.5	1.6	2.3
Characteristics of living systems that enable activities promoting health (active)	1.6	1.7	2.1	2.4	4.6	2.3	2.3	3.7	4.3	4.0	2.4	1.2	1.1	3.3	2.3	0.9	1.3	1.9
Characteristics of living systems that enable activities promoting health (observational)	1.5	1.6	2.4	2.8	4.3	2.4	2.4	3.3	4.0	4.1	2.5	0.8	0.8	2.4	1.8	1.0	1.6	1.7
Characteristics of living systems that enable scientific investigation	1.0	1.1	1.3	1.1	4.0	2.4	2.5	3.2	4.8	4.1	2.1	0.5	0.9	1.2	1.8	0.7	1.0	1.0
Characteristics of living systems that enable education and training	1.0	1.1	1.3	1.2	4.1	2.3	2.4	3.3	4.7	4.1	2.2	0.6	0.8	1.9	2.6	0.6	1.4	1.0
Characteristics of living systems that enable aesthetic experiences	1.3	1.4	1.9	2.1	4.6	2.4	2.1	3.7	4.8	4.6	2.9	0.9	0.9	1.5	1.9	0.8	1.3	1.5
Maximum Provisioning Service	1.9	2.7	2.7	2.9	2.9	2.9	2.6	3.0	4.7	3.8	3.1	1.7	1.6	1.5	2.0	0.8	1.9	2.6
Maximum Regulating Service	2.1	2.2	2.5	2.5	3.9	3.3	3.1	4.2	4.8	4.5	3.2	1.4	1.8	1.9	1.7	1.5	1.6	2.3
Maximum Cultural Service	1.6	1.7	2.4	2.8	4.6	2.4	2.5	3.7	4.8	4.6	2.9	1.2	1.1	3.3	2.6	1.0	1.6	1.9
Contrast	1.9	2.5	2.3	2.0	3.7	2.7	2.7	3.1	4.0	2.7	2.1	1.4	1.5	3.1	2.2	1.4	1.6	2.5

Table 2: Graded significance of ES (derived from CICES 5.1) by LULC class for Shanghai. Calculations based on results of an expert workshop held in 10/2019. Contrast (bottom row) is the range between highest and lowest ratings.

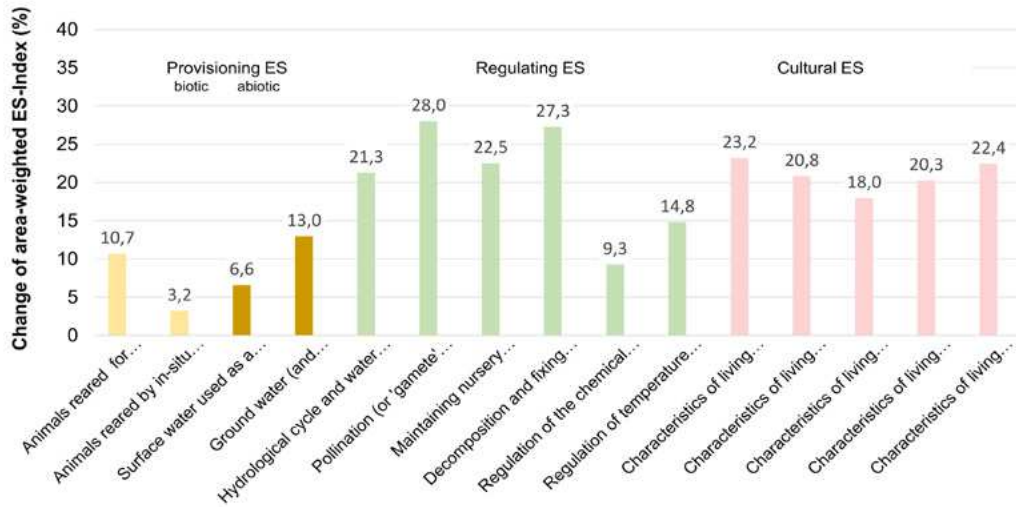


Figure 4: Change of area-weighted ES-Indices between 2017 and 2035. The index visualizes relative changes to compare the effects on single ES. It does not depict absolute increase or decrease of ES provision.

contrast with nearly all regulating and cultural services. The same is true for urban green areas. Sports and recreational areas provide respectable cultural services, which is the cause for the considerable contrast to ES with suitability.

3.3 Hypothetical Changes in ES Provision 2017–2035 in Terms of Contributing Areas

Assuming the prospective LULC changes are implemented, ES provisioning in the Baoshan district will increase in terms of areas. The area-weighted changes of ES supplies would be strengthened by 10% to 28% in comparison to 2017 (Fig. 4), depending on the ES considered. Again, provisioning services such as animals reared by in-situ aquacultures (CICES 1.1.4.1, +3.2%) and surface water used as a material (4.2.1.2, +6.6%) represent the smallest net gain in the supply of ES due to the lack of explicitly added blue infrastructure apart from ditches and ponds in agroforestry and urban green areas. Contrary to that, regulating ES exhibit the largest increase in the supply of ES, especially pollination (CICES 2.2.2.1, +28%) and decomposing and their effect on soil quality (2.2.4.2, +27.3%). Besides this, the planned LULCC will considerably strengthen cultural ES (CICES 3.1.1.1 to 3.2.2.4, +18% to 23.2%).

4. Interdisciplinary and Cross-Cultural Aspects

Ratings between the experts varied, which might be attributed to their disciplinary background. As the workshop ratings were done anonymously, we

cannot back trace possible disciplinary biases. The variability increases with decreasing ES significance (Fig. 5a), i.e., the consensus between the experts was higher in the case of LULC, which was rated as providing a higher ES supply. As the data are not normally distributed and no confidence interval can be visualized, Figure 5a depicts the ranges of variabilities that cover 75% of the lowermost variabilities within the five classes of ES significance. This confirms that the experts unanimously rated the strong ES performance of the various LULC systems. The scattergram of the standard deviations as a function of the five significance classes (shown by Fig. 5b) reveals that good agreements occur when mean ratings exceeded 3.5. On the other hand, the dome-shaped distribution illustrates that LULC with irrelevant (insignificant) ES performance (ratings of less than one) was unanimously rated to be low by the experts. Q3 of standard deviations in the ES significance classes 0-1, > 1-2, > 2-3, > 3-4, and > 4-5 are 1.0, 1.5, 1.7, 1.5, and 1.3, respectively.

The accuracy of the assessment is likely to vary for those LULC that are of intermediate value for the provision of services. The bias between experts of various fields is small when it comes to low or high ecosystem services provision. This finding is corroborated by Roche and Campagne (2019, 1) who concluded that “using expert knowledge through the matrix approach yields results very close to those from quantitative proxies or biophysical models for the evaluation of ES at

the regional level, particularly when there is a need to evaluate many ES or in a data scarce region.”

Spyra et al. (2019b) saw the challenges of developing a cohesive understanding among actors. Yet, in this contribution we could show that that a preliminary assessment of ecosystem services is possible in an interdisciplinary team of experts. On the whole, the results encourage that experts from various disciplines already have and can develop even more a common understanding of ecosystem services after interdisciplinary discussions.

In addition to what Albert et al. (2020) call the knowledge-to-action gap, we have to point to the extra challenges of literal translation of planning terms between culture areas. The ES-concept had been designed in Western science world. Only recently it trickles penetrates planning cultures around the globe. Even in German planning system, it is not yet being used operationally in planning

authorities and consulting. When Spyra et al. (2019b) attested to the potential of the ES concept to become the new Esperanto in planning processes, the hurdle to effectively implement this concept in countries with different cultural and linguistic backgrounds, as in China, should not be overlooked.

From our project experience, it is also clear that another problem becomes more important when the planning areas become fine-grained, regardless of the cultural background. The often fuzzy description of planned land use and land cover hinders the transition from the preliminary matrix approach to more sophisticated models to quantify ecosystem services.



Figure 5a

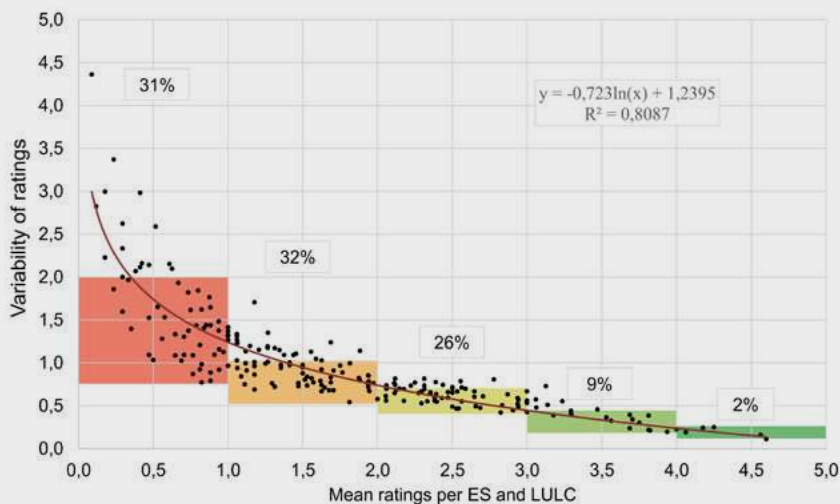


Figure 5b

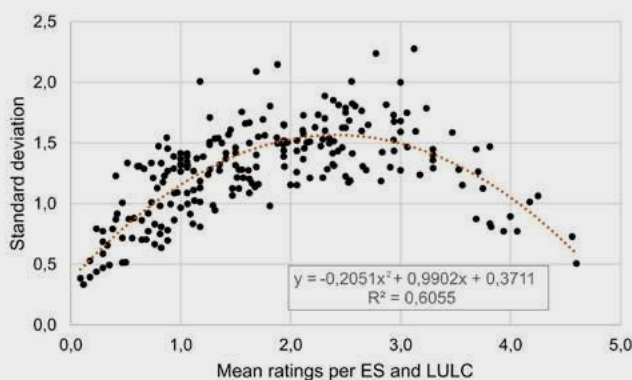


Figure 5: a) Variability of the ratings as a function of mean ratings per ES and LULC. Shaded areas visualize the intervals comprising 75% of the lowermost variabilities of each significance class. Colors are the same as in Table 2. Percentages refer to the proportion of all ratings within each significance class. b) Standard deviation as a function of mean ratings per ES and LULC. Regression lines for illustration only.



PolyUrbanWaters

Polycentric Management of Urban Waters: Responding to Water Challenges of Secondary and Tertiary Cities in South-East Asia – Preliminary Research Results and Outlook

Bernd Gutterer & Adrian Hodgson

Many secondary and tertiary cities in Southeast Asia are growing vigorously without comprehensively following urban planning guidelines. By primarily responding to dynamics in the private real estate sector, cities tend to adopt a reactive approach to such growth rather than a proactive one. This is often attributed to their limited institutional and financial capabilities, imprecise mandates, and informal decision-making frameworks. At the same time, there is a growing awareness that "water in the city" is much more than water supply and sanitation. In cooperation with three partner cities in Cambodia, Indonesia, and Laos, the PolyUrbanWaters project has identified and analysed the water-specific development characteristics of each city and elaborated approaches to effectively address these urban challenges by applying strategic, customised elements of water sensitive urban development.



Concepts such as water sensitive cities may support sustainable urban developments, but must be framed in accordance with the specific characteristics and capacities of the cities.

Figure 1: Wetlands Kratie





South-East-Asia

Banyak kota-kota sekunder dan tersier di Asia Tenggara tumbuh secara dinamis tanpa mengikuti pedoman perencanaan kota secara komprehensif. Kota-kota tersebut cenderung mengikuti dinamika sektor real estat swasta secara reaktif daripada proaktif karena kapasitas kelembagaan dan keuangan yang tidak memadai, mandat yang tidak tepat, dan struktur pengambilan keputusan yang informal. Pada saat yang sama, ada kesadaran yang berkembang bahwa "air di kota" lebih dari sekadar pasokan air dan sanitasi. Bekerjasama dengan tiga kota mitra di Kamboja, Indonesia, dan Laos, timPolyUrbanWaters telah mengidentifikasi dan menganalisis karakteristik pembangunan yang berkaitan dengan air di setiap kota dan menguraikan pendekatan untuk mengatasi tantangan perkotaan secara efektif dengan menerapkan elemen-elemen pembangunan perkotaan yang ramah air yang strategis dan disesuaikan.



Cities in Southeast Asia (SEA) are exceedingly diverse, ranging from hubs of the global economy to small marketplaces in remote areas. Most countries in SEA, despite large regional disparities at the start of the 2020s, have made significant achievements for a number of indicators in the Agenda 2030 Sustainable Development Goal (SDGs) framework. Yet with dynamic growth in many of these cities and the increasingly obvious impacts of climate change, there are significant urban water management challenges. Agreement is growing among urban development decision makers, scholars, and practitioners that classical models of urban planning and water-related infrastructure development cannot meet the development challenges of these cities alone. As such models no longer reflect the cities' realities, needs and capacities, a rethinking of current planning approaches and implementation schemes for these cities is required. The management of urban water resources should be removed from a solely sector-focused approach and understood as a cross-cutting issue of overall urban development. Infrastructure development should rely on flexible, integrated and financially sustainable modular approaches that can adapt to the development and needs of cities over time. New governance structures at city and neighborhood levels, which involve city administrations, communities, citizens, the private sector, civil society institutions and academia, should allow for a polycentric management of water resources. This comprehensive urban transformation may be guided by concepts such as "water-sensitive cities" or "water-wise cities".

The PolyUrbanWaters Project

The polyurbanwaters.org project aims to ensure that polycentric approaches to urban water resource management can contribute to the water-sensitive transformation of secondary and tertiary cities in Southeast Asia toward resilient, inclusive, and livable urban areas. In doing so, the project will support these cities in their effort to localise the 2030 Agenda in the field of the management of urban waters more effectively.

The project is a collaborative effort of a network of academic institutions, civil society organisations

and public entities from Cambodia, Germany, Laos, Indonesia, Thailand and Vietnam.

The concept of Polycentric Management of Urban Waters (PUW) responds to the challenges for urban areas and settlements and intends to include "water" as a cross-cutting issue requiring cross-sectoral solutions. PUW brings together security of supply of water-related services (water supply, wastewater and waste management, flood management, etc.), resilience to the impacts of climate change, and the creation of livable and inclusive urban spaces in an integrated approach to sustainable water resource management (IWRM) and participatory urban development planning. The solutions are developed and implemented according to the specific natural and socio-economic characteristics of the respective urban areas, the regulatory frameworks, and the financial and institutional capacities of the cities and local stakeholders.

The PolyUrbanWaters project works on polycentric approaches to water-sensitive urban management in three pilot cities: Kratié (Cambodia), Sam Neua (Laos) and Sleman (Indonesia). The three pilot cities represent a broad cross-section of contexts in terms of size, urban water resources challenges, urban scales, governance schemes, cultures, transformation models and financing capabilities at government as well as community level. In working with these cities, the project aims to reflect the multitude of realities faced by secondary and tertiary cities in SEA. Furthermore, the project undertakes comprehensive studies of the water management and urban planning framework and experiences in Indonesia, Cambodia, Laos, Thailand and Vietnam in order to create a robust and comprehensive understanding of challenges that secondary and tertiary cities in the region are facing, as well as possible options and solutions available to such cities in the face of such challenges.

Key Research Findings

The project elaborated comprehensive baseline studies between 2021 and 2023 that allow partner cities to understand existing and emerging water challenges in the wake of urban development and



Figure 2: Sariharjo

factors such as climate change. The results of the studies will allow local decision makers to make strategic decisions for sustainable, water-sensitive urban development. Some key-findings are listed here:

- All countries have made extensive efforts to decentralise public administration in recent decades, whereby the mandates and decision-making processes between national and local levels have been redefined by law. National development plans are essential for local processes to receive adequate finances, and national objectives pertaining to Agenda 2030 (Sustainable Development Goals – framework) are firmly incorporated within such plans. However, analyses of the respective governance structures have revealed that governance practices are characterized by overlapping mandates with fragmentation of different departments at the national and local levels, insufficient consistency of the regulatory framework, and insufficient implementation capacity.
- In recent decades, Southeast Asian cities have generally made substantial progress in infrastructure development (road network, electricity supply, etc.) (Figure 2). In the water sector, such progress is primarily limited to water supply; thus, cities are only partially prepared to tackle the diverse challenges of urbanization and climate change. Consequently, such cities have a limited ability to achieve comprehensive water-

related resilience. Despite this, it is worth highlighting that awareness for sustainable urban development, which is also vital for achieving water-sensitive development, is growing in many cities in Southeast Asia and partner cities. New middle-class areas (Figure 3) increasingly demand green urban development in which comprehensive water security plays an important role.

- The development of efficient structures for urban water management is highly dependent on the characteristics of each city. It is difficult to speak of "the" secondary or "the" tertiary city in Southeast Asia. Specific socio-cultural characteristics of the cities play a major role, which can transcend the political and governance systems of the countries, as well as the respective socio-economic and



Figure 3: Urban Sariharjo



demographic development dynamics, institutional and financial resources. Thus, decision-making processes, (also at the community level) in Javanese Sleman, Indonesia, differ substantially from those in Sam Neua, Laos, and Kratié, Cambodia. This underscores the fact that primarily technical approaches to development have a limited recognition as success factors.

- Today, many secondary and tertiary cities themselves still have insufficient technical capacity, institutional capacity, funding, and mandates to plan, implement and sustainably monitor more complex urban and infrastructure development processes. Participatory processes in urban planning are largely unknown. For example, a lack of "law enforcement" leads to regulatory requirements for wastewater treatment not being implemented, polluters not adequately treating their wastewater, and service providers having only a very limited resilient business model for septic sludge treatment. Infrastructural projects such as those financed by the Asian Development Bank, for example, in the expansion of water infrastructure, often find insufficient anchorage at the local level to sustainably finance their operation. Cities in Southeast Asia have made significant progress in infrastructure development in recent decades, but water-induced vulnerabilities are rapidly intensifying in many places.

- In the administrative practice of the cities, the concept of "urban water management" - let alone "integrated water resource management" - is also

little known or anchored in the city administrations. The organisational structure and the processes of financial resource allocation are also decisive for this. To date, in some countries, budgets are set at the national level and allocated to departments at the city level. In doing so, many cities have little revenue of their own. "The great challenge of resilience is that it is still a relatively abstract concept to many decision-makers in SEA. Due to its multi-sectoral nature, resilience is still difficult to frame and relatively complex to understand how it differs from more classic public policy tools. In parallel, the concept suffers from the *catch-all syndrome*, by which resilience appears to cover every aspect of urban governance and as a result suffers from a paralysis whereby it ends up *covering nothing at all*" (UNESCAP, 2019). This makes it even more important to break down the concept of resilience to concrete levels of action that cities can practically and realistically address.

- Growth in the urban-rural transition area in most of the cities follows urban planning guidelines to a very limited extent. Growth is largely driven by the demand for housing and commercial space or by the exploitation logic of private-sector actors and the financial interests of political actors. In this context, development of water management infrastructure (e.g., urban drainage, sewage) normally follows the course of construction activity, as there is no systematic, strategic urban planning conducted when developing new settlement areas.
- Changing land use patterns and discharges of urban stormwater runoff have significant impacts



Figure 4: Time series 1st image 2013 and 2nd image 2019 Sam Neua central built up area

on water quality and ecosystem performance. In many places, this results in increased water-related vulnerability, which is exacerbated by the effects of climate change. Agricultural land, such as rice paddy fields (widespread in the region) has an important function in the runoff regime of surface waters. With the dynamic development of land prices, these areas, which are mostly cultivated by small farmers, are being transformed into building land with a high degree of sealed surfaces. For example, between 2000 and 2015, 35.73% of the rice field area in the study area of Ngaglik, Sleman sub-county was converted to building land. In Sam Neua Town, it is expected that by 2030 rice paddy fields, which were extensive until recently, will have largely disappeared (Figure 4). Additionally, there is significant settlement pressure on wetlands. Coupled with changing land use patterns in the respective watersheds (e.g. due to deforestation), mutually reinforcing factors which influence increased vulnerability to flooding and climate change impacts, include increased heavy rainfall events, and inadequate drainage and water retention systems.

Outlook

Derived from these research results, in 2023 and 2024 PolyUrbanWaters supports the partner cities in strategy development (vision-building) for water-sensitive urban development and informed decision making based on their specific characteristics, needs, and capacities.

- The **Town of Sam Neua** is supported in achieving its vision of a "green, clean and beautiful town" in the context of water-sensitive urban development. Located in the mountains of northeastern **Laos**, the town is expanding into valleys whereby the surfaces are progressively being sealed, and the slopes are gradually being deforested.
- The vision includes strategies and options for action to reduce the city's increasing risks and vulnerabilities to flooding events and water-induced landslides, which will be exacerbated in the context of climate change. It also identifies solution strategies for decreasing water pollution, which poses a growing threat to safe drinking water supplies.
- The local government and communities are being



Figure 5 (top): City view from Ongtue temple
Figure 6 (middle): Flooding central Kratie
Figure 7 (bottom): Concrete sealing



assisted in adapting their vision to the emerging urban areas of Sam Neua Village and Naliew Village. A land-use plan for new a urban expansion area, currently in progress, emphasises - among other elements - effective stormwater management. This entails a comprehensive approach to developing both grey and blue-green infrastructures.

· Beyond creating efficient grey drainage systems and runoff retention facilities, there is a need for green solutions that promote substantial infiltration. The sustainable stewardship of existing green areas like meadows, riparian zones, etc., is planned to progress in tandem with the introduction of new nature-based solutions. Schemes for sustainable management of grey-green infrastructure by local government and communities are addressed from the beginning of the planning process.

Visions can give guidance for water sensitive urban development, but they must reflect the reality of people's lives and be underpinned by very concrete, achievable measures.

• **Sariharjo Village** with 22,000 inhabitants, is located in the in the Special Region of Yogyakarta in **Indonesia**, which has a population of more than 1 million inhabitants. Like many villages in the Special Region, Sariharjo village shows how traditional agrarian social structures and water use patterns will become more urban which poses significant challenges for sustainable water management. It can be predicted that by 2035 Sariharjo will be characterised as settlement and business area primarily of middle classes, upgraded traditional village centres with settlement areas of lower-income population groups in the peripheral zones.

Based on the results of the base-line assessments, the following parameters - among others - have been discussed with the local government:

- By 2030, in Sariharjo at least 30% of its area are green open spaces.
- By 2025 40 % and by 2030 80 % of households should have access to piped water.
- By 2025 50 and by 2030 90 % of households should be equipped with improved septic tanks and the generated sludge safely managed by annual emptying.

- By 2025, 100% of all newly built parking spaces are equipped with water infiltration structure.
- By 2030, 90 % of parking spaces public and private buildings are equipped with water infiltration devices.

Together with the local government and communities, PolyUrbanWaters has initiated a participatory process of vision building in two sub-villages of Sariharjo. The goal is to devise land-use plans tailored for water-sensitive development in these sub-villages. It's anticipated that essential interventions will be integrated into public village development plans, potentially financed under official budgetary frameworks.

- The town of **Kratié** in **Cambodia**, with nearly 30.000 inhabitants, is located on the banks of Mekong River. The urban area is frequently hit by severe flooding.
- The wetlands behind the city have an important function for the livelihood of the communities, serve as water reception basins during the flooding regimes and have an important function for a pleasant urban climate.
- As is the case in many other cities in Cambodia, urbanisation leads to the increasingly filling in of wetlands, significantly increasing the vulnerability of the urban area. PolyUrbanWaters supports a process of awareness - building among the provincial and city government and communities regarding the importance of wetlands for the sustainable development of the city.
- An Area Development Plan will address the options of a multifunctional use of the wetlands close to the city for income generation, resilience to flooding events and climate change impacts, tourism development and in general for increasing the livability of the city.

Between 2025 and 2027, the elaborated instruments are set to facilitate specific implementation activities.





URA

Professor YANG Guiqing

Professor **YANG Guiqing** is the leader of the Chinese consortium of the URA project. He is the Head of the Department of Urban Planning and the Principal Investigator of the "Urban and Rural Development and Rural Planning" research team in Tongji University, as well as the vice chairman of the Academic Committee of Mountainous Urban and Rural Planning in the Urban Planning Society of China (UPSC).

The case study area of the URA project in Huangyan, Taizhou has been introduced by Professor Yang based on his previous planning projects and networks with the local authorities. At the end of 2012, Yang Guiqing's team was invited by the Huangyan local government to support village revitalization. Under the guidance of Yang Guiqing, the old buildings, repaired to their original appearance, were "revived" by injecting new functions. The renovation of the historical street has brought new economic opportunities, and many villagers who had gone away have chosen to return to their hometowns. Hotels, shops and restaurants have opened one after another, and the commercial atmosphere is becoming increasingly strong. Yang Guiqing hoped that "in the future all

these unused storefronts will be revived". Huang Zhihong, the Secretary of the Party Branch of the Shatan Village in Yutou Township, Huangyan District, commented that "Under Professor Yang's guidance, we have also changed our views and improved our knowledge of the countryside. He has helped a lot with the upgrading of the village and the renovation of the old houses."

