



1. Insights from the Definition Phase

During the Build4People Definition Phase we were able to gain a deeper understanding of the Cambodian context and local characteristics that concern the research field of the Build4People project and the specific research questions according to WP#1. The research stays, the comprehensive exchange with our local research partners and other stakeholders in form of conferences and workshops, as well as many internal project discussions, specified our research approach. Furthermore, our interviews (as a preparation for our survey) and the first pre-test of the survey gave manifold insights into the contextual factors, the environmental conditions as well as perceptions and experiences of citizens of Phnom Penh. So far, we have observed a rather limited local knowledge on the mindset of the urban population from an environmental psychology perspective.

An important insight for us according to the environmental awareness of people in Phnom Penh was the difference between local and global environmental issues. Many local environmental problems such as air pollution and the lack of waste management were often reported. Local organizations and institutions already show some measures to meet those environmental problems, e.g. by aiming at the promotion of the avoidance of plastic, of less usage of plastic bags, of saving of drinking water, enhanced waste management, etc. Corresponding posters and materials are observable in public spaces, official institutions or restaurants. During the project discussions and exchange with local actors however, the awareness and understanding of global environmental problems such as climate change was lacking. The connection of one’s own individual behaviour with global environmental problems is usually not considered. This impression is in line with findings according to the Gallup World Poll, indicating that awareness of global climate change is higher in wealthier and higher educated countries (Knight, 2016). We reckon that this understanding should be addressed by special intervention techniques focusing on knowledge transfer and the reflection of observable social practices and their influence on the local and global environment. One possible way to approach this topic will be a collaborative workshop together with WP # 5 on urban climate, climate change consequences and climate change adaptation in Cambodia. Environmental concern and problem awareness can be defined as necessary, but not at all as sufficient preconditions of pro-environmental behaviour (see Abrahamse et al. 2005). However, an increase of problem awareness and salient social norms are important when developing interventions for behaviour change and campaigns, in order to prepare a basis for more sufficient strategies like strengthening social support or increasing self-efficacy by concrete information about possible behaviour options (Klößner, 2013).



Moreover, important insights that we could gain during the Definition Phase helped us to develop a better understanding of different pro-environmental behaviours in Phnom Penh. We were aiming at a wide observation of the urban population in general, and also on the urban middle and upper class with a rather high carbon footprint and unsustainable lifestyles to a certain extent. After having conducted interviews and workshops during our first research stay, the following environmentally relevant (private sphere) behaviours were identified for the daily life in Phnom Penh: modes and means of transportation, electricity consumption (with a special focus on air conditioning), waste management and the use of plastic. Hence, we were especially focusing on those behaviours in the survey and the planned intervention projects. Since behaviour always needs to be regarded in its context, we could also get a better understanding of the political and infrastructural factors that facilitate a certain behaviour or make it more difficult. Especially the interviews and workshops conducted by WP#6 on Sustainable Urban Transformation gave a comprehensive insight in relevant structural barriers for pro-environmental behaviour that shall be addressed by several urban transition strategies and by a focus on individuals and their (sustainable) interaction with the urban environment. Furthermore, the concept of Urban Quality of Life (UQoL) could be set in the Cambodian context during the Definition Phase, by considering the local social structures and the urban infrastructures. It is essential to put both the objective factors associated with Urban Quality of Life in the Cambodian context, as well as important social and cultural aspects that influence the subjective factors and the perception and evaluation of the city and its livability. Within our interdisciplinary approach to the concept of Urban Quality of Life, we focus for example on the domain of walkability as a relevant determinant of UQoL. Walkability often came up during our collaborative work and exchange with local actors as a relevant topic for the perception of the city and the interaction between people and their urban environment. Since pathways are also used for shops, as parking spaces, or are in no good condition, walking is not easily possible for citizens in most of the city of Phnom Penh. Urban green spaces as another determinant of UQoL are addressed within our approach and especially elaborated by WP#4 “Urban Green”, focusing on their positive effects on Phnom Penh’s citizens. Our first insight during the Definition Phase show that there is a decrease of urban green spaces, in the way that the available green space per person decreases and less people have access to green spaces or are not able to reach them. The multifaceted functionalities and options for use and the importance of urban green spaces on the UQoL of Phnom Penh’s citizens are encouraging the dealing with this interdisciplinary topic during the Research and Development Phase by both WP#1 and WP#4 and in joint working activities.



According to the methodology that we apply within our research design, important insights were gained according to the application of the survey instrument. We considered cultural influences on the responding behaviour and could learn from the experiences that our social science local research partners reported on carrying out surveys in Cambodia. We discussed for example specificities about the Khmer language intensively with our local partners. During the preparation and translation process of our questionnaire, it became clear that many words used in our research field, especially technical terms, could not be translated unambiguously. Those insights will help us to adapt the survey instrument and to develop further questionnaires.

According to the experiences gained from the Ecocity Transition Lab process that took place during the Definition Phase, the impression arose that participation concepts are rather unknown in the statutory urban planning practice and political context of Cambodia. Practiced participation does not seem to work in a comparable way to the processes we might experience within our western cultural context. Planning in urban Cambodia is not understood as a process but as a publication of planning documents which are already outdated upon publication given the high development dynamics. Correspondingly, architecture and urban planning does not seem to be much people-orientated but with a focus on design. We will investigate cultural, social and psychological factors in that regard, and we will thereby support WP#3 and WP#6 in their action research based activities and participation processes during the Research and Development Phase.

The exchange and cooperation with our highly motivated cooperation partners at the RUPP provided us a clearer picture of the challenges associated with the development of a curriculum of Environmental Psychology for the department of Psychology at the RUPP. First of all, the situation of psychology as a domain of science is different to the context of the German universities. At RUPP, psychology can be attended as a bachelor's degree but no master program has been established, so far. The education is more focused on practical courses instead of research techniques and methods, and there are no PhD opportunities. The next issue date for a change of the bachelor curriculum is announced for the year 2023. Within the Research and Development Phase, we are aiming to develop suitable seminar programs on environmental psychology topics such as human-environment interactions or intervention techniques for behaviour change within the bachelor curriculum of psychology. Furthermore, by the help of our cooperation with WP#5 on Urban Climate, we will develop a curriculum input to the master of Climate Change. The fruitful cooperation and open communication with the local research partners are notably encouraging the joint curriculum planning within the Research and Development phase.



2. Main Aims of the RD Phase

The main aim of the Research and Development Phase is to foster sustainable behaviours and sustainable living for people in Phnom Penh. This has to be realized in accordance with the overall aim to enhance Urban Quality of Life (UQoL) for all citizens of Phnom Penh through sustainable urban transformation.

2.1 Sub-aims

- Understanding and analyzing problem awareness, environmental concern and environmental behaviours in Phnom Penh.
- Analyzing the main drivers/barriers for sustainable behaviours of the middle-class (so-called “new consumers”) in Phnom Penh.
- Understanding possible contradictions between individual lifestyle preferences and sustainable lifestyles; and developing solutions for reducing these conflicts.
- Development and testing of theory-driven and data-based intervention techniques to foster sustainable behaviours in Phnom Penh.
- Transferring a people-centered psychological understanding of (Urban) Quality of life into a transdisciplinary Model of Urban Quality of Life.

Beside disciplinary research interests, WP#1 is mainly interested in the mainstreaming of people-centered, psychological concepts into formal planning, design and policy making processes with the goal of supporting an urban sustainability transition by enabling a socio-institutional change with means of participatory planning and involvement.

WP#1 will contribute to different transdisciplinary Build4People processes and products by feeding in theory-driven and data-based knowledge from the field of Environmental Psychology during all three spheres of the R& D Phase: *the societal and scientific problem-based research sphere, the transdisciplinary action research sphere, and the reflection, refinement & re-integration of created knowledge sphere.*

3. State of the Art

Understanding, explaining, and changing human behaviour can be defined as the main objectives of psychology. One goal of *environmental psychology* as a specific discipline is to understand what determines people’s behaviour with regard to *environmentally relevant domains*. A number of different approaches have been proposed throughout the field’s history



within the last 30 years. Understanding and explaining behaviour can be considered as the initial condition to be able to find ways to change one’s behaviour towards an environmentally friendly behaviour (De Young, 1993). When aiming to change an environmental significant behaviour, it is crucial to understand the factors influencing this behaviour and the context of the situation individuals face (Stern, 2011).

In order to conceptualize environmental behaviour, or sustainable behaviour, we have to keep in mind that there is not a *general* environmental behaviour. Behaviour always occurs under specific circumstances, e.g. using the bicycle instead of the private car, separating waste or saving energy at home. This is especially important when aiming at promoting pro-environmental behaviour: focusing only on an individual *general pro-environmental mindset* (e.g. general pro-environmental attitudes, values etc.) will not inevitably change a behaviour significantly, without addressing the barriers, drivers and attitudes for the *specific behavioural contexts*.

The environmental psychologist Paul Stern suggested to differentiate various facets of pro-environmental behaviours, in order to understand and promote these behaviours with respect to their specific causal and contextual factors (Stern, 2000). These causal factors may vary across these facets of behaviours and individuals, hence, each target behaviour has to be theorized and addressed suitably.

Researchers stress the importance of behavioural sciences (and psychology) for supporting pro-environmental behaviour and thereby tackling climate change (Stern 2000, 2005, 2011). One other aspect of the specificity of behaviours is considered in this regard: the importance of differentiating between *intent*- and *impact*-oriented strategies.

There are some behaviours associated with a high environmental impact, that might not be defined as everyday behaviours, e.g. investment decisions (investing in energy-efficient technologies such as a solar panel, deciding to buy a „green” building or to move to a sustainable neighbourhood). These behaviours underlie specific constraints and are characterized by high impact. At the same time, these behaviours are only significant for groups of the population, that have resources (in terms of socioeconomic status) to effort these decisions and investments. Data from the German panel “Umweltbewusstseinsstudie” indicate that income seems to be the most important predictor for carbon footprint (Moser & Kleinhückelkotten, 2017). New urban middle classes and their consumption styles are identified as a main driver of global environmental problems (WBGU 2016, S. 152; Myers & Kent, 2003) and thus as relevant actors in transformation processes towards a more sustainable society. Consequently, the so-called new consumers in Phnom Penh [income groups between 401 and 1,200 USD (National Institute of Statistics, 2018)] have to be defined as an essential target group, when it comes to questions of behaviour change. This target



group is characterized by its high saving potential and high degree of freedom (based on resources) in terms of investment decisions and behaviour change. Some studies in the Southeast Asian context already consider those societal groups in their role of relevant actors in the transformation process (Anantharaman, 2014; Fernandes, 2009).

Within the Build4People project the concept of Urban Quality of Life is a guiding component of sustainable urban transformation. In accordance with this, it makes sense to approach Urban Quality of Life in two ways: an analytic research approach that asks for the relative impact of different objective and subjective factors on Urban Quality of Life, and a more normative approach, that understands sustainable transformation as an essential prerequisite for Urban Quality of Life, especially with regard to the (comprehensive) Sustainable Development Goals.

The right to a certain quality of life has to be qualified with respect to solidarity, in order to prevent the restriction of others – this is especially the case for high density urban areas. The realization of a desired individual quality of life *may* happen at the expense of others (e.g. gentrification or living in gated communities). At that point, Urban Quality of Life is not only an individual project. Moreover, UQoL has to be considered as a social project and a process of negotiation (Jaeger-Erben & Matthies, 2018).

Fostering conditions that are considered through the concept of *resistance resources* might be one relevant goal in the domain of sustainability strategies. From the perspective of Environmental Psychology, psychological and social resistance resources play an important role when it comes to the entire resilience¹ of the eco-social system of urban spaces. Resilience is directly associated to the concept of *salutogenesis*², developed by Aaron Antonovsky (1997). With respect to the concept of salutogenesis, figure X depicts a framework that suggests the integration of different factors that affect Urban Quality of Life and reflects the interplay of subjective factors (people sphere) and objective factors (sphere of environment).

¹ Psychological resilience is defined as the ability to cope (mentally or emotionally) with a crisis or a critical situation by using mental processes and behaviours (Richardson, 2002).

² in contrast to the concept of pathogenesis, that explains causes of diseases



Resilience refers to the capabilities and characteristics of a person, as well as to those environmental conditions, that help the person to manage stress and stay well. These generalized *resistance resources* (see figure 1) enable a person to make sense of coherence and to manage situations. Resistance can appear towards environmental stressors (such as noise, pollution, etc.) and harmful experiences that citizens might have in the city. Over time, the successful use of resources can become a tool for coping with those stressors itself. Education, material resources, social cohesion, and individual capabilities, belong to those *resistance resources*. In contrast, generalized *resistance deficits* are described by stress and a lack of these capabilities and resources.

The figure depicts two spheres of the context of UQoL: the sphere of the human (people), and the sphere of the environment that surrounds him/her. The manifestation of UQoL depends on the balance between generalized *resistance resources* and *resistance deficits*. *This balance* will determine whether a factor will decrease, is neutral or increase Urban Quality of Life. The sphere of people includes human traits like *capabilities*, *needs* and *coping strategies*. The sphere of the environment includes the *designed urban environment* (buildings, streets), *urban green infrastructures* (public parks, recreation areas), and *urban governance* structures. Furthermore, the impact of *climate change* will affect Urban Quality of Life as well.

Factors like *social cohesion*, *active participation* (in the sense of social inclusion and a sense of belonging) can influence subjective quality of life by mediating the effects of environmental



factors. Thus, environmental stressors like noise annoyance, level of crime, and pollution will especially affect people with less psychological resilience in terms of higher levels of stress, illness, and social withdrawal. Taking these processes into account can enable hints for strategies to foster Urban Quality of Life by considering the complex interplay of different factors, instead of addressing isolated symptoms. The increase of urban green infrastructures will probably reduce environmental stress, with respect to an increase of psychological resilience, wellbeing, and Urban Quality of Life. Measures to strengthen social cohesion and joint responsibility for those spaces should be addressed as well. Thereby, the framework can help to understand and explain phenomena like the so-called “paradox of satisfaction” (Diener & Diener, 1996; Herschbach, 2002), addressing an alleged contradiction between “objective” (indicator based) measures of quality of life (environmental sphere) and the assessment of those environmental factors (people sphere): people may indicate quite high levels of life satisfaction, although objective indicators of their living conditions are harsh; others might indicate low levels of wellbeing and satisfaction, although objective indicators seem to be very supportive.

This consideration is crucial to us, since people who are socio-economically disadvantaged are especially affected by physical factors (also such as impacts of climate change on the urban climate), that have an impact on quality of life and wellbeing (see Marans, 2012). Because of a lack of resources and a lower degree of freedom, they have less opportunities to design their residential environments. As a consequence, they will be more affected by public resources like public urban green, public recreation areas, etc. Data from Kuo and Sullivan (2001) indicate, that residents living in “greener” surroundings seem to have lower levels of fear and show less aggressive and violent behaviours. Low-income residents seem to especially profit from the greener environments. Taylor, Kuo and Sullivan (2002) support these findings. Their data show a positive correlation of near-home nature and different forms of self-discipline and capacity of direct attention for city-girls from low-income families (7 to 12 years old) in Chicago. Taking into account possible culture-specific constraints, these results give a hint for the relevance of factors - like public green - that may impact urban quality of life for low-income residents.

Another perspective that has to be taken into account is the aspect of gender. Fadda (2003) suggests that the concept of UQoL needs to be understood as a social construct, which is in relation with gender and the environment. In this context human beings perceive their surroundings according to their social role. This might lead to quality of life also differing between gender. A meta-analysis showed that women in general have a higher *environmental concern* than men and participate more in environmentally friendly behaviour (Zelezny, Chua



& Aldrich, 2000). Moreover, a study showed that women have a higher perceived effectiveness, when it comes to environmentally friendly behaviour (Vicente-Molina, Fernandez-Sainz & Izagirre-Olaizola, 2013). Therefore, a gender perspective also needs to be taken into account, when examining environmental behaviours.

There exist many comparative studies that put environmental relevant psychological constructs side by side by comparing the descriptive data between countries, e.g. according to pro-environmental behaviour (Li, 2015), environmental consciousness (Sasaoka, 2014) or knowledge about the environment (Vicente-Molina, Fernández-Sáinz, & Izagirre-Olaizola, 2013). Moreover, some studies examine how culturally dependent psychological factors influence the relationship of cognitive, emotional or behavioural processes. An example is the assumption on the perception of control as an influencing factor on the degree of pro-environmental behaviour (Kalamas, Cleveland, & Laroche, 2014). The so-called environmental locus of control differs between cultures and can thereby influence people's choice of pro-environmental behaviours. Other factors that influence pro-environmental behaviour are social and cultural norms that give people an idea of what is socially accepted and expected. In a cross-cultural study, samples of Germany and Japan were interrogated according to their normative beliefs and pro-environmental behaviours (Ando, Ohnuma, Blöbaum, Matthies, & Sugiura, 2010). This study shows that social and societal norms play a major influencing role on pro-environmental behaviours in Japan, whereas the personal norms have a stronger impact on pro-environmental behaviours in Germany.

4. WP#1 Research Plan

Within the Build4People project Urban Quality of Life is a guiding component of the project's purpose aiming at sustainable urban transformation. WP#1 will therefore coordinate the measurement and conceptualization of the quality of life of people living in Phnom Penh. We are interested in understanding and supporting urban quality of life of people in Phnom Penh and strengthen the people-centered approach of the Build4People-project. The investigation of the concept of Urban Quality of Life (UQoL) will be both, a main research focus of WP#1, as well as the connecting scientific-conceptual, analytical and normative link between the different disciplines within the Build4People project.

WP#1 will focus on the interaction of people and the urban environment, considering the assessment of objective factors as the climate, the built environment and the socioeconomic sphere based on the cooperation with WP#2, WP#4, WP#5 and WP#6. Following a transdisciplinary approach, WP#1 will organize the process of conceptualizing the interplay of the facets that determine people's urban quality of life. The measurement of relevant



objective factors will be organized and conducted in close cooperation with WP#4 according to the application and development of a Citizen Science Input APP (see proposal of WP#4 for further technical details).

4.1 Household survey

During the first phase (scientific and societal problem-based research), a household survey will be conducted (realized as a standardized questionnaire, with face-to-face interviews), combining subjective and objective factors in regard of UQoL. A sample, stratified with respect to gender, socioeconomic status, and family status is asked for the evaluation of different factors that are expected to have a significant impact on their quality of life.

We do not aim at a demoscopic survey in order to describe the distribution of attitudes (this would require a very large representative sample). We ask for systematic impacts on UQoL instead. The sample size is based on power analyses (see Cohen, 1988), taking into account the number of relevant predictors, statistical power and estimated low and middle effect size. Assuming quite low statistical effects about $R^2=.05$, about 18 predictors (e.g. age, gender, socioeconomic status, education, location of housing, about 6 physical factors, 6 psychological factors), and a statistical power of about .9, a minimum sample size of $N = 485$ is needed in order to realize the testing of regression models (Cohen, 1988). Therefore, we are planning to conduct 500 face-to-face interviews. The field work of the face-to-face interviews will be carried out by a market research institute.

The variety of factors is determined by the state of the art from the field of Environmental Psychology (e.g. problem awareness: ecological system versus socio-political and socio-economic system; local versus global issues; ascription of responsibility: personal (internal) versus politics (external); norms, values, etc.), and by results from a Build4People Research Workshop scheduled at the end of the Definition Phase (November 2020), which is among others based on the results of a Roundtable Workshop at Royal University of Phnom Penh in March 2020. The survey will take into account both, the sphere of people (subjective factors), as well as the sphere of the environment (assessment of objective factors). Within our research, we encounter the cultural context specificity with respect to a culturally sensitive approach. Therefore, we take into account theoretical assumptions about cultural dependencies and methodological paths that will meet those specificities.

Complementary to the face-to face interviews of the household survey, participants will be asked for their willingness to use the smart phone app “Input APP” (“Citizen Science Input



APP”). We aim at a joint data set of $n = 100$ in order to realize parametric data analyses. This Input APP allows for collecting, storing and visualising objective and subjective data during the mobile mapping activity in field.

Thereby, we will have a linked data-set from participants who took part in the face -to face interviews and used the Input APP as well (for more detailed information concerning the Citizen Science Input APP see proposal of WP#4). In this research activity, we focus on collecting information on the citizen’s subjective perception and assessment of the quality of urban green spaces. In doing so, it will be possible to link subjective data with objective data from the field mapping [see also B4P Milestone TR3: (Month 12): First results / analysis of collected data from Citizen Science Input APP and from household survey]. At a later stage, such a citizen science approach shall be extended to analyze other aspects of urban quality of life, as well.

As the research focus of the Build4People project will shift to more transdisciplinary action research approaches during the second and third year, different participatory activities will take place (organized and conducted by WP#1) in order to supplement the ongoing analyses of the UQoL dataset. These activities will include a multi-stakeholder workshop with local stakeholders and decision makers, as well as focus groups that will discuss conflicts between individual lifestyle claims and sustainability goals.

Furthermore, the concept will be elaborated in iterative exchange with all Work Packages of the Build4people Project. All these activities will aim at a deeper and context-sensitive understanding of the concept of Urban Quality of Life. The results from the data analyses and



the participatory activities will enrich other Build4People processes like the Ecocity Transition Lab, the Sustainable Building Arena and the Sustainable Building Business Incubator.

Until now, there is no evidence-based interdisciplinary model of Urban Quality of Life. With this model, the Build4People project can contribute to closing the gap in scientists’ disciplinary understanding of Urban Quality of Life by providing data-based insights to interaction effects and moderating effects of subjective and objective predictors of Urban Quality of Life, that has to be understood as a component of sustainable transformation. Therefore, the *UQoL Model* will be finalized during the final Build4People research phase of reflection, refinement & re-integration of knowledge. An iterative process of including more objective data in collaboration with the other WPs and the respective experiences, measurements and data gained from their work. Moreover, refining the weighting of different factors (based on results of the survey data and the transdisciplinary action research) will conclude with a final transdisciplinary UQoL Model.

Beside the scientific dissemination of this transdisciplinary model, possible planning strategies, that will be derived from the model, will be discussed with all WPs, local research partners, and stakeholders during in a technical session during the Build4People Outlook Conference [B4P Milestone K3, Month 46] in order to enhance Urban Quality of life in Phnom Penh. These planning strategies will become part of the B4P Toolbox. All these insights will also flow into the development of Build4People dissemination products such as the awareness campaign, the poster and photo exhibitions, and the Handbook for Green Housing and Sustainable Living.

During the implementation Phase, WP#1 and WP#4 aim to further develop the Citizen Science Input App in order to enable the integrated measurement and calculation of Urban Quality of Life for specific districts, based on the most relevant predictors (influencing factors) of the UQoL model.

4.2 Online survey new consumers

The new consumers in Phnom Penh represent an essential target group, when it comes to questions of behaviour change (see chapter 3 / state of the art) because of its high energy saving potential and high degree of freedom (based on resources) in terms of sustainable investment decisions and behaviour change.

A standardized questionnaire that will be applied to this specific target group will reflect culturally specific aspects, the environmentally relevant mindset (e.g. personal beliefs about climate change, problem awareness: local versus global, values, norms and perceived



behaviour control), self-reported pro-environmental behaviour, as well as relevant questions from our colleagues from all B4P work packages. We aim to be sensitive to the aspect of gender in our research as well. Therefore, we will consider gender specific behaviour constraints and barriers for pro-environmental behaviours and include relevant questions in this respect.

The testing (questionnaires) will take place online as this target group will be able to use computer/smartphones to answer these questions (N=150). The implementation and conducting of the questionnaire will happen in cooperation with a market research institute.

In addition to the standardized questionnaire, we will conduct focus groups, addressing expected conflicts within individual demands concerning quality of life and social norms of sustainable lifestyles, in order to develop new perspectives, based on participatory methods. Both, the results from the questionnaire as well as the results from the focus groups will provide the basis for data- and theory-driven intervention techniques. Some of these tailored intervention techniques will be applied and pretested with a subsample of the new consumer target group [see also B4P Milestone AC2: (Month 38): Implementing a trial of a selected intervention on behaviour change (specific target group in the case area regarded within the ECTL process)]. The different intervention techniques will become part of the toolbox.

The results of the online-survey and of the focus group will enrich the development of the awareness campaign, and will stimulate the different products of the other Build4People processes like the Ecocity Transition Lab, the Sustainable Building Arena and the Sustainable Building Business Incubator Process.

4.3 Awareness Campaign

Thereby, we hope to initiate promising paths and policy measures that support a sustainable urban transformation and sustainable development in Cambodia. In addition to the governmental responsibility to take pro-environmental actions and decisions, the general public shall also be actively engaged in this transformation process that we are aiming to facilitate by the means of our project activities.

According to the current state of research, we consider social dynamics and social influence as a crucial role when aiming at addressing the general public and behaviour change towards more sustainable lifestyles (Griskevicius, Cialdini, & Goldstein, 2008; Kallgren, Reno, & Cialdini, 2000). The Build4People project will therefore aim on developing campaigning strategies, that utilize social influences in forms of descriptive social norms (e.g.



communicating *sustainable lifestyles* as common actions actually exhibited in relevant peer groups).

As well as empowering the citizens to contribute to the transformation by choosing a certain lifestyle and behaviours that are in line with sustainability goals.) To realize a good fit of measures and target groups, we will realize participatory techniques in order to develop (based on the results of the household survey and focus groups) adequate campaigning strategies. This participatory process will be part of the Build4People Eco City Transition Lab Process and part of multi-stakeholder workshops at the B4P conferences. This process is intended to realize a toolbox of different adequate strategies for awareness campaigns.

A trial of one specific measure for the target group of the new consumers is planned, the specific outline has to be adjusted within the participator process.

As a dissemination mean of our project, we strongly focus on the communication of our findings and our approach in order to raise awareness for sustainability issues and to equip the society with this knowledge in a wide scope. These general dissemination strategies will be finely tuned with the communication of positive descriptive social norms (s.o.). In doing so, dissemination products like the Poster Exhibitions, the Handbook for Green Housing and Sustainable Living, and the Build4People Photo Exhibition (Pioneers of sustainable lifestyles in Cambodia) can support the process of rising awareness and fostering a social norm of sustainable lifestyles (see Elgaaied-Gambier, Monnot, & Reniou, (2018).



4.4 WP#1 Sub-Work Packages and Activities

The activities of the WP#1 sub-work packages are well in line with the rest of the activities of the project. It is planned to transfer the results and analyses generated into the joint activities and products.