Professor Yang's publications include "Huangyan Practice – Exploration of Beautiful Countryside Planning and Construction" and "Wuyantou Village – Exploration of Regeneration of Huangyan Historical and Cultural Villages". In November 2015, a joint urban design workshop was organized by Professor Yang from Tongji University and Professor Misselwitz from Technical University of Berlin in Huangyan with international participants. In 2018, "Tongji Huangyan Rural Revitalization Institute" was inaugurated in Huangyan District, and the first training course was held. As the executive director of the academy, Yang Guiqing has planned 10 training courses for the academy.

The academy is dedicated to building a comprehensive learning and education platform integrating theoretical research, practical guidance and talent training on rural revitalization, accelerating the training of 'three rural' cadres and construction talents, and contributing Tongji wisdom, Taizhou solutions and Huangyan samples to the implementation of the rural revitalization strategy nationwide. The "Tongji Huangyan Rural Revitalization Institute" consists of two campuses: The South Campus is located in the former Rural Construction School in Wuyantou Village, Ningxi Town, with one multimedia classroom and one academic lecture hall; the North Campus is located in the former Ruchuan Academy block in Beach Village, Yutou Township, with two multimedia classrooms and one academic lecture hall. In addition to thematic teaching, the college has also set up 15 on-site teaching sites. At the same time, there is also the possibility of experiential teaching by means of outdoor experience and outreach training.

Li Fan

URA

New Connections in Beiyang Township

Yuting Xie, Jie Zou & Yating Zhu

The landscape of Beiyang Town

From 30 September to 6 October 2021, a URA workshop took place at Urban-Rural Living Lab 1: Beiyang Township Area. The workshop was organised by URA Working Package 4 (Urban-Rural Landscapes and Spatial Typologies), led by Dr. Xie Yuting from Zhejiang University. The workshop was attended by the URA team in a hybrid format, with a team from Zhejiang University on-site in Huangyan District, Taizhou City, Zhejiang Province, and the URA team in Germany participating online. During the one-week workshop, three groups exchanged their research and finding. These three groups include Group A, which focused on the inclusive spaces of modern farms in Beiyang town, Group B, which explored sustainable development models for modern agriculture, and Group C, which worked on water-sensitive rural development within territorial planning.

2021年9月30日至10月6日,城乡共构项目组在“城乡生活实验室1:北洋镇区”举办了一次工作坊。此次研讨会由城乡共构项目组第四小组(城乡景观与空间类型)组织,由浙江大学谢雨婷博士领衔。城乡共构项目组团队以线上线下的形式参加了此次工作坊,其中浙江大学团队在浙江省台州市黄岩区现场参与,城乡共构项目组德国团队在线参加。在一周的

工作坊期间,三个小组交流了各自的研究和发现。这三个小组包括关注北洋镇现代农场包容性空间的A组、探索现代农业可持续发展模式的B组和在国内空间规划中研究水敏感型农村发展的C组。

As part of the R&D (Research and Development) phase of the URA (Urban-Rural Assembly) project, consortium partners are exploring the possibilities of URLLs (Urban-Rural Living Labs) in China. The URLL model presents a series of regional community-driven pilot interventions which explore the possibilities of actor-oriented, participatory socio-spatial transformation scenarios with regards to circular economies, cultural heritage, renewable resources and food security. To strengthen ecological-oriented collaborations, Urban-Rural Living Lab #1 'Beiyang Township Area' focuses on enhancing sustainable nutrient and waste cycles to support ecological food production and inclusive eco-tourism. Its aim is to build site-specific implementation strategies, and research the potential of developments that invite rural communities to participate in the integration of agriculture transformation processes.

WP (Work Package) 4 of URA project focuses on



Urban-Rural Landscapes and Spatial Typologies, with the cooperation of parallel and interdisciplinary contextual research performed by other Working Packages (WP2-6). Coordinated by WP4, an open call for participation was launched which invited students from across China to join URA for an interdisciplinary workshop in Beiyang Township, Huangyan-Taizhou. The 11 students who were chosen to participate came from a wide variety of professional backgrounds, and joined URA WP4 for seven days of collaborative research from 30th September to 6th October 2021, with scholars from URA's Sino-German partners providing theoretical and technical support through online lectures.

The workshop was scheduled for seven days. On Day 1 the workshop was kicked off through group discussions and a first glance of the site. On Day 2 and Day 3 the group undertook questionnaire survey, household interview, and field survey. On Day 4 the team members presented their preliminary findings online. Day 5 and Day 6 were for further field survey and research. On Day 7 the final presentation took place online. During the workshop, experts and scholars from Sino-German consortium partners provided theoretical and technical support for interdisciplinary research through online lectures.



Beiyang, China



Figure 2: Workshop participants in Beiyang Town

German consortium members participated in the workshop through online sessions. On 30.09 Dr. Maria Frölich-Kulik gave a lecture on “Urban Rural Landscape & Typologies – reading and revealing the rural landscape of Huangyan-Taizhou Region”. On the following day 01.10.2021 Dr. Karl Beelen talked on “Exploratory Mapping, Narratives & Approaches: Urban Rural Landscape & Typologies – reading and revealing the rural landscape of Huangyan- Taizhou Region”, followed by Beatrice Chng from ICLEI Southeast Asia, who spoke about “The policy interfaces and the integrative momentum propelling urban-rural governance”. The workshop participants were divided into three groups (Group A, B, C) according to three topics of research aimed at decoding spatial typologies and scenario development.

Group A: Research on Inclusive Space of Modern Farms in Beiyang Town

Group A focused on the spaces of modern farms in Beiyang town with the cooperation of WP2 (Urban-Rural Socio-spatial Practices) and WP6 (Urban-Rural Mobilities and Social Inclusion).

Group A summarized four interdependent modes between villagers and modern agriculture, including the cooperation of abandoned family farms, farms run by villagers, farms run by businessmen, and integrated farms of agriculture and tourism. Based on villagers' daily-life map tracking and space syntax analysis, qualitative and quantitative analysis methods are used to discover inclusive space mainly concentrated in modern agriculture.

Through comparative interviews, case studies, and quantitative analysis of location-based services (LBS) and space syntax, inclusive space in modern agriculture mainly concentrated on the river, canteen, and village Bridges. The findings from field surveys coincide with high flow areas from space syntax analysis, but not all high accessibility spaces are densely active.

Group B: Exploring the Sustainable Development Model of Modern Agriculture

Group B explored sustainable development models of modern agriculture in collaboration with WP3 (Urban-Rural Material Cycles).

Through questionnaire survey and household interview, Group B investigated the differences in landscape, material circulation, industrial composition, income, and stakeholders of the four major local farms and made recommendations for sustainability development. The results show that:

1. a healthy, independent, and ecological self-circulation system should be formed in farm development;
2. the soilless cultivation should not be encouraged where the land conditions are superior;
3. a flexible buffer represented by plant boundaries and canals instead of fencing can reduce agricultural pollution and increase biodiversity and landscape effects; and
4. the government and large enterprises can influence modern agricultural development, and the attitude of the stakeholders often changes with demands.



家庭农场废弃地的合作 Family farm wasteland cooperation



合作
cooperation

本地村民 自我土地使用不便——灌溉水源太远
Local villagers find their land difficult to use - irrigation water is too far away

家庭农场果园的边角区域难以使用——借给本村村民种菜
The corner area of the family farm orchard is unusable - it is lent to the villagers to grow vegetables



正如生态的边缘效应, 边缘区域的多元性, 给人与人之间提供了更多融合的可能性。

Summary: Just like the ecological edge effect, the diversity of the edge region provides more possibilities for the integration of people.

Figure 3: Research outcomes on inclusive space of modern farms in Beiyang town

Group C: Water-Sensitive Rural Development under Territorial Planning

Group C looked into water-sensitive rural developments with the cooperation of WP5 (Urban-Rural Ecosystems).

Through field survey and mapping, Group C drew out the spatial distribution of the major water systems, sorted out the categories of water ecosystem services, and discovered a spatial mismatch between the supply and demand. Water ecosystem services are provided by water systems, including reservoirs, rivers, ponds, and ditches. The reservoir mainly provides water supply and regulation services. However, the low frequency of water discharge leads to the decline of the water level of Yongning River, and the cutting of irrigation water in the upstream area leads to the abandonment of ditches. There is a spatial mismatch between the supply and demand of water ecosystem services, mainly reflected in the contradiction in water supply services in upstream and downstream areas and the imbalance that other types of services caused. Strategies for improving water ecosystem services include control of agricultural non-point source pollution, ecological restoration of rivers and ditches, and coordinating stakeholders to improve reservoir operation and management mode.



Figure 4 (top): Site visit of the workshop participants
Figure 5 (bottom): Group discussion of the workshop participants

plement!

An Analytical Framework for Successful Community- Based Tourism Projects in the Global South

*Sabena Rajan Thomas, Susana Restrepo Rico &
Michael Peterek*

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Photography by Katharina M. Borgmann, in Vietnam



Community-based tourism (CBT) is a key aspect of the sustainable development of rural communities and, thus an important element of the urban-rural nexus in rapidly developing urban regions, specifically in the Global South. Within the emplement! research project as part of the SURE Funding Priority, a CBT pilot project in the Cu De River Valley, close to the city of Da Nang in central Vietnam, is being followed and investigated by the German and the Vietnamese project partners. For this purpose, it is important to understand the factors that have led to the success of other CBT initiatives in similar circumstances and to develop a framework for their assessment. The presented paper examines three communities in Thailand, Cambodia and Ecuador that implemented CBT initiatives in the past and have sustained their projects and benefits in the long term. The paper proposes an analytical framework for examining CBT approaches based on the existing literature. It utilises said framework to identify the main factors of success and information relating to the process of planning, managing and implementing CBT in rural communities. The lessons learned from the analysis of the case studies could inform the formulation of future CBT initiatives not only in the Cu De River Valley, but also in other regions of the Global South, transferring the strengths of these best practices and overcoming some of the challenges that the communities have been confronted with.

Tóm tắt tiếng Việt

Du lịch cộng đồng (Community-based tourism – CBT) là khía cạnh then chốt cho sự phát triển bền vững của các cộng đồng nông thôn và vì vậy là yếu tố quan trọng trong mối liên kết giữa thành thị và nông thôn ở các khu vực đô thị đang phát triển nhanh chóng, đặc biệt là các khu vực đô thị ở phía Nam bán cầu. Trong khuôn khổ dự án nghiên cứu emplement! – thuộc Quỹ Phát triển Bền vững Khu vực Đô thị SURE, một dự án thí điểm về du lịch cộng đồng đang được nghiên cứu thực hiện tại lưu vực sông Cu Đê – Đà Nẵng, Việt Nam với sự tham gia của các đối tác dự án đến từ CHLB Đức và Việt Nam. Để đạt được mục tiêu dự án, việc hiểu biết các yếu tố dẫn đến sự thành công của các sáng kiến du lịch cộng đồng trong bối cảnh tương tự cũng như việc đề xuất một khung đánh giá cho những yếu tố đó là rất quan trọng. Bài viết sau đây xem xét ba cộng đồng ở Thái Lan, Campuchia và Ecuador đã triển khai thành công, duy trì hoạt động du lịch

cộng đồng và đảm bảo lợi ích dài hạn cho cộng đồng. Bài viết đề xuất một khung phân tích để nghiên cứu các phương pháp tiếp cận du lịch cộng đồng dựa trên lý thuyết sẵn có và sử dụng khung phân tích này để xác định các yếu tố chính dẫn đến thành công cũng như quá trình lập kế hoạch, quản lý và triển khai du lịch cộng đồng ở các cộng đồng nông thôn. Những bài học rút ra từ việc phân tích các trường hợp nghiên cứu điển hình giúp định hình các sáng kiến du lịch cộng đồng ở lưu vực sông Cu Đê và các khu vực khác của Nam bán cầu, giúp phát huy các điểm mạnh và hạn chế những rủi ro mà các cộng đồng đã và đang phải đối mặt.

Introduction

With regards to the processes of global urbanisation, cities and their surrounding regions cannot be seen separately anymore, but only in adequate consideration of the systemic urban-rural nexus. Therefore, the objective of the research project “emplement! Empowering Urban Regions for Implementation and Resilience Strategies Considering the Urban-Rural Nexus”, which is part of the SURE Funding Priority and funded by the German Federal Ministry for Education and Research (BMBF) from 2019 to 2025, is to develop transferable tools and the needed capacities that enable administrations and relevant stakeholders in the city of Da Nang and the adjacent Quang Nam Province in Vietnam to implement relevant strategies and plans into practical, efficient and sustainable measures that interact synergistically on a city-regional scale. Both at the planning and the practical level, the emplement! project thereby focuses on four fields of action: tourism, agriculture, industry, and the built environment.

Within the larger consortium of the emplement! research partners, both from Germany and Vietnam, Frankfurt University of Applied Sciences has taken the lead, together with Da Nang Architecture University (DAU), in the action field of sustainable, community-based tourism (CBT) as a relevant element of sustainable city-regional development, scientifically accompanying a CBT pilot project in different villages along the Cu De River Valley, in close proximity to the city of Da Nang.

Community-based tourism (CBT) is hereby considered an integral part of sustainable tourism due to the affinity of its principles with the pillars



of sustainability (Asker et al., 2010). CBT initiatives are focused on community and economic empowerment, preservation of heritage and protection of the environment and biodiversity. Mtapuri and Giampiccoli (2019) state that the participation of communities and the local perspectives in the definition of tourism development is essential for the effectiveness of projects. Moreover, Yanes et al. (2019) and Asker et al. (2010) provide a theoretical basis for the definition of a CBT approach that could improve rural populations' livelihoods.

As background research for the above-mentioned pilot project in the Cu De River Valley, the purpose of the here presented paper is to identify the main components of a successful CBT initiative and highlight the main challenges and lessons learned from the implementation of the CBT approach in three reference communities of the Global South. The key success factors and instruments of CBT projects in these communities could then be transferred to the villages in the Cu De River Valley as well as to other projects. Examination of successful CBT initiatives could help identify the main factors to consider in formulating a CBT approach and determine the various instruments and lessons that can inform the development and implementation of future CBT projects in the Global South.

Methodology

The case studies investigated here were chosen based on the following criteria to define a CBT initiative in the Global South which was developed by Spenceley (2008) and adapted to the purpose of the analysis:

- the case study must be located within a developing region,
- the CBT project must be managed by one or more members of the community and must involve tourism-based activities,
- the project has been sustained for over ten years and has produced tangible benefits for the community involved.

The background of each project is explored together with the factors that contribute to its success as well as the challenges that each project may experience. To do this, an analytical framework

(see below) was developed based on the work of Yanes et al. (2019) and Asker et al. (2010).

Community-Based Tourism Reference Examples

The cases studied in this paper are the Banteay Chhmar community in Cambodia, the Agua Blanca community in Ecuador, and the Mae Kampong in Thailand. These are located in tropical and rural areas in Global South countries and the implementation of CBT initiatives is based on community participation, long-term sustainability and self-organisation for management (Spenceley, 2008; Yanes et al., 2019).

Banteay Chhmar, Cambodia

Located 20 km from the Thai border and with the nearest tourism locality approximately 170 km away, the traditional Khmer community in Banteay Chhmar was centred on farming rice and cassava. The major tourist attraction in the area is a protected Angkorian temple. The community contends with socio-economic concerns such as poverty and unemployment (Pawson et al., 2017).

The CBT project was developed in 2007 to protect the local culture and the natural landscape while improving the residents' quality of life. The project has developed numerous tourism products since, and the benefits have allowed the creation of a community CBT fund that has financed various community development projects such as water filters, solid waste management projects and a library. The profits are distributed to members of the CBT project only; however, contributions are made towards the aforementioned, which benefit the entire community. The CBT initiatives are based on attracting cultural tourism to the area and include:

- a homestay program,
- cooking groups and picnics for tourists,
- traditional music and dance,
- guided tours,
- ox cart tours,
- taxi services and
- participation in rice flattening activities.

The governance structure consists of one leadership committee where only the CBT project coordinator receives a salary (Pawson et al., 2017).



Figure 1: Agricultural festival as part of the community-based tourism initiative in Nam Yen village in the Cu De River Valley in Vietnam. Photography by Susana Restrepo Rico

Agua Blanca, Ecuador

The community of Agua Blanca is located in the Machalilla National Park with 260 inhabitants. The 8.000 ha territory is owned by the community, and tourist activity is regulated by the community with the park administration's approval (Ruiz-Ballesteros, 2011). CBT in Agua Blanca developed in the 1980s and is centred on the showcase and protection of archaeological remains. Initially, there was a conflict between the government and the community's visions for tourism, but this was resolved once the government understood that the CBT complements park tourism through environmental awareness and protection (Ruiz-Ballesteros, 2011). The main CBT activities in Agua Blanca are:

- guided tours
- sales of artisanal crafts and goods

Many community members also engage in other activities to sustain their livelihood by participating in livestock farming, creating vegetable gardens, or working in construction or as a tour guide in the greater park area. This range of activities ensures that many community members do not have to migrate out of the community to make a living. The introduction of tourist activities also ensures that there is less pressure placed on the environment, and it can continue to be protected sustainably (Ruiz-Ballesteros, 2011).

Mae Kampong, Thailand

Mae Kampong, 50 km from the city of Chiang Mai, accommodates around 500 inhabitants and is located between forests and mountains (Kontogeorgopoulos et al., 2014). The main income-generation activities are the agriculture of herbs, coffee, tea, and a tea-based snack known as *miang*. The concept of generating tourism in the region developed in the 1990s with the decline in the demand for *miang* and the aim to diversify economic activities in the community. Given the long-term impacts of tourism on the country, the villagers were concerned about the possible effects of tourism on their area. Community collaboration was therefore central to the emergence of CBT in Mae Kampong as the means to develop a CBT strategy that ensured that ownership, benefits, and the control of tourism activities remained with the community and was promoted through meetings, workshops, and focus group sessions (Kontogeorgopoulos et al., 2014). The CBT strategy focused on:

- a homestay program,
- traditional music and dance performances,
- guided tours and
- sales of artisanal crafts and goods.

There are two key points regarding the village's geographical location that favour Mae Kampong's CBT initiative. Firstly, the village is accessible compared to other remote villages due to its



proximity to Chiang Mai, a city with major transport connections and tourism opportunities. However, access to the area and the number of visitors are regulated by the precarious road infrastructure, which does not permit large tourist buses to enter the area. Secondly, Mae Kampong is situated at a higher elevation along a natural stream, creating an attractive environment with a pleasant climate (Kontogeorgopoulos et al., 2014).

The CBT Framework

A community-based tourism approach allows for integrated and inclusive community development; however, it is important to understand that CBT must be localised, contextualised, and adjusted to the social and legal structures of the communities. The literature provides a strong theoretical basis for the identification of the main components for a successful CBT project (Yanes et al., 2019; Asker et al., 2010), namely:

- preparation of CBT
- management and operation of CBT
- benefits and impact of CBT

These components must be adjusted to the specific contexts, but all of these have been found in all three of the best practices studied in this paper. The categorisation of these components provides an analytical framework that highlights a range of

factors, influences and structures used to implement CBT in these communities. Subsequently, the analysis of the three case studies explores the similarities, differences and lessons learned from implementing and maintaining the CBT projects. Preparation of CBT Projects.

Preparation of CBT Projects

Studies on CBT indicate the importance of avoiding top-down approaches and integrating the community into planning approaches (Asker et al., 2010; López-Guzmán et al., 2011; Mtapuri and Giampiccoli, 2019), thus participatory planning is essential for the development of CBT projects. Community participation empowers the residents, and creates a sense of ownership and shared responsibility. Furthermore, the community should be able to define the form of participation according to their capacities, interests, and traditions (Asker et al., 2010).

Collaborative action and consistent communication with public and external stakeholders such as government institutions, Non-Governmental Organisations (NGOs), and educational and non-profit organisations are also important

CBT Analytical Framework	Banteay Chhmar, Cambodia	Agua Blanca, Ecuador	Mae Kampong, Thailand
Community participation	Adequate levels of community participation	Self-organised planning with active participation	High community participation
Type and level of participation	Not defined by community	Defined by community	Defined by community
Collaboration between stakeholders	Collaborative relationships initiated but not maintained	Public stakeholder engagement, no private stakeholders involved	Collaborative relationships fostered
Existing plans and policy	Seeks to support community development	Independent of development plans	Supported by government agencies
Political support	Level of support unclear	Strong political commitment	Strong leadership
Capacity building	Yes, with multiple NGOs	Self-organised	Yes, with NGOs

Table 1: Analysis of the preparation stage for the CBT approach



parts of successful CBT initiatives (Yanes et al., 2010), along with political commitment and government action. A multi-stakeholder approach can facilitate the implementation through knowledge sharing, capacity building and formulation of supportive policy, adjusting projects to existing development plans.

Management and Operation of CBT Projects

As with the preparation of CBT, consistent public participation and continuous capacity building should also be extended to both management and operations.

The importance of extending community participation during the operational stage of the project is imperative to ensure better communication amongst stakeholders, create defined responsibilities for all and facilitate project flexibility. It also prevents corruption and miscommunication, as well as promotes the transferability of knowledge through capacity-building activities initiated by community members.

A strong organisational structure within the community linked to public and external stakeholders could create a management culture of efficiency, effectiveness, and inclusivity.

CBT Analytical Framework	Banteay Chhmar, Cambodia	Agua Blanca, Ecuador	Mae Kampong, Thailand
Community management structure	Yes, but with a top-down approach	Yes	Yes
Community participation	Not involved in management	Consensus-based participatory strategy	High participation
Community Capacity building	Not clear	Continuous mentoring and learning for tour guides	Not clear
Democratic team selection	Democratic elections every 2 years	Committee are trained	Not clear
Communication between stakeholders	Limited due to lack of transparency	Daily to monthly meetings	Meetings and workshops
Capacity building	Yes, with multiple NGOs	Self-organised	Yes, with NGOs
Dissemination of information	Democratic elections every 2 years	Committee are trained	Not clear
Clear roles for community	Not enough dissemination	Yes, clear dissemination	Yes, with some discrepancies
Operation within legal framework	Not defined	Yes	Yes
Adaptable and flexible	Challenges for financial sustainability	Yes, a diverse range of activities to reduce reliance on CBT	Dependent on current leadership
Monitoring and evaluation	Unclear	Continuous monitoring and evaluation process	Effective monitoring and evaluation

Table 2: Analysis of the management and operation stage of the CBT approach

The community’s organisational structure should include clearly defined roles where members use their expertise to advance the project. Establishing a community structure generates cohesion and a unified vision for management and operation, increasing accountability and fostering multi-stakeholder communication.

On the governmental side, a flexible structure could promote collaboration with the community and create an effective communication channel for disseminating information between all stakeholders (Yanes et al., 2010). CBT projects implemented within the current legal frameworks can prevent legal conflicts that could halt them altogether (Asker et al., 2010). The legal framework also provides a basis for monitoring and evaluation, a process required to adjust the projects to the emergent needs, placing growth at the forefront.

Due to the fluctuating nature of tourism, resilience, project adjustment, and flexibility become crucial components for the sustainability of CBT projects. Flexibility in income generation activities in tourism-

oriented areas is essential to survive during pandemics, product shortages or changing community expectations. Managing visitor expectations appropriately with realistic offers that avoid overpromising and under-delivery of goods as well as managing the behaviour of tourists by creating awareness and understanding of beliefs, customs, and other relevant behaviours, generate resilient communities and CBT projects (Asker et al., 2010).

Benefits and Impact of CBT Projects

The benefits of the proper functioning of a CBT project include social cohesion and empowerment of the community (Yanes et al., 2019). These are linked to the economic benefits with an equitable distribution of profits among all community members. Economic benefits are not limited to profit sharing but include employment, further stabilising socio-economic conditions. For the long-term benefit of CBT, it is important that the impact on the environment is minimised. A greater value in conservancy allows communities to thrive even without tourism.

CBT Analytical Framework	Banteay Chhmar, Cambodia	Agua Blanca, Ecuador	Mae Kampong, Thailand
Distribution of profits	Profits distributed amongst tourism committee members	Equitable distribution in the community	Equitable distribution in the community
Sense of ownership	Yes	Yes	Yes
Value in conservancy	Great value	Great value	Great value
Consumption of resources	Not clear	Depends on tourism demand	Not clear
Employment generation	Yes	Yes	Yes

Table 3: Analysis of the benefits and impact stage of the CBT approach

Lessons Learned

The Banteay Chhmar project evidences the need for the community to define their level and type of participation in order to maintain collaboration between stakeholders and have clear roles and responsibilities amongst the stakeholders. The

impact of this gap in the project is a lack of communication and transparency within the community (Pawson et al., 2017). In contrast, with the project in Agua Blanca, there is consistent community participation and strong



communication between residents. This is achieved through daily and monthly meetings, which are also used to plan and collaborate on the project and resolve any internal conflict (Ruiz-Ballesteros, 2011). A closer glance at the Mae Kampong example also indicates the strength of active community participation from the planning to the operation of the CBT project. The project in Mae Kampong also benefited from funding from the Thailand Research Fund (TRF), which enabled local residents to conduct focus groups, and workshops, which were very successful. This created an awareness and understanding of the benefits, costs, and impact of CBT tourism, providing a greater sense of ownership over the project, which subsequently activated meaningful participation within the community in the operational stage of the project. Additionally, the TRF invested in a marketing campaign (television and radio) that helped promote Mae Kampong leading to more visitors to the area (Kontogeorgopoulos et al., 2014). This indicates that regardless of the level and type of community participation, the support of external stakeholders is crucial for the sustainability of CBT projects. The involvement of NGOs and government agencies can help with funding for research, marketing, and training, along with the transferability of the CBT to similar communities.