WP#1.1 Data-based structure of Urban Quality of Life (UQoL) in Phnom Penh	
<i>Expected impacts</i>	<i>Understanding the relative impact of different factors on UQoL → basis for data-based suggestions to enhance UQoL in Phnom Penh</i>
scheduled	first project year
WP#1.1.1	Preparation of the representative household survey (practicability testing, defining sample criteria - linking a subsample to the Ecocity Transition Lab area)
WP#1.1.2	(a) data collection and (b) data preparation according to demands of all WPs
WP#1.1.3	Integration of subjective evaluation of objective factors within the Citizen Science Input APP in cooperation with WP#4
WP#1.1.4	Data-based input on ECTL; joint workshops on different factors influencing UQoL, e.g. climate comfort
WP#1.2 Analysis of the mindset and environmental behaviours of the new consumers	
<i>Expected impacts</i>	<i>Understanding of pro-environmental behaviours and (un)sustainable investment decisions → basis to derive tailored intervention techniques for behaviour change</i>
scheduled	second project year
WP#1.2.1	Preparation of the online-survey (adaption of the questionnaire to online-version, practicability testing, defining sample criteria)
WP#1.2.2	(a) data collection and (b) data preparation according to demands of all WPs
WP#1.2.3	Focus group discussions with new consumers, focus on conflicts between individual lifestyle claims and sustainability goals
WP#1.2.4	Multivariate analyses of data, report on psychological drivers and barriers of pro-environmental behaviours; contribution to the poster exhibition



WP#1.3	Data-based and theory-driven intervention plan in order to foster sustainable behaviours of the new consumers
<i>Expected impacts</i>	<p><i>Intervention framework for the specific target group of the urban middle class in Phnom Penh</i></p> <p><i>→ fostering sustainable behaviours for a target group with relatively high environmental impact</i></p>
scheduled	third project year
WP#1.3.1	Participatory workshop: development of data-based interventions for new consumers
WP#1.3.2	Development of an intervention design for a trial of a selected intervention on behaviour change (specific target group in the case area regarded within the ECTL process)
WP#1.3.3	Capacity building on intervention planning; Curriculum Development (at RUPP)
WP#1.3.4	Extracting content for reporting, dissemination, capacity building; Contribution on theory-driven interventions to the Build4People Toolbox
WP#1.4	Theory-driven and data-based framework for an awareness campaign in order to foster sustainable lifestyles and ecological norms in Phnom Penh
<i>Expected impacts</i>	<p><i>Basis for awareness campaigns and strategies for different target groups</i></p> <p><i>→ Awareness raising for sustainable lifestyles, supporting sustainable investment decisions, awareness rising for environmental problems, supporting and establishing a social norm of sustainability.</i></p>
scheduled	fourth project year
WP#1.4.1	Development of guidelines for campaigning strategies based on the results of the household survey and focus groups
WP#1.4.2	Participatory development of awareness campaigns and strategies with different stakeholders
WP#1.4.3	Exchange with local partners and networks on experience with participatory engagement in local projects; planning of an awareness campaign in the implementation phase
WP#1.4.4	Extracting content for reporting, dissemination, capacity building; Contribution to Build4People Photo exhibition and Handbook; Contribution of a Campaigning Module within the Build4People Toolbox



4.5 WP#1 Work- and Implementation Plan:

The following table (table 1) depicts a detailed, numbered list of all WP#1 activities. All procedures (work steps) are listed with respect to the following categories: Activities, methods, products, aims/results, and transdisciplinary connection to other work packages within the Build4People project.

Trans- and interdisciplinary procedures are labelled with the prefix *Build4People*. Procedures that are labelled with the prefix *WP* account for the WP#1 Work package.

The structure of the Work- and implementation plan is developed with respect to the three overlapping spheres of the Build4people project: the first year is mainly dedicated to *societal and scientific problem-based research* (e.g. household survey, data analysis). During the years 2 and 3, the focus will shift to *transdisciplinary action research* (multi-stakeholder workshops, focus groups, participatory development of intervention strategies), and will focus on *reflection, refinement & re-integration of created knowledge* during year 4 (e.g. development of a final, transdisciplinary model of Urban Quality of Life). The findings from the transdisciplinary action research phase are connected to the theory-based research of year 1 in an iterative way.

For a detailed description of the synchronized input to all working steps please refer to the table of *person month per task* (chapter 4.6 WP#1 resource plan).



WP#1 Work- and Implementation Plan

B4P R&D PHASE	Activities	Methods	Products
Work Steps	Aims / Results	Transdisciplinary Cooperation	
I. Build4People Coordination Meetings in Germany	Regular exchange within the Build4People project team Ongoing conceptualisation and modelling of Urban Quality of Life (UQoL) Face-to-face meetings in the context of the milestones, in-between regular online-meetings (every two months) Organizing and hosting a workshop at Magdeburg University for all German Project Partners regarding the data-based transdisciplinary conceptualization of Urban Quality of Life in Phnom Penh		
	Presentations, discussions and exchange Presenting results of the survey and the focus group discussions Planning of joint scientific dissemination		
	B4P Milestone WS1: Build4People RD-Phase Kick-off Meeting, Hamburg (Month 01) B4P Milestone WS2: Build4People UQoL-Survey Workshop, Magdeburg (Month 13) B4P Milestone WS3: Build4People UQoL-Processing Workshop, Eberswalde (Month 25) B4P Milestone WS4: Build4People Proposal Writing Workshop, Hamburg (Month 37)		
	Joint general research understanding (WS1) Joint scientific-conceptual work on urban quality of life (WS2 / WS3) Joint agreement of content of Build4People Implementation Phase proposal (WS4) Capacity mobilisation due to insights on urban sustainability best practices in Germany for invited research partners from Cambodia (WS4) Optimized agreement on the approach regarding scientific content		
	Managed by WP#7 with input from all other WPs (WS1 / WS4) Managed by WP#2 with input from all other WPs (WS2) Managed by WP#4 with input from all other WPs (WS3)		
II. Science / Roundtable Workshops / Focus Group Discussions in Cambodia	Regular scientific exchange with local research partners and local stakeholder groups Interdisciplinary Workshops on Urban Quality of Life, behaviour change, intervention techniques and awareness campaign strategies. Joint workshop with WP#5 on climate comfort		
	Presentations, discussions Exchange about subjective and objective factors of Urban Quality of life, sustainable living, and climate comfort		
	WP#1 Milestone SW1 (Month 04): Roundtable workshop: Perspective of Environmental Psychology on Urban Quality of Life and well-being WP#1 Milestone SW2 (Month 10): Science workshop: Exchange with local sustainability research projects and experts WP#1 Milestone SW3 (Month 14): Multi-stakeholder workshop on the conceptualization of UQoL and insights to the survey results WP#1 Milestone SW4 (Month 22): Focus Group Discussion with new consumers: Focus on conflicts between individual lifestyle claims and sustainability goals WP#1 Milestone SW5 (Month 27): Roundtable Workshop on Behaviour Change and Intervention Techniques for sustainable lifestyles WP#1 Milestone SW6 (Month 34): Roundtable Workshop on awareness campaign strategies WP#1 Milestone SW7 (Month 39): Science workshop on the UQoL Model WP#1 Milestone SW8 (Month 46): Roundtable workshop on implementation strategies supporting sustainable lifestyles Co-Organisation of WP#5 Milestone SW3 (Month 14)		



	<p>Communication of research agenda of each WP Increased mutual trans-disciplinary understanding and enhanced coherence of the project's objectives related content Joint agreement in regard of research design and methodologies Insights into views of local stakeholder groups Capacity Mobilisation Reciprocal, transdisciplinary understanding of Quality of Life in urban environments; increased transdisciplinary understanding of UQoL in PP Increased understanding about the meaning of climate comfort in PP (workshop with WP5) Finalized trans-disciplinary project products Joint Publication strategy Output- und impact management strategy</p> <p>Managed by each WP Exchange with all WPs and research partners and implementation partners Joint preparation and conduction of the workshop with WP5; feeding in results to WP2, WP3, WP4 & WP6</p>
III. Build4People Conferences in Cambodia	<p>Participation at the Build4People conferences with all German and Cambodian partners and relevant stakeholders</p> <p>Presentations / panel rounds / discussions</p> <p>B4P Milestone K1: Build4People Research Conference (Month 03) B4P Milestone K2: Build4People Research Conference (Month 26) B4P Milestone K3: Build4People Research Conference (Month 46)</p> <p>Increased public awareness and mutual understanding of the different Work Package approaches of the Build4People project Networking with stakeholders from the state, economy and civil society Discussion of model-based planning strategies to foster urban quality of life (K3) Increased public awareness about the topic of WP#1 considering people-environment interactions, sustainable lifestyles and Urban Quality of Life</p> <p>Managed by WP#7 with input from all other WPs; Exchange with all WPs, research partners and implementation partners</p>
IV. Scientific and Societal Problem Based Research: Data Collection and Analysis <i>IV.A. WP-related research</i>	<p>Updated review of literature and of state of the arts; bibliographical research Conceptualising of problem-based empirical research design Data collection and analysis Development of the research design and methods corresponding to the theory and insights from the definition phase Preparation and conducting of an online survey with New Consumers (N=150) about environmental behaviours, lifestyle goals, drivers and barriers of sustainable behaviour</p> <p>Compilation of most recent publications and methods Application of empirical research methods Conducting the survey, data analysis</p> <p>WP#1 Milestone R1 (Month 02): Updated bibliographic research and literature WP#1 Milestone R2 (Month 12): Report on results of the B4P household survey WP#1 Milestone R3 (Month 24): Report on psychological drivers and barriers of sustainable behaviour for the New Consumers</p> <p>Increased understanding and knowledge of state of the art for Asian context and relevant conditions of the research activities in Phnom Penh First scientific findings based on empirical research</p> <p>Managed by each WP</p>
IV. Scientific and Societal Problem Based Research:	<p>Preparing the Build4People UQoL household survey (collection of relevant questions from all WPs, compilation of questionnaire, pre-testing, etc.) Conducting the survey in cooperation with market research company: data collection and first data analysis</p>



Data Collection and Analysis IV.B. Build4People UQoL Household Survey / Data Input via APP	Statistical analysis Discussing first results on urban quality of life as perceived by citizens of Phnom Penh.
	B4P Milestone TR1: (Month 04): Final version of questionnaire for household survey B4P Milestone TR2: (Month 08): Final version of the Citizen Science Input APP (Integration of subjective evaluation of objective factors) B4P Milestone TR3: (Month 12): First results / analysis of collected data from Citizen Science Input APP and from household survey
	Insights into objective / subjective factors influencing urban quality of life in Phnom Penh Mutual trans-disciplinary understanding of urban quality of life Increased awareness about the importance of urban quality of life among stakeholders Preparation of survey results in regard of B4P Milestone WS2: Build4People UQoL-Survey Workshop at Magdeburg University (Month 13)
	Scientific-conceptual lead WP#1 with support from WP7 Data-Management lead WP#4 Input from all other WPs; input to all other WPs
V. Trans-Disciplinary Action Research: Process Facilitation and Product Development V.A. Build4People Ecocity Transition Lab Process	Exploration and application of innovative methodologies of collaborative and participatory planning in the context of an Eco Lab, based on a case study site typical for current urban development issues in Phnom Penh.
	Co-moderation and support of participatory planning techniques, hands-on-planning sessions and report-back sessions; input presentations from the perspective of environmental psychology and on main results of the surveys; support of Intensive stakeholder management process including personal and web-based meetings, support and co-moderation of Charrette as an integrated and multidisciplinary design workshop.
	B4P Milestone TL1: (Month 10): Ecocity Transition Lab I: Masterplan Study Area & Design Strategies B4P Milestone TL2: (Month 27): Ecocity Transition Lab II: Neighbourhood Plans & Guidelines B4P Milestone TL3: (Month 34): Ecocity Transition Lab III: Criteria & Implementation Strategies
	Deepened understanding of the local planning issues Empirical research and testing of general research findings based on a case study site Improved collaboration between local experts and decision makers Preparation of strategies, guidelines and criteria in regard of the Build4People Toolbox Establishing cross-linkages to Build4People Sustainable Building Arena (SBA) Capacity mobilisation at all involved parties
	Scientific-conceptual lead WP#3 with support from WP#7 Feeding in results from surveys, focus groups, workshops, supporting WP3
V. Trans-Disciplinary Action Research: Process Facilitation and Product Development V.B. Build4People Sustainable Building Arena Process	Participatory workshop series with front-runners from different stakeholder groups; co-development of transition challenge framing, vision and transition agenda co-development process; support of experimentation & socio-technical, and socio-institutional innovation, coalition and partnership building and knowledge co-creation and communication.
	Input from the perspective of environmental psychology; input on main results of the surveys with respect to transition processes Preparation, coordination and implementation of a transition management process (incl. interactive knowledge generation, world-café workshops, interviews, questionnaires, participant observation, input presentations, etc.)
	B4P Milestone SBA1: (Month 14): Implementation of first SBA workshop cycle B4P Milestone SBA2: (Month 27): Implementation of second SBA workshop cycle B4P Milestone SBA2: (Month 39): Workshop on Experiment Facilitation
	Co-development of challenge framing, a spatial-sectoral vision and a transition agenda to support alternative discourses, marginalized actors, social learning, network building and knowledge communication to ultimately inform an urban sustainability transition



	Scientific-conceptual lead WP#2 and WP#6 with support from WP#7 Feeding in results from surveys, focus groups, workshops, supporting WP#6
V. Trans-Disciplinary Action Research: Process Facilitation and Product Development <i>V.C. Build4People Sustainable Building Business Incubator Process</i>	Supporting the Sustainable Building Business Incubator Process workshops and active participation
	Input from the perspective of environmental psychology; input on main results of the surveys with respect to transition processes
	B4P Milestone SBI1: (Month 19): Final conceptualization of the Incubator Design B4P Milestone SBI2: (Month 22): Incubator Kick-off B4P Milestone SBI1: (Month 26): End of Incubator and pitch to investors B4P Milestone SBI1: (Month 32): Incubator reflection report
	The Sustainable Building Incubator aims to connect the Build4People project to the local entrepreneurs and change makers. Under the guidance of WP#6, Impact Hub Phnom Penh and local mentors, B4P team and insights will be connected to the entrepreneurial ecosystem to realize sustainability-oriented solutions. These shall subsequently be implemented experimentally with third party funding.
	Scientific-conceptual lead WP#6 with support from WP#7 Input from all other WPs
V. Trans-Disciplinary Action Research: Process Facilitation and Product Development <i>V.D. Build4People UQoL Citizen Science Process</i>	Participatory workshops with different stakeholders and representatives of different target groups, e.g. on sustainable buildings and housing (with new consumers representatives, housing estate management companies, other stakeholders from the case study site of the Build4People Ecocity Transition Lab)
	World café on sustainability + scenario-based methods with the topic: urban quality of life, norms, values. Application of participatory methods, e.g. back-casting Adaptation of the Citizen Science Input APP
	B4P Milestone QI1: (Month 14): Multistakeholder Workshop on UQoL (focus application) B4P Milestone QI2: (Month 22): Focus Groups with new consumers (focus on conflicts between individual lifestyle claims and sustainability goals)
	Basis for data-based planning suggestions to increase urban quality of life in Phnom Penh; Reducing the own ethnocentric bias; Further technical development of the Citizen Science Input APP
	Scientific-conceptual lead WP#1 with support from WP#7 Data-Management lead WP#4 Input from all other WPs (workshop preparation and participation) Feeding in results to the other B4P action research processes
VI. (Re-) Integration of Created Knowledge Refinement and Revision of Theory <i>VI.A. WP-related research</i>	Statistical analyses and hypothesis testing according to research questions and theory-based assumptions Integration of feedback loops from phase of scientific and societal problem-based research and from of action research (Re-)integration of created knowledge Refinement and revision of theory
	Integration of feedback loops (Re-)integration of created knowledge Review of existing theories Connection of theory with results from three research spheres of Build4People RD-Phase research design Publication of scientific papers



	<p>WP# 1 Milestone RF1 (Month 36): Baseline Report I: Integrating objective factors in order to explain UQoL and sustainable Behaviour</p> <p>WP# 1 Milestone RF2A (Month 46): Baseline Report IIA: Conception of context-adapted effective intervention techniques as a contribution to socially relevant challenges</p> <p>WP# 1 Milestone WP# 1 RF2AB (Month 48): Baseline Report IIB: Explaining and supporting sustainable lifestyles, and enhancing quality of life in Phnom Penh</p> <p>Refinement, revision and adding to theory</p> <p>Dissemination of research results at Build4People Outlook Conference</p> <p>Preparation for publications</p> <p>Managed by each WP</p> <p>Trans-disciplinary cooperation in regard of publishing joint scientific papers</p>
<p>VI. (Re-)Integration of Created Knowledge Refinement and Revision of Theory</p> <p>VI.B. Build4People UQoL-Model Development / Data Modelling</p>	<p>Modelling of the Urban Quality of Life concept by integrating subjective and objective data collected by means of the survey, the Citizen Science Input APP and others by other WPs</p> <p>Theory-driven and data-based statistical modelling</p> <p>B4P Milestone QM1: (Month 35): 1st draft of Urban Quality of life (UQoL) Model (based on survey + UQoL process; objective data and results from the UQoL Process included)</p> <p>B4P Milestone QM2: (Month 45): Feasibility study to grasp UQoL by means of Citizen Science Input APP, including budget plan (WP#4) in preparation of Build4People Implementation Phase</p> <p>B4P Milestone QM3: (Month 48): Final version of a theory-driven, data-based, and context adapted UQoL Model</p> <p>Preparation of scientific papers introducing the transdisciplinarily developed UQoL Model</p> <p>UQoL Model based planning strategies to foster urban quality of life in Phnom Penh as part of Build4People Toolbox (also in preparation of Build4People Implementation Phase)</p> <p>Detailed instructions for software company to develop an UQoL-App</p> <p>Scientific-conceptual lead WP#1 with support from WP#7</p> <p>Data-Management lead WP#4</p> <p>Input from all other WPs, input to all other WPs</p>
<p>VII. Build4People Dissemination</p> <p>VII.A. Build4People Poster / Photo Exhibitions</p>	<p>Participating at the poster and photo exhibitions; Contribution of one poster panel to the trans-disciplinarily developed exhibition introducing the topic of “promoting sustainable behaviour” to a general public</p> <p>Integrating results from the Ecocity Transition Lab</p> <p>Consultation of the exhibition curator from WP#3</p> <p>Integrating gained knowledge and experience of the process of developing an awareness campaign on sustainable living to the exhibition activities</p> <p>Identification of leading examples, frontrunners, change agents for visibility</p> <p>Preparation of input to poster exhibitions</p> <p>Processing of science-based knowledge for a wide audience</p> <p>B4P Milestone EX1: (Month 15): Green Buildings and Sustainable Neighbourhoods – Case Studies and Best-Practice from Asia</p> <p>B4P Milestone EX2: (Month 34): Results of the Build4People Ecocity Transition Lab</p> <p>B4P Milestone EX3: (Month 45): Photo Exhibition Sustainable Lifestyle Pioneers in Cambodia</p> <p>General information on the people-led transdisciplinary Build4People approach</p> <p>Enablement of networking activities between stakeholders from state, economy and civil society</p> <p>Increased awareness about issues of green buildings, sustainable neighbourhoods and sustainable lifestyles</p> <p>B4P Milestone EX1 / EX2: Scientific-conceptual lead WP#3 with support from WP#7</p> <p>Input from all other WPs</p> <p>B4P Milestone EX3: Conceptual Scientific-conceptual lead WP#7 and WP#1 (based on the Build4People Awareness Campaign: UQoL & Sustainable Living)</p>



VII. Build4People Dissemination Vii.B. Build4People Outreach Events	Management of outreach events to disseminate the results of the Build4People project with two main partners 1) Centre of Khmer Studies CKS) mainly reaching out to the academic / NGO-sector and 2) European Chamber of Commerce (EuroCham) mainly reaching out to the corporate sector
	Regular presentations of select research results with the support of our dissemination partners, either face-to-face or online (webinar-format)
	B4P Milestone OR6: (Month 18): Presentation of results from the household survey concerning the measurement of Urban Quality of Life in Phnom Penh (EuroCham) B4P Milestone OR14: (Month 42): Presentation on how to enhance sustainable lifestyles in Phnom Penh in accordance with the transdisciplinary UQoL Model (CKS)
	Increased awareness and knowledge about the research of the different Work Packages of the Build4People project Dissemination about Build4People processes and products
	Lead by WP#7 with support from other WPs
VII. Build4People Dissemination Vii.C. Build4People Toolbox including Build4People Handbook (Module of Toolbox)	Input to the <i>Toolbox Sustainable Neighbourhood Development</i> as an interactive web platform Compiling and preparing research results for dissemination; Input to the Handbook for Green Housing and Sustainable Living, a richly illustrated publication targeting a wide audience trying to convince people to implement sustainable housing solutions;
	Writing chapters in easy-to-understand language (thus being accessible to non-experts) and preparing for graphic material; Developing input for Build4People toolbox: sustainability strategies and guidelines for neighbourhood development Chapters on a) local drivers and barriers on behaviour change; b) promising interventions for behaviour change in PP; c) how to promote sustainable lifestyles in PP
	B4P Milestone TB1: (Month 15): First editorial meeting: Joint development of a Handbook content structure together with the local partners; distribution of related tasks B4P Milestone TB2: (Month 22): Second editorial meeting: Presentation of the Handbook inputs by the various partners and joint agreement on the visual design; management of the translation, language editing and the printing procedure B4P Milestone TB3: (Month 27): First editorial meeting to discuss content of Toolbox B4P Milestone TB4: (Month 34): Publication of the Handbook for Green Housing and Sustainable Living during a roundtable workshop (milestone SW6); development of a distribution, dissemination and impact management strategy B4P Milestone TB5: (Month 39): Web-Interface of Handbook ready (with inter-active elements) / first draft of Toolbox ready B4P Milestone TB6: (Month 46): Web-Interface of Toolbox ready B4P Milestone TB7: (Month 48): Build4People Toolbox Executive Summary Report: Science- and societal based strategies to foster urban quality of life in Phnom Penh
	Build4People Toolbox Sustainable Neighbourhood Development: Minimum and advanced requirements as a basis for informed decision-making, awareness-rising, transfer of knowledge Build4People Handbook: Awareness rising, transfer of knowledge, better household decisions in the field of green housing and sustainable living among the general public Increased understanding about people-environment interactions and behaviour change Mass effects through replication
	Conceptualisation of Toolbox by WP#3 with input from all other WPs Conceptualisation of Handbook by WP#7 with input from all other WPs Dissemination managed by WP#7 with support from all other WPs
VII. Build4People Dissemination Vii.D. Build4People Industrial Fair Representation	Representing the Build4People project at important industrial fairs in Cambodia Renting of a Build4People booth and dissemination of Build4People PR-materials Participating as presenter at related symposia / panel discussions
	PR-Work Representation and networking Providing evidence-based scientific research results to foster sustainability solutions in the corporate sector



	<p>B4P Milestone IF1: (Month 17): Cambodia Architecture & Décor 2022 B4P Milestone IF2: (Month 34): Industrial Fair Representation 2023 (specific event tbd)</p> <p>Dissemination of the Build4People approaches to representatives from the private sector Raised interest in supporting Build4People activities during Implementation Phase from the corporate sector</p> <p>Managed by WP#7 with input from all other WPs</p>
<p>VII. Build4People Dissemination</p> <p>VII.E. Awareness Campaign: UQoL & Sustainable Living</p>	<p>Development of an urban quality of life and sustainable living awareness campaign; exchange with stakeholders and research partners; recommendations for a social marketing campaign</p> <p>Theory-driven and data-based planning and designing of a campaign; participatory process and methods, focus group discussions with different target groups; interviews with stakeholders</p> <p>B4P Milestone AC1: (Month 24): Data-based and theory-driven framework for awareness campaigning in order to foster ecological awareness, pro-environmental social norms and sustainable lifestyles in Phnom Penh B4P Milestone AC2: (Month 38): Implementing a <i>trial</i> of a selected intervention on behaviour change (specific target group in the case area regarded within the ECTL process) B4P Milestone AC3: (Month 48): Final version of a Campaigning Module within the Build4People Toolbox</p> <p>Increased understanding about people-environment interactions and behaviour change Mass effects through replication</p> <p>Lead by WP#1 with input from all other WPs (among others collected through WP1 Milestone SW6 (Month 34): Roundtable Workshop on awareness campaign strategies)</p>
<p>VII. Build4People Dissemination</p> <p>VII.F. Build4People Social Media-Campaign</p>	<p>Input about project activities; input for Social Media Report</p> <p>Feeding in information on Build4People activities at Build4People Homepage, ResearchGate and on several social media platforms (Facebook, LinkedIn, Build4People youtube channel, instagram) Preparing for Build4People PR-video clips</p> <p>B4P Milestone SM1: (Month 01): Build4People Social Media Strategy RD-Phase B4P Milestone SM2: (Month 12): Build4People Social Media Report Year 1 B4P Milestone SM3: (Month 24): Build4People Social Media Report Year 2 B4P Milestone SM4: (Month 36): Build4People Social Media Report Year 3 B4P Milestone SM5: (Month 48): Build4People Social Media Final Report RD-Phase – Lessons learnt in regard of Implementation Phase</p> <p>Increased awareness and knowledge about Build4People related activities and products reaching out to different target groups (e.g. experts, professionals, academia, general public, youth)</p> <p>Managed by WP#7 with input from all other WPs Support of and exchange with WP#7</p>
<p>VIII. Build4People Donor Implementation Workshops</p>	<p>Organisation of regular workshops with donor organisations thereby introducing the Build4People project to donor organisations with the aim to prepare for Build4People supported projects during the subsequent Implementation phase Integrating the perspective and impact of Environmental Psychology to the workshops' content</p> <p>Presentations / exchange / discussions</p>



	<p>B4P Milestone IWS1: Implementation Donor Workshop I (Month 03)</p> <p>B4P Milestone IWS2: Implementation Donor Workshop II (Month 15)</p> <p>B4P Milestone IWS3: Implementation Donor Workshop III (Month 27)</p> <p>B4P Milestone IWS4: Implementation Donor Workshop IV (Month 39)</p> <p>B4P Milestone IWS5: Report on Implementation Preparation (Month 48)</p>
	<p>Donor-funded projects discussed, elaborated and prepared in regard of the subsequent Implementation Phase</p> <p>Clarification about the role of the Build4People research team in regard of donor-funded projects</p> <p>Managed by WP#7 with input from all other WPs</p> <p>Support of and exchange with WP#7</p>
<p>IX. Build4People Capacity Mobilisation: Curriculum Development</p> <p><i>Paññāsāstra University of Cambodia</i></p> <p><i>WP#1 specific RUPP, Department of Psychology</i></p>	<p>Supporting the enhancement of lecturing at our local research partners, particularly in regard of the development of master courses in the field of sustainable urban development / transformation, climate change adaptation / mitigation strategies and environmental psychology</p> <p>Development of a course unit about “people-orientated perspectives on urban development” (working title) as part of the master course at PuC (Contribution to B4P Milestone CM1-CM8)</p> <p>Joint development of a curriculum for Environmental Psychology at the RUPP; 2nd step of integrating Environmental Psychology into the curriculum of Psychology at the RUPP (Contribution to the WP#1 Milestone X1-X6)</p> <p>Consulting and capacity building activities</p> <p>Feeding in results of Build4People research into local curriculum development</p> <p>Bi-annual face-to-face meetings and online-meetings in-between</p> <p>Reconciling experience and knowledge gained within the curriculum development at different partner universities</p> <p>Evaluation of on-going consultation / lectures on key topics of environmental psychology / workgroups with practical examples; providing lectures, exchange of literature, and methods</p> <p>Exchange with colleagues from Psychology and Master “Climate Change” at the RUPP, regular real and online meetings, providing lectures, exchange of literature, and methods</p> <p>B4P Milestone CM1: Capacity Mobilisation Workshop I: Identification of needs; collection of ideas, discussion of a draft curriculum development strategy (Month 06)</p> <p>B4P Milestone CM2: Capacity Mobilisation Workshop II: Presentation of curriculum development strategy; formation of tandem teams to jointly develop specific course units (Month 12)</p> <p>B4P Milestone CM3: Capacity Mobilisation Workshop III: Reporting of tandem teams about their progress in regard of course unit development; collection of feedback (Month 18)</p> <p>B4P Milestone CM4: Capacity Mobilisation Workshop IV: Reporting of tandem teams about their progress in regard of course unit development; collection of feedback (Month 24)</p> <p>B4P Milestone CM5: Capacity Mobilisation Workshop V: Presentation of draft course units material (Month 30)</p> <p>B4P Milestone CM6: Capacity Mobilisation Workshop VI: Reporting on test-trials of draft course unit material (Month 36)</p> <p>B4P Milestone CM7: Capacity Mobilisation Workshop VII: Preparing for certification procedure (Month 42)</p> <p>B4P Milestone CM8: Status report on curriculum development with outlook to Implementation Phase (Month 48)</p> <p>WP#1 Milestone X1 (Month 06): Online lectures: Introduction to Environmental Psychology</p> <p>WP#1 Milestone X2 (Month 12): Measurement of environmental Behaviour</p> <p>WP#1 Milestone X3 (Month 18): Intervention techniques I; Scientific exchange</p> <p>WP#1 Milestone X4 (Month 24): Collection of topic for the curriculum</p> <p>WP#1 Milestone X5 (Month 30): Final concept of the Curriculum</p> <p>WP#1 Milestone X6 (Month 36): Strategies for implementing methodological knowledge</p>



	<p>Support in developing state of the art local master courses at local research partner institutions</p> <p>Enablement of local lecturers to teach the new course units</p> <p>Increased knowledge about state-of-the-art approaches towards urban sustainability among students and university teachers</p> <p>Increased understanding of relevance and potential of adapted Environmental Psychology knowledge</p> <p>Increased understanding of relevance and potential of adapted Environmental Psychology knowledge for the RUPP</p> <p>Capacity building; preparing a basis for international scientific exchange, and for people-environment studies in Cambodia</p> <p>Managed by WP#7 with input from all other WPs</p> <p>Support of WP#7; exchange with WP2, WP4, WP5 and WP6 about shared experiences</p>
X. Scientific Advisory Board	<p>Participation in Build4People-Advisory-Board meetings</p> <p>Guidance and advice in regard of scientific quality, adjustment to local context, dissemination opportunities and in regard of enablement of donor-funded projects</p> <p>B4P Milestone SAB1: Report of Build4People Scientific Advisory Board (Month 03)</p> <p>B4P Milestone SAB2: Report of Build4People Scientific Advisory Board (Month 27)</p> <p>Adjustment of the research and dissemination approaches</p> <p>Contacts to donor organisations interested in transferring the Build4People research into implementation-orientated projects</p> <p>Managed by WP#7 with input from all other WPs</p>
XI. Build4People Monitoring: Self-Reflexion, Internal Evaluation and Learning	<p>Regular rounds of internal monitoring and self-evaluation of project progress and reflexion about lessons learnt</p> <p>Discussion about joint publication strategies</p> <p>Input for reports; timely submission of the requested inputs for the interim reports and final report; composing scientific profitability reports</p> <p>Research reports</p> <p>Internal discussions (through online meetings)</p> <p>B4P Milestone IR1: Internal Evaluation Report (Month 06)</p> <p>B4P Milestone IR2: Internal Evaluation Report (Month 18)</p> <p>B4P Milestone IR3: Internal Evaluation Report (Month 30)</p> <p>B4P Milestone IR4: Internal Evaluation Report (Month 42)</p> <p>B4P Milestone IR5: Final Evaluation Report: Lessons learnt in regard of Build4People Implementation Phase (Month 48)</p> <p>Reflection of research and development</p> <p>Information of status quo for funding organization and WP partners; Critical self-reflection regarding the achieved accomplishments and information on the project progress towards the funding organization</p> <p>Adjusted Build4People research and publication strategies</p> <p>Joint publications at high-ranking journals</p> <p>Managed by WP#7 with input from all other WPs; Report on results and status quo to all WPs</p>

Table 1: WP#1 Work- and Implementation Plan

Build4People-Project: WP#1 Person Months Planning

WP#1 Activities and Milestones		2021												2022												2023												2024												2025	
		02	03	04	05	06	07	08	09	10	11	12	01	02	03	04	05	06	07	08	09	10	11	12	01	02	03	04	05	06	07	08	9	10	11	12	01														
		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41	42	43	44	45	46	47	48		
I.	Build4People Workshops / Online-Meetings in Germany																																																		
	Build4People Consortium	0,10												0,10							0,05																														
II.	Workshops / Focus Group Discussions in Cambodia																																																		
	Each WP			0,05	0,10	0,05										0,05	0,15	0,05									0,05	0,10	0,05																						
III.	Build4People Conferences in Cambodia																																																		
	Build4People Consortium				0,10																							0,10																							
IV.	Problem Based Research: Data Collection and Analysis																																																		
IV.A	Each WP	0,50	0,50	0,30	0,50	0,50	0,50	0,50	0,50	0,50	0,40	0,50	0,30	0,20	0,20	0,20	0,20	0,15	0,10	0,15	0,20	0,20	0,20	0,10	0,10																										
IV.B	Build4People UQoL Household Survey / Data Input via APP	0,10	0,15	0,15	0,10	0,10	0,10	0,10	0,20	0,20	0,15	0,10	0,10	0,10	0,10	0,05																																			
V.	Trans-Disciplinary Action Research																																																		
V.A	Build4People EcoCity Transition Lab Process											0,10	0,10	0,10	0,10	0,05	0,10	0,05	0,05	0,05	0,05	0,10	0,10	0,05	0,05	0,10	0,10	0,05	0,10	0,10	0,10	0,10	0,10	0,10																	
V.B	Build4People Sustainable Building Arena Process																																																		
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VI.	(Re-)Integration of Created Knowledge Refinement of Theory																																																		
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VII.	Build4People Dissemination																																																		
VII.A	Build4People Poster / Photo Exhibitions																																																		
VII.B	Build4People Outreach Events																																																		
VII.C	Build4People Toolbox including Build4People Handbook																																																		
VII.D	Build4People Industrial Fair Representation																																																		
VII.E	Awareness Campaign: UQoL & Sustainable Living																																																		
VII.F	Build4People Social Media-Campaign																																																		
VIII.	Build4People Capacity Mobilisation																																																		
	Build4People Consortium	0,05	0,05	0,05	0,10	0,10	0,05	0,10	0,05	0,05	0,05	0,05	0,05	0,05	0,05	0,05	0,10	0,10	0,05	0,10	0,05	0,05	0,05	0,05	0,05	0,10	0,05	0,10	0,10	0,10	0,10	0,10	0,05	0,10	0,05	0,10	0,10	0,10	0,05	0,05	0,05	0,05	0,10	0,10	0,10	0,10	0,10	0,10	0,10		
IX.	Build4People Donor Implementation Workshops																																																		
	Build4People Consortium				0,05											0,05																																			
X.	Build4People Scientific Advisory Board																																																		
	Build4People Consortium											0,05																																							
XI.	Build4People Monitoring: Self-Reflexion, Evaluation & Learning																																																		
	Each WP coordinated by Consortium Lead						0,05	0,10									0,05	0,10																																0,05	0,10
	Person Months Research Associate WP1 (36 Months)	0,75	0,75	0,75	0,75	0,75	0,75	0,75	0,75	0,75	0,75	0,75	0,75	0,75	0,75	0,75	0,75	0,75	0,75	0,75	0,75	0,75	0,75	0,75	0,75	0,75	0,75	0,75	0,75	0,75	0,75	0,75	0,75	0,75	0,75	0,75	0,75	0,75	0,75	0,75	0,75	0,75	0,75	0,75	0,75	0,75	0,75	0,75	0,75		
	Person Months Leader WP1 (4.8 Months)*	0,10	0,10	0,10	0,10	0,10	0,10	0,10	0,10	0,10	0,10	0,10	0,10	0,10	0,10	0,10	0,10	0,10	0,10	0,10	0,10	0,10	0,10	0,10	0,10	0,10	0,10	0,10	0,10	0,10	0,10	0,10	0,10	0,10	0,10	0,10	0,10	0,10	0,10	0,10	0,10	0,10	0,10	0,10	0,10	0,10	0,10	0,10	0,10		
	Total Person Months WP1 (40.8 Months)	0,85	0,85	0,85	0,85	0,85	0,85	0,85	0,85	0,85	0,85	0,85	0,85	0,85	0,85	0,85	0,85	0,85	0,85	0,85	0,85	0,85	0,85	0,85	0,85	0,85	0,85	0,85	0,85	0,85	0,85	0,85	0,85	0,85	0,85	0,85	0,85	0,85	0,85	0,85	0,85	0,85	0,85	0,85	0,85	0,85	0,85	0,85	0,85		

**The WP1 leader Dr. Anke Blöbaum is employed on a 50% position at the University Magdeburg. This position requires mainly teaching activities and leaves only very limited resources for research activities. A 10% partial position is allocated here to perform the research in this project. Within this time allocation, she will support and lead the research associate and will perform tasks of the WP and overall project organisation and research work.*



5. WP#1 Risk Analysis

The implementation of the planned activities within WP#1 involves little or no risk. The realization of the planned activities is supported by the research and network structures that have been established and consolidated during the definition phase. Moreover, the activities are based on a jointly agreed research strategy that was discussed intensively and coordinated at the beginning of the definition phase in a kick-off and coordination workshop in Germany and in a round table workshop in Cambodia with the local research partners. The cooperation with the implementation partners is consolidated, as a Memorandum of Understanding was signed by the Phnom Penh City Hall, that specifies the joint activities for the R&D phase and provides an outlook on the following implementation phase.

The quality of the survey instrument (standardized questionnaire) for the joint empirical research was already evaluated and adapted with regard to culture-specific factors. In order to control these aspects, the reliability of a preliminary survey (including item analysis) was carried out in the definition phase.

According to Covid-19, the global situation and travel restrictions can affect the work stays at the beginning of the R&D phase. The methodological approach allows an adaptation to the development of the pandemic. An alternative to conduct face-to-face interviews could be realized by an online survey. Regarding the collaborative activities, online meetings and conferences can take place, as it was also carried out during the Definition phase. In this respect, the research strategy and collaboration should not be affected by Covid-19.

6. APPLICATION POTENTIAL AND UTILIZATION POTENTIAL

6.1 Economic success prospects

For WP#1 there are no direct economic utilization or patent applications planned. WP#1 focuses on the investigation of theoretical and data-based findings on determinants of environmentally friendly behaviour in the city of Phnom Penh. The aim is to develop effective intervention techniques and practical strategies based on the findings of the definition phase and the research and development phase. In the further course, the developed measures will be implemented as well as evaluated in the Implementation phase. With the development of such concepts, we see our university making an important contribution to socially relevant challenges and issues.



6.2 Scientific success prospects

The interdisciplinary and transdisciplinary approach initiates new research fields that can make a significant contribution to disciplinary and interdisciplinary publication strategies (specialist journals, conferences). From the perspective of environmental psychology, little is known so far about culture-specific environmental relevant norms, values, attitudes and barriers for environmentally friendly behaviour in the region of Southeast Asia. The project offers the opportunity to analyze the role of established psychological constructs for pro-environmental behaviour in this specific cultural context and to develop and evaluate adapted, modified intervention techniques. The results can widen the teaching in environmental psychology at the University of Magdeburg and can further be used to build up and permanently establish environmental psychology as a teaching and research field in psychology at the Royal University of Phnom Penh. The project enables the promotion of young researchers in Germany through master's theses, dissertations and international exchange as well as the promotion of young researchers in Cambodia.

6.3 Scientific and economic connectivity

The main focus of our work package is on the scientific connectivity and compatibility. The expected results of our empirical research can enrich the transdisciplinary understanding of “quality of life in an urban context” in Cambodia. WP#1 integrates the dimensions of (environmental) behaviour, subjective perception and acceptance into the interdisciplinary group, targeting the theory-based interventions, enhancing Urban Quality of Life in accordance to sustainable urban transformation. The expected findings on tailored intervention techniques can help to promote pro-environmental behaviour in Phnom Penh. With regard to economic connectivity, we expect that our findings - through successful behavioural change - can contribute to reducing energy costs for the Cambodian population. In addition, a general increase in acceptance for “green buildings” and sustainable urban districts is expected.

7. WP#1 Contributions to trans-disciplinarity

The Build4People project’s main aim of enhancing the quality of life through sustainable urban transformation will be pursued by the manifold expertise of the different WPs’ disciplines. The scientific background of WP#1 on Environmental Psychology will strengthen the project’s people-centered approach by considering the perception and evaluation of the urban environment of Phnom Penh’s citizens and the human-environment interaction within the city.



In the leading role of developing and conducting the UQoL household survey and guiding the UQoL Citizen Science Process and the UQoL-Model Development / Data Modelling, WP#1 will contribute to the trans-disciplinarity of the Build4People project in multiple ways. The perspective of the other disciplines will be integrated within the contextualization and measurement of UQoL, as the theory-based assumptions reflect UQoL to be determined by the interplay of subjective factors (people sphere) and objective factors (sphere of environment). WP#1 will organize this trans-disciplinary process of measuring and modeling the interplay of the facets that determine people’s urban quality of life.

The B4P UQoL Citizen Science Process is a joint activity between the work packages WP#1, WP#5 (Urban Climate), WP#4 (Urban Green) and WP#7 (Overall Project-Coordination). WP#1 will contribute to this process with the methodological expertise of empirical data collection and statistical analysis of individual perception and assessment of the urban environment.

Furthermore, WP#1 will support the trans-disciplinary action research activities of WP#3 and WP#6 within the Ecocity Transition Lab Process and the Sustainable Building Arena Process on different scales. By giving input from the perspective of Environmental Psychology and on the main results of the surveys, WP#1 will include empirical insights of the people’s perspective on urban processes and determinants of a sustainable and livable city.

The dissemination strategies of the Build4People project can be finely tuned with the theory- and data-based psychological perspective and recommendations for an effective communication of positive descriptive social norms of sustainable lifestyles.

8. WP#1 preparation for Implementation Phase

As WP#1 focuses on the human sphere within the sustainable urban transformation, insights and explanations on environmental behaviours, environmental concern and social norms of sustainable lifestyles will allow the further implementation of context-adapted effective intervention techniques as a contribution to socially relevant challenges. The trial of one specific measure of an intervention for behaviour change for the target group of the new consumers will be monitored and evaluated in the R&D phase and will be further developed in the implementation phase. Behaviour change interventions shall then address different environmental relevant behaviours and be implied to a bigger audience.

The activities of the awareness campaign on UQoL and Sustainable Living will lead to the development of a module within the Build4People toolbox that will depict different adequate strategies for awareness campaigning and social marketing. This campaigning module shall facilitate the actual development of an awareness campaign on sustainable living within the implementation phase. As the general public shall be actively engaged in the sustainable



transformation process in Phnom Penh, the insights and results of WP#1 activities and the scientific and societal problem-based research will lead to further participatory processes within the project’s ongoing intervening. By the enablement of networking activities between stakeholders from state, economy and civil society and an increased awareness about issues of green buildings, sustainable neighbourhoods and sustainable lifestyles, we are aiming at a thorough and sustainable change that shall be strengthened during the implementation phase.

Regarding WP#1 research activities related to the Urban Quality of Life Process and Model Development, model-based planning strategies to foster urban quality of life in Phnom Penh as part of Build4People Toolbox will be elaborated. The recommendation of those planning strategies and policy measures will be further established by the means of the project’s comprehensive activities and local cooperation.

During the Implementation Phase, we aim to further develop the Citizen Science Input App in order to enable the integrated measurement and calculation of Urban Quality of Life for specific districts, based on the most relevant predictors (influencing) factors of the UQoL model. It is envisaged that further UQoL indicators will derive from the statistical model of WP#1 using the results of the household survey. A feasibility study to grasp UQoL by means of the Citizen Science Input APP is produced in the end of the Citizen Science Process. This report is the preparation for the Build4People UQoL Citizen Science App, one of the envisaged products/tools in the implementation phase. The main idea of this app is to allow citizens to evaluate a set of specified UQoL indicators. According to their ranking certain simple statics (median, quartiles, standard deviation, variance, coefficient of variation, standard error) are calculated. Resulting a ranking of specific neighbourhood takes place. The further and more profound analysis and evaluation of the collected data could be achieved in a web mapping software like Mappin (hosted by Lutra Consulting Limited), allowing the project team to display refined results as detailed hotspots maps to a much wider audience. In addition, Mappin could be used to provide our results to several mapping portals for the Phnom Penh’s Authority. Publishing monitoring recommendations of e.g. critical urban green areas due to a lacking public access and could also link into planning portal to show maps of planning applications (see proposal of WP#4).

9. WP#1 Rough Work- and Implementation Plan of Implementation Phase

The detailed work plan of the implementation phase will be developed during the research and development phase [see also B4P Milestone WS4: Build4People Proposal Writing Workshop, Hamburg (Month 37) and WP# 1 Milestone WP# 1 RF2AB (Month 48): Baseline Report IIB: Explaining and supporting sustainable lifestyles, and enhancing quality of life in



Phnom Penh]. The envisaged activities of the Implementation Phase will be intensively discussed and developed in an iterative process with the other WPs and the local partners. Associated partners and the consolidated network in Phnom Penh will enrich the ongoing intervening of the Build4People project and further planning.

During the Research & Development Phase, Impact Hub Phnom Penh (IH-PP); associated to WP#6) and WP#1 will discuss potential intervention forms and awareness campaigns based on B4P research results, and the experience and network of IH-PP to be implemented during the Implementation Phase. Other local partners, e.g. Urban Living Solutions (ULS; associated to WP#2) will support the implementation of tailored interventions and awareness campaigning by their experience at place and the provision of their network.

10. CONFIRMATION OF THE RIGHTS OF THIRD PARTIES

It is confirmed that the rights of third parties do not conflict with the intended utilization of the project’s results of WP#1, based on the current state of knowledge. Property rights and property right registrations will not be affected.

11. NECESSITY OF FUNDING

Third-party funding or own funds are not available to carry out the project. As a university, the Otto-von-Guericke-University of Magdeburg is therefore depending on 100% funding in this project.



WORK- AND IMPLEMENTATION PLAN

Work Package #2 "Sustainable Building"

Work Package Leader: Dr Dirk Schwede, Institute for Building Energetics,
Thermotechnology and Energy Storage (IGTE),
University of Stuttgart

Main Research Partners: **Institute of Technology of Cambodia (ITC)**
Dr Virak HAN, Faculty of Civil Engineering
Chanly HASH, Department of Architecture
Dr Kollika NGUON, Department of Industrial and
Mechanical Engineering

Guiding Research Question

How can buildings in Phnom Penh be designed, build and operated in order to enhance urban quality of life and to keep their environmental impact within the sustainable borders today and in future?

Sub-Questions

- How do people perceive the residential environment as supportive of quality of life? What is the influence of the occupant on building operation, and which design and technical parameters influence their behaviour and perception? How are supportive and sustainable environments built, equipped and operated?
- What are the domains of building, that are relevant for sustainable development and urban quality of life in Cambodia today and in the future? Which dimensions of a sustainable building must be addressed to achieve the quality of life and sustainable development at the same time?
- Which technological fields need to be advanced as enablers for sustainable transformation, and how can such development be achieved in selected technology fields? What are the steps of a technology roadmap towards urban quality of life in buildings?
- How can indoor environmental quality be evaluated, measured and enhanced, both on the user and building level in the specific context of Phnom Penh? How can its different aspects be improved? How can such evaluation be applied for building design and policy development?



1. Insights of the Definition Phase

During the Definition Phase Work Package 2 (WP#2) research focused on the understanding and awareness of the basic concepts of sustainability in buildings in Phnom Penh so that a research plan of the upcoming Research and Development Phase (R&D Phase) could be conceptualised. Methods of research during definition phase were the review of existing literature, the discussions with relevant stakeholders and building sector professionals during the two stays in Phnom Penh and a first measuring campaign acting as a test-campaign of our procedures to identify possible problems and help with developing and standardising a research protocol.

This research protocol, consisting of a Building Audit Guide & Questionnaire, was developed in collaboration with the CAMaRSEC project (BMBF CLIENT II project in Vietnam 7/2019-6/2022), the whole procedure and equipment are planned to be aligned so results from both projects can be analysed together, and synergies between the two projects and possible future collaborations are enabled, either in the next phase of the Build4People project or other related research in the area. Joint or coordinated efforts between projects can achieve more significant impact. They can lead in future project proposals that build on each other or parallel projects that complement each other.

From the discussions, it was evident that the awareness of sustainability issues in the building and construction sector in Cambodia is generally low, although gradually gaining support from stakeholders. Standard practices include the reliance on construction methods, design and materials that are inappropriate to local climates and conditions. Construction and building activities are not seen as meeting the needs of society and environmental protection but rather for stimulating the economy. Therefore managing the built environment in Phnom Penh will be a significant future challenge. The paradigm shift towards creating a more sustainable built environment in the region certainly requires the participation of all stakeholders, public-private partnerships, governance mechanisms and also strategies to encourage its implementation.

A problem that was mentioned as prominent is the reliance on 'western' construction methods, designs and materials that are often outdated, not energy-efficient, inappropriate to local climates and conditions and impose business and trade models that are expensive and unsustainable. Subsequently, cement has replaced indigenous materials and is responsible for 8% of carbon dioxide emissions worldwide. The replication of foreign approaches and building standards was the result of foreign investment with its corresponding imposed design, construction and development models. This phenomenon is being amplified by the shortage of skilled labour for the construction industry and by the adoption of designs and technologies, that have been developed in different contexts, usually in advanced industrialised countries. Such practice is resulting in dependence on imported materials and equipment, as well as foreign professionals and contractors.



The concept of sustainability has only recently been introduced to the building and construction sector in Cambodia. It is not yet an integral part of decision-making and business practice. The lack of awareness of sustainability issues in related professions and a lack of capacity amongst planners, architects, engineers, contractors and related stakeholders along with a lack of research and professional networks makes it obvious that well documented scientific and research references, tools, techniques, case studies and demonstration projects which are relevant to local conditions are needed. WP#2's R&D phase is being organised to address some of those issues, particularly in evaluating the current situation of the building stock in Phnom Penh, understanding what the future would ideally look like both from a sustainability and a desirability point of view and suggesting a path to get there. Raising awareness, building capacity, sharing and exchanging knowledge is also going to be part of this process.

Several local and international stakeholders have been identified during the definition phase, and contact has been established to continue exchange during the research and development phase. As an international frame for the planned development of a localised technical roadmap the UNEP GlobalABC's (Global Alliance for Buildings and Construction) current global and regional roadmap developments (GlobalABC 2020a, GlobalABC 2020b) are used and contact to the GlobalABC network has been established (see Letter of Support at Annex). On the local level, for example, the exchange has been set up with the General Department of Housing (GDH) in the Ministry of Land Management, Urban Planning and Construction (MLMUPC) already since the Build4People preparation phase, the Phnom Penh Capital Administration (PPCA) through the transdisciplinary Build4People EcoCity Transition Lab Process (ECTL) and the Green Building Working Group of the National Committee for Sustainable Development (NCSD) through WP#6 and with the local innovative design practice Urban Living Solutions (ULS).

For the academic and research work, the Institute of Technology of Cambodia (ITC) has been attracted as the main research partner of WP#2. ITC is exceptionally qualified to cooperate with WP#2 on the topic of "Sustainable Building" as they can provide expertise in the field of architecture, civil engineering and mechanical engineering. All these three faculties partner WP#2 so that a holistic design approach can be supported through joint research and local expertise.

2. Main aims of the R&D-Phase

The main aim of WP# 2's research is that buildings in Phnom Penh will be designed with low overall environmental impact and at the same time with enhanced quality of life now and in the future adapted to the local situation. This aim is addressed through the following sub-aims.



- In-depth understanding of aspects of urban living related to buildings like comfort, air quality, health and energy and further resource consumption
- Detailed analysis of the residential use, Indoor Environment Quality (IEQ) and the building physics behaviour of the inhabited apartments. Analysis of the interaction between use, functionality, energy consumption and quality of life perception.
- Analysis of the project development, project delivery and building operation. Development of means and instruments to support building sector professionals to reduce environmental impact during the whole life cycle of buildings and their neighbourhoods.
- Development and evaluation of practical interventions and technological solutions based on empirical research of the entire transdisciplinary project team and defining pathways on how to develop technical interventions for the achievement of long-term development goals.
- Co-Management of the Build4People Sustainable Building Arena Process together with WP#6.
- Active Participation and input to the Build4People EcoCity Transition Lab Process.
- Develop and continue exchange with the technical departments at the relevant ministries started in the preparation phase and continued in the definition phase.
- Support capacity building and academic exchange of the Institute of Technology of Cambodia (ITC).
- Support of master course development at the School of Architecture and Urban Planning (SAUP) at Pannastra University of Cambodia.