The initiative from Mae Kampong in Thailand has also benefitted from strong leadership which has been a key facilitator in connecting the community to the management, operation, and benefits of CBT. Strong and flexible leadership was instrumental in bringing the community together to participate in and understand the CBT process. However, this leadership was so influential that it also posed a challenge because respondents in interviews identified that the project may not be robust enough to survive changing leadership due to an overreliance on one particular leader (Kontogeorgopoulos et al., 2014). The sustainability of the project will require similar leadership qualities from future leaders. In Banteay Chhmar, leadership is democratically elected every two years, preventing an over-dependence on a singular leader (Pawson et al., 2017). In Agua Blanca, the management structure is different to the other two case studies in that Agua Blanca consists of more

than one tourism committee, each of which has different responsibilities. These committees are in charge of regulating resource use and creating a rotational schedule that ensures that all tour guides participate and benefit from tourism. This, therefore, requires income-generating activities not related to tourism, which allows residents to sustain themselves throughout the year. A key factor of success is, therefore their inclusive approach to tourism. The benefits of capacity building can also be seen in this community with their mentorship and training programme for tour guides, allowing for continuous knowledge sharing and development. (Ruiz-Ballesteros, 2011).

In terms of profit distribution, a key factor for success in both Banteay Chhmar and Mae Kampong is the existence of a social welfare and community development fund. Portions of the profits from CBT are added to the funds, which are then used to develop infrastructure projects within the community. In Banteay Chhmar, this has boosted morale and pride because residents can see tangible benefits within the community (Pawson et al., 2017).

The Mae Kampong and Agua Blanca Projects only have a few discrepancies in their respective projects with respect to the framework. In contrast, the project in Banteay Chhmar has a few more challenges relating to a lack of trust between the community and the leadership as well as the long-term financial sustainability of the project. Conversely, a higher volume of tourists in the future could pose a challenge for these relatively small communities to meet rising demands that may put pressure on their surrounding environments.

Conclusions

The foundation of a successful CBT project is active community participation, and all three cases do have either complete control of the planning and implementation process by the community or high levels of community participation in the planning and implementation phases. There is no one-size-fits-all definition of CBT projects; each initiative must be planned, designed, executed, and maintained by the community based on their existing financial, natural, and social resources.



Photography by Katharina M. Borgmann, Vietnam

The CBT framework indicates the importance of participation and project ownership in each of the distinct stages, i.e., preparation, management and operation, as well as impact and benefits distribution. The different project components require an integrated approach as these are interrelated. For example, sufficient and community-centred planning allows for the management component to function efficiently. The benefits and impact result from considering both the planning and management thoughtfully and carefully.

The higher the participation and control of the different project stages by the community, the higher the potential for community capacity-building activities and equitable distribution of CBT project profits among the entire community. Additionally, the participation of external stakeholders facilitates the promotion of CBT initiatives outside the villages and can attract other forms of funding for community development projects.

The analysis of the three case studies has cemented the importance of providing the community with a sense of ownership through active participation, equitable distribution of profits and capacity building and development as some of the key elements for successful growth. Each case study has indicated one or more of these elements and provided a deeper understanding of how communities can successfully develop CBT projects. These lessons learned should now also be transferred to the implementation pilot project in the Cu De River Valley.



CHARMS

OCTOBUS – An Innovative IIoT Platform to Support Sustainable Urban Development

Sustainable urban development is a complex matter that demands thoughtful examination and harmonization of numerous internal and external elements in order to foster cities that are both habitable and sustainable.

In order to handle the complexity of the planning and management processes in an efficient manner, the utilization of digital tools and applications is crucial. Digitalization can support the creation of a holistic view, the interaction between relevant stakeholders, citizen engagement and interaction or a sustainable improvement process by continuous monitoring and control. One innovative software application which meets those needs is the OCTOBUS¹ Industrial Internet of Things (IIoT) Platform². OCTOBUS is a Software as a Service (SaaS) IIoT Platform designed and created by integrationWorks Asia Co., Ltd. Thailand³. It collects data from machine computers (programmable logic controller / PLC), connected to an Edge Device (Internet Gateway), as well as data from commercial sensors using various communication techniques (e.g. Sigfox, LoRa (long range), NB-IoT (narrowband IoT)) and transforms and sends it to the OCTOBUS cloud. In the next step the user can easily create customized dynamic dashboards in order to visualize and monitor the environmental or business performance. A rule-based alerting and notification function automatically informs the user if data values out of defined tolerance levels. Via statistical aggregation the user can visualize, evaluate and report historical data on an hourly, daily, weekly, monthly, quarterly or yearly basis.

OCTOBUS is an industry independent IIoT Platform, it can be applied in manufacturing, healthcare, agriculture but also urban development projects. A practical example of the application of the OCTOBUS Platform in an urban development project is CHARMS (Carrying heritage buildings as part of urban regions into a modern and energy-efficient society) Thailand. CHARMS aims to improve the indoor comfort of historic wooden houses in Thailand. It develops an integrated strategy to increase the indoor comfort of historic homes in the city of Chiang Mai. Various stakeholders from the Fraunhofer-Gesellschaft and Chiang Mai University initiated this project in view of the prevailing insufficient air quality in the city and the COVID-19 related increasing importance of the domestic environment as a living and working space⁴. In order to ensure a continuous monitoring of the indoor air quality 15 AirWits PM sensors⁵ (commercial sensor to measure the air quality) have been registered in the OCTOBUS IIoT Platform and installed in historic homes in Chiang Mai.

Ralf Opierzynski



Figure 1: Continuous Emission Monitoring by OCTOBUS in historical Thai wooden Houses.

1 OCTOBUS meaning: “OCTO” – 8 (gathering data from multiple data sources) plus “BUS” – industrial bus system (communication system that transfers data between components or devices within different levels at a manufacturing plant)

2 www.octobus.asia

3 www.integrationworks.co.th

4 www.sustainable-urban-regions.org/project/charms

5 www.connectedinventions.com



SURE F&SR

Transdisciplinary Synthesis Research Challenges and Approaches of Impact-Oriented Urban and Spatial Research

Anika Slawski, Frank Schwartze & Kai Michael Dietrich

Photography by Katharina M. Borgmann, Vietnam

Growth, Change, and Impact

Urbanization is one of the main drivers of change in the 21st century. The global urban population is projected to grow to 6.7 billion people by 2050, meaning that 70 percent of the world's population will then live in cities. At the same time, 96 percent of urban growth is taking place in previously less-developed regions of East, South and Southeast Asia, and Africa. However, cities are not only places of change and challenges, but can also be seen as an opportunity for sustainable and inclusive growth (BMBF 2021b; UN DESA 2018; UN-Habitat 2020: xvi; United Nations 2016: 6–7; United Nations 2019: 44; WBGU 2016a: 6).

In order to contribute to a sustainable urban development, concepts for the sustainable transformation of fast-growing regions are being researched and so does the SURE funding priority. Thereby, the funding priority accompanied by a

networking, transfer, and synthesis project, which acts as transdisciplinary synthesis research (SURE Facilitation & Synthesis Research) and pursues, among other things, the aim of encouraging the scientific classification and synthesis of findings.

The authors are part of the SURE Facilitation & Synthesis Research and in this article, they assess how impacts in the context of sustainable development of urban regions can be observed. The impact to be captured is embedded in the context of global challenges, transdisciplinary urban and spatial research, and addressed by a comprehensive funding priority that includes ten projects and numerous interventions and actors. To achieve continuous learning processes and thus process quality, impact-oriented monitoring is proposed. As a part of the synthesis research, the task of the SURE Facilitation & Synthesis Research is

to develop a reference and reflection framework (SURE Framework). A key challenge in the development of this framework is the transdisciplinary and intervention-oriented character of the SURE funding priority, which is why the theoretical framework for transdisciplinary urban and spatial research is outlined in the following.

When will we ever Learn? The Logic of Transdisciplinary Urban and Spatial Research

The SURE funding priority and the SURE projects are exemplary for a genuinely actor-oriented and transdisciplinary research approach, in the sense of *Mode 2*. Whereas *Mode 2* research is transdisciplinary, *Mode 1* research generates knowledge based on basic research within its disciplinary boundaries and in the protected space of the respective institution as well as without compelling practical application. *Mode 2* research, however, generates knowledge in a broad context. This knowledge is gained with the approach of becoming useable in economy, politics, and society. *Mode 2* research is thus application-oriented in being the result of the interplay between the need for a solution and the supply of knowledge and produces over the specific demand as well as the disciplinary boundaries socially and societally usable knowledge (Gibbons 1994: 4; Langemeyer 2021: 185–186). The SURE funding priority pursues these same approaches by gaining knowledge in multidisciplinary research associations that lead to technological, social, and societal innovations that can be implemented and, at best, scaled up. The research approach also emphasizes the importance of actor orientation. For this reason, not only researchers from different (scientific) disciplines, but also additional practitioners work jointly in the research process, either as a member of the project team or as external stakeholders. This represents an essential characteristic in the differentiation from transdisciplinary to interdisciplinary research (see Figure 1) (Defila and De Giulio 2018a: 10–11).

In specific terms, this approach is expressed in the transformative concept of labs (Reallabor), in which transdisciplinary research is expanded to the extent

that the goal is no longer only to gain knowledge, but also to develop practical impulses and contributions for sustainable development during research (Parodi and Steglich 2018: 258). Within the framework of the normative approach of the SURE funding priority, as in *Mode 1* research, the question of objectifying the findings and their impact is of highest relevance. This question addresses both the research process as well as the outcome, which is not free of purpose and not only knowledge-oriented, but carries the claim of having a transformative effect. Transdisciplinary research is subject to a broader framework of criteria in terms of quality control and requires a process of reflection on the production of knowledge (Gibbons 1994: 4). A justification that by raising awareness on impact, the participation of the actors is already guaranteed by their participation itself is not sufficient here. Rather, questions of power relations (especially in funded research projects) and the handling of different forms of knowledge from the respective scientific disciplines and professional and political practice play a role which need to be clarified, so that new forms of knowledge can be used as expertise – in this case for sustainable urban regions – and not a kaleidoscopic structure of different elements (Langemeyer 2021: 189–190).

In this context, researchers must critically reflect on and make evident their actions, their decisions, and their normative attitudes, since these are

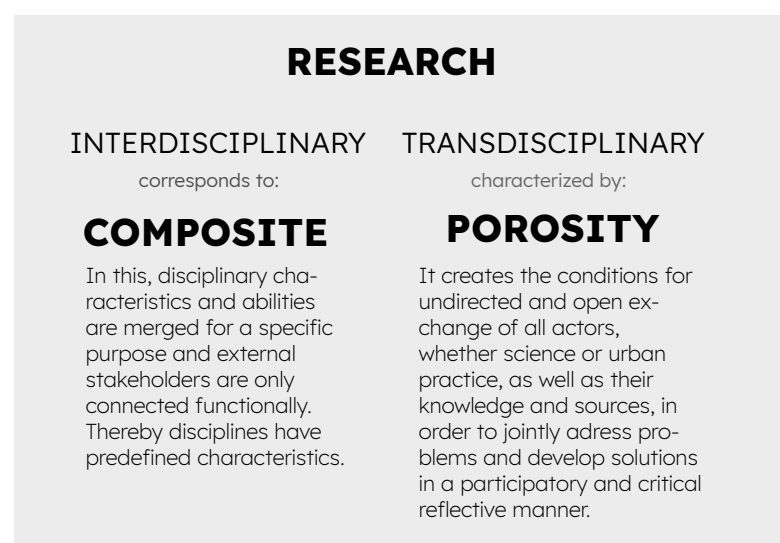


Figure 1: Differentiation from transdisciplinary to interdisciplinary research

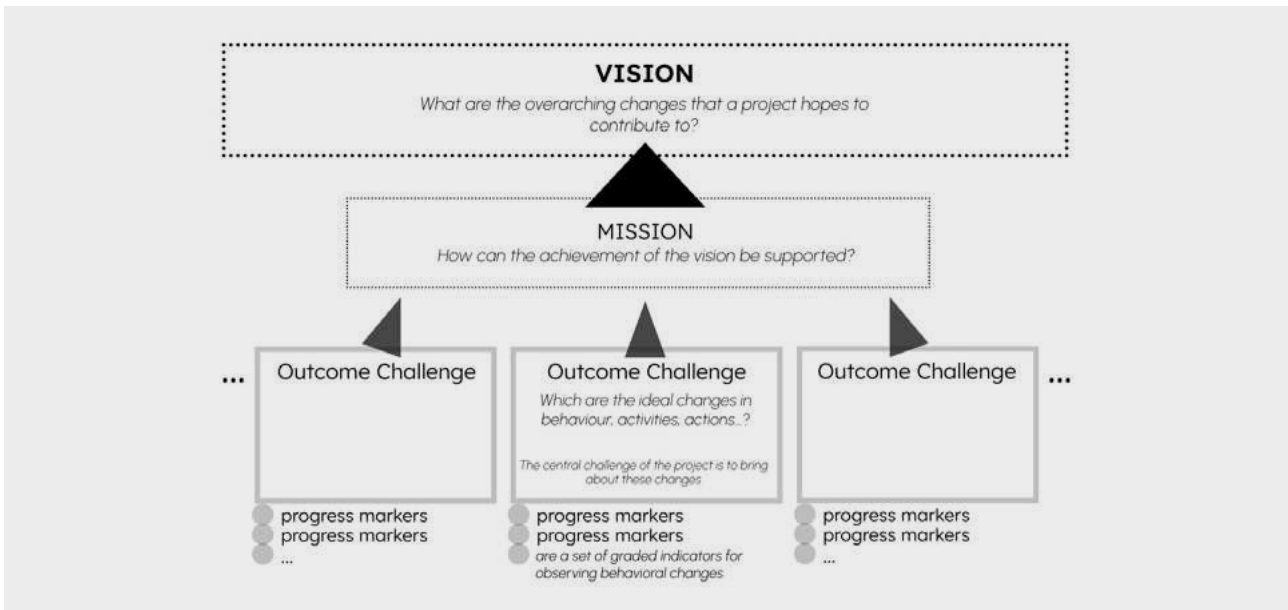


Figure 2: Outcome Mapping

necessarily embedded in, and not separate from, the systems they seek to observe (Fazey et al. 2018: 56–57). In transdisciplinary research contexts, the task of accompanying research lies in providing a framework of reference in order to secure and to verify findings (Eckhart et al. 2018: 118f).

At best, this should allow the actors in this research process, reflection, and feedback loops and generates insights and *learnings about the own action and its impacts*. Unlike in Mode 1 research, the criteria for assessing classical institutional and disciplinary frames of references must be supplemented. Also, *the German Advisory Council on Global Change (WBGU)* calls for guiding transformative research by criteria derived from upcoming challenges. These, too, are to be respectively recorded and named as an input size for a framework of reference, to enable critical reflection on the impact and relevance of the new knowledge in transdisciplinary research contexts.

Complexity and Impact – a Challenging Relationship

In the understanding of science, impacts are all changes that occur after interventions and unfold in change of structures, processes, or individual behavior. Impacts can be differentiated according to parameters like type of impact, the duration of impact or the level of the impact. In addition to expected impacts, i.e., impacts explicitly intended by the definition of the intervention's goal, and direct impacts, for which a clear cause-effect between the

measures and the observed impacts is identifiable, unexpected and indirect impacts also occur (Reade 2008: 3–4; VENRO 2002: 35, 37–39, 51). Determining the impact of a project in a definite way is a complex task that often relies on higher-level and established procedures of evaluation and monitoring. Evaluation is understood as an assessment carried out as systematically and impartially as possible of an activity, project, program, strategy etc. (UN Habitat 2018: 4). In spatial development, an evaluation comprises an evaluative assessment of spatial interventions to draw conclusions for future action (Weith 2018: 624). In distinction to this, an impact-oriented monitoring assumes a continuous function based on collecting and reflecting of data on relevant indicators to show information on actual development of predicted impacts and is performed internally. In the context of spatial development, monitoring implies a cyclical approach in which spatial planning becomes an iterative learning process that allows for reflection, adapts to change, and evolves (Hanusch 2018: 1563–1565; UN Habitat 2018: 4). The application of such an impact-oriented monitoring in urban regions shows theoretical and application-related as well as methodological challenges.

These include the diversified nature of problems, the large number of actors involved, the fullness of different spatial starting conditions, a range of physical and social changes, and a variety of direct and indirect impacts. Furthermore, spatial developments do not take place under laboratory



conditions, which makes it difficult to – also due to long impact periods – record changes and the assignments of intervention effects almost impossible (Einig and Zaspel 2012: 31; Hanusch 2018: 1573; Kühn 2004: 39, 41–42; Weith 2018: 628–629; Weith et al. 2019: 186, 191). The process dimension of spatial interventions also complicates the documentation, analysis, and evaluation of impacts, so that the complexity of the planning process must be reduced for data collection or indicator evaluation. Qualitative changes as, for instance, learning processes, frame setting- and coordinating impacts or corporation activities are rarely recorded (Einig and Zaspel 2012: 31; Hanusch 2018: 1573; Kühn 2004: 41–42; Weith et. al 2019: 191). Moreover, western monitoring standards cannot be applied unquestioningly to cities in the Global South without adapting them to regional and local institutions, geography, and culture (Stiftel 2021: 433).

To capture impacts within complex processes of urban development, it requires a modification and further development of the existing theoretical and methodological instruments (Weith et al. 2019: 191). Particularly against the backdrop of urbanization and the associated spatial change, the following question gains prominence: how could an impact-oriented monitoring in the context of transdisciplinary urban and spatial research for sustainable development of urban regions – especially in the SURE funding priority actually look like? The overarching goal of this impact-oriented monitoring is to show the impact achieved in the planning as well as implementation process and to open up the possibility of intervening at an early stage to lead to process quality. An evaluation in the middle or after the completion of the projects does not seem to be very purposeful, since action-oriented and transdisciplinary research is based on the generation of knowledge through collective learning and that transformative research seeks current solutions with a long-term perspective. To arrive at methodological approaches of impact-oriented monitoring, established models will be looked at in the following part of this article.

Across Theory – of Methods and Models

Although, various methods of the impact monitoring established in medical research, social welfare,

development research, and other fields over the past decades, in the field of urban and spatial planning, only a few examples of models and methods that operate in the context of sustainable urban regions can be found. The impact-oriented monitoring of the SURE Facilitation & Synthesis Research can therefore not fall back on comparable empirical values from the literature, although certainly there are starting points through established theoretical models in the fields mentioned above.

The starting point of an impact-oriented monitoring is often a *logic model* that shows the relationship between a programme's activities and its impact or results (Julian et al. 1995; Kaplan and Garrett 2005; Wyatt et al. 2013; McLaughlin and Jordan 1999, quoted after Chen 2015: 80). A logic model, like the so-called *Log Frame Approach*, comprises an impact chain consisting of *inputs*, *activities*, *outputs*, and *outcomes*. In the planning process of the Log Frame Approach, the intended impact of a project is condensed to a simplified and linear impact model. Criticism of the causality of the Log Frame Approach, in particular, has led to international organizations increasingly having used the *Theory of Change* for the monitoring of impact since the 2010s (UNDG 2016: 3; UN-HABITAT 2018: 9–10). The Theory of Change articulates assumptions about the process by which changes occur and specifies the type and way in which all required short- and medium-term outcomes are brought and documented in relation to achieving the desired long-term changes (Anderson 2005: 12, 35; Clark et al. 2012: 2–3). The Log Frame Approach and the Theory of Change are both based on a cause-effect relationship and, when applied effectively, serve as a basis for high-quality impact-oriented monitoring, through which the (causal) relations of the impact of programmes can be observed (Mayne 2012, quoted after Freer and Lemire 2019: 341).

The question of the specific achieved results in international development cooperation also leads to the use of *Outcome Mapping* (see Figure 2) (Roduner et al. 2008: 3). The Outcome Mapping focuses, as the name already suggests, on the observation of achieved outcomes and concentrates in particular on the relationship



between human behaviour and their environment. Here, the importance of a change of state as the overarching goal of a programme is not belittled but argues that for every change of state a correlating change in human's behavior can be observed (Earl et al. 2001: 1-2).

Since all models include different strengths and weaknesses, users are facing the challenge of using the advantages of several models through so-called hybrid or synthesis models (Bakewell and Garbutt 2005). These include the joint consideration of the Log Frame Approach and Outcome Mapping (Roduner et al. 2008: 4, 16) and the synthesis of the Log Frame Approach and the Theory of Change (Freer and Lemire 2019). Freer and Lemire thereby notice that the attempt of combining several models often results in the application of two models standing side by side, whose mutual integration is forgotten. Therefore, they propose a handling in which the individual models are not viewed as *authorities* but rather as collaborative and supportive tools that can be used in parallel by programs to explain and implement more comprehensively (Freer and Lemire 2019: 344-345). Only by integrating these two aspects of scientific excellence and societal relevance can research be performed responsibly and thus contribute to sustainable development (Feretti et al. 2016: 6). Following the understanding of Freer and Lemire, the developed SURE Framework, whose methodological approach described in the following part, is based on a synthesis model.

The SURE Framework – Criteria and Culture, References and Reflection

Assessment in the sense of evaluation, executed by external advisors that carry out an independent examination of the impact, is not a task and subject of the SURE synthesis research. In the context of transdisciplinary research, impact-oriented monitoring rather pursues the goal of constantly qualifying the interventions in the sense of action research, becoming aware of changes, analysing their causes, and initiating internal as well as ongoing reflection and learning processes, in order to strengthen intended impacts and be able to react to unexpected impacts on short notice. Accountability to donors plays a subordinate role in

this context (Döring and Bortz 2016: 979; UN Habitat 2018: 4; VENRO 2010: 5-6; VENRO 2002: 34, 40-45, 50-55). It is the goal of the SURE synthesis research to make both the impact of the individual SURE projects and of the funding priority visible. The SURE Framework therefore supports the individual projects in monitoring, identifying and optimizing their self-set impact goals and enables reflection on the impact process. At the same time, the SURE Framework creates the preconditions for highlighting the holistic impact of the SURE funding priority, i.e. the long-term outcome of new concepts and solutions for the development of sustainable regions in Southeast Asia and China.

The architecture of the SURE Framework (see Figure 3) therefore includes both the project level and the level of the funding priority. Since the impact of the funding priority results from the effective approaches of the SURE projects, the two levels are linked inseparably. The SURE projects work visibly through activities and outputs on the six focus topics that contribute to the achieving of the long-term outcome (sustainable urban regions) of the funding priority. The SURE projects, for their part, aim to have an impact by developing concepts and solutions within the framework of the focus topics and the respective spatial contexts. These local-specific outcomes on the level of the focus topics can be considered as medium-term impacts and preconditions, whereby each SURE project defines the outcomes to be achieved by itself. The outputs of the SURE projects contribute non-linearly and not only to a single outcome but may unfold their impacts in retrospect or become relevant again at a later stage.

The impact of the individual focus topics increases over the course of the funding period and will be strengthened by exchange and cooperation between the SURE projects and by content synergies. If a project-specific concept becomes applicable beyond the project through synthesis measures and can thus be scaled up, there is an impact of the SURE funding priority, which goes beyond the spatial focus of the individual SURE projects. The impact-oriented monitoring is part of the SURE Framework and is done on an ongoing basis for the six focus topics.