3. State of the Art (Theory)

As a result of the rapid economic development in Cambodia, lifestyles and needs of the inhabitants are changing, and new building typologies are emerging with materials, constructions and supply systems that were not previously common. Given the rapid pace of construction activity, socio-economic development and short-term climate protection goals, this development must now take place much more quickly in Phnom Penh and in the whole of Cambodia and regressions must be avoided. This development should be aligned with the efforts for improving new and future buildings. With changing comfort requirements, the indoor environment is also changing, and occupants are exposed to new indoor conditions, while the outdoor climate is warm and humid year-round. Efforts to save energy and conserve resources are urgently needed, as availability of resources, secure energy supplies, environmental pollution and climate change have been identified as pressing problems by policymakers at the national and global level. The construction sector, with its material flows and energy demand, is a significant contributor to these problems in Cambodia. Concrete demand in Cambodia was about 7 million tonnes in 2017, and it is expected to grow exponentially



in the next few years (The Nation Thailand 2019). The energy demand in the residential sector (total final energy consumption (TFEC)) of Cambodia increased at an average annual growth rate of 6.9% between 2010-2015, coal grew the fastest at 21.2% per year followed by electricity at 18.2%, thereby 31% of TFEC is attributed to residential use (General Department of Energy and General Department of Petroleum, Ministry of Mines and Energy of Cambodia 2016).

Despite the pressuring context, neither the Cambodian construction industry nor the residential sector has sufficiently tried to adapt to the needs of lowering the energy demand and environmental pollution caused by its activity. It needs to be investigated, both from an environmental but also from a peoples-perspective, how to promote such a transition with new designs, standards and technologies and their integration within the building systems. At present, however, the building sector does not have an in-depth understanding and knowledge of sustainability concepts, nor the skills to use them. There is a reported lack of knowledge and willingness in advancing the use of bioclimatic design principles and low energy building system technologies, building code adoption and compliance, building and appliances labelling, use of audit and building management tools and building integrated renewable energy systems.

According to the International Energy Agency (IEA) the number of new buildings likely to be built by 2050 under inadequate energy policies globally, is equivalent to 2.5 times the current building stock in the People's Republic of China (IEA 2019). Stalling on high-performance buildings construction and renovations for an additional ten year period can result in 2 Gt of extra CO₂ emissions from 3500 million tonnes of oil equivalent of unnecessary energy demand to 2050, increasing global spending on heating and cooling by 2.5 trillion USD (IEA 2019). Moreover, approximately 70% of building floor area additions will occur in places like Cambodia till 2050, with limited building energy codes in place today (IEA 2019). However, buildings are not only their environmental impact but also their interactions with their users and occupants. It is known that we spend 90% of our time indoors (Klepeis et al. 2015; Chapple 2011) and given the increasing interest on health, Indoor Air Quality (IAQ) and wellness inside buildings, it becomes clear that interior spaces should be made healthier. Proper Indoor Environmental Quality (IEQ) management can reduce indoor air pollution and promote the health of occupants (Nitmetawong et al. 2019).

Sustainable building design aims at maximising the quality both of the built environment and of the life within the building, while at the same time minimising negative impacts on the natural environment (McLennan 2006). With 9.5% of Cambodia's population living in Phnom Penh it has become apparent that building design processes must address energy demand, building form, construction materials, operation and maintenance, and above all, the long-term and changing needs of the user population, throughout the life cycle of the buildings (Williams 2007; Nag 2019). WP# 2's



level of analysis concerns the building and building design as part of the solution for moving towards a more sustainable city and an improved UQoL in Phnom Penh. A sustainable building approach is considered as a way for the building industry in Cambodia to swift to a more sustainable way of development taking into account environmental, socio-economic and governance issues. These issues were identified within the project under the aspect of transformation towards better UQoL. The practice of sustainable building refers to various methods in the process of implementing building projects that involve less harm to the environment preserve natural resources and improve our quality of life (World Green Building Council 2020). Hill and Bowen (Hill and Bowen 1997) state that sustainable building starts at the planning stage of a building and continues throughout its life to its eventual deconstruction and recycling of resources to reduce the waste stream associated with demolition.

Within the Cambodian context, the sustainability concepts in building design can be realised in multiple levels. Energy consumption is one of them since the prices of electricity in Cambodia are some of the highest in South-East-Asia (Le Fevre 2019) and at the same time total electricity consumption is on the rise (Ayman 2020). Despite the high local electricity prices, the recently constructed buildings are usually neither energy-efficient nor adapted to the tropical climate. Cambodia also lacks its own energy efficiency label in electric appliances, with the majority of them imported from other countries energy labels are depended on the country where the products are coming from. The Department of Energy Technique (DET) of the Ministry of Industry, Mines and Energy (MIME) collaborates with the Climate Change Department (CCD) to translate energy efficiency labels for selected electric appliances (Air Conditioners, Refrigerators, and Fans) sold in the market and an "Electricity Tariff reduction plan for consumer and Electricity billing adjustment for consumers plan for 2020 and 2021" has been announced (Ministry of Mines and Energy 2020). Overall no specific targets for energy use and building standards regarding efficiency are in place right now. Creating such codes and practices could be a way to portray the industry's responsibility towards protecting the environment (Ding 2008; Zainul Abidin 2010; Hill and Bowen 1997; Shen et al. 2010)

According to WP# 1's pretest survey, the Cambodians do consider low energy demand, low CO₂ emissions and minimum use of natural resources as part of the sustainable idea and they still prefer the traditional rural Khmer house along with the shop-house and borey type of residential building. Such typologies provide an opportunity for both traditional and technical solutions for sustainable and eco-friendly architecture and construction concepts to be adapted into modern forms. They can improve aspects of the indoor environment, quality of buildings materials and the use of renewable energies, among others (Schwede et al. 2016). But like in other places, such as Vietnam and



Thailand, highrise residential buildings will become more prominent in Cambodia and also localized solutions for sustainable construction of such new typologies must be introduced.

The literature identifies three general objectives which should shape the framework for implementing sustainable building design and construction (BBSR 2019). These objectives are:

1. resource conservation: energy and resource-efficient building design, LCA consideration
2. cost efficiency: LCC consideration
3. design for human well-being: human health and comfort

Building design processes within WP#2's activities may be seen as a system consisting of sub-systems that appropriately accommodate the elements of the bioclimatic and the sustainable perspectives:

- buildings being climate-adapted, having minimal impact on the environment, buildings, and building activities should create minimum dependence on polluting materials, treatments, fuels, management practices, energy and transport. (Halliday 2008)
- focusing on Quality of Life (QoL), with attention to human health and comfort while contributing to the overall improvement in indoor environmental quality (air, thermal, visual and acoustic quality). (Halliday 2008; Hill and Bowen 1997; Akadiri et al. 2012)
- being built and designed with energy- and resource-efficient design in mind (Guy and Farmer 2001). Buildings should not use a disproportionate amount of resources, energy, water, materials and land during construction, use or disposal. As much as possible renewable and recyclable resources should be used. (Halliday 2008; Tam and Le 2019; Kibert 2016).

Technical subjects that are going to be addressed within these objectives will include:

- material selection with consideration of the local practices and the environmental impact
- pollution control throughout the project life cycle (Abidin and Powmya 2014)
- comfort, not just as a matter of physical conditions and environment but also related to building typologies, space design, physiological and demographic indicators, and technological features embedded in the design of the building (Zr and Mochtar 2013; Bougdah 2010).
- optimisation of energy use strategies in building design (Sarté 2010) including a reduction in energy demand, efficient use of energy, selection of a sustainable energy source, and reduction in CO₂ emissions

Apart from the building design, using a green supply chain in the construction stage is another crucial part. At the moment, only basic construction materials with low-added value are produced in the



country (Bodach 2019). The vast amount of construction materials for both large commercial and residential projects are currently imported from Korea, Thailand, Vietnam, and China, but also the more high-end materials and fixtures from other places. With a big part of the region's infrastructure and industrial models still being developed and the relative stability and rapid economic growth, it is the ideal time for a switch from the low-performing, polluting, resource-inefficient technologies and practices to a performance-driven environmental model (OECD 2014).

An appropriate way to approach the necessary transformation is through the formulation of a *localised roadmap* (Schwede 2020) aligned to international and regional efforts (GlobalABC 2020a, GlobalABC 2020b). A roadmap is a strategic instrument to map out the development path towards a desirable future, such as a development goal by 2050, and the required development steps towards such goal for a technology field, a policy sector or the entire country, but under consideration of the predicted development of boundary conditions. Such a localised technical roadmap will be developed within WP#2 for selected technology fields towards urban Quality of Life and sustainable building and in relation to the regional and global roadmaps of GlobalABC and the local efforts of the National Committee for Sustainable Development (NCSD) in this regard.

In summary, the goal is to bring balance between the climate and the built environment, with interrelated considerations, such as the climate variables, human health, comfort and technological and architectural solutions in close collaboration with the other WPs. WP#2's contribution in R&D-Phase will be an effort to bring together all of these different facets of the building, not only within the building design level but also within a transdisciplinary perspective, addressing not only WP# 2's research questions but also related questions from other WPs. The following research plan was created keeping that in mind, not only providing solutions for building level sustainability issues but also produce results that can either support or be supported from other WPs, providing a holistic and transdisciplinary approach

4. Research Plan

The activities of WP#2 are planned throughout the four year period of the Build4People RD-Phase, and they are divided into four big worksteps, each one with its own sub-activities. WP#2's aim is to develop, in collaboration with the other WPs, the fundamentals of the context of energy-efficient, resource-efficient and sustainable construction in Cambodia, all of them from a people-centred perspective. In WP#2, current practices, sustainable building technologies and, the requirements for a good indoor environmental quality (IEQ) for present and future building projects will be examined. First measuring equipment will be installed for long-term measurement and evaluation of the indoor environment in residential buildings in Phnom Penh. Environmental perception and behaviour user



surveys, building physics measurements in the building and detailed building audits are interlinked in such a way that the transdisciplinarity of the research team is optimally exploited. The surveys are organised in such a way, that not only the detailed results of the building audits can be used for higher levels evaluation (neighbourhood, urban etc.), but possibly also transferred to other samples of similar buildings in Cambodia and other locations in the region with similar climate and building operations.

As a key product of WP#2 a technical roadmap will be developed to map out a strategy towards sustainable building and urban quality of life. Key information gaps will be identified and addressed by collecting data and evidence to support actions to improve the efficiency of buildings. Along with Build4People Sustainable Building Arena process (jointly managed by WP#2 and WP#6) and the Build4People Sustainable Building Incubator, activation and visioning for transformation will be supported and lead into improved building performance and construction methods that ideally would result in a bigger scale of sectoral change. Specifically WP#2 will develop a localised technical roadmap based on these transdisciplinary processes.

WP#2 will engage in capacity mobilisation and dissemination activities, at different levels of the building life cycle and for different target groups. The results of the measuring campaigns and sustainable building research will be translated into university curricula and workshop concepts. Furthermore, a Sustainable Building Incubator, organised by WP#6 and Impact Hub Phnom Penh (IHPP), will be supported by WP#2, by connecting the results and analysis of the activities to the ecosystem of IHPP entrepreneurs who will develop innovative and feasible solutions to challenges in the building and urban development sectors.

Also WP#2 will provide continuous input to Build4People's most important transdisciplinary action research activity, the Ecocity Transition Lab (ECTL) in cooperation with the key implementation partner of the Build4People project, the Phnom Penh Capital Administration. The ECTL will focus on a case study site representative of the current urban development dynamics of Phnom Penh. Hereby the final aim is to develop sustainability criteria to which WP#2 will contribute in the field of buildings. WP#2 will draw on the capacities of the project partners (lectures and workshops at the university, collaboration with students) and the activities of other WPs and joint activities for effective dissemination to broad user groups. WP2s activities results are going to be fed in and updated by the joint activities and events.

In WP#2 the focus is on the technical and engineering aspects of building use and on the life cycle aspects of materials and buildings as well as on the evaluation of these aspects. Furthermore, the group will review the current curriculum at ITC in the field of energy-efficient, resource-efficient and overall sustainable building at the schools of Civil Engineering, Architecture and Mechanical



Engineering and prepare aligned and complementary teaching materials for university teaching. WP#2 will also support the joint efforts of the Build4People team the master course development at the School of Architecture and Urban Planning (SAUP) at Pannastr University of Cambodia.

4.1. WP#2 sub-work packages

The activities of the sub-work packages are well in line with the rest of the activities of the project. It is planned to transfer the results and analysis generated into the joint activities and products.

WP#2.1	Analysis of User & Building Behavior
expected impacts	Detailed analysis of the residential use and the building physics behaviour of the inhabited apartments.
scheduled	first project year
WP#2.1.1	Building audits and basic measurements: evaluation of typical indoor climate and comfort conditions
WP#2.1.2	Indoor Environmental Quality (IEQ) measurements: evaluation of typical indoor environmental quality patterns
WP#2.1.3	Buildings, Health and Users: Evaluation of occupant overall health status and satisfaction in collaboration with WP#1
WP#2.1.4	Extracting content for reporting, dissemination, capacity building // Academic Exchange with ITC / Handbook Contribution / Poster Exhibitions
activity description	<p>This first sub-work package will develop an in-depth analysis of the residential use and the building physics behaviour of the inhabited apartments and of the interaction between use, functionality, energy consumption and quality of life perception resulting in a real understanding of the problem and help with coming up with guidelines and solutions for a better envisaged future. By identifying the link between occupant behaviour, building controls, energy-related consumption patterns and buildings thermal behaviour innovations for building technology adoption in the building sector can be suggested and evaluated (Hong et al. 2016). In this context, interdisciplinary theories and research can provide additional interpretations and insights, more accurately describe the energy-related human-building interactions and provide useful data (D’Oca et al. 2017). The monitoring and evaluating of the influence of the occupants’ behaviour on the energy use and the thermal behaviour of the buildings will be conducted by technical measurements as well as social scientific methods in cooperation with WP#1. The aim is to develop models for long-term engagement of the end-user in order to</p>



ensure at the same time comfort, health and energy saving.

By the end of the first year, we will already have a small set of robust measurements about IEQ in residential buildings in Phnom Penh, at the beginning of the year all of the equipment will be ordered and checked and the equipment installation procedure will be solidified based on our experience gained during the Definition Phase and the parallel forerunning CAMaRSEC project in Vietnam. Building on the Definition Phase gained insight, the analysis of the results will lead in a deep understanding of the problems in existing building stock and based on it we can build-up for the next steps of our research.

The locations and settings of the houses to conduct the measurements will be coordinated with survey activities of WP#1 (environmental psychology) and the urban climate investigation of WP#5 (urban climate) and WP#4 (urban green). It will also be aligned with the planning area in the ECTL in coordination with WP#3 in order to produce building physics, technical audit and IEQ-results applicable in the related processes.

In order to reduce the budget demand, the measurement equipment will be reused several times during the project duration. The equipment installation will be repeated in 6 months intervals aiming at having measurements taken in 100 buildings by the end of year 3.

WP#2.2 Defining Localised Sustainable Building Dimensions and Solutions	
expected impacts	Scope for sustainable building (building, near-surrounding level) in the context of Phnom Penh
scheduled	second project year
WP#2.2.1	Analysis of Building Design and Identification of main issues of Sustainable Building in Phnom Penh // GDH / NCSD / ULS / ITC collaboration
WP#2.2.2	Evaluation and Development of Solutions for main issues/technology fields identified // LCA/LCC, market assessment / Areana Process / Focus Group / ITC collaboration
WP#2.2.3	Development of generic localised holistic Sustainable Building // ITC / GDH / ULS / input to ECTL
WP#2.2.4	Extracting content for reporting, dissemination, capacity building // academic exchange with ITC / Handbook Contribution / Poster Exhibitions
activity description	In this sub-work package, it is investigated what has to be taken into account and when, during the design, construction, operation and maintenance of sustainable



buildings in Phnom Penh. The necessity of specific building designs/technologies that are suited particularly to the Cambodian climatic conditions and the current capacities of the market is being addressed within WP#2.2 activities. Results from WP#2.1 activities are being used to address the current situation.

The results of this milestone will consist of detailed approaches and recommendations, to be put in practice in the different stages of future building projects as well as key evaluation methods to be produced to effectively achieve the targets set at the beginning of the project, with particular reference to resource and energy efficiency. These approaches and recommendations will refer to the various stages of a building project, starting from the design, through the construction up to the operation and maintenance phase and they will be supported by the review of recent related literature, such as (Enteria et al. 2020; Kubota et al. 2018; Aste et al. 2020). Life-cycle impact and life-cycle costing (LCA/LCC) approaches as well as technical, energetic and economic criteria will be integrated within the activities related to this milestone, along with methods of prioritising strategies, which actions are relevant in which phase and which steps must be taken on the level of the building design process, which market context parameters must be improved to support the uptake of the solutions identified on a higher level. The approaches, recommendations and strategies will refer to building characteristics towards sustainable development and quality-of-life based on results of WP#2.1. These Strategies will address the project development, project delivery and building operation on various levels, such as design options, building performance, equipment and systems selection and specification, measurement and verification of energy consumption, tools and instruments for the delivery of buildings with performance improvements.

WP#2.3	Technical Roadmap towards Sustainable Building in Phnom Penh
expected impacts	Document the current context and draft the desired future performance. A pathway towards this desired performance is developed, focusing on technology fields (e.g. comfort cooling technology, material use, integrated renewable energies).
scheduled	third project year
WP#2.3.1	Identification of priority areas in buildings and construction (B&C) / Scenario definitions for roadmapping towards sustainable development and Quality-of-Life with the focus on selected technology fields (e.g. comfort cooling technology,



material use, integrated renewable energies).

- WP#2.3.2** Concepts for future proof-buildings in Phnom Penh, focusing on technology fields (e.g. comfort cooling technology, material use, integrated renewable energies)
- WP#2.3.3** roadmaps for key technical interventions and developments towards sustainable buildings in Phnom Penh // Focus Group Discussions (along with SBA workshops), Quality-of-Life // input for PPCH
- WP#2.3.4** Extracting content for reporting, dissemination, capacity building // Academic Exchange with ITC / Handbook Contribution / Poster Exhibitions / Toolbox
- activity description** A technology roadmap for sustainable building in Cambodia and especially in Phnom Penh will be developed and adapted to the expected economic, social and technological development of the country. In cooperation with WP#6 the roadmap is drafted for the building sector to define the expected development of the context. A technology roadmap is a strategic plan designed to facilitate the preferable future direction of technological development in the building sector. It aims to direct future paths of advancing technologies. One of the functions of the technology roadmap will be to provide a basis for decision-making by planning steps for the required technological innovation in the market. Another objective is to accelerate research and development in the sustainable building sector by creating a focus on environment, design and technological solutions for sustainable development and quality-of-life (see also exploitation plan).
- The results from WP#2.1, WP#2.2 and the other work packages are analysed together and used to develop a roadmap for sustainable construction in Cambodia and especially in Phnom Penh and adapt it to the expected economic, social and technological development of the country. The effects of climate change and the development of the urban microclimate will also be taken into account. The aim is to avoid unwanted developments and lock-in effects in the development of the building stock and to manage the transformation through appropriate standardisation and other accompanying measures. While the relevant aspects of the building sector are outlined in cooperation with WP#6, individual fields of technology are dealt with in detail. The technology fields (e.g. comfort cooling technology, material use, integrated renewable energies) will be identified in WP#2.1 and WP#2.2.
- On building design level “future-proofed” design principles with the desired performance and design qualities in 2050 are developed. With these principles, the



design is detailed taking into account reasonable long-term goals and developments at the time of designing, although not all planned systems are planned to be installed at the time of first construction (Schwede 2020).

In sub-work package 2.3 a vision for the desirable situation in 2050 is developed, and backtracking techniques are combined with engineering assessment methods (feasibility studies, LCA, LCC) to define the steps of the roadmap. As an international frame for the planned development of a localised technical roadmap the UNEP GlobalABC's (Global Alliance for Buildings and Construction) current global and regional roadmap developments (GlobalABC 2020a, GlobalABC 2020b) are used and contact to the GlobalABC network has been established (see Letter of Intent at the Annex). As the development of a complete and comprehensive roadmap would exceed the resources of this project, specific technology fields will be detailed in this localised roadmap. The selection will be conducted based on the previous assessment and in coordination with relevant stakeholders, such as the relevant ministries, Phnom Penh City Hall and technical cooperation organisations (GIZ, ADB, kfW), to ensure later uptake of the research results into implementation projects and policy initiatives (see exploitation plan).

WP#2.4 Development of localised IEQ-metrics / sustainable building metrics	
expected impacts	Analysis of the interaction between use, functionality, energy consumption and quality of life perception
scheduled	forth project year
WP#2.4.1	measurement analysis (WP#2.1.1 & WP#2.1.2), development of localised IEQ-metrics // practical guidance for improving and maintaining the indoor environment towards IEQ/QoL
WP#2.4.2	Establishment of clear procedures for measurement, monitoring and responding to IEQ problems / development of quality-based and IEQ design solutions for the context of Phnom Penh // ITC / GDH / NCSD (green building guidelines)
WP#2.4.3	Towards the implementation phase : evidence-based technical guidance for low energy, sustainable and high quality-of-life buildings // cooperation with ULS or other developer in adopting our design suggestions and ideas in a future project // ITC, GDH, ULS / input to ECTL
WP#2.4.4	Extracting content for reporting, dissemination, capacity building // Academic Exchange with ITC/ Handbook Contribution/ Poster Exhibitions / Toolbox
activity description	A localised IEQ model (Indoor Environment Quality) is developed with temperature, humidity, CO ₂ , VOC and PM concentrations, based on the



measurements started in WP#2.1 and performed throughout the duration of the project. All these aspects are analysed and quantified to evaluate the overall performance of the measured buildings and provide data to improve the indoor conditions. This analysis will contribute to the selection of intervention areas to optimise the indoor design and to identify technologies aimed at ensuring the best IEQ levels for users at the operational stage. This to-be-designed model is planned to act as an IEQ assessment tool for the rating of buildings in real operating conditions. For this, each of the mentioned measured factors is weighted based on literature and questionnaire data about comfort and user satisfaction with the indoor environment. The model is planned to be tested in residential buildings during the implementation phase.

This model will be used to create a practical guide on how to improve IEQ in residential buildings in Phnom Penh, this guide will be directed to the occupants of buildings and will include simple advice on comfort, better air quality and healthy environment within the building. A second guide directed to building sector professionals is developed to specify how to achieve satisfactory IEQ and indoor comfort requirements, but also how to integrate IEQ and energy performance into their designs. This guide will act, along with other criteria identified in collaboration with other WPs, as a basis for the development of technical guidelines for assessing the performance of the built environment towards quality-of-life at different stages from the design to the operational phase.

In this way, the implementation and further development of building standards is effectively promoted, and performance targets can be set, monitored and thus achieved.

4.2. WP#2 Work- and Implementation Plan

RD-PHASE	Activities	Methods	Products
Work Steps	Aims / Results		Transdisciplinary Cooperation
<i>I. Build4People Coordination Meetings in Germany</i>	Regular exchange within the Build4People project team Ongoing conceptualisation and modelling of Urban Quality of Life (UQoL) Face-to-face meetings in the context of the milestones, in-between regular online meetings (every two months)		
	Presentations, discussions		



	<p>B4P Milestone WS1 (Month 01): Build4People RD-Phase Kick-off Meeting, Hamburg B4P Milestone WS2 (Month 13): Build4People UQoL-Survey Workshop, Magdeburg B4P Milestone WS3 (Month 25): Build4People UQoL-Modelling Workshop, Eberswalde B4P Milestone WS4 (Month 37): Build4People Proposal Writing Workshop, Hamburg</p> <ul style="list-style-type: none"> Joint general research understanding (WS1) Joint scientific-conceptual work on urban quality of life (WS2 / WS3) Joint agreement of content of proposal of Build4People Implementation Phase (WS4) Capacity mobilisation due to insights on urban sustainability best practices in Germany for invited research partners from Cambodia (WS4) <p>Managed by WP#7 with input from all other WPs</p>
II. Science / Roundtable Workshops / Focus Group Discussions in Cambodia	Regular scientific exchange with local research partners and local stakeholder groups
	Presentations, discussions
	<p>WP#2 Milestone SW1 (Month 04): development audit, measurement and survey plan WP#2 Milestone SW2 (Month 10): review of first audit, measurement and survey results WP#2 Milestone SW3 (Month 15): development of localised sustainable building scope WP#2 Milestone SW4 (Month 22): definition of a localised sustainable building framework WP#2 Milestone SW5 (Month 27): discussion of roadmap concept, roadmap planning and definition of scope & depth WP#2 Milestone SW6 (Month 34): road map review and finalisation for presentation WP#2 Milestone SW7 (Month 39): review of audit, measurement and survey results and planning for the development of localised IEQ-metrics / sustainable building metrics WP#2 Milestone SW8 (Month 46): review of localised IEQ-metrics / sustainable building metrics and development of an implementation perspective in standard and policy development</p>
	<ul style="list-style-type: none"> Increased mutual research understanding with local research partners Joint agreement in regard of research design and methodologies Insights into views of local stakeholder groups Capacity mobilisation
	Managed by WP#2 and local research partner ITC, invitation of other WPs and experts, actors and stakeholders.
III. Build4People Conferences in Cambodia	Participation in the Build4People conferences with all German and Cambodian partners and relevant stakeholders
	Presentations / panel rounds / discussions
	<p>B4P Milestone K1 (Month 03): Build4People Research Conference B4P Milestone K2 (Month 26): Build4People Status Conference B4P Milestone K3 (Month 46): Build4People Outlook Conference</p>
	<ul style="list-style-type: none"> Increased public awareness and mutual understanding of the different Work Package approaches of the Build4People project Networking with stakeholders from the state, economy and civil society
	Managed by WP#7 with input from all other WPs