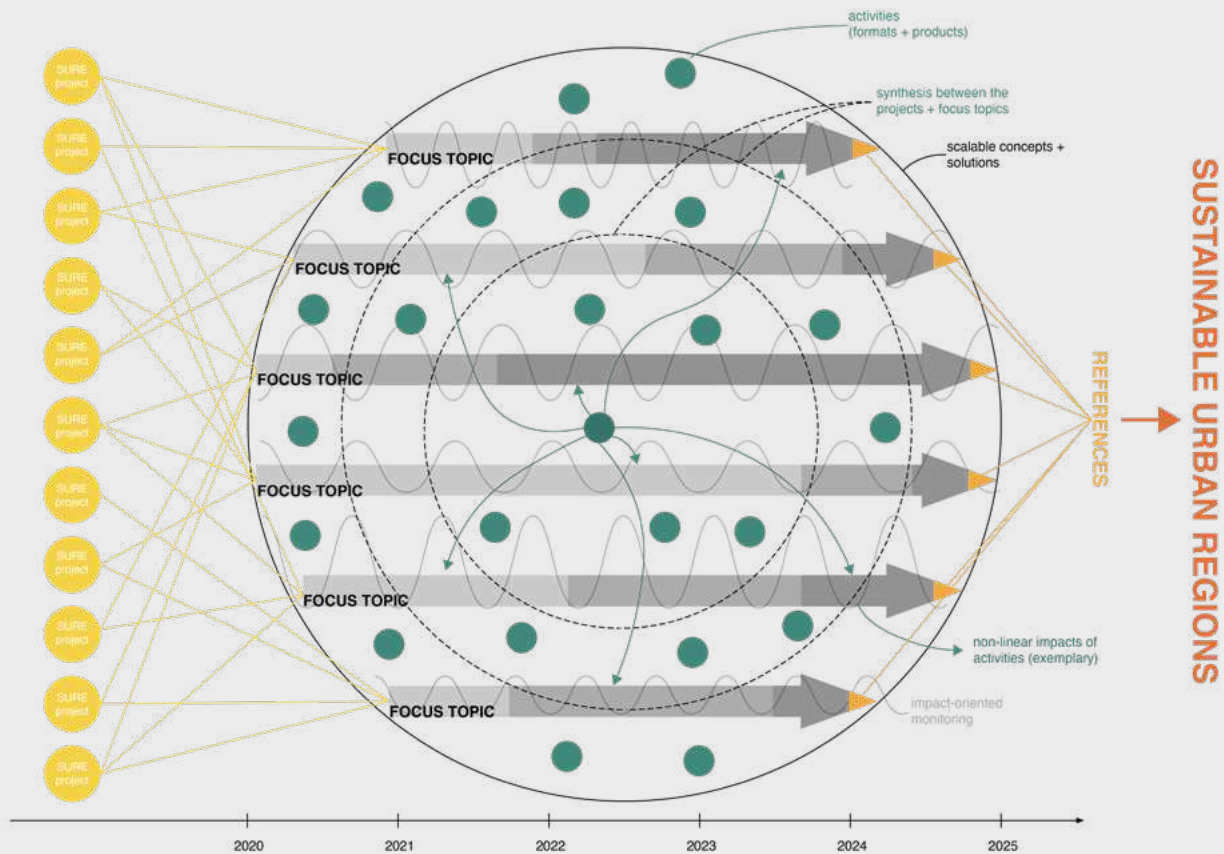


Figure 3: The Architecture of the SURE Framework

This monitoring requires both criteria (references) and a culture (reflection): In the next step of the development of the SURE Framework, the actual references of all SURE projects and thus the references for the six focus topics of the entire SURE funding priority will be highlighted.

Once all references have been highlighted, the ability to reflect and the associated culture of reflecting on one's own actions, to intervene and possibly change the approach arises. Only through such a culture, a dynamic framework can be created that ensures feedback, learning and renewal processes and thus the best possible achievement of the references. The impact-oriented monitoring includes for the purpose of this reflection a portfolio of tools and methods to allow dynamism, flexibility, and adaption to the various thematic and local contexts of each SURE projects. Since each of the SURE projects has different necessities, a variety of different tools of reflection are provided. The toolbox makes use of established methodological approaches of the Log Frame Approach, the Theory of Change, and the Outcome Mapping.

The SURE Framework is currently in a development process whereby its architecture will be *filled with life* in the next step. After the references have been

highlighted, the tools will be used to develop an individual methodology for the culture of reflection and thus the project-specific reference and reflection framework.

The urban challenges presented at the beginning of this article, the theoretical framework on transdisciplinarity, and the models outlined make it clear that there is no blueprint for an impact-oriented monitoring in the context of urban and spatial research for the sustainable development of urban regions.

The approach of the SURE synthesis research to emphasize effective interventions and methods is a processual one, in which references are sharpened, progress is continuously reflected and for this purpose, needs-adapted tools are provided. However, although the complexity of the framework makes a uniform solution difficult, urban, and spatial research must set out and prove that their interventions and strategies work, make them transferable and, above all, bring them into practical applications.





URA

Evolving Socio-Spatial Typologies for Dwelling in Huangyan's Industrialising Hinterland

Ava Lynam

Photography by Katharina M. Borgmann in Taizhou, China

By studying formerly rural villages surrounding the Smart Moulding Town in Huangyan in the process of fragmented transition toward industrialization, the paper presents a selected catalogue of hybrid and dynamic practices, characteristics, and spatial typologies for dwelling uncovered at Huangyan's industrializing urban-rural interface. An empirical socio-spatial methodology was employed in Huangyan's hinterland to gain an understanding into the influence of the Smart Moulding Town on the everyday life of villagers living in its vicinity. The empirical research reveals a particular discord between the social and mental dimensions of spatial production in Huangyan's urban-rural interface, provoking that materialization of emerging dwelling typologies that do not necessarily align with the top-down visions epitomized by the Smart Moulding Town. Instead, these typologies integrate pre-industrial and industrial social structures, pre-urban and post-modern spatial features, and hybrid urban-rural cultural representation of dwelling space.

通过对黄岩智能模具小镇周边的农村进行研究, 本文展示了在黄岩工业化城乡接合部所发现的混合和动态的居住实践、

特征和空间类型。在黄岩腹地采用了实证社会空间方法, 以了解智能造型小镇对其周边村民日常生活的影响。实证研究揭示了黄岩城乡接合部空间生产的社会维度和精神维度之间的不和谐, 引发了新兴居住类型的产生, 而这些类型并不一定与智能造型小镇自上而下的愿景相一致。相反, 这些类型融合了前工业和工业社会结构、前城市和后现代空间特征, 以及居住空间的城乡混合文化表征。

The Practice of Dwelling

Globally, and particularly in China, the scale and pace of urban expansion is resulting in uneven and polarising socio-spatial development, with its impact most exaggerated at urban-rural interfaces (Brenner and Schmid, 2014; Soja, 2011; Wu et al., 2013). Interpreting these vast agglomerating regions requires an insight into the everyday struggles and inventive practices of inhabitants, or dwellers, who continuously adapt to and shape processes of extended urbanisation at regional and global scales (Brenner, 2000; Ruddick et al., 2017, p. 2). Since the 1960s, sociologists and philosophers such as Henri Lefebvre (1991, 2003) and Michel de Certeau (1984) have employed the lens of Marxist theory to conceptualise the production of space in terms of mundane and repetitive everyday practices, shifting our understanding of urbanisation toward a process



made up of socially produced space. This notion remains ever more critical today in revealing how the impact of these everyday practices is materialised and scaled up to inform the socio-spatial development of constantly expanding regions.

One type of everyday space relates to the activity of homemaking, i.e. dwelling (Lefebvre, 1991). Produced by heterogeneous social processes that give it meaning, the materiality of dwelling space reveals wider socio-cultural dynamics and locates them in a particular context (Bertuzzo, 2008, p.6), while also embodying the identity and emotional state of those who use it (Heidegger, 1971). Thus, to facilitate an understanding of the local impact of extended urbanisation, this article presents a selected catalogue of hybrid and dynamic practices, characteristics, and spatial typologies for dwelling uncovered at Huangyan's industrialising urban-rural interface.

Huangyan's Fragmented Transition toward Industrialisation

Within the mega-urban Yangtze River Delta corridor, the Smart Moulding Town (SMT) in Huangyan-Taizhou's hinterland is leading the local moulding industry's regional industrial upgrading process (Zhejiang Provincial Urban-Rural Planning Academy, 2015, p. 9). The development is a manifestation of the Characteristic Town (CT) policy, a national rural

urbanisation programme aiming to address food security, rural economic development, and urban-rural polarisation through a 'one town, one characteristic industry' model (Liao & Yi, 2018, p.17; Wenfang, 2018, p.449). Often, however, these developments only minimally or superficially address local challenges, instead imposing tabularasa developments that simply extend urbanisation into rural areas (Miao & Phelps, 2019, p.50).

This is the case at Huangyan's urban-rural interface, where formerly rural villages surrounding the SMT are undergoing a fragmented transition toward industrialisation, enabled by top-down farmland acquisition to provide profitable development sites. Entire villages are dependent on the renting of land to factories as lucrative income for village

collectives, while many ex-farmers are undergoing drastic increases in wealth and/or living conditions. However, this concentration and over-reliance puts the local area at risk of industrial decline, leaving unskilled villagers and landless farmers particularly vulnerable. Despite the physical flexibility and dynamism of use of everyday space in China, in which residential space often serves a dual productive purpose, the majority of the new top-down housing developments instead implement functionalist architecture with compartmentalised uses (Woodman, 2011, p. 126).

Emerging Socio-Spatial Typologies at the Urban-Rural Interface

To gain an understanding into the influence of the SMT on the everyday life of villagers living in its vicinity, an empirical socio-spatial methodology was employed by the author in Huangyan's hinterland. Moving beyond the notion of dwelling as an end-product or noun (habitat), towards a process or verb (to inhabit), Lefebvre's framework for spatial production was conceptualised through three interacting dimensions: social (dwelling practices and local rituals); physical (their material reality); and mental (the principle that governs dwelling practices; the way individuals perceive the constraints of their social world) (Kofman & Lebas, 1996, p. 17; Stanek, 2011). Focusing on the role of everyday practices within urbanisation processes, it remains an apt critical prism for revealing the complex transitional and informal conditions that characterise the Chinese urban-rural interface. As a methodology, it allows the potential for the relocation of theory production to diverse global contexts (Roy, 2011). Operationalising this framework as a methodology in the field generated several overarching themes – productive dwelling, evolving urban-rural identity, villagers as pioneers – which enabled the definition of emerging typologies for dwelling at Huangyan's urban-rural interface.

Productive Dwelling

Even within the regulated environments of functionalist new rural housing developments, dwelling remains intertwined with productive practices as industrial activity creeps into housing. The extra space offered by new developments is highly valued, for its potential for new income

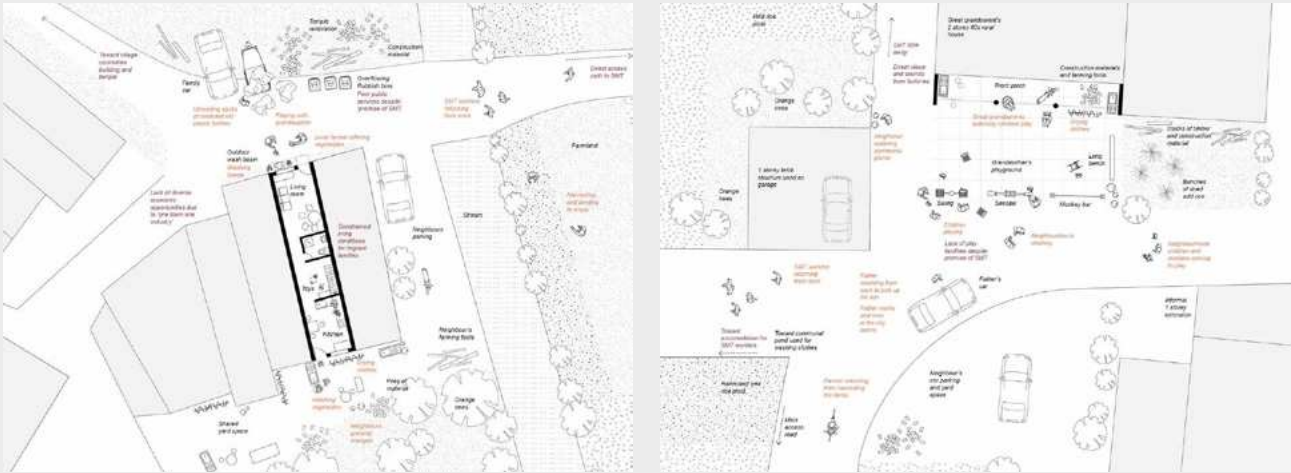


Figure 1 (left): Evolving urban-rural identity: Socio-spatial analysis of ‘the migrant family’s new rural house’ in Xingtou Village, a single storey old rural rental house lived in by an elderly migrant couple who look after their granddaughter and are involved in informal waste collection. Figure 2 (right): Villagers as pioneers: Socio-spatial analysis of ‘the grandmother’s playground’ in Xingtou Village, a playground built by a grandmother on the street space in front of her elderly parents’ old rural house and used by the whole neighbourhood.

opportunities such as household workshops. In some cases, work space is integrated into living rooms and garages, while in others, entire structures designed as private dwellings are repurposed for productive use. The SMT is often considered indirectly positive in terms of the productive potential of household industries, with opportunistic villagers capitalising on their relocation into more spacious developments. While the rapid shift from agricultural to non-agricultural income sources has a profound impact on villagers’ everyday practices, the long-term environmental impact of integrating industry into the everyday environment is largely overlooked by residents and policymakers alike. Workers endure harsh working conditions demanded by the moulding industry; their everyday lives entirely revolve around long working hours and 24 hour shifts, lacking time for family and leisure activities. Furthermore, the increase of migrant workers due to employment opportunities offered by the construction and operation of the SMT is changing the physical landscape of the surrounding villages. An informal rental market has emerged in response to the manifold constraints faced by these migrants (restrictions of the hukou system, low paid work, lack of affordable housing), generating new dwelling typologies and living arrangements, such as extensions to existing housing, temporary container structures on driveways, or informal subdivisions of new rural housing. By introducing their own forms of spatial appropriation, migrants add to the hybrid everyday dwelling practices in the villages.

Evolving Urban-Rural Identity

The rapid pace of industrialisation is resulting in

dramatic lifestyle changes in which perceptions of urban and rural areas differ vastly between villagers of different age groups. While older generations tend to remain attached to traditional rural practices centred around agricultural production, younger villagers more often embrace busy urban lifestyles and struggle to relate to the nostalgia of their older family members or neighbours. Nevertheless, spaces which suggest a persistence of an engrained rural identity remain prevalent, in even the most urbanised villages. While the majority of villages have lost most of their agricultural production, many retain their practice of vegetable growing for household consumption. However, new rural housing developments typically disregard the morphology of existing village and dwelling layouts, failing to provide space which caters for the everyday activities of rural lifestyles. Despite this, the habitual farming practices of older villagers persist in any available space around housing, industrial workshops, and vacant land. Farmland is re-appropriated at a micro-scale, where spaces designed for urban lifestyles, such as parking spaces and driveways, are used for drying rice, vegetable gardens, and keeping chickens. Despite CT rhetoric of promoting local culture, a loss of building heritage is common, with traditional housing structures, many with ornate decorative features, left in a dilapidated condition without inclusion in development plans. Often repurposed as storage, workshop, kitchen, or rental space, these old structures are generally disregarded. This forgotten rural landscape also includes water ponds which were once integral to village daily life, used for drinking water and washing vegetables, the majority of which are now contaminated with household and industrial waste.



Villagers as Pioneers

Many cases of innovative socio-spatial appropriation can be identified in the villages, often driven by an entrepreneurial mindset. In some cases, creative adaptive reuse of space is perceived as a unique marketing device for a family business, such as the creative craftsmanship of a private dwelling of a local carpenter, and the elaborately designed workshop of a door manufacturer. Others embrace practices that emerge from industrialisation, such as the informal recycling practices identified as an economic incentive in some villages. These entrepreneurial villagers often have an adaptive attitude to transformations in the area and do not remain attached to farming practices. In other cases, villagers take on the role of providing neglected public services, using their own resources to repurpose space toward a social function that can foster networks between neighbours. Particularly within new rural housing developments, it is common for garages to be used as public living rooms and neighbourhood mahjong halls. Simple facilities are often sufficient for the creation of collective dwelling spaces, such as communal vegetable gardens or a temporary tent structure erected on the street for a neighbourhood birthday party. Some institutionalised spaces are appropriated by villagers to serve their own social needs; many village senior centres function beyond their intended purpose, becoming key public spaces for all types of residents. The social capital built by these spaces is critical in allowing for effective informal negotiations, with residents from the new and old village areas negotiating the use of space at different times of the day.

Negotiating Multi-Scalar and Hybrid Transformations

These emerging socio-spatial typologies offer snapshots of the various stages of the transformation of this productive hinterland, illustrating the pivotal role of the micro-scale tactics of villagers in influencing top-down processes of extended urbanisation. At a regional and global scale, moulding industry investment is transforming villages, with their land critical in providing for industrial uses. Villagers are embedded, formally and informally, in trans-local moulding production lines which generate employment and attract

regional labour. At a city and neighbourhood scale, villagers create an informal local economy through their productive households and bottom-up provision of local amenities. At a family and individual scale, micro-scale survival tactics and evolving urban-rural practices play a crucial role in placemaking and facilitating social capital. Thus, regional industrialisation processes are not only transforming physical space, but also extending into the everyday lives of many people in the area surrounding the SMT: residential space with a dual productive purpose, a family member employed at a local moulding enterprise, a means of informal income in the production line, or the loss of farmland to the construction of a new factory. Furthermore, the empirical research reveals a particular discord between the social and mental dimensions of spatial production at Huangyan's urban-rural interface, provoking the materialisation of emerging dwelling typologies that do not necessarily align with the top-down visions epitomised by the SMT. Instead, these typologies integrate pre-industrial and industrial social structures, pre-urban and post-modern spatial features, and hybrid urban-rural cultural representations of dwelling space.

Despite vulnerable conditions and unequal agencies, these socio-spatial experimentations are redefining rural identity and defying the top-down compartmentalisation of space, through a negotiated urbanism (AlSayyad & Roy, 2004) between various scales and actors who carve out their own needs, identities, and practices (Fokdal & Herrle, 2019, p. 90). Uncovering these networks highlights the potential for local actors to take a leading role in more sustainable urban-rural development. In revealing the sometimes contradictory transformation dynamics playing out on the ground, these hybrid urban-rural typologies become a potential tool for challenging increasingly redundant urban-rural binaries, offering a foundation for defining new theoretical categories to capture the complex socio-spatial restructuring of planetary urbanisation.

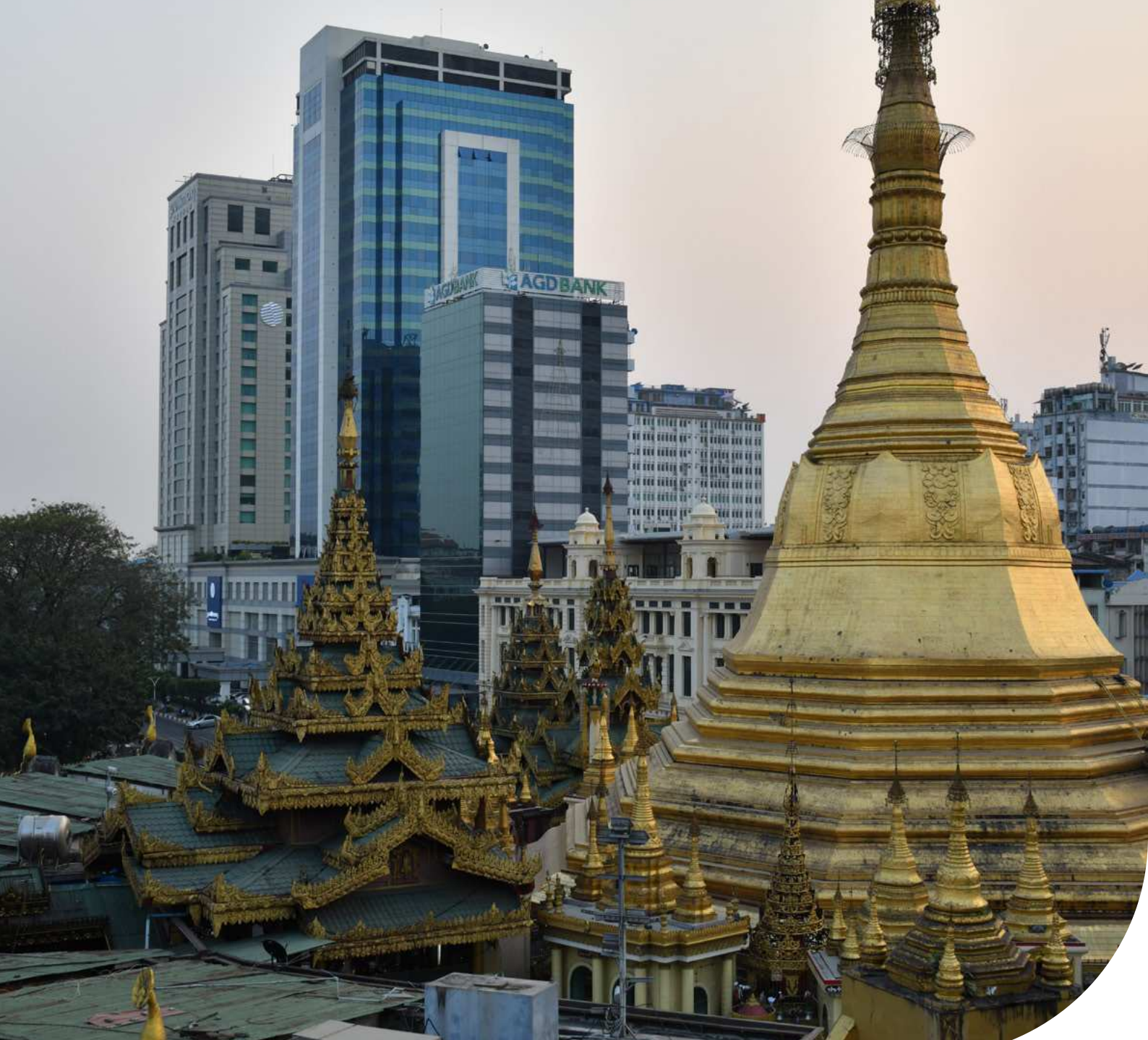


MYrisk

Disaster Risk Reduction in Yangon – Where are we now?

First Research Results of the Project 'Multiple Risk Management of Extreme Events in fast-growing (Mega)Cities in Myanmar'

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The joint research project 'Multiple Risk Management of Extreme Events in fast growing (Mega)cities in Myanmar' (MYrisk, formerly RiskUrbMyanmar) works towards establishing a holistic disaster risk management in Yangon and further cities in Myanmar and to improve preparedness and response strategies. The project is funded by the German Ministry of Education and Research (BMBF). During the 2017–2018 preparation phase, the key research and implementation questions, the research design and the procedures of the German Myanmar project consortium were discussed and established. The research in the following definition phase, Phase I (2019–2021), focused on forming and specifying the research topics and created a base for the current Phase II (2021–2025). Qualitative and quantitative data have been collected in the city of Yangon, and analysed and published in four scientific papers. The findings indicate a general need for improving institutional disaster risk reduction (DRR) and preparedness of institutions and households. This paper provides an overview on research focus, methods, progress, and published key findings of the MYrisk project.

ဂျပန်-မြန်မာ ပူးပေါင်းဆောင်ရွက်သော သုတေသနစီမံကိန်းဖြစ်သည့် “မြန်မာနိုင်ငံရှိ အလျင်အမြန် တိုးတက်နေသော မြို့ကြီးများတွင် သဘာဝဘေးအန္တရာယ်ကျရောက်မှုအား ဘက်ပေါင်းစုံမှ စီမံခန့်ခွဲခြင်း” ၏ ရည်ရွယ်ချက်မှာ ရန်ကုန်မြို့တွင် သဘာဝဘေးအန္တရာယ် စီမံခန့်ခွဲမှုများအား ဆောင်ရွက်ခြင်းနှင့် အခြားမြို့ကြီး များတွင်လည်း ကြိုတင်ပြင်ဆင်မှုနှင့် တုံ့ပြန်မှုအတွက် နည်းဗျူဟာများကို တိုးတက်ကောင်းမွန်စေရန် ဖြစ်သည်။ အဆိုပါ စီမံကိန်းကို ဂျပန်ပညာရေးနှင့် သုတေသန ဝန်ကြီးဌာန (ဘီအမ်ဘီအက်မ်)က ရန်ပုံငွေ ထောက်ပံ့ပေး ခဲ့ပါသည်။ ၂၀၁၇-၂၀၁၈ ခုနှစ် ကြိုတင်ပြင်ဆင်မှုကာလအတွင်း သုတေသန လက်တွေ့ အကောင်အထည်ဖော် ဆောင်ရွက်ရေးတို့နှင့် ပတ်သက်သော မေးခွန်းများ၊ ဂျပန်-မြန်မာ စီမံကိန်းအဖွဲ့ ၏ သုတေသနလုပ်ငန်းစဉ်များနှင့် လုပ်ထုံးလုပ်နည်းများကို ဆွေးနွေးဖော်ဆောင်ခဲ့ပါသည်။ စီမံကိန်း၏ ပထမအဆင့်အဖြစ် ၂၀၁၉-၂၀၂၁ ခုနှစ်တွင် သုတေသန အကြောင်းအရာများကို အဓိကထား၍ လုပ်ဆောင်ပြီး ဒုတိယစီမံကိန်းကာလဖြစ်သော ၂၀၂၁-၂၀၂၅ ခုနှစ်အတွက် စီမံကိန်းလုပ်ငန်းဆောင်တာများကို ကြိုတင်လျာထားခဲ့သည်။ ရန်ကုန်မြို့တွင် သဘာဝ ဘေးအန္တရာယ်နှင့်ပတ်သက်သည့် အချက်အလက်များကို Qualitative နှင့် Quantitative နည်းလမ်းဖြင့် စစ်တမ်းကောက်ယူပြီး လေ့လာဆန်းစစ်၍ သုတေသနစာတမ်း (၄) စောင် ရေးသားပြုစုခဲ့ပြီး ဖြစ်ပါသည်။ စီမံကိန်း၏ပထမပိုင်းတွင် သုတေသနလုပ်ငန်းစဉ်များကိုရန်ကုန်မြို့တွင်ပြုလုပ်ခဲ့ပါသည်။ သုတေသနတွေ့ရှိချက်များက သဘာဝဘေးအန္တရာယ်လျှော့ချရေးအဖွဲ့အစည်းများနှင့် အိမ်ထောင်စုများအတွက် ကြိုတင်ကာကွယ်ရေး

လုပ်ငန်းစဉ်များကို လုပ်ဆောင်ရာတွင် အထောက်အကူပြုနိုင်ရန် ရည်ရွယ်ပါသည်။ ဤစာတမ်းတွင် စီမံကိန်း၏ သုတေသနမေးခွန်းများ၊ သုတေသနအထူးပြုလေ့လာမှုများ၊ နည်းလမ်းများ၊ လုပ်ငန်းစဉ်တိုးတက်မှုများနှင့် အဓိကတွေ့ရှိချက်များကို ခြုံငုံသုံးသပ်၍ တင်ပြထားပါသည်။

Introduction and State of the Art

A holistic disaster risk reduction (DRR) scheme is a key pillar to effective disaster risk management (DRM). DRR is defined by the United Nations Office for Disaster Risk Reduction (UNDRR) as a concept and practice of reducing disaster risks through systematic efforts to analyse and manage the causal factors of disasters (UNISDR, 2009). DRM includes response, recovery, preparedness, mitigation, and prevention of multiple risks and hazards (UNDRR 2015).