<p>IV. Scientific and Societal Problem Based Research: Data Collection and Analysis</p> <p><i>IV.A. WP-related research</i></p>	<p>Baseline and start-up of activity</p> <ol style="list-style-type: none"> 1. Updated review of literature and of state of the arts <p>Analysis of User & Building Behaviour:</p> <ol style="list-style-type: none"> 2. Development of survey, audit and measurement plans and instruments / procurement of equipment 3. Selection of buildings in coordinations with research in WP#1/WP#3/WP#5 4. Building audits and basic measurements: evaluation of typical indoor climate and comfort conditions 5. Indoor Environmental Quality (IEQ) measurements: evaluation of typical indoor environmental quality patterns 6. Buildings, Health and Users: Evaluation of occupant overall health status and satisfaction in collaboration with WP#1 <p>Defining Localised Sustainable Building Dimensions and Solutions:</p> <ol style="list-style-type: none"> 7. Analysis of Building Design and Identification of main issues of Sustainable Building in Phnom Penh 8. Evaluation and Development of Solutions for main issues/technology fields identified 9. Development of generic localised holistic Sustainable Building <ul style="list-style-type: none"> ▪ Compilation of most recent publications, methods and results on building audit, measurement and survey ▪ Detailed building audits (architecture, building structure, appliances etc.) ▪ Measurements (temperature, humidity, CO₂, PM_{2.5}, PM₁₀, VOCs) ▪ Thermal Comfort Questionnaire Survey ▪ Build4People UQoL and User Behaviour Survey ▪ LCA/LCC methodologies ▪ Focus Group Discussions with stakeholders and experts <p>WP#2 Milestone R1 (Month 02): Updated bibliographic research and literature / agreement and definition of research plan / procurement of equipment</p> <p>WP#2 Milestone R2 (Month 12): Setup of measuring equipment / real understanding of local context and challenges</p> <p>WP#2 Milestone R3 (Month 24): Definitions of the scope of Sustainable Building in the context of Phnom Penh / framework report</p> <ul style="list-style-type: none"> ▪ Increased understanding and knowledge of state of the art for Asian context ▪ Detailed analysis of the residential use and the building physics behaviour of the inhabited apartments ▪ Increased understanding of the current status of Sustainable building and construction in Cambodia right now. ▪ In-depth knowledge to develop adapted strategies towards implementing sustainable building and development of the building sector in Cambodia. ▪ Basis for the development of a technical sustainable building road map and IEQ-metrics and sustainable building metrics. <p>Managed by WP#2 and local research partner ITC, invitation of other WPs and experts, actors and stakeholders.</p>
<p>IV. Scientific and Societal Problem Based</p>	<ul style="list-style-type: none"> ▪ Input to the trans-disciplinarily developed Build4People survey from the aspect of housing and sustainable building, building physical comfort models ▪ Consultation to the principal investigator of the survey



<p>Research: Data Collection and Analysis</p> <p>IV.B. Build4People UQoL Household Survey / Data Input via APP</p>	<ul style="list-style-type: none"> Contribution of adequate indicators / questions to ensure the usability of survey results for engineering methods Establishing cross-links to audits, measurements and survey in WP#2 research in V.A Analysis of survey results for development of design and engineering knowledge <p>B4P Milestone TR1 (Month 04): Final version of questionnaire for household survey B4P Milestone TR2 (Month 08): Final version of the Citizen Science Input APP (Integration of subjective evaluation of objective factors); B4P Milestone TR3 (Month 12): First results / analysis of collected data from Citizen Science Input APP and from household survey</p> <ul style="list-style-type: none"> Insights into objective / subjective factors influencing urban quality of life in Phnom Penh Mutual trans-disciplinary understanding of urban quality of life Increased awareness about the importance of urban quality of life among stakeholders Preparation of survey results in regard of B4P Milestone WS2: Build4People UQoL-Survey Workshop at Magdeburg University (Month 13) <p>Scientific-conceptual lead WP#1 with support from WP#7 Data-Management lead WP#4 Input from all other WPs</p>
<p>V. Trans-Disciplinary Action Research: Process Facilitation and Product Development</p> <p>V.A. Build4People EcoCity Transition Lab Process</p>	<p>Input based on WP#2 activities and adapted to the neighbourhood level</p> <ul style="list-style-type: none"> Analysis of User & Building Behaviour (ECTL I) Defining Localised Sustainable Building Dimensions and Solutions (ECTL II) Technical Roadmap towards Sustainable Building in Phnom Penh (ECTL III) <ul style="list-style-type: none"> Presentations based on WP#2s research results: the products of each activity are being presented and updated accordingly from ECTLs outputs. Data-based input about drivers and barriers for sustainable building design techniques Data-based framework for sustainable neighbourhoods from the perspective of sustainable building Consultation on the organisation of each event Analysis of ECTL results for development of design and engineering knowledge <p>B4P Milestone TL1 (Month 10): Ecocity Transition Lab I: Masterplan Study Area & Design Strategies B4P Milestone TL2 (Month 27): Ecocity Transition Lab II: Neighbourhood Plans & Guidelines B4P Milestone TL3 (Month 34): Ecocity Transition Lab III: Criteria & Implementation Strategies</p> <ul style="list-style-type: none"> Increased awareness about the topic of sustainable buildings and sustainable urbanisation Introducing about the topic of "sustainable building" to a broad audience New contacts to architects, developer companies and other stakeholders who would like to cooperate with our team Basis for problem and domain definition towards the development of a technical roadmap and IEQ-metrics in WP#2-VI.A Preparation of strategies, guidelines and criteria in regard of the Build4People Toolbox Establishing cross-linkages to Build4People Sustainable Building Arena (SBA) <p>Scientific-conceptual lead WP#3 with support from WP#7 Input from all other WPs</p>
<p>V. Trans-Disciplinary Action Research:</p>	<p>Participatory workshop series with front-runners from different stakeholder groups Input based on WP#2 activities adapted to the SBA context</p> <ul style="list-style-type: none"> Defining Localised Sustainable Building Dimensions and Solutions Technical Roadmap towards Sustainable Building in Phnom Penh



<p>Process Facilitation and Product Development</p> <p>V.B. Build4People Sustainable Building Arena Process</p>	<p>Preparation, coordination and implementation of a transition management process (incl. interactive knowledge generation, world-café workshops, interviews, questionnaires, participant observation, input presentations, etc.)</p> <ul style="list-style-type: none"> Focus Group Discussions with stakeholders and experts Presentations of the related activities results and findings Analysis of SBA results for problem and domain definition towards the development of a technical roadmap Analysis of SBA results for development of design and engineering knowledge <p>B4P Milestone SBA1 (Month 14): Implementation of first SBA workshop cycle B4P Milestone SBA2 (Month 27): Implementation of second SBA workshop cycle B4P Milestone SBA2 (Month 39): Workshop on Experiment Facilitation</p> <p>Co-development of challenge framing, a spatio-sectoral vision and a transition agenda to support alternative discourses, marginalised actors, social learning, network building and knowledge communication to ultimately inform an urban sustainability transition</p> <ul style="list-style-type: none"> Joint knowledge production. In depth understanding of the desirable future for Phnom Penh's building sector/built environment. Basis for problem and domain definition towards the development of a technical roadmap and IEQ-metrics in WP#2-VI.A Update of WP#2s Technical Roadmap based on SBAs outcomes and generated 'Transition Agenda' <p>Scientific-conceptual lead WP#2 and WP#6 with support from WP#7 Input from all other WPs</p>
<p>V. Trans-Disciplinary Action Research: Process Facilitation and Product Development</p> <p>V.C. Build4People Sustainable Building Business Incubator Process</p>	<p>Facilitation of Sustainable Building Business Incubator Process in cooperation with Phnom Penh Impact Hub Input based on WP#2 activities:</p> <ul style="list-style-type: none"> Input on Sustainable Building existing challenges and opportunities in Phnom Penh Defining Localised Sustainable Building Dimensions and Solutions Technical Roadmap towards Sustainable Building in Phnom Penh <ul style="list-style-type: none"> Presentations of the related activities results and findings. Mentorship position during the incubator period (SBI2-SBI3). Analysis of SBI results for problem and domain definition towards the development of a technical roadmap <p>B4P Milestone SBI1 (Month 19): Final conceptualisation of the Incubator Design B4P Milestone SBI2 (Month 22): Incubator Kick-off B4P Milestone SBI1 (Month 26): End of Incubator and pitch to investors B4P Milestone SBI1 (Month 32): Incubator reflection report</p> <ul style="list-style-type: none"> Connection of the research results to Phnom Penh's entrepreneurs who will develop innovative and feasible solutions to challenges in the building sector. The developed solutions can be supported and monitored in the Implementation phase. Understanding of the state of the market and business community in the field of sustainable building in Phnom Penh Basis for problem and domain definition towards the development of a technical roadmap and IEQ-metrics in WP#2-VI.A <p>Scientific-conceptual lead WP#6 with support from WP#7 Input from all other WPs</p>



V. Trans-Disciplinary Action Research: Process Facilitation and Product Development V.D. Build4People UQoL Citizen Science Process (via APP)	Participatory workshops with different stakeholders and representatives of different target groups, e.g. on sustainable buildings and housing (with new consumers representatives, housing estate management companies, other stakeholders within the case study of the Build4People Ecocity Transition Lab)
	World café on sustainability + scenario-based methods with the topic: urban quality of life, norms, values. Application of participatory methods, e.g. back-casting
	B4P Milestone QI1 (Month 14): Multistakeholder Workshop on UQoL (focus application) B4P Milestone QI2 (Month 22): Focus Groups with new consumers (focus on conflicts between individual lifestyle claims and sustainability goals)
	Basis for data-based planning suggestions to increase urban quality of life in Phnom Penh; <ul style="list-style-type: none"> Reducing the own ethnocentric bias. Increased mutual understanding about the concept of urban quality of life Increased awareness about the impact of urban quality of life and comfort in residential buildings UQoL basis for problem and domain definition towards the development of a technical roadmap and IEQ-metrics in WP#2-VI.A
	Scientific-conceptual lead WP#1 with support from WP#7 Data-Management lead WP#4 Input from all other WPs (workshop preparation and participation) Feeding in results to all other WPs
VI. (Re-) Integration of Created Knowledge Refinement and Revision of Theory VI.A. WP-related research	Technical Roadmap towards Sustainable Building in Phnom Penh: <ol style="list-style-type: none"> Identification of priority areas in buildings and construction (B&C) / Scenario definitions for roadmapping towards sustainable development and QoL with the focus on selected technology fields (e.g. comfort cooling technology, material use, integrated renewable energies). Concepts for future proof-buildings in Phnom Penh, focusing on technology fields (e.g. comfort cooling technology, material use, integrated renewable energies) Roadmaps for key technical interventions and developments towards sustainable buildings in Phnom Penh, coordination with global and regional GlobalABC roadmaps and NCSD efforts
	Development of localised IEQ-metrics / sustainable building metrics based on analysis of audits, measurements and survey results: <ol style="list-style-type: none"> Development of localised IEQ-metrics / practical guidance for improving and maintaining the indoor environment towards IEQ/UQoL Establishment of clear procedures for measurement, monitoring and responding to IEQ problems / development of quality based and IEQ design solutions for the context of Phnom Penh
	<ul style="list-style-type: none"> Utilisation and development of engineering and building physics methods Integration of feedback loops Focus Group Discussions (along with SBA workshops) Use of UQoL survey results Use of ECTL process results and findings (Re-)integration of created knowledge
	WP#2 Milestone RF1 (Month 36): Research Achievements Year 3, <ul style="list-style-type: none"> Technical Roadmap towards Sustainable Building in Phnom Penh Concept for technical cooperation project in Build4People-Implementation Phase Research&Implementationplan for Build4People-Implementation Phase WP#2 Milestone RF2A (Month 46): Preliminary Research Achievements; to be presented at B4P Milestone K3: Build4People OUTLook Conference WP#2 Milestone RF2B (Month 48): Overall Research Achievements <ul style="list-style-type: none"> Technical Roadmap towards Sustainable Building in Phnom Penh



	<ul style="list-style-type: none"> Final Measurement Analysis / IEQ-Metrics
	<ul style="list-style-type: none"> Refinement and revision of theory Dissemination of research results at Build4People OECTLook Conference Preparation for publications
	<p>Managed by WP#2 and local research partner ITC, invitation of other WPs and experts, actors and stakeholders.</p> <p>Trans-disciplinary cooperation in regard of publishing joint scientific papers</p>
VI. (Re-) Integration of Created Knowledge Refinement and Revision of Theory VI.B. <i>Build4People UQoL-Model Development / Data Modelling</i>	<ul style="list-style-type: none"> Input based on expertise and experience gained on housing and sustainable buildings in Phnom Penh. Investigation of the possible integration of WP#2s data and IEQ-metrics within the model and the combination with data from other WPs. Consultation to the principal developer of the model.
	<ul style="list-style-type: none"> Provide of WP#2s Building Survey and Thermal Comfort Survey data Contribute WP#2 IEQ-metrics and sustainable building metrics and other engineering domain knowledge from WP#2-VI.A.
	<p>B4P Milestone QM1 (Month 35): 1st draft of Urban Quality of life (UQoL) Model (based on survey + UQoL process; objective data and results from the UQoL Process included)</p> <p>B4P Milestone QM2 (Month 45): Feasibility study to grasp UQoL by means of Citizen Science Input APP, including budget plan (WP#4) in preparation of Build4People Implementation Phase</p> <p>B4P Milestone QM3 (Month 48): Final version of a theory-driven, data-based, and context adapted UQoL Model</p>
	<ul style="list-style-type: none"> Preparation of scientific papers introducing the transdisciplinarily developed UQoL Model UQoL Model based planning strategies to foster urban quality of life in Phnom Penh as part of Build4People Toolbox (also in preparation of Build4People Implementation Phase) Detailed instructions for software company to develop an UQoL-App
	<p>Scientific-conceptual lead WP#1 with support from WP#7</p> <p>Data-Management lead WP#4</p> <p>Input from all other WPs</p>
VII. Build4People Dissemination VII.A. <i>Build4People Poster / Photo Exhibitions</i>	<ul style="list-style-type: none"> Contribution of adequate poster panels to all the transdisciplinary developed exhibition introducing about the topic of "sustainable building" to a general public and connecting it with the specific thematology of the exhibition. Consultation of the exhibition curator from WP#3
	<ul style="list-style-type: none"> Preparation of input to poster exhibitions Processing of science-based knowledge for a wide audience
	<p>B4P Milestone EX1: (Month 15): Green Buildings and Sustainable Neighbourhoods – Case Studies and Best-Practice from Asia</p> <p>B4P Milestone EX2: (Month 34): Results of the Build4People Ecocity Transition Lab</p> <p>B4P Milestone EX3: (Month 45): Photo Exhibition Sustainable Lifestyle Pioneers in Cambodia</p>
	<ul style="list-style-type: none"> General information on the people-led transdisciplinary Build4People approach Enablement of networking activities between stakeholders from state, economy and civil society Increased awareness about issues of green buildings, sustainable neighbourhoods and sustainable lifestyles
	<p>B4P Milestone EX1 / EX2: Scientific-conceptual lead WP#3 with support from WP#7</p> <p>Input from all other WPs</p> <p>B4P Milestone EX3: Conceptual Scientific-conceptual lead WP#7 and WP#2</p>



VII. Build4People Dissemination	Management of outreach events to disseminate the results of the Build4People project with two main partners 1) Centre of Khmer Studies CKS) mainly reaching out to the academic / NGO-sector and 2) European Chamber of Commerce (EuroCham) mainly reaching out to the corporate sector
VII.B. Build4People Outreach Events	<p>Regular presentations of select research results with the support of our dissemination partners, either face-to-face or online (webinar-format)</p> <p>B4P Milestone OR1 (Month 03): WP#7 (CKS) B4P Milestone OR2 (Month 06): WP#5 (CKS) B4P Milestone OR3 (Month 09): WP#2 (Eurocham) on Indoor Environmental Quality B4P Milestone OR4 (Month 12): WP#6 (CKS) B4P Milestone OR5 (Month 15): WP#4 (Eurocham) B4P Milestone OR6 (Month 18): WP#1 (CKS) B4P Milestone OR7 (Month 21): WP#3 (EuroCham) B4P Milestone OR8 (Month 24): WP#7 (EuroCham) B4P Milestone OR9 (Month 27): WP#7 (CKS) B4P Milestone OR10 (Month 30): WP#2 (Eurocham) on Roadmapping B4P Milestone OR11 (Month 33): WP#4 (CKS) B4P Milestone OR12 (Month 36): WP#3 (EuroCham) B4P Milestone OR13 (Month 39): WP#6 (CKS) B4P Milestone OR14 (Month 42): WP#1 (EuroCham) B4P Milestone OR15 (Month 45): WP#5 (CKS) B4P Milestone OR16 (Month 48): WP#7 (EuroCham)</p> <ul style="list-style-type: none"> Increased awareness and knowledge about the research of the different Work Packages of the Build4People project Dissemination about Build4People processes and products <p>Lead by WP#7 with support from other WPs</p>
VII. Build4People Dissemination VII.C. Build4People Toolbox including Build4People Handbook	<p>Preparation and assembling design and assessment tools, such as checklists, rules-of-thumb and design criteria, in a Toolbox for application in urban design, building design and building operation Compiling and preparing research results for dissemination; Input to the Handbook for Green Housing and Sustainable Living, a richly illustrated publication, targeting a wide audience trying to convince people to implement sustainable housing solutions;</p> <ul style="list-style-type: none"> Writing chapters in easy-to-understand language (thus being accessible to non-experts) and preparing for graphic material; Developing input for Build4People toolbox: sustainability criteria for neighbourhood development Use and adaptation of the data and results from WP#2s activities to fit the Handbook and Toolbox content and objectives. <p>B4P Milestone TB1 (Month 15): First editorial meeting: Joint development of a Handbook content structure together with the local partners; distribution of related tasks B4P Milestone TB2 (Month 22): Second editorial meeting: Presentation of the Handbook inputs by the various partners and joint agreement on the visual design; management of the translation, language editing and the printing procedure B4P Milestone TB3 (Month 27): First editorial meeting to discuss content of Toolbox B4P Milestone TB4 (Month 34): Publication of the Handbook for Green Housing and Sustainable Living during a roundtable workshop (milestone SW6); development of a distribution, dissemination and impact management strategy B4P Milestone TB5 (Month 39): Web-Interface of Handbook ready (with inter-active elements) / first draft of Toolbox ready B4P Milestone TB6 (Month 46): Web-Interface of Toolbox ready B4P Milestone TB7 (Month 48): Build4People Toolbox Executive Summary Report: Science- and societal based strategies to foster urban quality of life in Phnom Penh</p>



	<ul style="list-style-type: none"> Build4People Toolbox: supporting sustainable urban design skills and assessment techniques according to criteria among experts Build4People Handbook: Awareness rising, transfer of knowledge, better household decisions in the field of green housing and sustainable living among the general public Mass effects through replication <p>Conceptualisation of Toolbox by WP#3 with input from all other WPs Conceptualisation of Handbook by WP#7 with input from all other WPs Dissemination managed by WP#7 with support from all other WPs</p>
VII. Build4People Dissemination VII.D. Build4People Industrial Fair Representation	<p>Representing the Build4People project at important industrial fairs in Cambodia Renting of a Build4People booth and dissemination of Build4People PR-materials Participating as presenter at related symposia / panel discussions</p> <p>PR-Work Representation and networking Providing evidence-based scientific research results to foster sustainability solutions in the corporate sector</p> <p>B4P Milestone IF1 (Month 17): Cambodia Architecture & Décor 2022 B4P Milestone IF2 (Month 34): Industrial Fair Representation 2023 (tbc)</p> <ul style="list-style-type: none"> General information on the Build4People Project to representatives from the private sector Raised interest in supporting Build4People activities during Implementation Phase from the private sector <p>Managed by WP#7 with input from all other WPs</p>
VII. Build4People Dissemination VII.E. Awareness Campaign: UQoL & Sustainable Living	<p>Development of an urban quality of life and sustainable living awareness campaign; exchange with stakeholders and research partners; recommendations for a social marketing campaign</p> <p>Theory-driven and data-based planning and designing of a campaign; participatory process and methods, focus group discussions with different target groups; interviews with stakeholders</p> <p>B4P Milestone AC1 (Month 24): Data-based and theory-driven framework for awareness campaigning in order to foster ecological awareness, pro-environmental social norms and sustainable lifestyles in Phnom Penh B4P Milestone AC2 (Month 38): Implementing a trial of a selected intervention on behaviour change (specific target group in the case area regarded within the ECTL process) B4P Milestone AC3 (Month 48): Final version of a Campaigning Module within the Build4People Toolbox</p> <ul style="list-style-type: none"> Increased understanding about people-environment interactions and behaviour change Mass effects through replication <p>Lead by WP#1 with input from all other WPs</p>
VII. Build4People Dissemination VII.F. Build4People Social Media- Campaign	<p>Comprehensive management of Build4People social media activities</p> <p>Feeding in information on Build4People activities at Build4People Homepage, ResearchGate and on several social media platforms (Facebook, LinkedIn, Build4People YouTube channel, Instagram) Preparing for Build4People PR-video clips</p> <p>B4P Milestone SM1 (Month 01): Build4People Social Media Strategy RD-Phase B4P Milestone SM2 (Month 12): Build4People Social Media Report Year 1 B4P Milestone SM3 (Month 24): Build4People Social Media Report Year 2 B4P Milestone SM4 (Month 36): Build4People Social Media Report Year 3 B4P Milestone SM5 (Month 48): Build4People Social Media Final Report RD-Phase – Lessons learnt in regard of Implementation Phase</p>

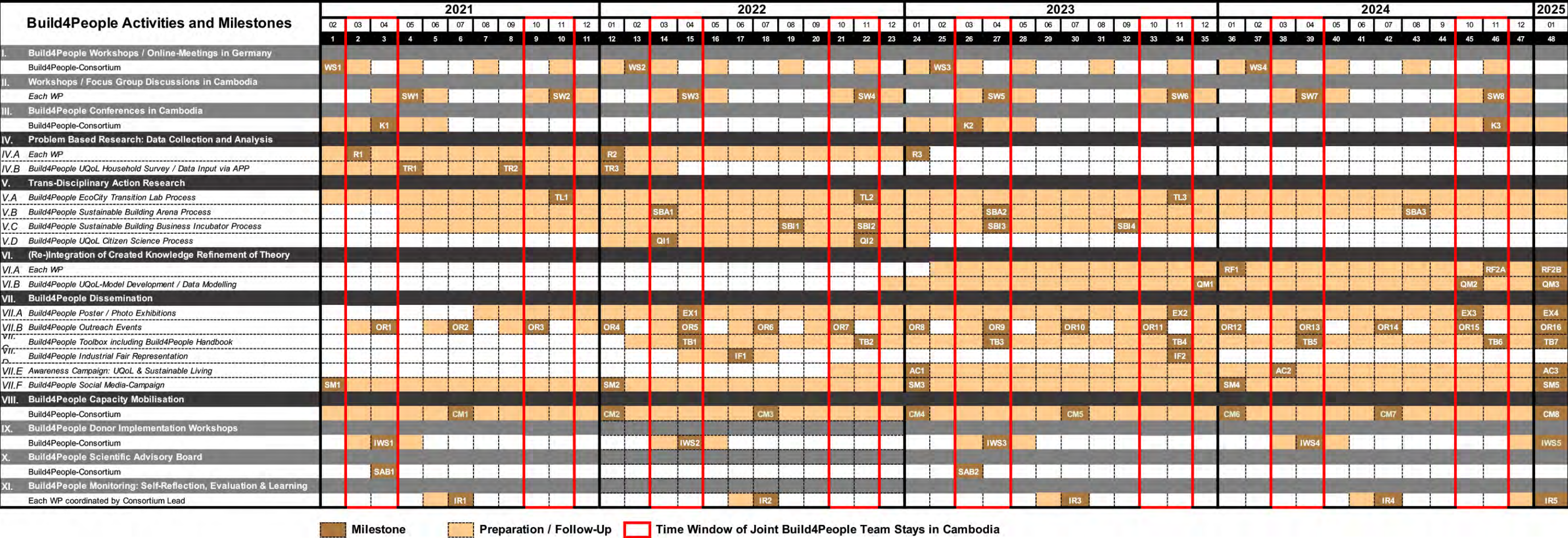


	Increased awareness and knowledge about Build4People related activities and products reaching out to different target groups (e.g. experts, professionals, academia, general public, youth)
	Managed by WP#7 with input from all other WPs
VIII. Build4People Donor Implementation Workshops	<p>Organisation of regular workshops with donor organisations thereby introducing the Build4People project to donor organisations with the aim to prepare for Build4People supported projects during the subsequent Implementation Phase</p> <p>Thematic Input from the field of sustainable buildings</p> <p>Presentations / exchange / discussions</p> <p>B4P Milestone IWS1 (Month 03): Implementation Donor Workshop I B4P Milestone IWS2 (Month 15): Implementation Donor Workshop II B4P Milestone IWS3 (Month 27): Implementation Donor Workshop III B4P Milestone IWS4 (Month 39): Implementation Donor Workshop IV B4P Milestone IWS5 (Month 48): Report on Implementation Preparation</p> <ul style="list-style-type: none"> Donor-funded projects discussed, elaborated and prepared in regard of the subsequent Implementation Phase Clarification about the role of the Build4People research team in regard of donor-funded projects <p>Managed by WP#7 with input from all other WPs</p>
IX. Build4People Capacity Mobilisation	<p>Supporting the enhancement of lecturing at our local research partners, particularly in regard of the development of master courses in the field of sustainable urban development / transformation and of climate change adaptation and mitigation strategies</p> <p>Consulting and capacity building activities Feeding in results of Build4People research into local curriculum development Bi-annual face-to-face meetings and online-meetings in-between</p> <p>B4P Milestone CM1 Capacity Mobilisation Workshop I: Identification of needs; collection of ideas, discussion of a draft curriculum development strategy (Month 06) B4P Milestone CM2 Capacity Mobilisation Workshop II: Presentation of curriculum development strategy; formation of tandem teams to jointly develop specific course units (Month 12) B4P Milestone CM3 Capacity Mobilisation Workshop III: Reporting of tandem teams about their progress in regard of course unit development; collection of feedback (Month 18) B4P Milestone CM4 Capacity Mobilisation Workshop IV: Reporting of tandem teams about their progress in regard of course unit development; collection of feedback (Month 24) B4P Milestone CM5 Capacity Mobilisation Workshop V: Presentation of draft course unit's material (Month 30) B4P Milestone CM6 Capacity Mobilisation Workshop VI: Reporting on test-trials of draft course unit material (Month 36) B4P Milestone CM7 Capacity Mobilisation Workshop VII: Preparing for certification procedure (Month 42) B4P Milestone CM8 Status report on curriculum development with oUTLook to Implementation Phase (Month 48)</p> <ul style="list-style-type: none"> Support in developing state of the art local master courses at local research partner institutions Enablement of local lecturers to teach the new course units Increased knowledge about state-of-the-art approaches towards urban sustainability among students and university teachers <p>Managed by WP#7 with input from all other WPs</p>
X. Build4People Scientific Advisory Board	<p>Active Participation in Build4People Scientific Advisory Board Meetings in the aftermath of Build4People Conferences</p> <p>Guidance and advice in regard of scientific quality, adjustment to local context, dissemination opportunities and in regard of enablement of donor-funded projects</p>



	B4P Milestone SAB1 (Month 03): Report of Build4People Scientific Advisory Board
	B4P Milestone SAB2 (Month 27): Report of Build4People Scientific Advisory Board
	Adjustment of the research and dissemination approaches Contacts to donor organisations interested in transferring the Build4People research into implementation-orientated projects
	Managed by WP#7 with input from all other WPs
XI. Build4People Monitoring: Self-Reflection, Internal Evaluation and Learning	Regular rounds of internal monitoring and self-evaluation of project progress and reflection about lessons learnt
	Discussion about joint publication strategies
	Internal discussions (through online meetings)
	B4P Milestone IR1 (Month 06): Internal Evaluation Report
	B4P Milestone IR2 (Month 18): Internal Evaluation Report
	B4P Milestone IR3 (Month 30): Internal Evaluation Report
	B4P Milestone IR4 (Month 42): Internal Evaluation Report
	B4P Milestone IR5 (Month 48): Final Evaluation Report: Lessons learnt in regard of Build4People Implementation Phase
	Adjusted Build4People research and publication strategies
	Joint publications at high-ranking journals
	Managed by WP#7 with input from all other WPs

4.3. Milestone plan



4.4. WP#2Resource plan

WP#2 Activities and Milestones		2021												2022												2023												2024												2025	
		02	03	04	05	06	07	08	09	10	11	12	01	02	03	04	05	06	07	08	09	10	11	12	01	02	03	04	05	06	07	08	9	10	11	12	01														
		1	2	3	4	5	6	7	8,00	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41	42	43	44	45	46	47	48		
I.	Build4People Workshops / Online-Meetings in Germany																																																		
	Build4People-Consortium	0,10												0,10							0,05																														
II.	Workshops / Focus Group Discussions in Cambodia																																																		
	Each WP				0,05	0,10	0,05						0,05	0,10	0,05								0,05	0,10	0,05				0,05	0,10	0,05														0,05	0,10	0,05				
III.	Build4People Conferences in Cambodia																																																		
	Build4People-Consortium				0,10																								0,10																			0,10			
IV.	Scientific and Societal Problem Based Research: Data Collection and Analysis																																																		
IV.A	Each WP	0,50	0,60	0,40	0,50	0,50	0,50	0,50	0,50	0,30	0,20	0,40	0,40	0,30	0,20	0,20	0,30	0,30	0,20	0,20	0,20	0,20	0,10	0,10	0,30																										
IV.B	Build4People UQoL Household Survey / Data Input via APP	0,10	0,10	0,10	0,10	0,10	0,05	0,10	0,20	0,10	0,10	0,10	0,10	0,10	0,10	0,05																																			
V.	Trans-Disciplinary Action Research																																																		
V.A	Build4People EcoCity Transition Lab Process											0,10	0,20	0,10										0,10	0,20	0,10																									
V.B	Build4People Sustainable Building Arena Process																																																		
V.C	Build4People Sustainable Building Business Incubator Process																																																		
V.D	Build4People UQoL Citizen Science Process																																																		
VI.	(Re-)Integration of Created Knowledge Refinement of Theory																																																		
VI.A	Each WP																																																		
VI.B	Build4People UQoL-Model Development / Data Modelling																																																		
VII.	Build4People Dissemination																																																		
VII.A	Build4People Poster / Photo Exhibitions																																																		
VII.B	Build4People Outreach Events																																																		
VII.C	Build4People Toolbox including Build4People Handbook																																																		
VII.D	Build4People Industrial Fair Representation																																																		

*As the WP2-Leader, Dr. Dirk Schwede, is not not employed on a position financed by the universsity budget, a 10% partial position is alloacted here to perform the research in this project. Within this time allocation, he will support and lead the research associate and perform tasks of the WP and overall project organisation and research work.



5. Risk Analysis

The implementation of the envisaged activities is obviously subject to risks. However, we are confident to implement the original work plan and that we can respond to all challenges effectively. The research structures have already been established during the preparation phase with a reliable leading local academic partner, namely the Cambodian Institute of Technology. All activities can effectively be implemented with alternative, but similar, setups.

- Delays in planned measuring campaign: There is a possibility our planned measuring activities to be delayed or to be hard to find apartments for measurement. Through the university ITC we have access to a large number of people to find a comparatively small number of apartments. In the unlikely case that this is not successful, the problem can be dealt with, by measuring in alternative settings, such as other types of rooms.
- Travelling difficulties due to Covid-19 travel restrictions: This is a likely risk, especially during the 1st year of our R&D phase. Possible problems can be resolved; for instance, the installation of the measurement equipment (see WP#2.1) can be done by our project partner. Although this is not the preferred option, it can be dealt with, since the same difficulties have already been successfully resolved in similar activities in the CAMaRSEC project in Vietnam.

The WP#2 work plan is designed in such a way that its internal work steps (WP#2.1 / WP#2.2 / WP#2.3 and WP#2.4) lead to valuable results alone already and are complemented and “refined” by transdisciplinary cooperation within the consortium and with other partners. Therefore the WP’s work can also be successful when a single partner does not perform as required.

6. Exploitation Plan

6.1. Economic success prospects

Prospects of Economic Success: The economic success of the WP#2s results can be based on the transition to a better building stock and construction practice in Cambodia. The developed activities in the project can help enhance the quality of life in the buildings but also the quality of the building itself and the quality of the energy and technical systems used. It is expected that the policy requirements, as well as the expectations of the users on the building quality in terms of energy and resource efficiency but also in terms of comfort and functionality, will increase. It will provide the members of the new emerging middle class (new consumers) in Phnom Penh with high quality and sustainable solutions for their homes. It will also lower their energy use and minimise any health



issues related to the indoor environment. Furthermore, it will positively affect the Cambodian manufacturers and providers of building materials and building systems, but also the project developers and designers by creating sustainability-related business opportunities. With enhanced quality requirements, European and German suppliers will be more likely to be successful in the Cambodian market in future.

Germany is a pioneer in the use of new construction systems concerning energy-saving and sustainable construction. Market knowledge and also market access must be developed for the markets in developing and emerging countries and the climate zone of the tropics. The knowledge of the market situation and of local building regulations and construction methods gained in the project and through the network will make it much easier for the German and European construction industry to gain a foothold in the region and to place its products on the market in the short and medium-term.

Prospects of Operational Success: With the help of the knowledge gained in the project about technical contributions to solution and development approaches (WP#2) for sustainable and people-oriented development in Phnom Penh and other cities and regions in developing and emerging countries, a concrete development roadmap will be defined (WP#2.3) and, in particular, evaluation criteria for technical solutions will be provided (WP#2.4). For the first time, this will enable planning, tenders in construction projects and guidelines for sustainable procurement in Cambodia. These development-oriented quality indicators and evaluation criteria also particularly strengthen the implementation of sustainable construction, especially in connection with the approaches developed in the other WPs (user perspective (WP#1), political and social perspective (WP#6), dissemination and capacity building (WP#7)).

The “Roadmap Development” (WP#2.3) will create a transformation-oriented framework that can directly be incorporated into future technical development cooperation projects, for example, those of GIZ, ADB or UNDP, or by local ministries. Appropriate applications of the project results are systematically prepared at an early stage through discussions with relevant actors in the course of the project (“Arena Process”). The time horizon is strategically set in such a way that, with the necessary preparatory work in the technical disciplines of WP#2 in WP#2.1 and WP#2.2 in project years 1 and 2, a roadmap will be available at the end of project year 3, which can be incorporated in parallel and subsequently into a larger technical development cooperation project. Ideally, such a development project can then be scientifically accompanied by the project consortium during the Build4People implementation phase.



6.2. Scientific success prospects

The prospects of achieving the objectives of the Build4People project can be rated as extremely good. With the Cambodia Institute of Technology (ITC) as our main partner, we work together with the leading research institute in the field of sustainable building in Cambodia. Through the ITC our WP is linked to the local engineering scene, so we can expect our results to have a direct impact on standardisation and further activities in the area of sustainable buildings. The cooperation scope of WP#2 and ITC will be further developed in the course of the project. Therefore the equipment and methodology implemented will be used in the future to carry out further joint research projects. Corresponding research proposals and ideas will be developed in the Implementation phase. The project results will be made available to the scientific and professional audience in reviewed paper publications. The publications will focus on the technical aspects of the project, as well as joint transdisciplinary publications on governance aspects, health and comfort, and effective education and training.

The interdisciplinary nature (social science, psychology, engineering, etc.) of the project team ensures that not only technical solutions are incorporated into this development. Also, the socio-economic and broader market context is taken into account. This holistic people-led approach is an innovative feature of our project and points the way forward for sustainable development in the building sector.

The apparent need also gives the prospect of a successful and impact-oriented implementation of the research project for localised and detailed technical and systemic approaches to sustainable development in the building sector and for sustainable development in urban areas. While the basic principles and necessities of sustainable building are well known and have been widely disseminated worldwide in recent years, effective implementation requires a detailed analysis, development of adapted and localised measures among others by means of action research, and long-term strategies. WP#2's work plan is designed in such a way that its internal work steps (WP#2.1/WP#2.2/WP#2.3 and WP#2.4) lead to valuable results and are complemented and “refined” by transdisciplinary cooperation within the consortium and with other partners.

6.3. Economic connectivity

The research in WP#2 will contribute research evidence to the development of applicable standards and policies in Cambodia. By application of life-cycle assessment (environmental impact and economic impact) most feasible solutions and concepts will be identified (on the project level, as well as on the level of the Cambodian economy). Given the high energy prices in Cambodia, energy-



efficient design solutions will benefit buildings owners, as well as the achievement of the climate protection goals.

As this project is primarily concerned with research on sustainable development in the building sector, and sustainable urban development, the direct economic exploitation of the results is not the primary objective. However, as the construction sector and the built environment is also one of the most important economic sectors in Cambodia, the potential economic impact of the project is evident.

The dimensions of local, sustainable development defined in WP#2.2 and the assessment criteria for sustainable construction in Cambodia developed in WP#2.4 provide impact-oriented instruments for steering the building sector. The roadmap developed in WP#2.3 will continue to provide impulses for the development of the building sector and the built environment, so that new business areas will be opened up for innovative and responsible market actors (builders, planners, architects, manufacturers, operators).

6.4. Scientific connectivity

With the development of a roadmap (WP#2.3), a research agenda for the necessary future technical and application-oriented development will also be established, which will subsequently lead to new research activities at the level of basic research and application-oriented product and system development. The identified development needs are already addressed during the project, e.g. via the “Business Incubator Process” but also through other consultations with industry representatives and also with representatives of local ministries so that scientifically supported application-oriented developments are initiated.

In the medium and long term, new research projects will be conceived and implemented by the applicant from this research agenda together with the research partners of the ITC (Cambodian Institute of Technology) and other partners. Regional links are also envisaged, e.g. via the current applicant’s projects in Vietnam CAMaRSEC and ReBuMat.

7. Cooperation with Third Parties

The applicant’s research group is currently involved in further research projects on energy-efficient and sustainable construction in Asia: “Climate-Adapted Material Research for the Socio-Economic Context of Vietnam (CAMaRSEC) - Enabling Research and Development for Sustainable Buildings in the socio-economic context of Vietnam” (BMBF CLIENT II, funding code 01LZ1804A), and the “German-Vietnamese Cooperation Project on Resource-Efficient Construction with Sustainable



Building Materials (ReBuMat)" (CONNECT Programme, funding code 01DU20001A). Duplication of work between the projects is deliberately avoided. Instead, synergies and technical and impact-oriented strengthening effects are worked out between these projects and the project applied for here.

Furthermore, the applicant is currently involved as a consultant in a GIZ project in Vietnam to achieve climate protection goals and to develop a NAMA instrument (Nationally Adapted Mitigation Action) and is active in other international technical cooperation projects, for example for the ADB (Asian Development Bank) and the UNDP. These activities will be used to develop a transformation-oriented development perspective.

8. Property Rights and Exploitation of Results

No property rights or property right applications are discernible that would prevent the later exploitation of the project results.

The project is not already the subject of other research/developments/studies and patents.

9. Necessity of the Research Grant

This project is a research and cooperation project on basic research with implementation and transformation-oriented components derived from basic research. An economic benefit cannot be achieved by the research partners during the project period. Above all, the project is based on a pronounced scientific interest and the desire for academic and scientific exchange with the partners in the international research consortium and the wider circle of partners in Cambodia. Furthermore, the project aims at developing a scientifically based contribution to sustainable development in the construction sector and to sustainable urban development in Cambodia and other countries in the region.

Without the funding applied for, the project objectives described above could not be achieved. The funding for this project is absolutely necessary for the University of Stuttgart since no budget, third-party or own funds are available for this project. The project cannot be carried out without the federal funds applied for. As a university, the University of Stuttgart is dependent on 100% funding for this project.

10. Explanations how WP-activities during the R&D-Phase contribute to trans-disciplinarity

In summary, the goal is to bring balance between the climate and the built environment, with interrelated considerations, such as the climate variables, human health, comfort and technological



and architectural solutions in close collaboration with the other WPs. Within WP#2 already at ITC the fields of architecture, civil engineering and mechanical engineering will work jointly in trans-disciplinary manner with the German research team. WP#2 will contribute to all joint and transdisciplinary activities in the Build4People project with the technical and engineering-based perspective. WP#2's contribution in R&D- Phase will be an effort to bring together all of these different facets of the building, not only within the building design level but also within a transdisciplinary perspective, addressing not only WP#2's research questions but also related questions from other WPs.

The scientific work plan of WP#2 is designed in such a way that its internal work steps (WP#2.1/WP#2.2/WP#2.3 and WP#2.4) will lead to valuable results already alone and are complemented and “refined” by transdisciplinary cooperation within the consortium and with other partners. Trans-disciplinary connections within the Build4People consortium are evident in the WP#2.1 where traditional engineering methods of IEQ-measurements and environmental behaviour and comfort user survey methods are applied in combination with WP#1's led Build4People UQoL Household Survey but on a more technical level and with fewer participants in indoor environments. WP#6 and WP#2 will manage together the Sustainable Building Arena Process (SBA): Whereas WP#6 is developing a sustainable transition agenda in a participatory stakeholder process, WP#2 is utilising this process for the development of a technology roadmap. Both developments will support each other, and WP#2 will assess ideas developed in the stakeholder process for feasibility and environmental impact through LCA-methods. The Build4People ECTL process led by WP#3 is utilised by WP#2 to identify topics for technical development. At the same time WP#2 will support the Build4People ECTL process with technical expertise.

11. Explanations how WP-activities during the R&D-Phase prepare for Implementation Phase

The “Roadmap Development” (WP#2.3) will create a transformation-oriented framework that will guide the research team in designing an effective work program in the later Implementation phase. The roadmap can directly be incorporated into future technical development cooperation projects, for example, those of GIZ, ADB or UNDP, or by local ministries. Appropriate applications of the project results are systematically prepared at an early stage through discussions with relevant actors in the course of the project (“Arena Process”). The time horizon is strategically set in such a way that, with the necessary preparatory work in the technical disciplines of WP#2 in WP#2.1 and WP#2.2 in project years 1 and 2, a roadmap will be available at the end of project year 3, which can be incorporated in parallel and subsequently into a larger technical development cooperation project.



Ideally, such a development project can then be scientifically accompanied by the project consortium during the Build4People Implementation Phase.

12. Rough Work- and Implementation Plan of Implementation Phase

The workplan of the implementation phase (2025-2027) will be developed during the Build4People Research and Development Phase (see WP#2 Milestone RF1). Various opportunities for application-oriented research and for innovative implementation are given, for example in the context of the development a transition agenda by WP#6 and the development of a technical roadmap by WP#2.



WORK- AND IMPLEMENTATION PLAN

Work Package #3 "Sustainable Neighbourhoods"

Work Package Leader:	Rolf Messerschmidt, Architect and Urban Designer, DGNB Auditor Eble Messerschmidt Partner, Tübingen
Main Research Partner:	School of Architecture and Urban Planning (SAUP) Paññāsāstra University of Cambodia (PuC)
Implementation Partner:	Phnom Penh Capital Administration (PPCA)

Guiding Research Question

How can sustainable neighbourhoods (design, construction, operation and management) contribute to the urban quality of life in Cambodia?

Thereby we pay special regard to following aspects:

- Addressing the cultural heritage of Cambodia, changing socio-cultural conditions and the need for an increased public space area with a high quality of sojourn and liveability for new and existing developments
- Climate protection by energy-efficient buildings, employing smart energy supply systems and using renewable energy sources on the neighbourhood level
- Climate adaptation by climate responsive urban design for buildings and open spaces supporting comfort and health
- Circular economy including sustainable resource management, material flows and water cycles in a blue-green infrastructure
- Analyzing and applying innovative and interactive participatory community planning and design processes in the Cambodian socio-cultural context



1. INSIGHTS OF THE DEFINITION PHASE

1.1. Insights from Analysis of Local Context

During the Definition Phase, Work Package 3 "Sustainable Neighbourhoods" (WP#3) was able to get a profound understanding of the environmental, socio-cultural and institutional context in Cambodia, particularly in Phnom Penh. The planning frameworks have been studied, an analysis of stakeholders for local neighbourhood development was made and vernacular and contemporary urban patterns were compiled.

A main insight of the research was to understand the present condition and the constraints of the urbanization process in Phnom Penh and Cambodia: With the takeoff of the economy, the urbanization process in Phnom Penh is now going very fast and with almost no control. There is growing need for cities in Cambodia to invest in green infrastructure such as green space, public space and walkability. Flooding has become more serious, where private-sector commercial developments have been constructed in areas that were originally public green spaces, natural lakes or wetlands. (World Bank Group 2018, p. 42). Transportation systems in Cambodian cities are not multimodal or integrated at the moment. Although Phnom Penh has implemented public transport, ridership has been low due to poor traffic conditions, unreliable schedules and the poor quality of the buses. (World Bank Group, p. 31)

Unfortunately, the country went through a dramatic historic event, which affected the development of cities and, as a consequence, generates constraints in the present urbanization process. With the gradual return of the resident population to the city, after the fall of the Khmer Rouge, many properties had been informally occupied and their eventual re-titling favored current occupants, causing numerous conflicts and frictions. (ICEM 2016, p. 30) This is one of the reasons why the government started a program of relocation over the past decades, in which more than 150,000 persons have been displaced at least to 54 relocation sites, most of them lacking basic services or are vulnerable to floods. (Sina Brod, p. 106)

Another main insight of the research is on the understanding of the planning system and the overview of the planning instruments in Cambodia and Phnom Penh. While the framework of planning systems and many planning policies exist, the synergy between the two major planning systems, the Socio-Economic Development Plan and the Spatial Plan, is not existing. For instance, the recommendations for implementation of economic development plans, lack the corresponding spatial plans to establish and safeguard land for identified economic sectors (World Bank Group 2017b, p. 47). Furthermore, most municipalities began establishing offices of "Urban Development" and "Urban Beautification". However, the lack of capacity (funding and technical skillsets) is often a bottleneck to developing urban, spatial, and land use plans, especially at the Khan and Sangkat levels. For this reason, urban sectoral masterplans are often prepared by donors. (World Bank Group



2017b, p. 26). Despite these limitations, PPCA has taken the lead in Cambodia and has been involved in progressive projects and plans, which have been studied and taken into account by WP#3.

This situation gives the Build4People project the opportunity to tackle the problem through a series of capacity building workshop sessions, in which all stakeholders, local and international experts and the working packages of the B4P project could work in a transdisciplinary way, sharing best practices from Europe and Southeast Asia in strategic planning and sustainable urban design.

A final insight, relevant to the research of WP#3, was to understand the cultural and historic conditions of the architecture and urbanization in Cambodia that shaped particularly the city of Phnom Penh. In this regard, it is important to mention that the city and the country in general has a valuable cultural heritage. During the colonization period the French brought important engineering and infrastructural projects (Henning and Koditek 2020) such as water sewage, electricity, railway and boulevards, as well as first planning projects of city development, with new housing typologies and materials. Particularly in Phnom Penh, many migrants settle down for trade, which is increasing the multi-cultural character of the city. Unfortunately some major planning works in the city did not respect nature and many of the existing channels and lakes were drained and covered by dirt or sand. (Shelby Elizabeth Doyle 2012). Unfortunately, this is a practice that has been carried out until now. As consequence, there is a dramatic disappearance process of lakes and reservoirs, increase of vulnerable areas to floods and other environmental problems. However, the cultural exchange with the French was of course very valuable.

On the other hand, there are some interesting sustainable approaches found in the cultural heritage of Cambodia which are relevant to our research. For instance the impressive sustainable water management systems from the Khmer Empire, which managed the annual cycle of flooding and made productive use of water rises, (Vann 2003, p.10) (Evans and Fletcher 2015) or the "New Khmer Architecture" movement, which blended modernism with traditional Khmer elements. (Shelby Elizabeth Doyle 2012, pp. 142–144), (Bodach and Waibel 2017, p. 12). The integration of architecture to landscape and climate was again visible in this movement: buildings were designed with green technologies such as double roofs, cross-ventilation, brise soleils, indirect lighting, evaporative cooling and the use of local materials (The Vann Molyvann Project 2019).

These approaches to sustainability will help to justify and convince stakeholders to use the concepts, strategies and guidelines to sustainable neighbourhood development, since many of these are already to find in the culture of Cambodia and in the memory of the people.



1.2. Insights from Action-Research

WP#3 organized the first Ecocity Transition Lab together with Andreas von Zadow as an internationally experienced moderator. The main facilitation of the transdisciplinary Build4People Ecocity Transition Lab was held at Phnom Penh Capital Administration from 01-06 March 2020. The goal of the collaborative planning workshop was to create an understanding of the relevant local issues in a case study area in the Chbar Ampov district, which was previously selected by the local administration. The Build4People Ecocity Transition Lab was undertaken by means of active interaction of the international Build4People experts' team (professors and professionals) from Germany, Phnom Penh Capital Administration representatives (including architects and urban planners), local authority, housing developers, local university professors, and other local experts, intensively supported by students from the Paññāsāstra University of Cambodia and of Norton University.

In a joint Post-It Session, "problems – dreams – solutions" were identified and prioritized, major issues and potential solutions were explored more deeply in a hands-on-planning sessions, a design workshop with several topics such as "Water, Green & Climate", "Traffic & Mobility", and "Social Behavior & Education". The design team develop 1st concepts and strategies for the site, based on the workshop results and represented in a land use plan and an urban structure plan, supplemented by contributions from all Work Packages. This transdisciplinary process shall serve as a starting point to further discuss and specifically develop an eco-town development within Chbar Ampov. This will also serve to develop valid strategies and site selection criteria for sustainable urban development in Phnom Penh in general and for a 1st conceptualization of strategies and criteria for sustainable neighbourhoods. For the documentation of the results, please see B4P Website (<https://build4people.org>).



The general expectation among the B4P team is that the results of the case study area in Chbar Ampov district will be a good basis for the research and development work during the upcoming 4-year-RD-phase.

Other activities were carried out by WP#3 such as curating the 1st edition of the exhibition on "Green Buildings and Sustainable Neighbourhoods" as a roadshow to Cambodia. The opening event exceeded the expectations and attracted high attention among local experts, administrative staff from PPCA, developers, professors and students. The posters are currently being translated into Khmer language to reach out to an even wider public.

For this event, an extensive study and analysis of state-of-the-art sustainable neighbourhood development projects, which have been implemented in Europe, was carried out. Contributions from every working package on relevant concepts were collected and expressed in research posters. For the documentation of the results, please see B4P Website (<https://build4people.org>).

WP#3 also contributed to the transdisciplinary School Demonstration Project, participating actively in a joint workshop organized at the AIS- School, together with administrative staff from the school in Phnom Penh. WP#3 also gave valuable input to the B4P Survey and the Quality of Life City Index with questions related to sustainable neighbourhoods.



2. MAINS AIMS OF THE R&D-PHASE

The main aim of WP#3 is to increase the sustainability performance in urban development at the scale-level of neighbourhoods in Phnom Penh and Cambodia, and to improve the urban quality of life at the same time.

Therefore innovative planning elements, methodologies and processes will be explored in order to infuse sustainability approaches into local neighborhood development with following sub-aims:

- Deepening the understanding of the environmental, socio-cultural and institutional context in Cambodia and extended stakeholder analysis
- Elaboration of an Integrative & Collaborative Masterplan Framework for an exemplar eco-town development in an already defined case study area on the urban fringe of Phnom Penh as transdisciplinary planning product
- Process design, facilitation and evaluation of 3 Ecocity Transition Labs as a transdisciplinary planning and participation methodology and related stakeholder management (in cooperation with Andreas von Zadow)
- Conceptualization of an assessment system for sustainable neighborhoods incl. criteria and indicators, exploration of preconditions for establishing a certification system (in cooperation with DGNB)
- Definition of minimum and advanced requirements for sustainable neighborhood development, key considerations for early project development phases towards a sustainability pathway (in cooperation with DGNB)
- Conceptualization and testing of a web-based Toolbox for Sustainable Neighborhood Development including a catalogue of strategies, guidelines and criteria as transdisciplinary product
- Curation of two new Poster Exhibitions on Green Buildings and Sustainable Neighbourhoods incl. as a roadshow to Cambodia (second edition) and on the results of "Integrative & Collaborative Masterplan Framework"
- Extended cooperation and capacity building with the research partner: School of Architecture and Urban Planning (SAUP) of the Paññāsāstra University of Cambodia
- Extended cooperation and capacity building with the main implementation partner of the B4P-project: Phnom Penh Capital Administration (PPCA)
- Contributions other transdisciplinary products and processes such as the Sustainable Building Arena Process, Sustainable Building Business Incubator Process, UQoL Citizen Science Process as well as the participation in joint dissemination and outreach events
- Feasibility Study on Implementation Strategies for preparing the implementation of elaborated products and methodologies



3. STATE OF THE ART (THEORY)

3.1 Urbanization Processes and Planning Instruments in Cambodia

Cambodia is at an early stage of urbanization with 21 percent of people living in cities, which is considerably lower than other countries in the region. However, it is expected that the country will continue to urbanize at an average annual rate of approximately 2.5 in the next 35 years, and by 2050 it is expected that 36 percent of residents will live in urban areas (World Bank Group 2017a, p. 15). This leads to an unbalanced population growth, particularly in Phnom Penh, which tripled its population in the past ten years reaching around 2.1 million inhabitants. This urbanization process pushes a constant influx of low-income workers into the main cities, placing a heavy demand for affordable housing and a strain on natural resources. There is a strong demand for urban renewal and a considerable number of new neighbourhoods with a large socio-cultural, economic and environmental impact. With the substantial improvement of living standards, mainly for the middle-class, for the next years, an increase of energy demand is expected (Waibel 2017, p. 15). Large-scale private developments have significantly increased the housing and commercial real estate supply for the market. However, there is a risk of a real estate market bubble from over-supply and over-priced units due to speculation, especially at high-end condominiums (World Bank Group 2018, p. 39).