DRM is defined as the systematic process of using administrative directives and organizations to implement strategies and improved coping capacities in order to reduce the possibility of disasters (UNISDR, 2009). An ideal DRM addresses and includes various societal levels, from administrative and government levels to the individual and household level. The goal of a holistic DRR is to improve each of the four main phases within the DRM cycle: a) response – saving lives and minimizing the impact, b) recovery – restoring daily life activities and services, c) prevention – improving the infrastructure to minimize impacts of future disasters, and d) preparedness – establishing DRR strategies to minimize impacts of future disasters (Le Cozannet et al., 2020). However, DRR is only as good as its weakest part and can be limited by, e.g., (technical) resources or insufficient governance. Therefore, the most crucial step in DRR research is to identify such weak points and find solutions that maximize the DRR quickly, easily, and cost-efficiently (UNDRR 2015). Consequently, it is also important to understand the livelihoods of the people affected. Since effective responses to disasters cannot rest solely on technical solutions, the people living in hazardous areas are usually prepared for disasters and develop risk- and disaster-conscious habits (Shaw et al., 2009). In modern history, major disasters have often been the kick-off points for starting and extending a nationwide DRM to prevent current and future



generations from the consequences of similar disasters (Coppola, 2011). With changes in the natural and human environments, such as climate change, rapid urbanization, and land use change (Vogel et al., 2022), sustainable and future-oriented DRR strategies need to be improved and standardised regularly within a national DRM under consideration of a population's living conditions. The Hyōgo (2005) and Sendai Frameworks (2015) provide valuable reference points for politicians and stakeholders, providing possible intervention measures to improve the institutional and individual DRR, such as encouraging institutional cooperation (UNDRR 2015).

In Myanmar, Cyclone Nargis (2008) was a starting point for a national DRM and for establishing institutional DRR. Nargis was one of the most fatal cyclones in Southeast Asia, causing about 138,400 fatalities in the Ayeyarwady and Yangon Regions (Kraas 2009, Kraas et al., 2017; Vogel et al., 2022). In the same year, the Myanmar government introduced the Myanmar Action Plan for Disaster Risk Reduction (updated in 2017) (NDMC 2017). In line with the Action Plan, further regulations were introduced, such as the National Disaster Management Law (2013), Disaster Management Rules (2015), and the Myanmar Building Code (2012) (Ministry of Social Welfare, Relief and Resettlement 2015; President of the Republic of the Union of Myanmar 2013). Rescuing technologies were provided to the country, but as in many other countries, the bottleneck of measures was the lack of societal knowledge and experience to adequately respond in an emergency (Fernandez et al., 2018). The DRM on the national level in Myanmar is governed by the National Disaster Management Committee (NDMC). At more local levels, disaster risk reducing activities are overseen by Disaster Management Committees (DMC), which operate as executive boards, including the Township Disaster Risk Management Committees (TDMC) at lowest administrative levels (Zin Mar Than et al. 2020). Recent research has shown that implementing and monitoring DRR at township level and beneath is one of the weak points within the administrative DRM in Myanmar (Zin Mar Than et al. 2020), although the response at lowest administrative levels is known to be the most

important in saving lives and preventing further damages (UNDRR 2015). To improve DRR at township level, a local administration needs to become familiar with the environments of its specific administrative areas, e.g., the settlement and societal structures of its townships. Additionally, those responsible, even at lowest administrative levels, must be able to anticipate risks and disasters (Ishiwatari, 2013; Malalgoda et al. 2010). Not only are Myanmar's (mega)cities not yet prepared enough for future natural hazards, moreover rapid urbanisation is aggravating the risks of those hazards (Vogel et al., 2022). Additionally, increasing demand for houses and rising land prices make it difficult to preserve sufficient existing retention and evacuation areas.

The four-stage research project "Multiple risks management of extreme events in fast growing (mega)cities in Myanmar" (MYrisk) is part of the German framework of the promotion of sustainable development (FONA) and one of ten funded research projects of the 'Sustainable Development of Urban Regions' funding line of the German Federal Ministry for Education and Research (BMBF). The aim of MYrisk is to help reduce negative socio-economic consequences of natural hazards in urban regions of Myanmar. The international and transdisciplinary research and development project addresses DRR of multiple risks in Yangon and further cities in Myanmar. Leading scientific concepts for safeguarding a basic infrastructure are currently being developed and implemented onsite. During the preparation phase in 2017-2018, the key research questions, the research design, and the procedures of the project consortium were established. The following definition phase, Phase I (2019-2021), specified the research topics for the subsequent and current R&D Phase II (2021-2025). The project's research design is a mixed-method approach with a focus on quantitative and qualitative data collection and analysis. The project consortium consists of the University of Cologne (UoC), Yangon City Development Committee (YCDC) as leading German and Myanmar partners, Cologne Fire Department, Institute for Security Science and Rescue Technology (ISR), City of Cologne, Department of Urban and Housing Development, Ministry of Construction Myanmar,



Figure 1: MYrisk helps improve the DRM in Myanmar by analysing DRR (green) while considering different societal levels (yellow) and highly probable risks and natural hazards (blue) (with examples for each field)

Flood Protection Centre of Cologne, Myanmar Environment Institute (MEI), German Committee for Disaster Reduction (DKKV), and the University of Yangon (UY) as a leading scientific institution. Further, associated partners are Nay Pyi Taw City Development Committee, Mandalay City Development Committee, Yangon Region Government, Shan State Government, Mon State Government, the Centre of Excellence for Urban and Regional Development, University of Yangon, Remagen Pastoral Emergency Care, Hotel Resilient Certifications, the universities of Mandalay, Mawlamyine and Taunggyi.

Reaching the project goals requires collaboration with relevant stakeholders at different societal levels, such as government and administration, institutions and private sector, and communities and households. The project fosters growing interaction between these levels. The wide local and expert knowledge of all partners, from both Myanmar and Germany, is the key to successful data collection and analysis and to using the findings to develop culturally adapted concepts for improving DRR. A core principle of the MYrisk collaboration is the cooperation as equals and in partnership.

Although Myanmar is a highly risk-exposed country, it is not yet as much in the global DRR focus as it

should be. International DRR research was only intensified in 2009, after Cyclone Nargis. Even today, only a few international institutions are conducting research in this area (Meguro & Honma, 2020). MYrisk, with its wide range of experienced and specialised partners and through its empirical research, provides an opportunity for a scientific exchange between DRR stakeholders and for a more collaborative development of DRR strategies that include the civil society.

Due to the high risks of water- and weather-associated hazards in Yangon, the first project publications focused on flood, cyclone, and heavy rainfall hazards. Special attention was given in the initial project phase to disaster preparedness at the household level and at the administrative and institutional levels. MYrisk investigated the current disaster preparedness strategies and DRM in Yangon City and used scientifically approved methods to search for potential improvements to the local conditions. The approach and findings could be transferred to other Southeast Asian cities.

The project helps improve DRM in Myanmar's (mega)cities mainly in the preparation phase while also touching on aspects from the response and prevention phases, considering different societal levels and highly probable risks and natural hazards (see Figure 1).

2. Project Area and Methods

Yangon is located on the Gulf of Mottama in the Andaman Sea, has 5.5 million inhabitants and is the biggest megacity in and an economic hub for Myanmar (Kraas et al., 2017). Due to its geographic location, Yangon is highly exposed to multiple risks, primarily the natural hazards of earthquakes, floods, heavy rainfall, and cyclones. Major fault lines, such as the Sagaing fault, run through the city causing seismic activity and earthquakes.

The tropical cyclone Nargis in 2008 was one of the most fatal cyclones worldwide, affecting the Ayeyarwady Delta region and many cities, including Yangon. Three major rivers, Yangon River, Bago River, and Pazundaung Creek, pervade the city, making townships along them prone to flooding since urbanisation is increasing and the retention areas are decreasing (Heinkel et al. 2021; Kraas et al., 2017). Therefore, a holistic DRR in Yangon would save not only lives but also reduce losses, thus stabilising society and the national economy. Preparedness, adaptation, and mitigation of multiple risks must be improved. Moreover, rapid urbanisation, here as in many other coastal cities in Southeast Asia, contributes significantly to vulnerability to extreme weather events and is becoming a risk factor in case of extreme events (Vogel et al., 2022).

MYrisk combines qualitative and quantitative data sets with GIS and remote-sensing analyses. Quantitative and qualitative data were collected through surveys and expert interviews. From 2019 to 2022, three different stratified household surveys were conducted in 14 of 33 townships in Yangon. In total, 1,519 households were interviewed to investigate their risk awareness and perception and their knowledge about natural hazards. Additionally, the households' disaster preparedness levels were assessed. Additionally, 623 questionnaires were analysed using descriptive and analytical statistics (Heinkel et al., 2022; Khin Khin Soe et al., 2019). Simultaneously, a series of semi-structured interviews (n = 51) with experts from DRR-related administrations and institutions was conducted. The aim was to understand institutional interlinkages, strengths, and weaknesses of institutional disaster preparedness

in Yangon. Furthermore, the institutional disaster risk preparedness and safety for basic and critical infrastructure were assessed. Experts from different administrative levels in Yangon and national disaster risk institutions were interviewed, of which twenty-six were analysed (Zin Mar Than et al. 2020, Heinkel et al. 2021). All data was collected by scientists and members of UoC, YCDC, MEI, UY, StEB Köln, and DKKV.

Furthermore, secondary data, consisting of historical disaster records and census data (2014) was considered in the fieldwork design and later analysed (Republic of the Union of Myanmar 2015). During all project phases, the knowledge data base was continuously extended through an analysis of literature reviews and generation information. Unexpected limitations for the research work occurred with the Covid-19 pandemic in March 2020 and the political changes in Myanmar in February 2021. Covid-19 was included as natural-human hazard in the focus of the research project.

3. Results and Discussion

The household surveys revealed that the residents have limited knowledge about how to appropriately prepare for disasters, for example, by assembling emergency kits or knowing where to find safe shelter. First aid knowledge is also limited. They also revealed that residents who have been previously exposed to natural risks have an elevated level of risk awareness and, for any immediate risk response, highlighted the role of the administration and institutions and of media and communication (Khin Khin Soe et al., 2019). Furthermore, they showed that education level is a crucial factor in preparedness (Khin Khin Soe et al., 2019). The residents in four flood-prone townships had developed various coping strategies such as constant stock-piling of water and food or storing alternative sources of energy. Specific urban life conditions, such as those of male single workers or low-income households, make people more vulnerable to risks since those people have limited capacities to prepare for upcoming disasters. These social groups are highly dependent on local retailers of fresh food and water and other services for their daily supply since they usually do not store food or water at home (Heinkel et al., 2022).



The expert interviews disclosed the complexity of DRM in Yangon City and indicate in detail how the institutions collaborate and communicate with each other. The analysis showed that the institutional collaboration leaves room for improvement since international frameworks such as the Sendai and Hyōgo Frameworks had only recently been implemented at the national DRM level. Besides presently weak intra-institutional collaboration, the analysis indicated that structural improvement in institutional DRR was essential. The willingness for cooperation, also with international experts, was highlighted in the outcomes as well. The centralised administrative structure prevents the lower administration levels from acting at bottom levels when disasters occur, and decision-making takes time, with partly unclear responsibilities. The communication of institutions and authorities with local communities is weak due to frequent personnel transfers and promotion of people in charge. Joint upfront coordination and planning processes can bring institutions and local stakeholders together, which could improve current DRR strategies and help clarify responsibilities (Zin Mar Than et al. 2020).

The expert interviews highlight fields in which the established DRM system could be improved. Institutional preparedness, especially at township levels, shows weaknesses due to the centralised system, which limits the possibilities for actions in the local communities and creates expectations toward upper administration levels and communication (Zin Mar Than et al. 2020). Bringing the different stakeholders and institutions together by creating a DRR network, which is one goal of MYrisk, could improve the development of interactive DRR strategies.

Obstacles to improving urban DRR in Yangon can also be found in the solid waste management and the drainage system: Blocked drainages increase the risk of flooding (Zin Mar Than et al. 2020; Heinkel et al. 2021). Flood adaptations would be more efficient if coordinated better with other risk-reducing strategies, such as reducing blockages in the sewage system and educating local people. Due to the high exposure of Yangon City to multiple risks, all stakeholder levels and main multiple risks must

be addressed. Our research revealed school and extracurricular education for DRR as a key factor in improving preparedness. Bringing DRR to schools, colleges, and universities as a part of primary and secondary education could improve the household disaster preparedness tremendously (Khin Khin Soe et al., 2019). To increase the resilience, of marginalized societal groups, additional community-based DRR educational offers in the sense of lifelong learning classes should also be made available. In the MYrisk project, five special pamphlets, in Myanmar and English language, were developed and disseminated as printed and digital versions to institutions and households in all parts of Yangon. The pamphlets provide information about which natural hazards Yangon might be facing, such as earthquakes, floods, and tropical cyclones, providing recommendations regarding the Covid-19 pandemic, and recommendations in case of an evacuation. These pamphlets can be used as blueprints for other cities in Southeast Asia and have been made available online for further use.

Myanmar started relatively late to establish institutions for a national DRM. Households, however, are experienced in dealing with risks and hazards (such as floods and frequent power-cuts) that have long been part of their daily life (Khin Khin Soe et al., 2019). The culturally high readiness and willingness of the citizens to help others, beyond the family and community level, are seen as a strong potential source in improving disaster preparedness and reactions in Yangon. This willingness could be turned into even more organised volunteering in any phase within the DRM cycle (Asian Disaster Preparedness Center 2016).

The Myanmar Action Plan highlights the need for bringing DRR to all societal levels (NDMC 2017), which is also one aim of MYrisk. In the definition phase of the project, we identified that Yangon's citizens already have a certain level of risk awareness, which is not surprising due to previous experiences with regular floods, earthquakes and cyclones (Khin Khin Soe et al., 2019). Thus emphasis should be placed on supporting the administration, institutions, and different stakeholders and communities in preparing for multiple risks



(Khin Khin Soe et al., 2019). Further, elaborated risk and crisis communication concepts are not yet fully established at institutional levels. The Myanmar Weather Forecast, for instance, currently depends on foreign satellites, and some of the remote sensing data are collected and analysed abroad (Zin Mar Than et al. 2020). Improvements to the DRM have meant that important hazard maps are available online at the Myanmar Information Management Unit (MIMU) and the Myanmar Unified platform for Disaster Risk Application (MUDRA) (Heinkel et al. 2021), showing that efforts in this section have been made despite all obstacles.

All presented research results show the hard work of the people and institutions in Myanmar in developing and improving the DRR activities in Myanmar.

4. Conclusion

The findings complement the already existing research in the DRR field in Myanmar. The fieldwork revealed areas for improvement, such as the lack of communication at institutional level. Valuable potentials are apparent in the local and regional DRM, mainly the willingness to collaborate and to develop the current DRR strategies. They provide a good basis for further research work and a knowledge basis for the scientific community in Myanmar. The surveys and interviews also highlight and explain specific difficulties and gaps in administrative, institutional, and household preparedness. In Yangon, as in other cities, the collaboration between stakeholders and with the civil society provides potential to improve disaster preparedness.

A deeper understanding of the specific needs and limitations of the current DRM could significantly improve a sustainable DRR in Yangon. The Myanmar 'supportive culture' provides remarkable and local potential to enhance a volunteer system in DRR, one that could provide support especially in the response phase, when evacuating people, and in the preparedness phase, e.g., in the provision of knowledge. Multi-stakeholder collaboration, adequate adaption to risks and the implementation of specific, culturally adapted education programmes could contribute greatly to

civil society's resilience. Therefore, to achieve holistic DRR in Yangon and furthers cities in Myanmar – in all its phases and aspects – the relations between the different societal levels should be deepened, while taking multiple risks and hazards into account. Moreover, projecting and adapting MYrisk's results to other regional cities might improve resilience to disasters of urban civil societies in the greater region of Southeast Asia.

Acknowledgement

The research results stem from the joint German Myanmar research project 'Multiple Risk Management of Extreme Events in Fast Growing (Mega)Cities in Myanmar' (MYrisk), which is investigating disaster preparedness and risk communication in the megacity Yangon and further cities in Myanmar. The project is funded under the program 'Research for Sustainability' (FONA), 'Sustainable Urban Regions' (SURE), of the German Federal Ministry of Education and Research (BMBF—01LE1904A1-C1). We thank our core project and associated partners for the fruitful cooperation and mutual trust in the joint research project.





Photography by the SURE Project implement!

ement!

A Connected Partner for the emplement! Project: The “Community Engaged Learning Center (CELC-DAU)”

The “Community Engaged Learning Center” of the Da Nang Architecture University (CELC-DAU) focuses on community-based research towards disadvantaged and vulnerable communities in Da Nang city and the surrounding region. This makes CELC-DAU the perfect partner for the implementation-oriented project “ement! Empowering urban regions for cooperative, synergistic and practical implementation of sustainability and resilience strategies considering the urban-rural nexus”. One of the main focus areas of the project is the Cu De River Valley, located in the northern part of the Da Nang metropolitan region. The main objective there is to promote a sustainable, culturally adapted and ecologically sensitive Community-Based Tourism (CBT) that brings with income security, socio-economic improvements, environmental protection and a resilient infrastructure. Since 2021, CELC-DAU plays the role of a key local academic partner, facilitating the communication and partnership with the communities in order to strengthen local capacities for tourism, agriculture, forestry and the improvement of the built environment.

CELC-DAU was established in September 2018 with the goal of improving the quality of education, helping students connect with the community, developing skills in community engagement, and creating meaningful opportunities to build partnerships between the academia and the community. In its five years of operation, CELC-DAU has encouraged collaboration among five faculties, more than 20 lecturers, 2000 students, and 15 community partners. The collaboration process is based in applying knowledge that fulfils pedagogical objectives with the aim to address the

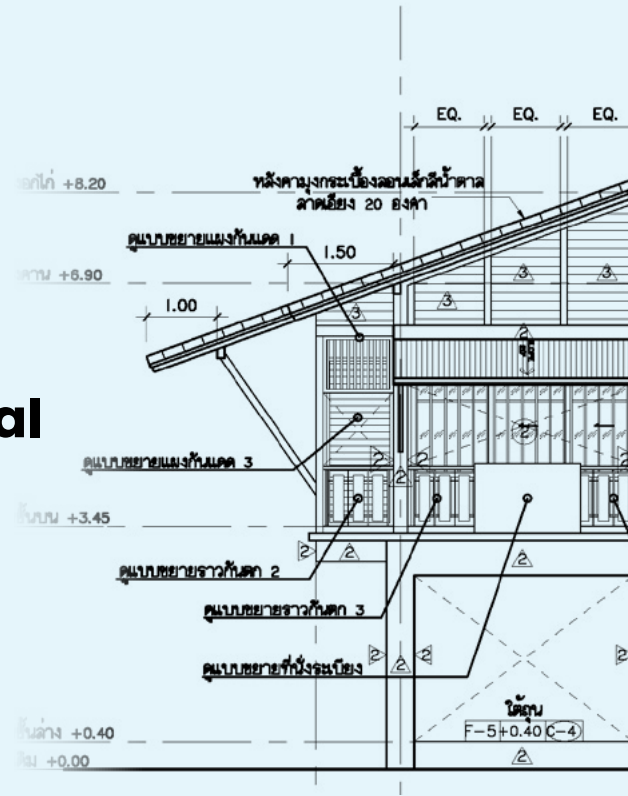
needs of the community via academically based or co-curricular activities. An example of the research projects implemented until now by the center is “Preserving cultural heritages to improve livelihoods in response to rapid urbanization for Da Nang fishing villages” from 2019 to 2021. In partnership with the Asian Coalition for Housing Rights, The Bartlett Development Planning Unit at UCL, and within the context of the “Knowledge in Action for Urban Equality Project (KNOW)”, CELC-DAU has sought to contribute to the increased recognition of traditional fishing communities as a pathway toward urban equality at the city level. The project identified and mapped 16 fishing communities in Da Nang, documenting their cultural, historical, and socio-economic assets, currently under threat from rapid urbanisation. The research collected and preserved local community knowledge for archival and academic purposes creating a general city database. Additionally, the research introduced the concept of Community-Based Tourism (CBT) to Da Nang fishing villages; activities such as networking, capacity building, mapping, and workshops were conducted in the fishing communities to discuss the potentials for CBT and promote the development of fishing communities through the preservation of their culture, knowledge, and socio-cultural-environmental systems. CELC-DAU also shares knowledge and enhances teaching and increased learning opportunities for lecturers and students through national and regional training programs, seminars and workshops related to Community Engaged Learning. CELC-DAU is a core member of Vietnam Network of Engaged Scholars (VNES).

Phan Trần Kiều Trang

CHARMS

Policy Brief on the Efforts to Promote Energy Saving and Energy Efficiency of Residential Buildings in Thailand

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Blueprint of DEDE's Rak Nam 1, one of 12 energy-saving house models promoted by the DEDE (DEDE Energy-Saving House Designs, n.d.)

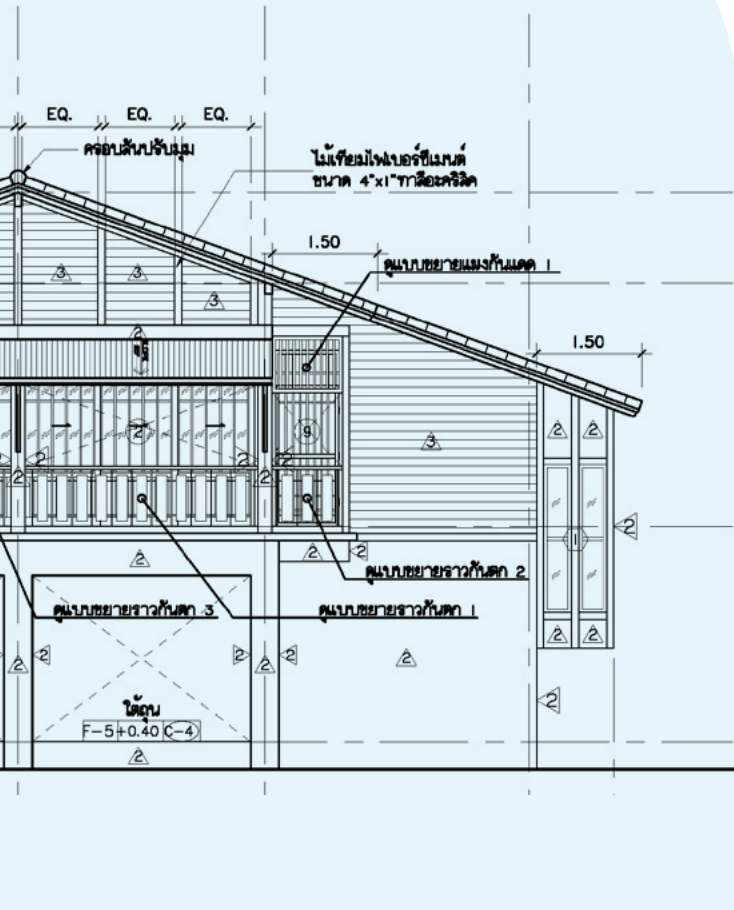
Saving electricity and increasing energy efficiency at residential buildings is essential for helping alleviate energy costs and reducing greenhouse gas emissions. This policy brief reviews policy instruments deployed by multi-level governance to discuss how Thailand releases the untapped potential of the household sector in cutting down energy consumption while mitigating greenhouse gas emissions. The policy brief conducted a desk review of three key policy documents. The first one is at the national level, the Energy Efficiency Plan (EEP), which has two versions- the 2015-2036 and 2018-2037. The second is at the sectoral level, the Building Energy Code (BEC); the third is at the municipality level, the Municipal ordinance on residential building construction. The paper found that the residential sector has yet to be a target of policies at three levels despite its increasing energy consumption. Thailand should implement a more effective regulatory approach for enhancing energy efficiency in the residential sector rather than relying on the market-based approach and the customers' willingness to pay for additional materials to make their houses energy efficient. It proposes three policy recommendations for the government authorities to address the policy gaps.

First, National Housing Authority, a state enterprise, should invest in constructing affordable and energy-efficient houses using the Energy-Saving House Designs implemented by the Department of Alternative Energy Development and Efficiency, Ministry of Energy. The concept of Nearly Zero Energy Buildings (NZEB) can be helpful to adapt in the country. Second, a one-stop service center should be set up at the municipality office to provide free advice for house owners, including enhancing energy efficiency. Municipality offices are encouraged to partner with civil society organizations and private companies to receive in-kind service. Lastly, more options for nature-based energy-saving solutions should be provided as they are low-cost and foster a sustainable relationship between humans and nature.

บทคัดย่อ

การประหยัดพลังงานไฟฟ้าและเพิ่มประสิทธิภาพการใช้พลังงานในภาคที่อยู่อาศัยมีส่วนสำคัญในการลดต้นทุนค่าใช้จ่ายด้านพลังงาน และลดการปล่อยก๊าซเรือนกระจก ร่างนโยบายนี้ใช้หลักวิธีการ ทบทวนเครื่องมือทางนโยบายในระดับต่างๆของภาครัฐ โดยมีจุด ประสงค์เพื่อเพิ่มศักยภาพการดำเนินการเชิงนโยบาย

ในการลดการใช้พลังงานของภาคที่อยู่อาศัย ในขณะที่เดียวกันยังช่วย



ลดการปล่อยก๊าซเรือนกระจกอีกด้วย นโยบายในสามระดับถูกนำมาใช้ในการทบทวน ซึ่งได้แก่ (๑) นโยบายระดับชาติ : แผนอนุรักษ์พลังงาน พ.ศ. ๒๕๕๘-๒๕๗๙ (EEP๒๐๑๕-๒๐๓๖) และ แผนอนุรักษ์พลังงาน พ.ศ. ๒๕๖๑ - ๒๕๘๐ (EEP๒๐๑๘-๒๐๓๗) (๒) นโยบายระดับภาคส่วน : มาตรฐานอาคารด้านพลังงาน (Building Energy Code :BEC) (๓) นโยบายระดับท้องถิ่น : การขออนุญาตก่อสร้างอาคารใหม่ตาม พ.ร.บ. ควบคุมอาคาร พ.ศ. ๒๕๒๒ จากเจ้าพนักงานท้องถิ่น จากการทบทวนนโยบายทั้งสามระดับพบว่าภาคที่อยู่อาศัยไม่ได้เป็นกลุ่มเป้าหมายหลักในการดำเนินการของนโยบาย ถึงแม้ว่าภาคที่อยู่อาศัยจะมีการใช้พลังงานเพิ่มขึ้นอย่างต่อเนื่อง ดังนั้นประเทศไทยควรวางแผนทางของนโยบายในการกำกับดูแลการอนุรักษ์พลังงานภาคที่อยู่อาศัยให้มีประสิทธิภาพ มากกว่าการอาศัยกลไกตลาดหรือการยอมจ่ายของประชาชนกับวัสดุก่อสร้างบ้านที่ช่วยประหยัดการใช้พลังงาน ร่างนโยบายฉบับนี้จึงได้จัดทำข้อเสนอแนะเชิงนโยบาย ๓ ประเด็น เพื่อให้หน่วยงานภาครัฐสามารถแก้ไขช่องว่างของนโยบายที่ได้กล่าวมา ได้แก่ ข้อเสนอแนะเชิงนโยบายที่ ๑ : การเคหะแห่งชาติซึ่งเป็นหน่วยงานรัฐวิสาหกิจควรลงทุนก่อสร้าง “โครงการบ้านอนุรักษ์พลังงานในราคาประหยัด” โดยใช้แบบบ้านประหยัดพลังงานที่ได้มีการพัฒนาจากกรมพัฒนาพลังงานทดแทนและอนุรักษ์พลังงาน กระทรวงพลังงาน แบบบ้านดังกล่าวอิงตามแนวคิดอาคารที่ใช้พลังงานใกล้เคียงเท่ากับศูนย์ (Nearly Zero Energy Buildings : NZEB) ที่สามารถนำมาปรับใช้

กับการสร้างบ้านในประเทศได้ ข้อเสนอแนะเชิงนโยบายที่ ๒ : การจัดตั้งศูนย์ one stop service ของเทศบาลท้องถิ่นโดยความร่วมมือกับ ภาคประชาสังคม และบริษัทเอกชน เพื่อให้คำปรึกษาโดยไม่เสียค่าใช้จ่ายแก่เจ้าของบ้านในการสร้างบ้านประหยัดพลังงาน ข้อเสนอแนะเชิงนโยบายที่ ๓ : เพิ่มทางเลือกที่ช่วยเพิ่มประสิทธิภาพการใช้พลังงานที่อิงกับธรรมชาติออกไปจากการใช้เทคโนโลยีอย่างเดียว โดยทางเลือกที่อิงตามธรรมชาตินั้นมีข้อดีคือต้นทุนต่ำ อีกทั้งช่วยส่งเสริมความสัมพันธ์ที่ยั่งยืนระหว่างมนุษย์กับธรรมชาติ

Background Information on Thailand's Electricity Demand and Energy Saving Targets by Each Economic Sector

On 15 August 2022, the Energy Regulatory Commission (ERC) approved the change in electricity price as 4.72 baht (€ 0.13¹) per kilowatt hour (unit), the highest price ever recorded in Thailand (Bangkok Post, 2022). The new charge is 18% higher than the present figure at 4.00 baht (€ 0.11¹) per unit and will take effect in September 2022. Among those sectors struck by a higher energy cost, households would be severely impacted as they have a continued rise in demand for electricity. Figure 1 presents electricity demand by sector from 2011-2020. It is found that while other sectors have reduced electricity consumption in past decades, only households' demand has increased. In contrast, the industrial sector has been reducing electricity consumption, especially during 2019-2020, due to the economic downturn during the COVID-19 pandemic. Electricity prices per unit rise, as do the electricity expenses of households per month, as shown in Figure 2.

A significant source of Thailand's greenhouse gas emissions is grid-connected electricity and heat production at around 108,238.6 GgCO₂eq² or 42.84% of total emissions according to the mid-century, long-term Low Greenhouse gas emission Development Strategy 2021 (Thailand, 2021). Households or the residential sector are critical in mitigating greenhouse gas (GHG) emissions via energy saving and efficiency. The Energy Efficiency Plan (EEP) 2018-2037 set a goal to reduce energy intensity (EI) by 30% from 2010 levels in 2037. Five main economic sectors, including residential

1 Bank of Thailand exchange rate as of 15 August 2022: 36.66 THB = 1 Euro

2 Total greenhouse gas emissions measured in the unit of gigagrams of a carbon dioxide equivalent

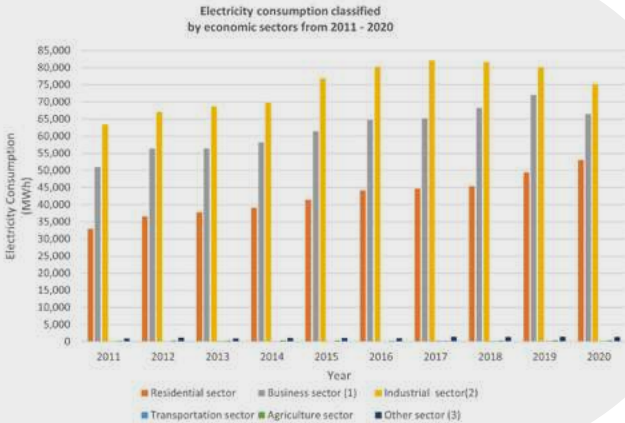


Figure 1: Electricity consumption by sectors from 2011–2020 (National Statistical Office Ministry of Digital Economy and Society, 2021b)

buildings, are prioritized by the EEP 2018–2037 to conserve a certain amount of electricity and heat, as shown in Table 1. Targets set by Energy Efficiency Plan, together with the other four national policies, namely Power Development Plan, Oil Plan, Gas Plan, and Alternative Energy Development Plan (AEDP) are vital for Thailand to achieve its pledge announced at the COP26 to become carbon neutral by 2050 and to be an economy with net-zero GHG emissions by 2065 (Bangkok Post, 25 November 2021). Given the importance of residential buildings

for Thailand's energy conservation and climate change mitigation, the policy brief investigates vital policy documents to reveal how the government authorities attempt to reduce electricity consumption in this sector. The following section is the key findings from the policy review.

Key Findings from the Policy Documents Review: Some key results from the analysis of key policy documents are as follows;

1. Thailand has Implemented the Most Compulsory Policy Instruments in Other Economic Sectors (Industrial, Transportation, and Commercial Buildings) while Only Implementing a Few Voluntary Measures in the Residential Sector with Few Incentives to Comply with Them.

Thailand's Energy Efficiency Policy has two versions, the EEP 2015–2036 and the EEP 2018–2037. Both EEP versions had set the same energy intensity target of 30%. However, at the time this policy brief was written in August 2022, the government was drafting the EEP 2022–2037, which will have a more ambitious Energy Intensity (EI) target than the previous versions, meaning the EI will be 36% by 2037 and 40% by 2050 for Thailand to reach its carbon neutrality (Green network, 2023)³. As the EEP 2022 has not been announced yet, the paper will review only the EEP 2015–2036 and the EEP 2018–2037.

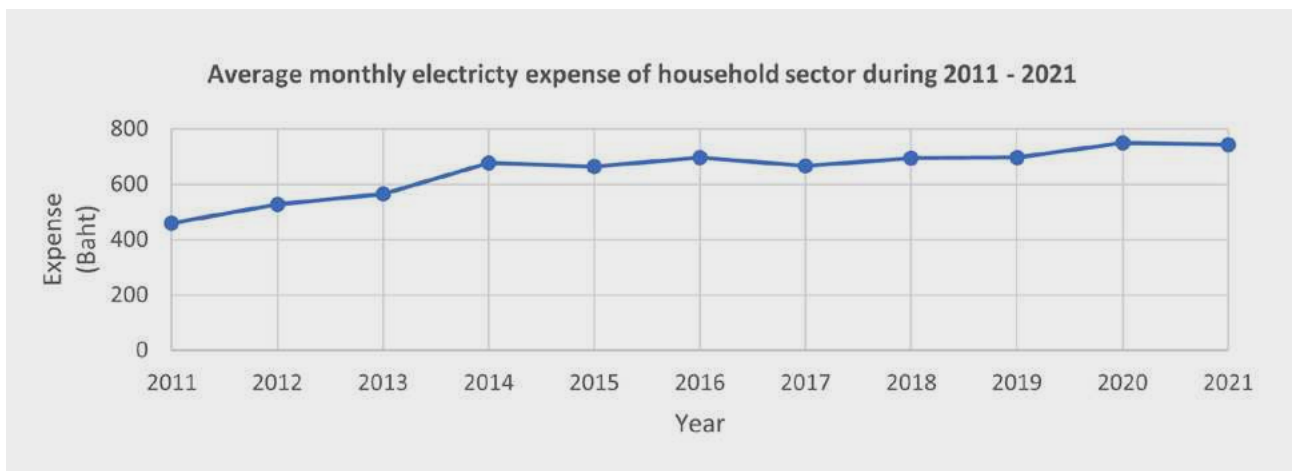


Figure 2: Average monthly electricity expenses of the household sector during 2011–2021 (National Statistical Office Ministry of Digital Economy and Society, 2021a)

³ https://www.greennetworkthailand.com/energy-efficiency-plan_eep2022/ accessed on 22 February 2023



Economic sector	Electricity (ktoe)	Heat (ktoe)	Total (ktoe)
Industry	6,777	14,360	21,137
Commercial	5,532	886	6,418
Residential	2,923	377	3,300
Agriculture	147	380	527
Transport	0	17,682	17,682
Total	15,379	33,685	49,064

Table 1: Energy saving targets by sectors (Thailand, 2021)

It is found that despite several policy instruments comprising three categories: compulsory, voluntary, and complementary programs, as illustrated in Table 2, there are only two voluntary measures for the owners of residential buildings to take action themselves. The first one is a voluntary measure to change light bulbs in the household into LED (light emitting diode), which was introduced by the EEP 2015–2036⁴ (add reference), and the second one is the measure to enforce Energy Efficiency Standards (Energy Code) in the residential sector stated by the EEP 2018–2037.

The review of policy documents clearly shows that all existing compulsory programs regulate all other economic sectors except the residential buildings sector. To give some examples, the Energy Conservation Promotion Act Amended B.E. 2550 seeks to increase energy saving in factories that installed high voltage adapters over 1,000 kW or installed the heating system from thermal over 20 MJ, the Building Energy Code applies only to the newly constructed government and business buildings which have a total usable area of more than 2,000 m², and the Energy Efficiency Resource Standard (EERS) is imposed only on electricity suppliers. With various compulsory measures, the government expects higher energy-saving targets in those main economic sectors. In contrast, the residential sector is expected to reduce energy

usage by only 3,300 ktoe out of the national target of 49,064 ktoe (Table 1).

Such limited policy instruments provided to the residential sector resulted in the house owners not fully participating in the energy-saving paths as they needed to realize what else they could do at their house or with their houses. The Department of Alternative Energy Development and Efficiency (DEDE), Ministry of Energy, conducted a study on "Research and Development in the field of Energy Conservation and Renewable Energy in Thailand," published in 2012 (DEDE, 2012). The report presented various energy conservation technologies in main economic sectors, including commercial buildings and households. However, many potential technologies are not considered policy instruments in the EEP 2018–2037. According to the report, energy conservation should commence from the design process. The study found that if the buildings are designed since the beginning with energy-saving principles and built with high energy-efficient technology and equipment, energy consumption can be decreased to 25–50 kWh/m²/year, which is very nearly net-zero energy.

The building envelope should aim to reduce air-conditioning usage but must be designed to suit the tropical weather. It is noted that the building sector's energy conservation does not depend upon

⁴ The EEP 2015–2036 was the first version of the country. The EEP 2018–2037 was a revised version of most of the content and the targets were the same as the EEP 2015–2036.

Compulsory program	Voluntary program	Complementary program
1. Measures to Enforce Energy Conservation Standards	1. Measures for setting benchmarks and labeling energy efficiency for equipment, machinery, and materials.	1. Measures to promote personnel development in energy conservation
2. Measure to enforce energy efficiency standards (Energy Code) in factories/control buildings.	2. Measure to enforce Energy Efficiency Standards (Energy Code) in the residential sector	2. Public relations and educational measures on energy efficiency with the general public
3. Measure to Enforce Energy Efficiency Standards (EERS) for energy producers and distributors.	3. Measures to change equipment and promote high-efficiency technology	3. Measure for research and development (R&D) of energy efficiency technologies and innovations
4. Measures for the use of practical equipment/machinery benchmarks	4. Measures to support investment in implementing energy-saving measures	
5. Tax measures in the transport sector	5. Measures to promote innovation	
	6. Energy efficiency measures in the transport sector	
	7. Energy efficiency measures in the agricultural sector	

Table 2: Policy Instruments (EEP, 2018)

only technologies and innovation. However, it is highly influenced by the geographical areas where the buildings are located. Environmental factors, i.e., sun radiation, daylight, wind flow, temperatures, humidity, precipitation, and even environmental problems such as PM2.5 air pollution, are precisely local contexts. Thus the energy conservation effort for the buildings needs to be customized to specific geographical locations. Table 3 presents the energy conservation technologies in commercial and small residential buildings, adapted from the report by DEDE (2012).

2. Building Energy Code (BEC) has Targeted Only Large Buildings, while all Residential Buildings have not been Regulated for Energy Performance. This lack of a Building Energy Code (BEC) for small residential buildings is concerning given the fact that the residential buildings in Thailand will increase to 36,419,247 buildings (i.e., detached houses, townhouses, and apartments, etc.) in 2036

according to the forecast of Department of Administrative Affairs, Ministry of Interior. Among those, 8,003,250 buildings will be located in Bangkok and the metropolitan, while 28,415,997 will be in other provinces nationwide (DEDE, 2018). The existing Building Energy Code (BEC) endorsed by the EEP 2018-2037 is a measure to enforce energy conservation standards for factories and new construction with a usable area of more than 2,000 m². They are, for example, hospitals, university facilities, offices, hotels, theatres, department stores, conventional halls, condominiums, etc. The EEP 2018-2037 selected several commonly-used standards to be implemented by large-area buildings and factories in Thailand, such as the LEED standard (Leadership in Energy and Environmental Design) and the TREES standard invented by the Thai Green Building Institute.

Despite the lack of a Building Energy Code (BEC) for small residential buildings, several pilot projects are

Energy conservation technologies	Areas for energy conservation
1. Building envelope and design	<ul style="list-style-type: none"> • Wall materials and glass • Insulated envelope- can optimize natural light and make thermal comfort in the building. • Envelope design to make use of daylight
2. Air-conditioning and ventilation and thermal comfort	<ul style="list-style-type: none"> • High-efficient air-conditioner • Options for cooling, i.e. solar cooling, passive cooling, and hybrid system for thermal comfort
3. Use of daylight and light innovation	<ul style="list-style-type: none"> • High-efficient lamps (and their component), i.e. LED
4. Equipment and appliances in the building	<ul style="list-style-type: none"> • Refrigerator and cooling retention • Air-condition • Cooking stove • General electric appliances, i.e. fan, water pump • Electric appliance using low interrupt power supply
5. Controlling system and building management	<ul style="list-style-type: none"> • Methods and procedures to follow up and control energy use for activities in a particular area, such as tasked lighting • Methods and procedures for energy management with building automation system (BAS)
6. Cogeneration (CHP) and district cooling	<ul style="list-style-type: none"> • Combined heat and power system by using clean energy i.e. natural gas, including district cooling • Absorption cooling using waste heat

Table 3: Energy conservation technologies in commercial buildings and small residential buildings (Adopted from DEDE, 2012)

done by both the government department and the business sector to enhance household energy performance and energy conservation. To name a few, Sena Development Public Company Limited, a leading real estate entrepreneur in Thailand, initiated the design of house models using renewable energy and energy saving under the solar smart village concept in 2011 (Mongkolrangarit, 2019). The company developed two pilot projects, Sena Park Ville and Sena Park Grand located in Raminthra-Wongwaen district in Bangkok. The Department of Alternative Energy Development and Efficiency (DEDE), the Ministry of Energy, attempting to promote better energy performance of Thailand's residential buildings voluntarily, has promoted 12 energy-saving house models. The blueprints of architectural structure, electricity systems, and sanitary work are available for free download from the website <https://www.aad.kmitl.ac.th/dede/>. The 12 houses-models are the outcome of the study on energy performance

standards of Thai residential buildings and on creating pilot energy-saving house models in which the DEDE collaborated with the Faculty of Architect, King Mongkut's Institute of Technology Ladkrabang (DEDE Energy-Saving House Designs, n.d.).

3. The Energy Efficiency Concept has not been Mainstreamed into Municipal Ordinances on Residential Building Construction.

The Building Control Act, B.E. 2522 has authorized Local Administrative Offices (LAO) to approve a permit for construction, modification, demolition, or change of the use of a building in their administrative areas (Department of Local Administration Ministry of Interior, 2006). The process to apply for a construction permit of new residential buildings comprised of the owner of the houses or authorized people by the owners submitted the permission requests, the LAO officers checked the required documents, examined the city plan and public condition, and reviewed the



drawing by the technician or the engineer, and finally the major of LAO decided whether to approve the permit. According to Article 21 of the Building Control Act B.E. 2522, a permit must be obtained prior to the commencement of construction and should be granted within 25 working days. However, the Ministry of Interior's Directive มท 0892.2/ว 1582 issued on 11 May 2004 stated that if the design of the buildings is from a house model created by the Local Administrative Office or by the Department of Public Works and Town & Country Planning, all process could be shortened to 10 working days to facilitate and ease administrative burdens of the petitioners (Department of Local Administration Ministry of Interior, 2006).

The process to obtain a permit for construction is shortened to give the green light for the construction. Furthermore, the required documents to be submitted for a permit application mainly focus on the house's physical characteristics and structure, i.e., area plan, floor plan, wastewater treatment, and land ownership declaration. The construction permit application is a regulatory

approach that, if used correctly, can be an effective policy instrument to enhance energy saving and energy efficiency of residential buildings. However, the energy performance of the houses needs to be included in the consideration for a permit application process by the Local Administrative Offices. Energy-saving in households in Thailand has been an individual choice of the house owners if they would like to invest more in this issue. Some materials for thermal insulation, for example, Aluminium Foil, Polyethylene Foam-PE, Air Bubble or Bubble Foil, and Fiberglass (SCG, 2022), are all available for consumers who are willing to pay more for their houses to use less electricity for cooling. Therefore, energy-saving in households in Thailand has so far depended upon a market-based approach and individual choice. That means once the prices of the materials are costly, they could be the first thing to be deleted from the list.

Discussions

The residential sector has a high potential to contribute to greenhouse gas emission reduction by enhancing energy efficiency. However, the

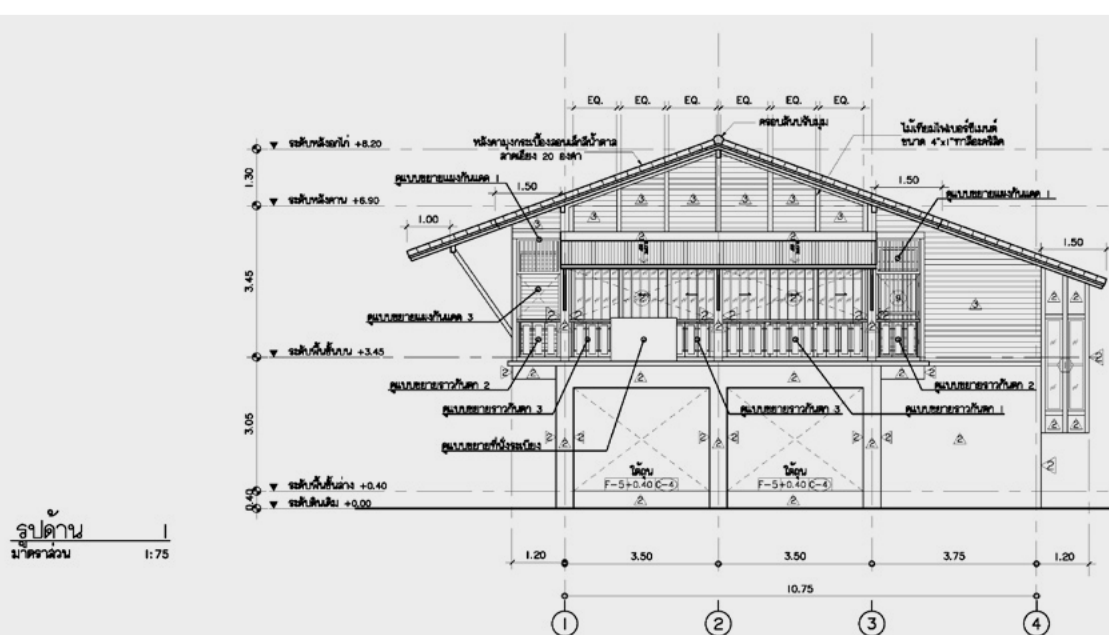


current policy instruments must be revised to include house owners' actions. Also, because some of them are based on a market-based approach, it will likely stimulate only some Thai people to purchase additional materials for thermal insulation. The research proposes some policy responses as follows.

First, government departments such as National Housing Authority (NHA) should invest in constructing affordable and energy-efficient houses using the DEDE Energy-Saving House Designs. Such government investment promotes the house's new design to a broader public. Moreover, National Housing Authority is a state enterprise under the supervision of the Ministry of Social Development and Human Security. It aims to provide housing for low and moderate-income earners to enhance their well-being and develop strong and resilient communities and environmentally friendly cities. Considering its missions, NHA is a perfect state authority that would take on such pioneer construction work of the energy-efficient house in the country. Furthermore,

it could be beneficial for NHA to apply the concept of Nearly Zero-Energy Buildings (NZEB), which is implemented in many countries. For instance, the European Union has promoted the NZEB via the Energy Performance of Buildings Directive, which required new buildings built as Nearly Zero-Energy by the end of 2020, and to have all new public buildings be nearly zero-energy after 31 December 2018 (European Commission, n.d.). The European Union has recently set a new ambitious target to go beyond the current NZEB to Zero-Emission Building (ZEB) by revising the directive in December 2021. The revised directive set the goal that ZEB, which is defined "as a building with a very high energy performance, with the very low amount of energy still required fully covered by energy from renewable sources and without on-site carbon emissions from fossil fuels," will be applied to all new buildings by 1 January 2030, and to all new buildings occupied or owned by public authorities by 1 January 2027 (ibid).