As consequence of this constrains, the Royal Government of Cambodia has adopted a cross-cutting National Green Growth Policy and Strategy since 2009 ("The Green Growth Roadmap") (IGGWWG 2009). This has been integrated into the National Strategic Development Plan 2014 - 2018 and to the National Urban Development Strategy Framework as an essential means for sustainable development. (Makathy Tep 2016, pp. 8–9). Under this framework, the Phnom Penh Capital Administration, in close collaboration with the National Council for Sustainable Development (NCSD) and the Global Green Growth institute (GGGI), launched the Phnom Penh Sustainable City Plan 2018 - 2030. This plan is accompanied by a Green City Strategic Planning Methodology, which is a step-by-step guide for municipalities, district and commune officials and the relevant stakeholders of each municipality across Cambodia seeking to embark on the process of transforming their cities towards green growth (GGGI 2019, p. 1).

The Phnom Penh Sustainable City Plan is designed to support the implementation of the Phnom Penh Master Plan for Land Use 2035, through the design of specific green growth actions related to the strategic priorities identified in the Master Plan. Moreover, it will support the achievement of the strategic goals set within the Phnom Penh Urban Transport Masterplan and the Phnom Penh Masterplan for Drainage and Sewerage (GGGI 2019, p. 1).



Although planning frameworks and instruments exist, there is a lack of resources and capacity (funding and technical skillsets) to develop urban, spatial, and land use plans, especially at the lower administrative levels. For this reason, urban sectoral master plans are often prepared by donor organizations. (World Bank Group 2017b, p. 26).

3.2 Relevance of Sustainable Neighbourhoods

With the constant shifting of the population from rural to urban areas, the urbanization process is one of the main demographic mega-trends. More than half of the world's population live already in cities. In 2018, already 55% of the inhabitants were living in urban areas and this phenomenon will continued to increase up to 68 % by 2050 according to urban population projection (UN 2019).

Urbanization has generally been a positive force for economic growth, poverty reduction and human development (UN 2018). However, this trend also has tremendous socio-economical and environmental consequences when there is a lack of sustainable planning practices. For instance, Cities account for about 70 per cent of global carbon emissions and over 60 per cent of resource use (UN 2019). the resulting urban growth could have a negative impact in biodiversity, increase global warming, climate change, growth of slums, social-inequity, access to basic services and infrastructure, vulnerable natural risk disasters, and even diseases (such as the Covid-19 pandemic).

Responding to these challenges, countries and governments have signed the 2030 Agenda for Sustainable Development and were committed to integrate the UN-Sustainable Development Goals and targets into their national development plans and to align policies and institutions behind them. These address the global challenges we face, including those related to poverty, inequality, climate change, environmental degradation, peace and justice. The Sustainable Development Goal 11 "Sustainable Cities and Communities" is a commitment to making cities inclusive, safe, resilient and sustainable (UN 2019).

The Paris Agreement in 2015, was another major commitment, to keep global warming increase of 1.5 to a maximum of 2 degrees Celsius and therefore to reduce risks and impacts of climate change (UNFCCC 2015).

However, these agreements, laws and instruments are not sufficient to resolve the problem. In this regard, sustainable neighbourhood development is a potential solution to address this rapid urbanization process with all these constrains. They are considered as key elements for a more sustainable city growth. Moreover, as socio-spatial units, neighbourhoods offer a suitable scale of intervention for integrated planning measures for sustainable urban redevelopment (Franke 2011, Bott et al. 2019).



The ultimate goal is to promote vibrant, resilient and future proof neighbourhoods with a long-term economic infrastructure. The focus should be on people's aspirations and needs. But at the same time, sustainable neighbourhoods should address climate protection and climate change for the open spaces, the building patterns and the technical infrastructure. Furthermore, energy-efficient urban layout in neighbourhoods, is an essential for effectively and economically implementing strategies to reduce pollution from buildings and supply systems (Bott et al. 2019).

Sustainable neighbourhoods include an added value for the environmental, people and society and for the economy. For instance, sufficient green and open spaces provide animal and plant habitats, as well as an improvement of microclimate, thus, human well-being and health also rises. Mixed use, the provision of facilities for daily life and public and leisure spaces contribute to the sense of community. Furthermore, good access to public transport also contribute to low traffic levels, it promotes environmentally friendly mobility and increases safety. Resource efficiency in energy, water, building materials and other valuable resources as well as more generally, land, cost and time also contribute to. For instance, massive construction, maintenance and service costs for traffic areas (streets, car parks) can be cut, thus more space could be dedicated to high-quality residential infill development (Anders 2019).

3.3 Integrative Masterplanning and Multi-Layered Design Approaches

An important approach to sustainable neighbourhoods is to integrate relevant experts and aspects of sustainable development as explored in the Ecocity Project (see Figure 1). These aspects are related to the sectoral design of the urban structure, transport system, energy and material flows, a community's way of life and the urban economy. The successful implementation depends on such integrated planning approach. (Philine Gaffron, Gé Huismans, Franz Skala 2005, p. 17)

This constitutes the core of sustainable urbanism. It is based on acknowledging the complexity of every urban process and is trying to tackle this complexity by focusing mainly on the interrelationships among different fields and sectors, but without neglecting the necessity of appropriate, sector-specific solutions. The key issues of integrated planning are: a multidisciplinary approach, an iterative (i.e. repeated and ongoing) processes of analysis, and a holistic integration of the results obtained through sectoral analysis (Philine Gaffron, Gé Huismans, Franz Skala 2005, p. 38).



Another interesting approach is the multi-layered neighbourhood development strategy as applied for the UMORE project in Minneapolis in cooperation the University of Minneapolis and based on a participatory design process, support integrated design approaches for achieving synergetic effects and a high sustainability profile (Joachim Eble Architektur et al. 2011).

The urban planning complexity could be addressed with this multi-layered neighbourhood development strategy, which is a great tool that helps to understand and to propose solutions to each main sector without getting lost while trying to resolve everything at once. It also helps to identify characteristics of different systems and their interrelations. (Joachim Eble Architektur et al.)

The visualization of synergetic effects between the involved sectors and disciplines is a key issue to support handling the complexity of sustainable neighbourhood development. It also helps to identify and understand sectoral problems and to create specific solutions as a part of the holistic approach (Anders, Messerschmidt 2019).

3.4 Assessment Systems

The rating system for Sustainable Urban Districts considers the following quality sections: ecology, economy, socio-culture and function, technology and process. The scheme includes all areas relevant to sustainable building: from the location and energy supply of the district, to public space amenities and mixed use, sustainable mobility and reducing costs throughout the entire life cycle. (DGNB). This is the only rating system until now carefully dedicated to urban districts. The criteria of each section mentioned below form the basis for a conceptualization of sustainable neighbourhood in Cambodia and a further development of a rating system adapted to the Cambodian context.



3.5 Participation Processes

The key factor in delivering sustainable urban neighbourhoods is process quality. The planning process can be improved by including innovative participation processes. The design and management shall be based on citizens' and user's interactive participation processes, which should be highly communicative for all involved parties and which focus on exchanging information, generating creative solutions and building consensus between stakeholders (Rolf Messerschmidt, Andreas von Zadow 2019). Furthermore, early engagement of all stakeholders and coordinating goals shared by property owners, investors, elected councilors and municipal planning departments as well as interested citizens, allows for the development of an integrated planning process. This process aims, above all, at reaching consensus and is appropriate for developing interdisciplinary design workshops such as the "Community Planning Events". This methodology combines workshops and hands-in-planning sessions with a Charrette and a report-back session within one week (Zadow 1997; Campion 2018).

3.6 Basic Methodologies



These are methodologies used in previous successful projects, which will be used as background and a starting point. These shall support the research and development activities. The methodologies will be transformed and adapted to the Cambodian context:

- The European framework for sustainable urban planning that has been developed by 30 partner from 8 European countries within the EU founded project Ecocity (Messerschmidt et. al., 2002-2005).
- The city coaching and process design methodology of the EU funded project SNOWBALL – Energy Smart Urban Design (Messerschmidt et. al., 2006-2008)
- The assessment and rating system for Sustainable Urban Districts by the German Sustainable Building Council DGNB incl. a comprehensive set of criteria and indicators. (DGNB, Messerschmidt et. al., from 2009 on) and a country adaptation of the DGNB system on sustainable urban districts to China, leading the first cortication in China with Sino-German Ecopark in Qingdao
- Messerschmidt, Rolf (1999): NetzWerkZeug. Diploma. University of Stuttgart, Stuttgart.
- The development of a toolbox as an internet platform illustrating the synergies of different research sectors applied for a sustainable urban development in South-east Karlsruhe. Messerschmidt, Rolf (2003): NetzWerkZeug Nachhaltige Stadtentwicklung. Anwendung Karlsruhe Südost. In: Wohnbund Informationen. Available online at: <http://www.netzwerkzeug.de/engl/index.htm>.

4. RESEARCH PLAN

The WP#3 on Sustainable Neighborhoods is strongly linked to joint activities of the Build4People (B4P) project. Particularly the Toolbox for Sustainable Neighbourhood Development and the Ecocity Transition Labs (ECTL) are two major B4P products and processes. Furthermore the elaboration of an Integrative & Collaborative Masterplan Framework for a case study area in Phnom Penh, carried out in cooperation with the implementation partner Phnom Penh Capital Administration (PPCA), is another key element of the B4P project. The curation of two Poster Exhibitions is a major contribution to the dissemination of B4P contents and results. These activities, which are mutually integrated within the WP#3 and the entire project, will be led by WP#3 and will include input from all other work packages. The cooperation with the main research partner School of Architecture and Urban Planning (SAUP) of the Paññāsāstra University of Cambodia will be used - both for joint research and students' activities as an element for capacity building. In addition, other collaborations, e.g. with Penh Hough as a major Borey developer who attended the 1st Ecocity Transition Lab in the definition phase, and other interested consultants are intended.



4.1. WP#3 Sub-Work Packages

The main and mutually integrated processes and related activities are structured to Sub-Work Packages and described below.

4.1.1. Overview WP#3

4.1.2. Integrative & Collaborative Masterplan Framework

The goal is to develop an exemplar collaborative, dynamic and comprehensive masterplan framework for an Eco-town Development in Phnom Penh. The focus will be on the scale-level of neighbourhood development in an already defined case study area in the Khan Chbar Ampov. But also the wider context of the Khan and the interrelations with the entire city of Phnom Penh will be considered. This masterplan will be deepened and further elaborated based on concepts that have been developed in the Definition Phase in a very successful first Ecocity Transition Lab.

The detailed investigations to be undertaken should include several topics that are relevant locally and for Cambodia, such as Borey developments for new consumers, mixed use transport hubs and river front projects. Furthermore, interventions in existing urban environments, also as a precondition for the integration with new developments, and the urban-rural integration of city edge developments will be explored.



The intention is to undertake an integrated masterplanning process, which is based on the results obtained through multidisciplinary and sectoral analysis. In order to tackle the complexity of urban processes, specific concepts in each sector and field should be developed first. Without neglecting these sectoral solutions, the mutual integration to a holistic and integrative approach in an iterative process will be a key issue. (Philine Gaffron, Gé Huismans, Franz Skala 2005, p. 38).

This process will be carried out with a multi-layered approach (see Fig.9), which will include transdisciplinary input from all work packages of the B4P project, as well as from local research and implementation partners. The conceptual impulses by the B4P team will include: Social infrastructure and structure (physical & behavior change), sustainable building (energy efficiency and supply), urban green (analysis, program, and network), urban climate (preconditions, guidelines, simulation) and urban transformation (institutional context and stakeholder management).

The Ecocity Transition Lab methodology will also be a major contributor to the collaborative masterplanning process. The idea is to introduce an active participatory planning process, which will be highly communicative for all involved parties and which will focus on exchanging information,



generating creative solutions and building consensus between the stakeholders (Rolf Messerschmidt, Andreas von Zadow 2019). This methodology, combines a series of interactive workshops with a Charette as a compact and highly effective design workshop and a report-back session within one week (Zadow 1997; Campion 2018).

The final product is an Integrative & Collaborative Masterplan Framework including a land use plan, urban structure plan and related sustainability concepts. These will also serve to develop valid strategies and criteria for sustainable urban development in Phnom Penh and Cambodia in general.

4.1.3. Toolbox for Sustainable Neighbourhood Development

The B4P Toolbox for Sustainable Neighbourhood Development will be a transdisciplinary product, which will include a catalogue of strategies, guidelines and criteria incl. LCA (Life Cycle Assessment) and Life Cycle Costs (LCC). These will be derived from the Integrative Masterplan Framework for the case study area in Phnom Penh and adapted European and South-East-Asian approaches to sustainable masterplanning. In particular, the advanced assessment system for sustainable urban districts developed by the German Sustainable Building Council (DGNB 2020) will be an important starting point.

The provided strategies and guidelines will promote integrated and improved planning processes for sustainable neighbourhoods. A specific set of criteria will define minimum and advanced requirements for sustainable development and should be applied to the city of Phnom Penh and other cities in Cambodia. The conceptualization of an assessment system for supporting the implementation will be carried out in cooperation with German Sustainable Building Council DGNB (DGNB). The application will be illustrated and showcased with the Integrative & Collaborative Masterplan Framework for the study area in Chbar Ampov.

One key issue will be the visualization of synergetic effects between the involved sectors and disciplines. This should support handling the complexity of sustainable neighbourhood development. It will help to identify and understand sectoral problems and to create specific solutions as a part of the holistic approach (Stephan Anders 2019).

The main target groups that will be addressed are city administrations, universities, developers, consultants and NGOs. The application of the toolbox will promote capacity building by presentations, joint workshops and train-the-trainer sessions (SNOWBALL 2009).

The goal for the R&D phase is the conceptualization of the toolbox as an internet platform and a testing for a later implementation in the Implementation Phase. The interactive website will also be linked with the B4P Handbook on Green Living.



The main responsibility for the Toolbox will be at Work Package #3, but the development of minimum and advanced requirement for sustainable neighbourhoods, criteria for early project phases towards a sustainability pathway and an assessment system will be supported by the German Sustainable Building Council (DGNB), who will be integrated into the Build4-People project with a subcontracting.

4.1.4. Ecocity Transition Labs

The Ecocity Transition Labs (ECTL) process will be a key product of the Build4People trans-disciplinary action research and capacity mobilization in Phnom Penh and Cambodia. By means of Ecocity Transition Labs, innovative methodologies of collaborative and participatory planning will be explored and applied to the study area in Phnom Penh in order to support the elaboration of the Integrative & Collaborative Masterplan Framework. Furthermore, this approach should promote the development of strategies, guidelines and criteria for the Toolbox Sustainable Neighbourhood Development. At the same the Ecocity Transition Labs are expected to be a strong instrument for local capacity building at Phnom Penh Capital City Hall (PPCA) and all other participants of the events.

The first Ecocity Transition Lab event in 2020 in the Definition Phase of the B4P project has been carried out very successfully and resulted in a site analysis, first masterplan concepts and related sustainability strategies. A main effect was a deepened understanding of the local planning issues for all participants and particularly building trust with PPCH and a major developer of the study area.

All work packages of the B4P team incl. local research and implementation partners will be involved in this transdisciplinary process to address complex sustainable urban development issues. A particularly strong link will be with the B4P Sustainable Building Arena Process of WP#6. The entire Ecocity Transition Lab process will be supported by establishing a stakeholder management.

The methodology, which is based on a community planning approaches (Zadow 1997; Campion 2018) combines a series of interactive workshops with a compact and highly effective design workshop and a report-back session within one week (Charette).

After an introduction, the Ecocity Transition Lab Kick-Off Workshop starts with a discussion workshop about 'problems - dreams –solutions', which is derived from Robert Jungk's Future Workshops (Jungk and Müllert 1987). The process will be either for invited groups of participants or open to the public. The subsequent hands-on-planning sessions are for deepening the identified issues and will lead to the production of sketchy drawings by parallel topical, or multidisciplinary,



working groups and report-backs. The workshop will be inspired by input presentations on international and regional best practice, as well as on the specific local context.

The results of the Kick-Off Workshop will be taken as a basis for a Charrette as an integrated design workshop by the international and multidisciplinary B4P research & design team, as well as local partners. This workshops will be supported by several meetings with PPCA and relevant local organizations.

Finally the outcome of the Kick-off Workshop and the Charrette will be report-backed to all participants of the Ecocity Transition Lab or a wider audience in the Report-Back Session. A discussion of the results and the way-forward will close the planning and consultation week.

The planned three Ecocity Transition Labs will have changing topics and participants for the R& D Phase of the Buld4People project. The first Ecocity Transition Lab will focus on the Masterplan study area & design strategies, the second Ecocity Transition Lab on neighbourhood plans & guidelines and the third Ecocity Transition Lab on criteria & implementation strategies.

This process will be linked with a stakeholder management process for deriving input for the planning process and for capacity building at the involved parties. Therefore three groups will be formed: The Support Group (local experts, departments of city administration, local universities, etc.) should promote the process, while the Steering Group (head of city administration and 3 key decision-making departments) should make decisions on process design and way forwards. The Stakeholder Group (political lead, land & property owners, etc.) will link the B4P planning and consultation process with implementation partners. Next to personal meetings, web meetings should contribute to a continuous communication and exchange of information.

The main responsibility for the Eco Labs will be at Work Package #3, but process design and facilitation will be supported by the external communication expert Andreas von Zadow, who will be integrated into the Build4-People a with a subcontracting. This has a long-term experience and joint track record with similar complex urban developments.

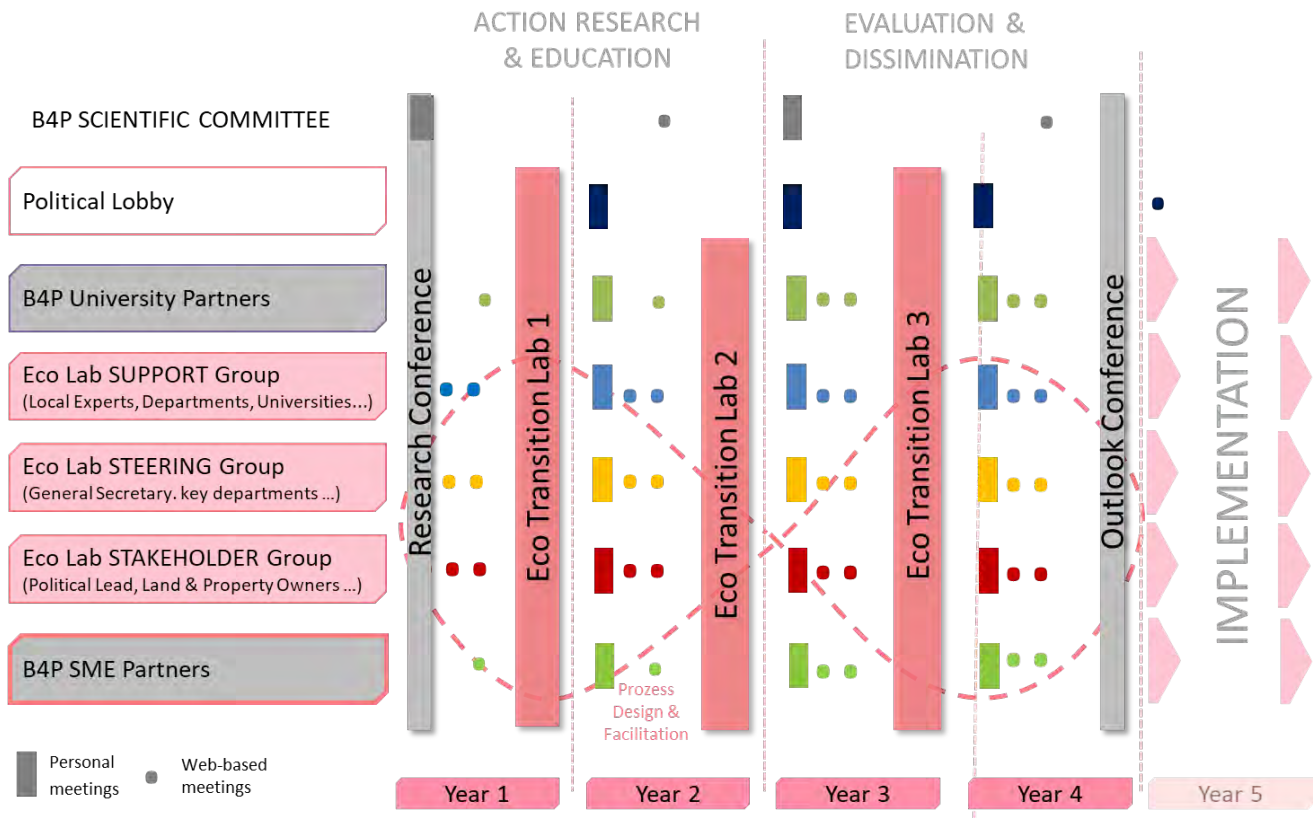


Fig.10: Ecocity Transition Lab Process Design and Structure

4.1.5. Poster Exhibitions

Based on the success of the 1st edition of the Exhibition on "Green buildings and Sustainable Neighbourhoods", WP#3 will be responsible of curating two Poster Exhibitions. The first one will be an exhibition on "Green Buildings and Sustainable Neighbourhoods – Case Studies and Best-practice from Asia". For this event, an extensive study and analysis of sustainable neighbourhood development projects, which are in Cambodia and similar context in Southeast Asia, will be done. A second exhibition on "Results of the Build4People Ecocity Transition Labs" will also be organized to present the results of the participatory process and the Integrative & Collaborative Masterplan Framework. These two dissemination events will include contributions from every work package on relevant concepts and best-practice examples of their research and will be expressed in research posters as a part of the exhibition. Also input from the local research partners is expected.

The cooperation with the cultural dissemination partner Meta-House and with the research partner, the School of Architecture and Urban Planning (SAUP) of the Paññāsāstra University of Cambodia will be very important for the managing and coordination of these events.



The main focus is to increase awareness about issues of green buildings, sustainable neighbourhoods and sustainable lifestyles to the public and to outreach the B4P Project.

4.1.6. Other Transdisciplinary Activities

The Work Package #3 "Sustainable Neighbourhoods" will also be engaged in other transdisciplinary knowledge co-production processes. Valuable input and active participation will be carried out for the B4P Sustainable Building Arena Process, the B4P Sustainable Building Business Incubator Process, and the Build4People Urban Quality of Life Process. WP#3 will support these activities and events giving relevant input from the sustainable neighbourhood development perspective.

4.1.7. Capacity Mobilization with the Research and Implementation Partners

WP#3 expects to continue collaborating with, the School of Architecture and Urban Planning (SAUP) of the Pannāsāstra University of Cambodia, as a research partner during the RD-Phase, as well, and particularly, with their students. WP#3 intends to organize, as a capacity building process, joint design studios and student competitions, to share approaches on bioclimatic design, urban mobility, and water-sensitive urban design, among others. WP#3 will also contribute on the development of a master course for the School of Architecture and Urban Planning (SAUP), mainly elaborating content focused on sustainable neighbourhood development concepts and approaches.

An important activity will be capacity mobilisation at the Build4People key implementation partner Phnom Penh Capital Administration (PPCA). This will be done with roundtable workshops, input presentations and train-the-trainer sessions in order to enable the city administration to apply the B4P contents and methodologies.

Furthermore, capacity building is also intended with developers, consultants and other administrations for promoting sustainable neighbourhood development.