Second, municipality offices are critical in giving construction permits to build new houses and



Blueprint of DEDE's Rak Nam 1, one of 12 energy-saving house models promoted by the DEDE (DEDE Energy-Saving House Designs, n.d.)



directly contacting the house owners. The research suggests that there should be one stop-service center at municipality offices around the country to provide comprehensive advice related to house construction, including how to enhance the house's energy efficiency. Such an idea can be done with little budget should the municipality offices establish a Memorandum of Agreement (MOA) with stakeholders who share similar missions and can provide in-kind support. They are, for example, the Association of Siamese Architects under the Royal Patronage, the Thai Contractors Association Under H.M. The King's Patronage, and the Home Builders Association. Moreover, some private companies have conducted Corporate Social Responsibility (CSR) in their social engagement and business promotion. Thus, they may be interested in providing free advice on construction materials at a one-stop service center at the municipality offices.

Third, solutions for enhancing energy saving and energy efficiency can be nature-based and thus low-cost. Table 3 presents energy conservation technologies and innovations in commercial and small residential buildings proposed by the study of DEDE. However, the task can be accomplished with nature-based solutions. Fernandes and Guiomar (2018) pointed out that nature-based solutions that integrate natural processes and functions in the built environment, such as residential, industrial, and infrastructures, would reconnect nature and humans and foster a sustainable relationship between the two actors. Some examples of nature-based solutions which enhance thermal comfort for people are green roofs, green walls, vertical structures with vegetation to shade holes, plant selection in an outdoor garden, and free-cooling ventilation (Gómez et al., 2021).

Conclusions

Thailand's residential buildings consume increasing electricity and face economic difficulty due to rising electricity prices. The paper reviewed four key policy documents; the EEP 2015-2036, the EEP 2018-2037, the Building Energy Code, and the Municipality ordinance (based on Article 21 of Building Control Act B.E. 2522) and investigated policy instruments that the Thai authorities implement to enhance energy saving and energy efficiency at the


household level. The results reveal critical gaps in government policies, including residential buildings for cutting down energy and reducing greenhouse gas emissions. A permit for construction approved by the Local Administrative Offices is a practical regulatory approach to enhance household energy saving. However, there is no requirement to examine the energy performance of the buildings before granting the construction permit. The choice of energy saving in Thailand is, therefore, on the hand on market mechanism and on the willingness to pay additional costs of the house owners. This policy brief argues that there is great potential for saving energy.

The paper suggests that the government utilize the existing knowledge of the DEDE and private sectors and Building Energy Code (BEC) on the more prominent buildings to apply for the small residential buildings sector. Furthermore, it is advised that the investment should be made by National Housing Authority to build pilot energy-efficient and affordable houses for low and middle-income families. The municipality office should play an active role in seeking collaboration with other stakeholders to set up a one-stop service center to provide free comprehensive advice for house owners, including how to enhance energy efficiency. The concept of Nearly Zero Energy Buildings (NZEB) and even Zero-Emission Buildings (ZEB), which the European countries have been pioneers in, are helpful for Thai authorities to follow and adopt. Finally, it is essential to offer nature-based solutions as options for house owners apart from technology-based ones because the former is low-cost and could reconnect humans and nature for a sustainable relationship.





Photography by Katharina M. Borgmann, in Bangkok



CHARMS

Social Groups and Interpretive Flexibilitie(s) in the preservation of Vernacular Wooden Houses in Chiang Mai, Thailand

Christine Richter, Nuchwaree Boonkumkrong,
Henrik Beermann, Urban Kaiser

Photography by U. Kaiser

Thailand is well known for its diverse vernacular wooden architecture. Besides valuing these buildings as cultural heritage and for their touristic appeal, the preservation of wooden vernacular housing in cities can make a significant contribution to sustainable urban development in environmental, social and economic terms. Preservation through use can save materials for new construction, provides living space rather than clearing land for large-scale commercial business, and can foster mixed use neighborhoods. Continued use of these buildings depends not only on technical improvements, but also on several socio-technical factors that play out at different scales. Taking this bigger picture into account, our study's overall aim is to identify the requirements for the preservation of vernacular wooden houses in the city of Chiang Mai, especially those that are related to indoor comfort, from the perspective of different social groups in the city. In this paper we

address this broader aim through two initial questions that have emerged during qualitative research in 2021 and 2022, namely: who are the relevant social groups in the city, depending on varying perceptions of the preservation of wooden houses, and how do the characteristics of houses and their immediate surroundings (potentially) mediate the perceptions of residents? The paper provides a glimpse into the study's path, where we make the (empirical as well as methodological) move from exploring groups, perceptions as well as contextual dynamics at city and regional scale to the more specific requirements of different social groups at the scale of the individual home.

บทคัดย่อภาษาไทย

ประเทศไทยขึ้นชื่อในด้านสถาปัตยกรรมไม้พื้นถิ่นที่หลากหลาย นอกเหนือจากคุณค่าในฐานะมรดกทางวัฒนธรรมและการดึงดูดนักท่องเที่ยวแล้ว อาคารเหล่านี้ยังแสดงถึงการอนุรักษ์ที่อยู่อาศัยพื้นถิ่นที่ทำด้วยไม้ในแต่ละเมือง ซึ่งมีส่วนสำคัญในการพัฒนาเมืองอย่างยั่งยืน



ทั้งในด้านสิ่งแวดล้อม สังคมและเศรษฐกิจ การอนุรักษ์โดยการให้ประโยชน์ สามารถประหยัดวัสดุสำหรับการก่อสร้างใหม่ ให้พื้นที่ใช้สอยมากกว่าการใช้พื้นที่สำหรับธุรกิจเชิงพาณิชย์ขนาดใหญ่ และสามารถส่งเสริมการใช้พื้นที่ใกล้เคียงแบบผสมผสาน การใช้อาคารเหล่านี้อย่างต่อเนื่อง ไม่ได้ขึ้นอยู่กับ การปรับปรุงทางเทคนิคเท่านั้น แต่ยังขึ้นอยู่กับปัจจัยทางสังคมและเทคนิคหลายประการที่ส่งผลในระดับที่แตกต่างกัน เมื่อพิจารณาถึงภาพรวมที่ใหญ่ขึ้นนี้ จุดมุ่งหมายโดยรวมของการศึกษาของเราคือ การระบุข้อกำหนดสำหรับการอนุรักษ์บ้านไม้พื้นถิ่นในเมืองเชียงใหม่ โดยเฉพาะอย่างยิ่งในสิ่งที่เกี่ยวข้องกับความปลอดภัยภายในอาคาร จากมุมมองของกลุ่มสังคมต่างๆ ในเมือง ในบทความนี้ เรากล่าวถึงจุดมุ่งหมายที่กว้างขึ้นผ่านคำถามเริ่มต้นสองคำถามที่เกิดขึ้นระหว่างการวิจัยเชิงคุณภาพในปี ๒๕๖๔ และ ๒๕๖๕ ได้แก่ กลุ่มใดคือกลุ่มสังคมที่เกี่ยวข้องในเมือง ซึ่งขึ้นอยู่กับมุมมองที่แตกต่างกันเกี่ยวกับการอนุรักษ์บ้านไม้ และลักษณะของบ้านรวมทั้งสิ่งแวดล้อม(อาจ)มีผลต่อการรับรู้ด้านความปลอดภัยของผู้อยู่อาศัยได้อย่างไร บทความนี้ให้ภาพรวมคร่าวๆ ในระหว่างการวิจัย ซึ่งเราได้มาจากการสำรวจจากกลุ่มทางสังคมต่างๆ (ทั้งเชิงประจักษ์และระเบียบวิธี) การรับรู้ ตลอดจนพลวัตตามบริบทในระดับเมืองและระดับภูมิภาค ไปสู่ความต้องการที่เฉพาะเจาะจงมากขึ้นของกลุ่มสังคมต่างๆ ในระดับของบ้านแต่ละหลัง

1. Introduction

Thailand is well known for its diverse vernacular wooden architecture, which has also been the focus of much research (Shimizu, 2018; Sukwai, Mishima, & Srinurak, 2022; Pinijarasin, 2017). Besides valuing these buildings as cultural heritage and for their touristic appeal, the preservation of wooden vernacular housing in cities can make a significant contribution to sustainable urban development in environmental, social and economic terms (Avrami, 2016; Dessein, et al., 2015; Ferretti, Bottero & Mondini, 2014; Go-Sam & Keys, 2018; Grossman et al., 2017a, 2017b, Ryrkema, 2006, Soini & Dessein, 2016). Existing wooden vernacular building stock constitutes a carbon storage and its preservation can help to avoid the greenhouse gas-intensive production of mineral based construction materials (Churkina, et al., 2020; Ryrkema, 2006). Continued use of these buildings depends not only on technical improvements to increase both energy efficiency as well as indoor comfort and air quality, but also on a number of socio-technical factors that play out at different scales. Our study's longer-term aim is to identify the requirements for the preservation of vernacular wooden houses in Chiang Mai, Thailand, from the perspective of different groups of residents in the city. Preservation is to take place specifically through (continued) residential use of the buildings.

Chiang Mai, the largest city in northern Thailand, located in the Northwest of the country, has attracted many tourists and researchers with an interest in the region's cultural history, social structure (Johnson, 2010, specifically points to social structure studies from the 1970s to 1990s by Bowie, 1997; Davis, 1984; Potter, 1976 and Rhum, 1994) as well as architecture, especially elements of what has come to be known and promoted as "Lanna culture" (Johnson, 2010).

Against this broader framework, the present paper discusses specifically two questions that emerged during qualitative research in 2021 and 2022, namely who are the relevant social groups in the city, depending on varying perceptions of the preservation of wooden houses, and how do the characteristics of houses and their immediate surroundings (potentially) mediate the perceptions of residents? The paper provides a glimpse into the study's path, where we make the (empirical as well as methodological) move from exploring groups, perceptions as well as contextual dynamics at city and regional scale to the more specific requirements of different social groups at the scale of the individual home

2. Research Approach and Methods

Our research is inspired by literature on the social construction of technology (SCOT), an analytical approach to the study of innovation, which focuses on the dynamic influences of varying social groups, which are relevant to the development of technology (Bijker, Hughes, & Pinch, 2012; Bijker, 2010). The approach has been applied to urban geography in a few instances, for example by Aibar and Bijker (1997) in a historical study of Barcelona's development. In our study the approach translates into the assumption that different social groups in the city of Chiang Mai (potentially or actually) influence the various facets of vernacular wooden housing – both as singular artefact (the individual building) and as sociotechnical ensemble (the socio-technical context of the buildings) through their ideas, perceptions as well as different uses of the houses. The variation in meanings that the houses hold to different people is referred to as "interpretive flexibility" in SCOT vocabulary. The empirical material, which this paper is based on,



consists of summaries of 8 preliminary interviews from October and November 2021 and 13 additional in-depth interviews from different points in time between April to July 2022, with interviewees from architecture, city development, civil society organizations and media (including social media), with a close affinity to the topic of cultural heritage and/or urban development and construction in Chiang Mai. In April 2022 two focus groups with residents of the pilot neighborhoods were conducted. In addition, we draw on field notes and notes from three informal conversations taken during a visit to Chiang Mai from 12th until 22nd of July, including site visits to Lam Chang, Wat Ket, Chang Moi neighborhoods, various (wooden) temples, the Lanna Cultural Center, and the Chiang Mai University's outdoor museum of vernacular housing. The discussion is also tangentially informed by notes of 5 project meetings that took place between July 2021 and February 2022 and aided in developing the methodological approach. The results presented here are based on first reviews of these empirical materials and focuses on the two selected themes of social grouping and housing characteristics. Other themes, that emerged as important during review and preliminary analysis, for instance the influence of regional policy or labor dynamics, are not discussed here due to word count limitations.

3. Relevant Social Groups and the House as Mediating Circumstance

In the first of the following sub-sections, we describe how social groups can be differentiated in terms of the meanings that wooden vernacular houses hold for them reflected in people's perceptions of and requirements for preservation, as well as different actual uses of wooden vernacular houses. In the second sub-section, we illustrate how varying characteristics of houses themselves and their immediate surroundings act as mediating circumstances to residents' uses of the houses and perceptions regarding their preservation.

3.1. Relevant Social Groups and their Relationship to Vernacular Housing

We identified social groups at two different scales. At city scale, people are included, who do not

currently live in or are soon expected to buy or inherit wooden houses. These social groups are akin to an "indigenous typology" (Bryman, 2016, p. 586) in the sense that they have been identified by our interview partners as groups holding specific views on wooden houses. This scale of grouping is important in the long run to address various groups in the city appropriately when communicating about the preservation of wooden houses at policy and planning levels. A second social grouping involves all those people who own, rent or otherwise use vernacular wooden houses now or expect to do so in the near future, for instance through inheritance. At this scale, we differentiate between social groups based on the socio-economic characteristics of an individual and/or household. These groups provide more specific insights into the requirements and perceptions of wooden house owners and residents that are important for the preservation at household and neighborhood levels. In the following, we describe each of these groupings in a very synthesized form.

Social groups at the city scale include businesspeople, who own shops, coffee houses or guest houses in a neighborhood, for instance, and who profit from proximity to well-maintained wooden houses if these help to attract customers, for example young people following a favorite past-time, which we might call "coffee shop hopping" where they visit various coffee shops across the city to socialize and take photos of the surrounding place. Hence, customers of these businesses, both tourists and young Chiang Mai residents come to play a role as a social group as well, albeit more implicitly, because to them wooden houses mean a specific sought-after aesthetic indicating "northern Thai tradition." The local community, organized through the neighborhood's temple (or in some cases mosque or church, for example in the Wat Ket area of Chiang Mai) may come to constitute a social group to whom wooden houses hold a common meaning. For instance, young people and tourists may value a neighborhood as a cultural heritage site partially in lieu of its wooden architecture. Within local communities, carpenters and other craftspeople working specifically with wood constitute a social group, whose connection to wooden houses goes



beyond the house as a singular artefact, extending into the needs to preserve the skill sets that have historically developed. The loss of wooden houses as residential buildings in everyday life also means the loss of these skills and craftsmanship. Various migrant groups may hold specific views on vernacular housing. For instance, because rental prices may be lower in old wooden houses, they are important shelter options for migrant laborers from Myanmar. “Digital nomads” from Europe, on the other hand, might prefer living in a vernacular wooden building of the old city and surrounding neighborhoods, because of its “traditional feel.”



A wooden house located in the city must provide a broad range of benefits, including convenience, comfort, stability, security, and social status. It is this complexity that makes the house valuable.

Another social group are commercial land developers, who influence land use and housing changes, the distribution of land values and corresponding sales of houses. Developers also influence, explicitly or implicitly through their supply, the taste and consumption patterns in the housing market, e.g. by attracting increasing numbers of people to master planned (sometimes gated) communities and through targeting specific consumer segments. To local government officials vernacular housing holds meaning in so far as it constitutes an object of planning and property regulations. An influential group consists of what we might call here preservation advocates and cultural (heritage) researchers in Chiang Mai, especially with backgrounds in architecture and planning, who, for different reasons, leverage various meanings of wooden vernacular housing to advocate for its preservation. This group has overlaps with people, whom Johnson (2010) refers to as “cultural brokers” in his research in Chiang

Mai, as well as the media, specifically social media in our study. The “heritage advocate group” also includes members of the younger generation seeking to establish sustainable ways of life and values while at the same time preserving traditional craftsmanship. Wooden vernacular houses to this group means treasured personal memories from childhood, and an indicator of history and cultural heritage of Chiang Mai, especially as a representation of the much promoted “Lanna culture” of northern Thailand, and it is seen as an asset in the promotion of Chiang Mai as tourist destination and its designation as UNESCO World Heritage site. At this instance, a final social group requires at least mentioning here, although it takes us beyond the city scale and Chiang Mai’s center, namely the Royal family of Thailand, who have a fair amount of influence on Thai architecture and its role in national imagery and narrative also at local levels¹, through urban development and cultural heritage preservation agencies (for more details on their role, see Grossman, et al., 2017b; Krairiksh, 2013; Lertcharnrit, 2017; Pimonsathean, 2013; Sakulpanich, 2013).

At the second scale of social grouping, at the scale of individual houses and their immediate surroundings, we consider those people, who have a comparatively closer connection with wooden houses than groups at the city scale. These may be current owners or renters, people who are likely to inherit or consider buying vernacular wooden houses, specifically for residential use and preserve the house as such. Important distinguishing characteristics are age and income, with older people generally more inclined to live in and maintain wooden family houses than the younger generation; and because the maintenance of wooden houses can be quite costly the household requires a minimum amount of income for repairs and upgrading. We found the dichotomy “old versus young generation” evoked in the context of urban change more generally, going beyond differences in the perceptions of vernacular housing. Rather than constituting a measurable variable (age above or

¹ Johnson (2010) also points to the influential role of the national government under Northern-born Prime Minister Thaksin Shinawatra, as one of the “largest force[s] influencing construction and re-invention of space in the city [Chiang Mai]” (p. 334).



Figure 1: Wooden residential house in the Chang Moi neighborhood with kalae
Photography by C. Richter, July 2022

below xy) to explain variations in perception in a statistical sense, the evocation of the age dichotomy might be interpreted as part of a more general narrative representing urban transformations in Chiang Mai in different aspects. Important to people's perceptions is also whether they have lived in wooden vernacular houses during their childhood or even at a later point in time and made pleasant memories. Not surprisingly, this increases the openness to considering the reuse of existing wooden buildings and their maintenance. In addition, crafts related skills of household members themselves or knowledge and connection on how to access craftspeople influence how current and future preservation of houses are viewed. We further distinguish between owners and renters as these not only have different attachments to the houses (e.g. as home of family ancestors in the case of owners, who inherited the house), but also have different ties to the surrounding community and different decision making powers with respect to the house. The prevalence of various social norms and values within a household influences perceptions and views on what to do with the home. For example, inheritance practices might demand of the oldest daughter to take care of house in some families, whereas in other families profit orientation may prevail leading to a somewhat more relaxed attitude towards selling the house.

3.2. Houses and Indoor Comfort as Mediating Circumstances

Characteristics of the house itself and its

surrounding areas constitute a mediating circumstance in so far as they influence the views of owners, renters or (potential) users and buyers regarding the houses' preservation. Our pilot districts are the Lam Chang neighborhood, a predominantly Buddhist community around Wat Lam Chang, located in the eastern sub-district of Si-Phum of Mueang Chiang Mai and Wat Ket, an old merchant community of Muslim, Buddhist and Christian residents located in the eastern Wat Ket sub-district of Mueang Chiang Mai along the Ping River. Both neighborhoods are characterized by strong neighborhood ties. The wooden houses in these neighborhoods range in age between 20 to 90 years and to this day are still used for residential purposes or mixed residential-commercial uses. While materials and styles have changed through time, e.g. from wood masonry and clay tile roofs to post-modern minimalist styles with mixed materials, wood as a material dominates in its stylistic contribution and as a core structural element in the houses being studied. Structures often contain elements that evoke a Lanna past or tradition, especially the kalae (carved wooden crossing attached to the gables of the house, see figure 1). As indicator of a past taken into the future, the kalae also decorates many new structures, even if steel, concrete and glass dominate the structure.

The age of the house itself is a mediating circumstance. One academic, with whom we discussed the topic explained that this can be likened to the value ascribed to cars. New wooden



houses, often in Scandinavian or Japanese looking styles and mixed with concrete elements are highly valued as modern luxury items. Very old wooden houses are also highly valued as cultural heritage. But there is an age span in between, that cannot be unequivocally defined, where a wooden house may simply be regarded as not modern enough (in terms of indoor comfort and aesthetics) and hence worth the extra expenses of maintenance by some people, for instance young buyers, or it may be considered worthwhile preserving by others, for example due to its value as family heritage. In the addition, there is variation in terms of use. Some houses, regardless of age, may be considered more suitable for commercial, for instance touristic use, while others remain at least partially residential (see figure 2). It is this sort of “middle-range” residential housing, which we now briefly discuss, and which will constitute a more prominent focus of the research in the immediate future.

In case of residential use, indoor comfort of current and future residents mediates people’s perceptions on the preservation of residential or mixed-use wooden houses. In the following very brief discussion we draw on material from the focus groups only, i.e. insights from relatively homogenous groups of respondents (mostly 50 years of age and older, who either used to or currently live in wooden houses) to show how perceptions differ for this group due to the house’s characteristics in relation to its surroundings. Overall, respondents attribute wooden houses a peaceful, harmonious, beautiful atmosphere with close associations to nature. These meanings of the houses are mostly associated with the material (wood) itself, but often also with the characteristics of the immediate surroundings, especially trees and shade. The surrounding area’s influence may partially explain contradictions in residents’ perceptions of indoor comfort, especially thermal conditions. While

some residents state that wooden houses are cool and well ventilated in summer, others point out that they become stuffy and dusty requiring either an A/C to be installed, which can be costly, or windows to be enlarged for better ventilation. Residents specifically mention planting trees as an important factor to support the preservation of wooden houses (see figure 3).

Perceptions of indoor comfort are quite individual². For example, while one focus group respondent finds the indoors comfortable in summer, but too cold in winter, another stated that “the wooden house is suitable for the local climate’s airy summer, and in the winter it has the warm feeling of living in the woods.” The latter quote is interesting as it possibly hints to the perception of warmth associated with the “feel” of wood rather any actual, measurable temperature. In addition, there are perceived differences between floors. While the higher floor may be too hot in summer, the lower floors are still comfortable. The older generation



Figure 2: The lower floor of these buildings in the Wat Ket community is used for commercial purposes, while the upper floor of the buildings is for residential use. The building on the far-right side of the photo also shows how materials are often mixed with concrete or cement being used for the lower floor while the upper floor remains wooden (Photography: School of Public Policy, CMU, December 2019)

² It should be noted that this may have epistemological reasons. For instance, while we assume that responses reflect people’s actual, subjective perceptions of indoor comfort, there is a possibility that the responses regarding this topic reflect to some degree how much people value wood as a material and seek to advocate for the preservation of wooden houses. An especially poignant example is the interview with a housing developer, who makes the opposite argument, namely that concrete absorbs the heat better and therefore an A/C is more likely to be required in a wooden building. He later explained that he “trusts” concrete more. In other words, questions and responses about indoor comfort may tell us as much or more about the value of different materials among people than the perceived comfort in terms of air quality and temperature.



Figure 3: Wooden residential houses in San Pa Tong, at the outskirts of Chiang Mai, surrounded by greenery and trees. Photography by U. Kaiser, April 2022

represented in the focus groups also emphasizes the important role of wooden houses at the neighborhood scale in strengthening communal ties and identity, upholding family identity and lineage, being the pride of owners and as reference point to learn about traditional, especially Lanna, ways of life. Focus group representatives expressed concerns regarding the maintenance of wooden houses specifically due to high costs, low availability of affordable materials, high cost of repairs and the damage caused by termites and the bending of wood through time, as well as the need to lower fire risks, especially by improving electrical infrastructure in and surrounding the houses to avoid short circuits (see figure 4).

On the other hand, younger respondents, with whom we have mostly talked informally, and to a lesser degree as part of the interviews and focus groups so far, may have specific concerns living in wooden houses. They remember, for instance, being afraid as children to walk on higher floors with large cracks between the planks or the noises of screaming floorboards that would upset the adults and elders in the family. Their perspective will be explored in more depth in future steps of the study.

4. Reflection and Future Research

The research so far shows that social groups and their perceptions are dynamic and scale dependent, influenced by a number of what we

called here “mediating circumstances.” Here we focused on the house and its immediate surroundings as mediating circumstance, but others including changing household situations through time and regional dynamics also play an important role. For example, at the scale of the households living in wooden houses and/or the owners of wooden buildings, we see various possibilities, in which factors influencing the perceptions and requirements for preservation through use overlap and combine with one another, e.g. a household’s income, the building’s age, and the land prices in the surrounding neighborhood constitute unique conditions and situations, which lead to certain perceptions and actions.

In brief, the meanings houses hold for people and the corresponding social groups are the conglomerate outcome of social, physical and locational influences. Conceptually speaking this means that “interpretive flexibility” has a double significance in this case. First, it pertains to the flexible meanings over vernacular wooden houses depending on social groups. Second, it also relates to the scale-dependent dynamics in and between these social groups, which unsettle stable sets of social criteria that would allow for a social structuration unequivocally associated with perceptions and uses.

Therefore, *future applied research* needs to relate socio-economic characteristics of (current and potential) residents and their corresponding perspectives to specific locational situations and building characteristics, as a basis for the identification of requirements to preserve houses through residential use across the city.

At a more summative level and cutting across the double-significance of interpretive flexibility, the different meanings of wooden houses described in this paper are reflected in Soini’s and Birkeland’s (2014) “four political and ideological contexts,... which provide ... perspectives on the political ideologies and policy arenas to which cultural sustainability may refer,” (p. 213) and which the authors identified based on storylines evident in the discourse on cultural sustainability. In the first, the conservative perspective, tangible and intangible



culture are seen as a capital to be preserved for future generations and carry value for the creation of collective identities. This view is represented in our analysis especially by the “heritage advocate group,” but may also be held by members of the older generation and those people, who have lived in wooden houses before or in their childhood. The second perspective on cultural sustainability, namely a neoliberalist view, emphasizes culture as a resource for economic development, which in our case is represented, for instance, by businesspeople, who benefit from proximity to well-maintained wooden houses if these help to attract customers or by house owners and young people inheriting houses, who change the function of the house to commercial uses. According to the third, communitarian perspective, “culture is considered broadly as a process and as a diversity of ways of life [and] values, ...where cultural development is to be treated in the specific and local cultural context, a community” (Soini & Birkeland, 2014, p. 219). For example, older members of the focus groups in our study emphasize the important role of wooden houses to strengthening communal ties and identity. And finally, the environmental perspective, where “culture is considered in terms of the human-nature interface” (Soni & Birkeland, 2014, p. 219) and ecological reasoning dominates, finds expression in our study, in people’s appreciation of wood as a building material, because of its “natural feel” and recyclability as well as the importance attributed to natural surroundings of wooden houses, especially trees.

The technologies of housing (preservation, construction, renovation, etc.) are likely to take on different shapes depending on these four political and ideological contexts. Accordingly, *future conceptual research* may document and identify pathways of stabilization of technology according to these respective socio-political contexts, in which they evolve.



Figure 4: Electrical wiring in front of wooden house in Wat Ket
Photography by: School of Public Policy, CMU, Chiang Mai,
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FloodAdaptVN

Thematic Legend Harmonization for Central Vietnam

Michael Schultz & Nguyen Hien

Photography by Katharina M. Borgmann, In Vietnam





Centered on the land-use legend from the Vietnamese Department of Natural Resources and Environment (DONRE), a thematic legend harmonization was formulated for the central Vietnamese province of Thừa Thiên Huế (TTH). This harmonized legend facilitates interoperability between distinct land use and land cover categories, serving as a relevant tool for flood management. It is also conducive to activities focused on the integration of ecosystem-based approaches into flood risk management, thereby promoting adaptive and sustainable urban development in central Vietnam. The harmonization process was executed in three sequential phases. Initially, pertinent land use and land cover products, as well as project perspectives, were identified, and their respective thematic legends were compiled. Subsequently, a land cover classification system was employed to disaggregate the legend classes into discrete building blocks, termed classifiers. Ultimately, common thematic elements were discerned, a conversion table was constructed to align the disparate legends, and a newly harmonized legend was generated.

Tóm tắt tiếng Việt

Dựa trên huyền thoại về sử dụng đất từ Bộ Tài nguyên và Môi trường Việt Nam (DONRE), một huyền thoại chủ đề được hòa quyện đã được xây dựng cho tỉnh Thừa Thiên Huế (TTH) ở miền Trung Việt Nam. Huyền thoại hòa quyện này giúp tương thích giữa các loại sử dụng đất và phủ đất khác nhau, phục vụ như một công cụ liên quan cho việc quản lý lũ lụt. Nó cũng có lợi cho các hoạt động tập trung vào việc tích hợp các phương pháp dựa trên hệ sinh thái vào quản lý rủi ro lũ lụt, do đó thúc đẩy sự phát triển đô thị linh hoạt và bền vững ở miền Trung Việt Nam. Quá trình hòa quyện được thực hiện trong ba giai đoạn liên tiếp. Ban đầu, các sản phẩm sử dụng đất và phủ đất liên quan, cũng như các quan điểm dự án, đã được xác định và các huyền thoại chủ đề tương ứng của chúng đã được biên soạn. Tiếp theo, một hệ thống phân loại phủ đất đã được sử dụng để phân tách các lớp huyền thoại thành các khối xây dựng riêng biệt, được gọi là bộ phân loại. Cuối cùng, các yếu tố chủ đề chung đã được nhận diện, một bảng chuyển đổi đã được xây dựng để căn chỉnh các huyền thoại khác nhau, và một huyền thoại hòa quyện mới đã được tạo ra.

Introduction

Accelerating climate change has led to variations in water and temperature regimes worldwide, resulting in increased intensities of calamitous events such as droughts and floods [1]. Vulnerabilities of ecosystems and societies to these events differ by type and vary spatially and temporally. Southeast Asian agglomerations are particularly affected [2]. Driven by rapid economic development, political, economic, and civil society institutions face challenges in adaptation. Adaptation performance and societal resilience against climate change are influenced by experience, implementation capacity, and sustainable planning prospects [3]. Central to successful adaptation activities is the interdependency of various societal actors—politicians, administrators, scientists, and responders—in shaping a joint planning process.

A common understanding of affected assets and land, through a unified nomenclature of information, is essential for constructive communication and collaboration among stakeholders. Definitions of land use (LU) and land cover (LC) and their associated expectations differ depending on perspective. While administrative staff may focus solely on land use, modelers often consider land cover; both perspectives are crucial for calamity management. Land cover refers to the biophysical surface of the Earth, whereas land use pertains to its anthropogenic function [4]. Multiple legends can impede collaborative efforts and erode cohesion. We propose a legend harmonization for projects involving multiple societal actors to facilitate seamless integration of spatially explicit products and perspectives.

This activity falls under the Federal Ministry of Education and Research (BMBF) Sustainable Development of Urban Regions (SURE) umbrella, targeting Southeast Asian agglomerations and covering various challenge-related projects. Specifically, we designed a legend harmonization for the Integrating Ecosystem-based Approaches into Flood Risk Management for Adaptive and Sustainable Urban Development in Central Viet Nam (FloodAdaptVN) project, focusing on the area of interest (AOI) in Thừa Thiên Huế (TTH) province.

Results should be scalable and potentially reproducible in other SURE or related projects.

A key component is the Economics of Climate Adaptation (ECA) tool, which combines infrastructural asset groups with Representative Concentration Pathways (RCP) and Shared Socioeconomic Pathways (SSP) scenarios to determine asset values impacted by flood events. Assessments aim to capture the diversity of impacts and associated vulnerabilities, an approach termed as multi-risk [5] or multi-vulnerability [6]. The assessment will primarily utilize existing land use maps, infrastructure data, and field survey data.

We accommodated different perspectives by using existing LU data from the Department of National Resources and Environment (DONRE) as the foundational geographic information system (GIS) layer. Classes were tailored to align with existing descriptions in the Vietnamese language for quick adoption into existing planning processes. The ECA tool required refinement of DONRE classes towards detailed building descriptions and assets, including thematic depth for land offering ecosystem services and recreational values linked to green spaces, both natural and artificial. Compatibility with common urban growth and hydrological models was also a requirement. In the context of the spatial and temporal requirements of TTH, two objectives were formulated:

- Identify existing legends suitable for urban growth modeling, hydrological modeling, ecosystem analysis, land use, and infrastructural asset groups
- Harmonize identified legends, prioritizing a Vietnamese-centered perspective

To address these research questions, discussion rounds were set up among the FAVN research consortium to identify legend requirements in alignment with proposed project and research activities. A legend harmonization tool was applied as the methodological device.

2. Methods

Here, methods are presented to create a harmonized legend that accommodates economic

perspectives on asset value estimations, ecological functions, models, and is centered around a regional used existing legend. A legend is the application of a classification in a specific area to express its thematic attributes [7]. For comparative interrogation the legend of a LULC product has an impact on its accuracy. The most common classification systems are the Anderson Legend [8] and the Intergovernmental Panel on Climate Change (IPCC) Land Use, Land Use Change and Forestry (LULUCF) legend [9]. Classes of legends can be aggregated, split up or extended to offer comparison across different legends, in other words a legend harmonization. An option to identify common thematic denominators of different legends is through the United Nations (UN) Food and Agriculture Organization (FAO) Land Cover Classification System (LCCS). Common in all classification systems is the capability in covering all land surface characteristics within the AOI, meaning no object can remain unclassified. Different geographic scales reveal more or less details of the land surface or its anthropogenic function requiring the legend to adjust using different levels of detail. Thus, major classes can contain subclasses. The Anderson Legend contains 4 Levels of details and within the Remote Sensing science community was the first one widely accepted. LCCS provides essential classifier blocks that can be combined to create any land cover class in explicit thematic detail.

Figure 1 provided an outline of the study. First, a suited Vietnamese legend was identified through bilateral meetings of local stakeholders and review of existing maps. It was mandatory to center the

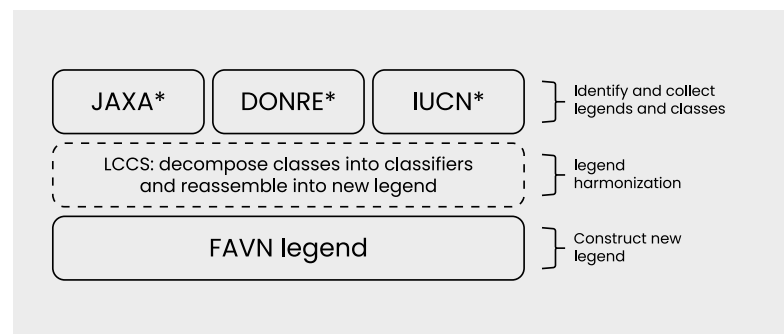


Figure 1: Methodological setup of legend harmonization; *considered legends



legend harmonization around a local used legend to ensure local acceptance. Due to its relevancy within the planning process across Hué province departments, the DONRE legend was chosen. Second, legends were identified to accommodate the research and planning needs of FAVN project. And finally, we identified thematic class overlaps and legend harmonization by using LCCS. The proposed legend was not limiting thematic depths and can be expanded further within a specific class. For instance, the amount of bed for the class medical hospitals can still be added or species can be amended for forest related class as needed. We defined three axioms for the legend harmonization: Vietnamese centered, forward and backward convertibility across legend and scalability.

2.1. Legends and requirements

Legends and their associated requirements are articulated in the subsequent section. The foremost requirement was to harmonize the new legend with the existing DONRE legend [10]. A secondary emphasis was placed on accommodating ECA asset estimations, which required intricate descriptions of urban functionalities. While the majority of these functionalities were already encapsulated by the DONRE legend, specific augmentations were made, notably in categories such as land designated for traffic infrastructure and residential zones (Table 1). For the delineation of ecosystems, the International Union for Conservation of Nature (IUCN) legend was employed [11], [12]. The Slope-Land-Cover-Excluded-Urban-Transportation-Hillshade (SLEUTH) model was utilized for FAVN's urban growth modeling activities. This model integrates historical Land Use and Land Cover (LULC) data, topographical elements, and infrastructure parameters to generate spatially explicit urban growth simulations. It functions as a cellular automaton, utilizing a predefined set of growth parameters and associated rules [13]. Due to SLEUTH's limited requirement for land cover classes and its lack of specificity for urban land use functionalities, the Japan Aerospace Exploration Agency (JAXA) legend was selected for its robustness and compatibility with extant LULC products [14]. This JAXA legend was also considered appropriate for the hydrological modeling component.

2.2. Legend harmonization

Legend harmonization was conducted using the LCCS3 tool, version 1.8.3, sourced from the Food and Agriculture Organization (FAO). Given the tool's orientation toward Land Cover (LC), thematic gaps related to Land Use (LU) were addressed through expert consultation and by extending definitions where required. LCCS serves as a reference classification system and provides avenues to specialized expertise. Classes within LCCS are decomposed into independent diagnostic criteria, termed classifiers. These classifiers are selectable from a comprehensive array of options. Any existing legend can be translated into LCCS by employing these classifiers as foundational elements to construct classes. The comparison of legends translated into LCCS facilitates the identification of common thematic denominators across different legends. The LCCS user interface is organized into categories related to vegetation characteristics, abiotic surfaces, and land cover class attributes. Classes are structured through horizontal strata, organized as branches akin to a decision tree. Thematic detail is represented through dichotomous pathways, leading from specific criteria (e.g., herbaceous growth forms) to more general criteria (e.g., presence or absence of vegetation).

3. Results

Figure 2 illustrates a representative example of classes decomposed into classifiers and their thematic overlap. Displayed are the classes "rice paddies" from the IUCN legend and "other cropland" from the JAXA legend. The classes exhibit significant overlap, with the exception of the blue water classifier unique to the IUCN's rice paddies category. Consequently, the IUCN class could be considered a subclass of the JAXA class, and their common thematic denominator is represented by boxes of identical color. This analytical process was replicated for all classes and legends to identify thematic overlaps, substrates, and potential aggregations. The outcome of this exercise is presented in Table 1, where the FAVN legend is displayed.

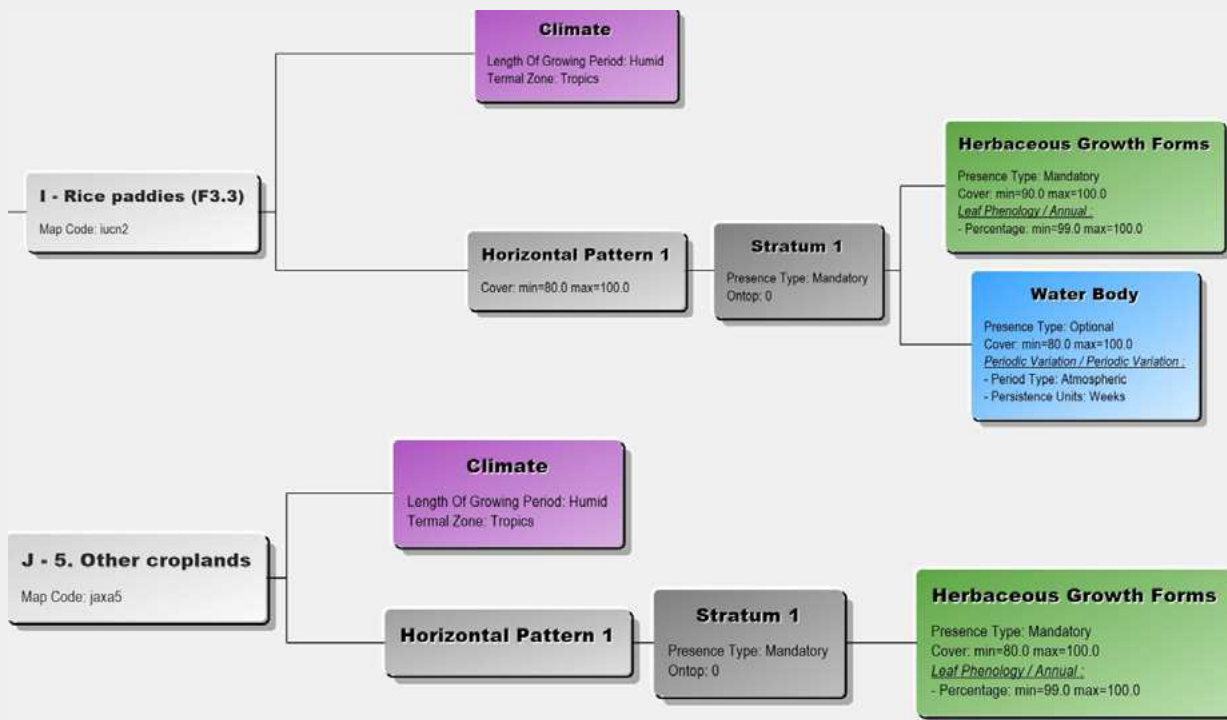


Figure 2: Dichotomous classification scheme example of LCCS3

4. Discussion and Conclusions

This study underscores the significance of adeptly managing landscape heterogeneity for the comparative amalgamation of multiple perspectives and disparate legend systems. It also addresses the challenges of handling sites characterized by multiple classification schemes. The study thus facilitates international information fluidity while maintaining a Vietnamese-centric focus for the project. Given the absence of a unified Land Use (LU) classification system, we sought to bridge this gap through Land Cover (LC) classifications and call upon the research community to further address this issue. Problematic classes identified in the study were those that are highly mixed (e.g., land designated for other natural, non-agricultural purposes), which may be overlooked in practical project work but expose existing limitations.

Long-term, computationally intensive activities, such as modeling, necessitate a stable legend within ongoing project activities. Conversely, more exploratory research activities, like Economic Cost of Adaptation (ECA), may require a legend with a degree of flexibility for potential alterations based on outcomes. To meet these varied requirements, we provided a legend harmonization that accommodates both pre-existing classes and a recommended harmonized legend. Interchangeability between these legends is facilitated by our thematic legend conversion table. Consequently, each class can be linked to an existing or incorporated legend system, making our harmonized legend a thematic compilation and conversion hub that ensures interoperability.





Generalized FAVN class - EN	Generalized FAVN class - VN	DONRE classes - EN	DONRE classes - VN	IUCN classes	JAXA classes
1. Land for rice	Đất chuyên trồng lúa	Land for rice crop (all seasons); Land for remaining rice crop (Rice combines with other crops); Land for terrace rice	Đất chuyên trồng lúa nước; Đất trồng lúa nước còn lại; Đất lúa nương	Rice paddies	Rice paddies
2. Land for other crops	Đất trồng cây nông nghiệp khác	Land for other annual crops; Upland land for other annual crops; Land for perennial crops; Other agricultural land	Đất bằng trồng cây hàng năm khác; Đất nương rẫy trồng cây hàng năm khác; Đất trồng cây lâu năm; Đất nông nghiệp khác	Cropland; Sown pastures & fields; Derived semi-natural pastures and old fields	Woody crops; Other croplands; In-house crops; Grassland/Herbaceous vegetation
3. Land for plantation forest	Đất rừng đồn điền	Land for production forests	Đất rừng sản xuất	Plantations	Plantation land
4. Land for evergreen forest	Đất rừng thường xanh	Protective forest	Đất rừng phòng hộ	Tropical/Subtropical lowland rainforests; Tropical/Subtropical dry forests and thickets; Tropical/Subtropical montane rainforests; Warm temperate laurophyll forests	Deciduous broadleaf forest; Evergreen needle-leaf forest; Evergreen broadleaf forest
5. Land for special-use forest	Đất rừng đặc dụng	Land for special-use forest	Đất rừng đặc dụng	Tropical flooded forests and peat forests; Tropical/Subtropical lowland rainforests	Mangrove; Bamboo area
6. Land for aquaculture	Đất nuôi trồng thủy sản	Aquaculture land	Đất nuôi trồng thủy sản	Freshwater aquafarms	Aquaculture
7. Land for salt-making	Đất làm muối	Land for salt-making	Đất làm muối	Coastal saltmarshes and reedbeds	Inland wetland
8. Land for residential areas	Đất ở	Rural residential land; Urban residential land	Đất ở tại nông thôn; Đất ở tại đô thị	Urban & Industrial	High developed area; Low developed area
8.1. Single family house	Nhà cho một gia đình				
8.2. Multi family house - apartment building	Nhà nhiều gia đình và nhà chung cư				
8.3. Villa	Biệt thự				
8.4. Irregular/informal house	Nhà không chính thức				



Generalized FAVN class - EN	Generalized FAVN class - VN	DONRE classes - EN	DONRE classes - VN	IUCN classes	JAXA classes
9. Land for governmental and military infrastructure	Đất cho cơ quan nhà nước và quân đội	Land for state-run offices/ buildings; Land for non-business organizations; Land for building cultural facilities; Land for social service facilities; Land for foreign/ diplomatic facilities; Land for other facilities; Land for national defense; Land for national security; Land for post and tele-communication facilities	Đất xây dựng trụ sở cơ quan; Đất xây dựng trụ sở của tổ chức sự nghiệp; Đất xây dựng cơ sở văn hóa; Đất xây dựng cơ sở dịch vụ xã hội; Đất xây dựng cơ sở ngoại giao; Đất xây dựng công trình sự nghiệp khác; Đất quốc phòng; Đất an ninh; Đất công trình bưu chính, viễn thông	Urban & Industrial	High developed area; Low developed area
10. Land for healthcare facilities	Đất cho cơ sở y tế	Land for healthcare facilities;	Đất xây dựng cơ sở y tế	Urban & Industrial	High developed area; Low developed area
10.1. Medical hospital	Bệnh viện y tế				
10.2. General practitioner	Phòng khám chuyên khoa				
10.3. Pharmacy	Nhà thuốc tây				
11. Land for education, research facilities	Đất cho cơ sở nghiên cứu, giáo dục và đào tạo	Land for education and training facilities	Đất xây dựng cơ sở giáo dục và đào tạo; Đất xây dựng cơ sở khoa học và công nghệ	Urban & Industrial	High developed area; Low developed area
11.1. Primary/ secondary school	Trường tiểu học, trung học cơ sở				
11.2. Highschool	Trường trung học phổ thông				
11.3. University	Trường đại học				
11.4. Research center	Trung tâm nghiên cứu				
12. Land for sport activities	Đất cho cơ sở thể dục thể thao	Land for sport facilities	Đất xây dựng cơ sở thể dục thể thao	Urban & Industrial; Derived semi-natural pastures and old fields	Scrub/Shrub
13. Land for industry	Đất cho khu công nghiệp	Land for industrial parks; Land for industrial processing zone; Land for industrial clusters; Land for non-agricultural production facilities	Đất khu công nghiệp; Đất khu chế xuất; Đất cụm công nghiệp; Đất cơ sở sản xuất phi nông nghiệp	Urban & Industrial	High developed area; Low developed area



Generalized FAVN class - EN	Generalized FAVN class - VN	DONRE classes - EN	DONRE classes - VN	IUCN classes	JAXA classes
14. Land for commercial services	Đất thương mại dịch vụ	Land for commerce and services	Đất thương mại, dịch vụ	Urban & Industrial	High developed area; Low developed area
15. Land for mineral activities	Đất cho hoạt động khoáng sản	Land for mining activities; Land for construction materials and ceramics	Đất sử dụng cho hoạt động khoáng sản; Đất sản xuất vật liệu xây dựng, làm đồ gốm	Urban & Industrial	Barren land
16. Land for traffic infrastructure	Đất giao thông	Traffic land	Đất giao thông	Urban & Industrial	High developed area; Low developed area
16.1. Primary road	Đường chính				
16.2. Secondary road	Đường phụ				
16.3. Tertiary road	Đường làng				
16.4. Highway	Đường cao tốc				
16.5. Bridges	Cầu				
16.6. Airport	Sân bay				
16.7. Transportation hub	Trạm phươg tiện di chuyển				
17. Land for energy facilities	Đất cho công trình năng lượng	Land for energy facilities	Đất công trình năng lượng	Urban & Industrial	High developed area; Low developed area
17.1. Petrol station	Trạm xăng dầu				
17.2. Power plant	Nhà máy điện				
17.3. Power line	Đường điện cao thế				
17.4. Electric substation	Trạm điện cao thế				
18. Land for general public use	Đất cho sinh hoạt và dịch vụ cộng đồng	Land for community services; Land for public entertainment and recreation; Land for landfill and treatment facilities; Land for other public facilities	Đất sinh hoạt cộng đồng; Đất khu vui chơi, giải trí công cộng; Đất bãi thải, xử lý chất thải; Đất công trình công cộng khác	Urban & Industrial	High developed area; Low developed area
18.1. Land for public use general	Đất cho dịch vụ cộng đồng				
18.2. Land for fire station	Đất cho trạm chữa cháy				



Generalized FAVN class - EN	Generalized FAVN class - VN	DONRE classes - EN	DONRE classes - VN	IUCN classes	JAXA classes
19. Land for market	Đất chợ	Market land	Đất chợ	Urban & Industrial	High developed area; Low developed area
20. Land with historical and cultural sites	Đất có di tích lịch sử - văn hóa	Historical and cultural sites; Scenic land/ tourism sites; Land for religious facilities; Land for believe bases; Land for cemeteries, graveyards, funeral homes, crematoriums	Đất có di tích lịch sử - văn hóa; Đất danh lam thắng cảnh; Đất cơ sở tôn giáo; Đất cơ sở tín ngưỡng; Đất làm nghĩa trang, nghĩa địa, nhà tang lễ, nhà hỏa táng	Urban & Industrial	High developed area; Low developed area
21. Land with semi-natural water surface	Đất có mặt nước bán tự nhiên	Land for rivers, streams and canals; Irrigation landland	Đất sông, ngòi, kênh, rạch, suối; Đất thủy lợi	Canals, ditches and drains; Seasonal upland streams; Seasonal lowland rivers	Open water
22. Land with natural water surface	Đất có mặt nước tự nhiên	Land for water surface	Đất có mặt nước chuyên dụng	Ephemeral freshwater lakes; Constructed lacustrine wetlands; Seasonal floodplain marshes; Permanently open riverine estuaries & bays; Intermittently closed & open lakes & lagoons; Rocky Shorelines; Muddy Shorelines; Sandy Shorelines; Artificial shorelines	Open water
23. Barren land	Đất bằng chưa sử dụng	Unused flat land; Unused mountain land; Rocky mountains without forests	Đất bằng chưa sử dụng; Đất đồi núi chưa sử dụng; Núi đá không có rừng cây		Barren land
24. Land for other natural non-agricultural purposes	Đất phi nông nghiệp khác	Land for other natural non-agricultural purposes	Đất phi nông nghiệp khác	Pyric tussock savannas; Coastal shrublands and grasslands	

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