4.2. List of Sub-Work Packages

The WP#3 is split-up to the following sub-work packages:

WP#3.1	Strategies for Sustainable Neighbourhood Development (1st Project Year)
Expected Impacts	Deepened analysis & basic concepts for case study area in Phnom Penh development of design strategies for sustainable neighbourhoods
WP#3.1.1	Updated review of literature and of state of the arts about design strategies and concepts for sustainable urban planning in Europe, Southeast Asia and Cambodia
WP#3.1.2	Further analysis of study area and deepening of preliminary masterplan and related sustainability concepts of Definition Phase, cooperation with all WPs and inputs on sectoral analyses, basic concepts & strategies
WP#3.1.3	Workshop on design strategies for sustainable neighbourhood development with SAUP
WP#3.1.4	Preparation of design strategies for discussion and further development with B4P-team and different stakeholders in the transdisciplinary Ecocity Transition Lab 1, after event compilation and refinement of design strategies for sustainable neighbourhood development
WP#3.1.5	Contributions to other B4P activities: Extracting content of 1st year's activities for reporting, dissemination, capacity building; participation and contributions to Sustainable Building Arena Process, B4P Sustainable Building Business Incubator Process, Donor Implementation Workshops; (Social Media Campaign, Eurocham, CKS); participation in Scientific Advisory Board; internal evaluation
	>> Milestone R1: Updated bibliographic research and literature (Month 02) >> Milestone R2: Strategies for Sustainable Neighbourhood (Month 12)

WP#3.2	Integrative & Collaborative Masterplan Framework (2nd Project Year)
expected impacts	Elaboration of an exemplar masterplan, sectoral concepts & neighbourhood plans for case study area in Phnom Penh
WP#3.2.1	Deepening of Masterplan as follow up from the Ecocity Transition Lab 1
WP#3.2.2	Preparation of guidelines & criteria for sustainable neighbourhood development (inc. LCA, LCC) and requirements for early project stages for discussion and further development with B4P-team and different stakeholders in the transdisciplinary Ecocity Transition Lab 2 (cooperation with DGNB)
WP#3.2.3	Round table workshop with PUC / PPCH: Guidelines & criteria for early project stages of sustainable neighbourhood development
WP#3.2.4	Preparation of neighbourhood plans for discussion and further development with B4P-team and different stakeholders in the transdisciplinary Ecocity Transition Lab 2, after event compilation and refinement of for sustainable neighbourhood development
WP#3.2.5	Contributions to other B4P activities: Extracting content of 2 nd year's activities for reporting, dissemination, capacity building; participation and contributions to Sustainable Building Arena Process, Sustainable Building Business Incubator Process, UQoL Citizen Science Process, Donor Implementation Workshops; presentation in dissemination and outreach events (Social Media Campaign, Eurocham, CKS, Architecture and Deco); internal evaluation
	>> Milestone R3: Integrative & Collaborative Masterplan Framework incl. Sectoral Concepts and Neighborhood Plans (Month 24)



WP#3.3	Assessment System incl. Set of Criteria & Guidelines for Sustainable Neighbourhood Development (3rd Project Year)
Expected Impacts	Elaboration of criteria, deepening of guidelines and conceptualisation of an assessments system
WP#3.3.1	Deepening of guidelines as follow up from the Ecocity Transition Lab 2
WP#3.3.2	Preparation of a set of criteria and conceptualization of an assessment system for sustainable neighbourhood development for discussion and further development with B4P-team and different stakeholders in the transdisciplinary Ecocity Transition Lab 3, after event compilation and refinement (cooperation with DGNB)
WP#3.3.3	Implementation workshop with PUC / PPCH: Criteria, minimum & advanced requirements for sustainable neighbourhood development
WP#3.3.4	Preparation of implementation strategies for discussion and further development with B4P-team and different stakeholders in the transdisciplinary Ecocity Transition Lab 3
WP#3.3.5	Contributions to other B4P activities: Extracting content of 3 rd year's activities for reporting, dissemination, capacity building; participation and contributions to Sustainable Building Arena Process, Sustainable Building Business Incubator Process, UQoL Citizen Science Process, Donor Implementation Workshops; presentation in dissemination and outreach events (UQoL & Sustainable Living, Social Media Campaign, Awareness Campaign, Eurocham, CKS, Industrial Fair); participation in scientific advisory board; internal evaluation
	>> Milestone RF1: Assessment System incl. Set of Criteria & Guidelines for Sustainable Neighbourhood Development (Month 36)

WP#3.4	Toolbox for Sustainable Neighbourhood Development & Preparation of Implementation
expected impacts	Elaboration of a toolbox incl. catalogue of strategies, guidelines & criteria Preparation of implementation
WP#3.3.1	Elaboration of Toolbox and deepening of criteria as follow up from the Ecocity Transition Lab 3
WP#3.3.2	Implementation strategies for sustainable neighbourhood development
WP#3.3.3	Implementation workshop with PUC / PPCH: Implementation strategies for sustainable neighbourhood development
WP#3.3.4	Contributions to other B4P activities: Extracting content of 4 th year's activities for reporting, dissemination, capacity building; participation and contributions to Sustainable Building Arena Process, Sustainable Building Business Incubator Process, UQoL Citizen Science Process, Donor Implementation Workshops; presentation in dissemination and outreach events (UQoL & Sustainable Living, Social Media Campaign, Eurocham, CKS); internal evaluation
	>> Milestone RF2a: Elaboration of Toolbox & Feasibility Study on Implementation Strategies (Month 46) >> Milestone RF2a: Finalizing Toolbox & Feasibility Study on Implementation Strategies (Month 48)



WP#3.5	Ecocity Transition Labs (ECTL) (1st, 2nd and 3rd Project Year)
Expected Impacts	Exploration and application of innovative methodologies of collaborative and participatory planning in the context of an Eco Lab based on a case study site typical for current urban development issues in Phnom Penh
WP#3.5.1	Preparation of the content, methodology & process design of the Ecocity Transition Lab in cooperation with VZI
WP#3.5.2	Stakeholder Management between Ecocity Transition with personal meetings and web-based meetings
WP#3.5.3	Ecocity Transition Lab I: Masterplan Study Area & Design Strategies Preparation, organization of the event in regard of potential stakeholders participants, venues etc. together with the local partner and WP7 and in cooperation with VZI, Coordination and support in the facilitation of the event with VZI, elaboration of reports on ECTL
WP#3.5.4	Ecocity Transition Lab II: Neighbourhood Plans & Guidelines Preparation, organization of the event in regard of potential stakeholders participants, venues etc. together with the local partner and WP7 and in cooperation with VZI, Coordination and support in the facilitation of the event with VZI, elaboration of reports on ECTL
WP#3.5.5	Ecocity Transition Lab III: Criteria & Implementation Strategies Preparation, organization of the event in regard of potential stakeholders participants, venues etc. together with the local partner and WP7 and in cooperation with VZI, Coordination and support in the facilitation of the event with VZI, elaboration of reports on ECTL
WP#3.5.6	Compilation of reports on ECTL, evaluation of obstacles, success factors and potential improvements for implementation phase
	>> Milestone TL1: Ecocity Transition Lab I (Month 10) >> Milestone TL2: Ecocity Transition Lab II (Month 27) >> Milestone TL3: Ecocity Transition Lab III (Month 34)

WP#3.6	Poster Exhibitions (2nd and 3rd Project Year)
Expected Impacts	Preparation of input to poster exhibitions Processing of science-based knowledge for a wide audience
WP#3.5.1	Preparation of poster exhibition in cooperation with cultural dissemination partner META House Phnom Penh
WP#3.5.2	Analysis and compilation of best examples of sustainable development projects in South East Asia and concepts for sustainable design with all WPs, curating of the transdisciplinary developed exhibition on "Green Buildings and Sustainable Neighbourhoods and Best-Practice from Asia" as a roadshow to a general public, elaboration of the exhibition posters (2nd edition of the exhibition of the Definition Phase)
WP#3.5.3	Elaboration of the exhibition posters, presentation of results of the Build4People Ecocity Transition Lab and Integrative Masterplan, coordination of venues and invitation to participants with WP7 and local partner
WP#3.5.4	Support to WP7 for "Photo Exhibition Sustainable Lifestyle Pioneers in Cambodia"
	>> Milestone EX1: Green Buildings and Sustainable Neighbourhoods – Case Studies and Best-Practice from Asia (Month 15)

**>> Milestone TL2: Results of the Build4People Ecocity Transition Lab/
Masterplan (Month 34)**

4.3. WP#3 Work- and Implementation Plan

Following table gives an overview of the general work- and implementation plan of the WP#3 project during RD-Phase. All work steps are listed with respect to the following categories: Activities, methods, products, aims / results, and transdisciplinary connection to other work packages.

This work- and implementation plan refers to all milestones. Trans disciplinarily developed milestones (so-called B4P milestones), which are led by WP#3, and specific activities and tasks have been presented in more detail in section 4.1. before.

RD-PHASE	Activities	Methods	Products
Work Steps	Aims / Results		Transdisciplinary Cooperation
I. Build4People Coordination Meetings in Germany	Regular exchange within the B4P project team Ongoing conceptualisation and modelling of Urban Quality of Life (UQoL) Face-to-face meetings in the context of the milestones, in-between regular online meetings (every two months)		
	Presentations, discussions		
	B4P Milestone WS1: RD-Phase Kick-off Meeting, Hamburg (Month 01) B4P Milestone WS2: UQoL-Survey Workshop, Magdeburg (Month 13) B4P Milestone WS3: UQoL-Processing Workshop, Eberswalde (Month 25) B4P Milestone WS4: Proposal Writing Workshop, Hamburg (Month 37)		
	Joint general research understanding (WS1) Joint scientific-conceptual work on urban quality of life (WS2 / WS3) Joint agreement of content of B4P Implementation Phase proposal (WS4) Capacity mobilisation due to insights on urban sustainability best practices in Germany for invited research partners from Cambodia (WS4)		
	WS1 / WS4 managed by WP#7; WS2 managed by WP#2; WS3 managed by WP#4; Input from all other WPs		
II. Science / Roundtable Workshops / Focus Group Discussions in Cambodia	Regular scientific exchange with local research partners and local stakeholder groups		
	Presentations, discussions Managing feedback loops e.g. by discussing outcomes of action research with the local scientific community		
	WP Milestone SW1 (Month 04): WP Milestone SW2 (Month 10), WP Milestone SW3 (Month 15), WP Milestone SW4 (Month 22), WP Milestone SW5 (Month 27), WP Milestone SW6 (Month 34), WP Milestone SW7 (Month 39), WP Milestone SW8 (Month 46)		
	Communication of research agenda of each WP Increased mutual research understanding with local research partners Joint agreement in regard of research design and methodologies Insights into views of local stakeholder groups Capacity mobilisation		
	Managed by each WP		
	Organisation of B4P conferences with all German / Cambodian partners / relevant stakeholders		
	Presentations / panel rounds / discussions		



III. Build4People Conferences in Cambodia	<p>B4P Milestone K1: Research Conference (Month 03) B4P Milestone K2: Status Conference (Month 26) B4P Milestone K3: Outlook Conference (Month 46)</p> <p>Increased public awareness and mutual understanding of the different Work Package approaches of the B4P project Networking with stakeholders from the state, economy and civil society Discussion of model-based planning strategies to foster urban quality of life (K3)</p> <p>Managed by WP#7 with input from all other WPs; exchange with all WPs, research partners, implementation and dissemination partners</p>
IV. Scientific and Societal Problem Based Research: Data Collection and Analysis <i>IV.A. WP-related research</i>	<p>Updated review of literature and of state of the arts; bibliographical research Conceptualising of theory and problem-based empirical research design Data collection and analysis by each WP</p> <p>Compilation of most recent publications and methods Desktop data collection</p> <p>Application of specific empirical research methods by each WP such as semi-structured expert interviews, standardised quantitative interviews, measurements with technical equipment, actor mapping tools, data analysis, geo-spatial data modelling, focus group discussions, etc.</p> <p>WP Milestone WP R1 (Month 02): Updated bibliographic research and literature WP Milestone WP R2 (Month 12): Research Achievements Year 1 (every WP) WP Milestone WP R3 (Month 24): Research Achievements Year 2 (every WP)</p> <p>Increased understanding / knowledge of state of the art for the local context based on literature research; first scientific findings based on empirical research</p> <p>Managed by each WP</p>
IV. Scientific and Societal Problem Based Research: Data Collection and Analysis <i>IV.B. B4P UQoL Household Survey / Data Input via APP</i>	<p>Preparing the B4P UQoL household survey (collection of relevant questions from all WPs, compilation of questionnaire, pre-testing, etc.) Survey in cooperation with market research company: data collection and first data analysis</p> <p>Statistical analysis Discussing first results on urban quality of life as perceived by citizens of Phnom Penh.</p> <p>B4P Milestone TR1: (Month 04): Final version of questionnaire for household survey B4P Milestone TR2: (Month 08): Final version of the <i>Citizen Science Input APP</i> (Integration of subjective evaluation of objective factors); B4P Milestone TR3: (Month 12): First results / analysis of collected data from <i>Citizen Science Input APP</i> and from household survey</p> <p>Insights into objective / subjective factors influencing urban quality of life in Phnom Penh Mutual transdisciplinary understanding of urban quality of life Increased awareness about the importance of urban quality of life among stakeholders Preparation of survey results in regard of B4P Milestone WS2: B4P UQoL-Survey Workshop at Magdeburg University (Month 13)</p> <p>Scientific-conceptual lead WP#1 with support from WP7; data-management lead WP#4 Input from all other WPs</p>
V. Transdisciplinary Action Research: Process Facilitation and Product Development <i>V.A. Build4People Eco City Transition</i>	<p>Exploration and application of innovative methodologies of collaborative and participatory planning in the context of an Eco Lab based on a case study site typical for current urban development issues in Phnom Penh</p> <p>Participatory planning techniques incl. workshops, hands-on-planning sessions and report-back sessions; input presentations incl. Cambodian, SEA and international best-practice examples Intensive stakeholder management process including personal and web-based meetings Charrette as an integrated and multidisciplinary design workshop</p> <p>B4P Milestone TL1: (Month 10): ECTL I: Masterplan Study Area & Design Strategies B4P Milestone TL2: (Month 27): ECTL II: Neighbourhood Plans & Guidelines B4P Milestone TL3: (Month 34): ECTL Transition Lab III: Criteria & Implementation Strategies</p>



Lab (ECTL) Process	<p>Deepened understanding of the local planning issues Involvement of local community Empirical research and testing of general research findings based on a case study site Improved collaboration between local experts and decision makers Preparation of strategies, guidelines and criteria in regard of the B4P Toolbox Establishing cross-linkages to B4P Sustainable Building Arena (SBA) Capacity mobilisation at all involved parties</p> <p>Scientific-conceptual lead WP#3 with support from WP#7 Input from all other WPs</p>
V. Transdisciplinary Action Research: Process Facilitation and Product Development V.B. Build4People Sustainable Building Arena Process	<p>Participatory workshop series with front-runners from different stakeholder groups; co-development of transition challenge framing, vision and transition agenda co-development process; support of experimentation & socio-technical, and socio-institutional innovation, coalition and partnership building and knowledge co-creation and communication</p> <p>Preparation, coordination and implementation of a transition management process (incl. interactive knowledge generation, world-café workshops, interviews, questionnaires, participant observation, input presentations, etc.)</p> <p>B4P Milestone SBA1: (Month 14): Implementation of first SBA workshop cycle B4P Milestone SBA2: (Month 27): Implementation of second SBA workshop cycle B4P Milestone SBA3: (Month 39): Workshop on Experiment Facilitation</p> <p>Co-development of challenge framing, a spatial-sectoral vision and a transition agenda to support alternative discourses, marginalized actors, social learning, network building and knowledge communication to ultimately inform an urban sustainability transition</p> <p>Scientific-conceptual lead WP#2 and WP#6 with support from WP#7 Input from all other WPs</p>
V. Transdisciplinary Action Research: Process Facilitation and Product Development V.C. B4P Sustainable Building Incubator Process	<p>Facilitation of Sustainable Building Business Incubator Process in cooperation with Phnom Penh Impact Hub</p> <p>Strategic Niche Management: Preparation, coordination and implementation of incubator process (incl. input presentations, mentoring, masterclasses, field trip)</p> <p>B4P Milestone SBI1: (Month 19): Final conceptualization of the Incubator Design B4P Milestone SBI2: (Month 22): Incubator Kick-off B4P Milestone SBI1: (Month 26): End of Incubator and pitch to investors B4P Milestone SBI1: (Month 32): Incubator reflection report</p> <p>The Sustainable Building Incubator aims to connect the B4P project to the local entrepreneurs and change makers. Under the guidance of WP#6, Impact Hub Phnom Penh and local mentors, B4P team and insights will be connected to the entrepreneurial ecosystem to realize sustainability-oriented solutions. These shall subsequently be implemented experimentally with third party funding.</p> <p>Scientific-conceptual lead WP#6 with support from WP#7 Input from all other WPs</p>
V. Transdisciplinary Action Research: Process Facilitation and Product Development V.D. Build4People UQoL Citizen Science Process	<p>Participatory workshops with different stakeholders and representatives of different target groups, e.g. on sustainable buildings and housing (with new consumers representatives, housing estate management companies, other stakeholders within the case study of the B4P ECTL)</p> <p>World café on sustainability + scenario-based methods with the topic: UQoL, norms, values; Application of participatory methods, e.g. back-casting; Adaptation of the B4P Citizen Science Input APP</p> <p>B4P Milestone QI1: (Month 14): Multistakeholder Workshop on UQoL (focus application) B4P Milestone QI2: (Month 22): Focus Groups with new consumers (focus on conflicts between individual lifestyle claims and sustainability goals)</p> <p>Basis for data-based planning suggestions to increase urban quality of life in Phnom Penh; Reducing the own ethnocentric bias; Further technical development of the Citizen Science Input APP</p>



	<p>Scientific-conceptual lead WP#1 with support from WP#7</p> <p>Data-Management lead WP#4</p> <p>Input from all other WPs (workshop preparation and participation)</p> <p>Feeding in results to the other B4P action research processes</p>
VI. (Re-) Integration of Created Knowledge Refinement and Revision of Theory	<p>Integration of feedback loops from phase of scientific and societal problem-based research and from of action research</p> <p>(Re-)integration of created knowledge; refinement and revision of theory</p>
VI.A. WP-related research	<p>Review of existing theories; connection of theory with results from three research spheres of Build4People RD-Phase; publication of scientific papers</p>
	<p>WP Milestone RF1 (Month 36): Research Achievements Year 3 (every WP)</p> <p>WP Milestone RF2A (Month 46): Preliminary Research Achievements (every WP); to be presented at B4P Milestone K3: Outlook Conference</p> <p>WP Milestone RF2B (Month 48): Overall Research Achievements (every WP)</p>
	<p>Refinement and revision of theory</p> <p>Dissemination of research results at B4P Outlook Conference</p> <p>Preparation for publications</p>
	<p>Managed by each WP</p> <p>Transdisciplinary cooperation in regard of publishing joint scientific papers</p>
VI. (Re-) Integration of Created Knowledge Refinement and Revision of Theory	<p>Modelling of the Urban Quality of Life concept by integrating subjective and objective data collected by means of the survey, the Citizen Science Input APP and others by other WPs</p>
VI.B. Build4People UQoL-Model Development / Data Modelling	<p>Theory-driven and data-based statistical modelling</p>
	<p>B4P Milestone QM1: (Month 35): 1st draft of Urban Quality of life (UQoL) Model (based on survey + UQoL process; objective data and results from the UQoL Process included)</p> <p>B4P Milestone QM2: (Month 45): Feasibility study to grasp UQoL by means of Citizen Science Input APP, including budget plan (WP#4) in preparation of B4P Implementation Phase</p> <p>B4P Milestone QM3: (Month 48): Final version of a theory-driven, data-based, and context adapted UQoL Model</p>
	<p>Preparation of scientific papers introducing the transdisciplinarily developed UQoL Model</p> <p>UQoL Model based planning strategies to foster urban quality of life in Phnom Penh as part of B4P Toolbox (also in preparation of B4P Implementation Phase)</p> <p>Detailed instructions for software company to develop an UQoL-App</p>
	<p>Scientific-conceptual lead WP#1 with support from WP#7</p> <p>Data-Management lead WP#4</p> <p>Input from all other WPs</p>
VII. Build4People Dissemination	<p>Preparation of poster and photo exhibitions in cooperation with cultural dissemination partner META House Phnom Penh</p>
VII.A. Build4People Poster / Photo Exhibitions	<p>Preparation of input to poster exhibitions</p> <p>Processing of science-based knowledge for a wide audience</p>
	<p>B4P Milestone EX1: (Month 15): Green Buildings and Sustainable Neighbourhoods – Case Studies and Best-Practice from Asia</p> <p>B4P Milestone EX2: (Month 34): Results of the B4P Ecocity Transition Lab</p> <p>B4P Milestone EX3: (Month 45): Photo Exhibition Sustainable Lifestyle Pioneers in Cambodia</p>
	<p>General information on the people-led transdisciplinary B4P approach</p> <p>Enablement of networking activities between stakeholders from state, economy, civil society</p> <p>Increased awareness about issues of green buildings, sustainable neighbourhoods and sustainable lifestyles</p>
	<p>B4P Milestone EX1 / EX2: Scientific-conceptual lead WP#3 with support from WP#7</p> <p>Input from all other WPs</p> <p>B4P Milestone EX3: Conceptual Scientific-conceptual lead WP#7 and WP#1 (based on the B4P Awareness Campaign: UQoL & Sustainable Living)</p>
VII. Build4People Dissemination	<p>Management of outreach events to disseminate the results of the B4P project with two main partners 1) Centre of Khmer Studies (CKS) mainly reaching out to the academic / NGO-sector and 2) European Chamber of Commerce (EuroCham) mainly reaching out to the corporate sector</p>



VII.B. <i>Build4People Outreach Events</i>	Regular presentations of select research results with the support of our dissemination partners, either face-to-face or online (webinar-format)
	B4P Milestones OR1-OR16, every 3 months, alternatively at CKS or EuroCham
	Increased awareness, interest and knowledge about the research of the different Work Packages of the B4P project Dissemination about B4P processes and products
	Lead by WP#7 with support from other WPs
VII. <i>Build4People Dissemination</i> VII.C. <i>B4P Toolbox / B4P Handbook</i>	Compiling and preparing research results for dissemination; Input to Toolbox Sustainable Neighbourhood Development as an interactive web platform incl. a catalogue of strategies, guidelines and criteria; illustrated with Cambodian, Southeast-Asian and international best practice examples Input to the Handbook for Green Housing and Sustainable Living, a richly illustrated publication targeting a wide audience trying to convince people to implement sustainable housing solutions; publication as a soft-copy and via an interactive web platform
	Writing chapters addressing different target groups (both for experts and in easy-to-understand language, thus being accessible to non-experts) and preparing for graphic material; Developing input for B4P toolbox: sustainability strategies, guidelines and criteria for neighbourhood development
	B4P Milestone TB1: (Month 15): First editorial meeting: Joint development of a Handbook content structure together with the local partners; distribution of related tasks B4P Milestone TB2: (Month 22): Second editorial meeting: Presentation of the Handbook inputs by the various partners and joint agreement on the visual design; management of the translation, language editing and the printing procedure B4P Milestone TB3: (Month 27): First editorial meeting to discuss content of Toolbox B4P Milestone TB4: (Month 34): Publication of the Handbook for Green Housing and Sustainable Living during a roundtable workshop (milestone SW6); development of a distribution, dissemination and impact management strategy B4P Milestone TB5: (Month 39): Web-Interface of Handbook ready (with inter-active elements) / first draft of Toolbox ready B4P Milestone TB6: (Month 46): Web-Interface of Toolbox ready B4P Milestone TB7: (Month 48): B4P Toolbox Executive Summary Report: Science- and societal based strategies to foster urban quality of life in Phnom Penh
	B4P Toolbox Sustainable Neighbourhood Development: Minimum and advanced requirements as a basis for informed decision-making, awareness-rising, transfer of knowledge; B4P Handbook: Awareness rising, transfer of knowledge, better household decisions in the field of green housing and sustainable living among the general public Mass effects through replication and web platform
	Conceptualisation of Toolbox by WP#3 with input from all other WPs Conceptualisation of Handbook by WP#7 with input from all other WPs Dissemination managed by WP#7 with support from all other WPs
	Representing the Build4People project at important industrial fairs in Cambodia Renting of a B4P booth and dissemination of B4P PR-materials Participating as presenter at related symposia / panel discussions
	PR-activities; Representation and networking; providing evidence-based scientific research results to foster sustainability solutions in the corporate sector
	B4P Milestone IF1: (Month 17): Cambodia Architecture & Décor 2022 B4P Milestone IF2: (Month 34): Industrial Fair Representation 2023 (specific event tbd)
	Dissemination of the B4P approaches to representatives from the private sector Raised interest in supporting B4P activities during Implementation Phase from corporate sector
	Managed by WP#7 with input from all other WPs
VII. <i>Build4People Dissemination</i>	Development of an urban quality of life and sustainable living awareness campaign; exchange with stakeholders and research partners; recommendations for a social marketing campaign
	Theory-driven and data-based planning and designing of a campaign; participatory process and methods, focus group discussions with different target groups; interviews with stakeholders



VII.E. Awareness Campaign: UQoL & Sustainable Living	<p>B4P Milestone AC1: (Month 24): Data-based and theory-driven framework for awareness campaigning in order to foster ecological awareness, pro-environmental social norms and sustainable lifestyles in Phnom Penh</p> <p>B4P Milestone AC2: (Month 38): Implementing a <i>trial</i> of a selected intervention on behaviour change (specific target group in the case area regarded within the ECTL process)</p> <p>B4P Milestone AC3: (Month 48): Final version of a Campaigning Module within B4P Toolbox</p> <p>Increased understanding about people-environment interactions and behaviour change</p> <p>Mass effects through replication</p> <p>Lead by WP#1 with input from all other WPs (among others collected through WP1 Milestone SW6 (Month 34): Roundtable Workshop on awareness campaign strategies</p>
VII. Build4People Dissemination VII.F. Build4People Social Media-Campaign	<p>Comprehensive management of Build4People social media activities</p> <p>Feeding in information on Build4People activities at B4P Homepage, ResearchGate and on several social media platforms (Facebook, LinkedIn, B4P YouTube channel, Instagram)</p> <p>Preparing for B4P PR-video clips</p> <p>B4P Milestone SM1: (Month 01): Social Media Strategy RD-Phase</p> <p>B4P Milestone SM2: (Month 12): Social Media Report Year 1</p> <p>B4P Milestone SM3: (Month 24): Social Media Report Year 2</p> <p>B4P Milestone SM4: (Month 36): Social Media Report Year 3</p> <p>B4P Milestone SM5: (Month 48): Social Media Final Report RD-Phase – Lessons learnt in regard of Implementation Phase</p> <p>Increased awareness and knowledge about B4P related activities and products reaching out to different target groups (e.g. experts, professionals, academia, general public, youth)</p> <p>Managed by WP#7 with input from all other WPs</p>
VIII. Build4People Donor Implementation Workshops	<p>Organisation of regular workshops with donor organisations thereby introducing the Build4People project to donor organisations with the aim to prepare for B4P supported projects during the subsequent Implementation Phase</p> <p>Presentations / exchange / discussions</p> <p>B4P Milestone IWS1: Implementation Donor Workshop I (Month 03)</p> <p>B4P Milestone IWS2: Implementation Donor Workshop II (Month 15)</p> <p>B4P Milestone IWS3: Implementation Donor Workshop III (Month 27)</p> <p>B4P Milestone IWS4: Implementation Donor Workshop IV (Month 39)</p> <p>B4P Milestone IWS5: Report on Implementation Preparation (Month 48)</p> <p>Donor-funded projects discussed, elaborated and prepared in regard of the subsequent Implementation Phase</p> <p>Clarification about the role of the B4P research team in regard of donor-funded projects</p> <p>Managed by WP#7 with input from all other WPs</p>
IX. Build4People Capacity Mobilisation	<p>Supporting the enhancement of lecturing at our local research partners, particularly in regard of the development of master courses in the field of sustainable urban development / transformation, climate change adaptation / mitigation strategies and environmental psychology</p> <p>Consulting and capacity building activities</p> <p>Feeding in results of B4P research into local curriculum development</p> <p>Bi-annual face-to-face meetings and online-meetings in-between</p> <p>Course unit development in a co-design way</p> <p>B4P Milestone CM1: Capacity Mobilisation Workshop I: Identification of needs; collection of ideas, discussion of a draft curriculum development strategy (Month 06)</p> <p>B4P Milestone CM2: Capacity Mobilisation Workshop II: Presentation of curriculum development strategy; formation of tandem teams to jointly develop specific course units (Month 12)</p> <p>B4P Milestone CM3: Capacity Mobilisation Workshop III: Reporting of tandem teams about their progress in regard of course unit development; collection of feedback (Month 18)</p> <p>B4P Milestone CM4: Capacity Mobilisation Workshop IV: Reporting of tandem teams about their progress in regard of course unit development; collection of feedback (Month 24)</p> <p>B4P Milestone CM5: Capacity Mobilisation Workshop V: Presentation of draft course units material (Month 30)</p>



	<p>B4P Milestone CM6: Capacity Mobilisation Workshop VI: Reporting on test-trials of draft course unit material (Month 36)</p> <p>B4P Milestone CM7: Capacity Mobilisation Workshop VII: Preparing for certification procedure (Month 42)</p> <p>B4P Milestone CM8: Status report on curriculum development with outlook to Implementation Phase (Month 48)</p> <p>Support in developing state of the art local master courses at local research partner institutions</p> <p>Enablement of local lecturers to teach the new course units</p> <p>Increased knowledge about state-of-the-art approaches towards urban sustainability among students and university teachers</p> <p>Managed by WP#7 with input from all other WPs</p>
X. Build4People Scientific Advisory Board	<p>Organisation of B4P Scientific Advisory Board Meetings in the aftermath of B4P Conferences</p> <p>Guidance and advice in regard of scientific quality, adjustment to local context, dissemination opportunities and in regard of enablement of donor-funded projects</p> <p>B4P Milestone SAB1: Report of Build4People Scientific Advisory Board (Month 03)</p> <p>B4P Milestone SAB2: Report of Build4People Scientific Advisory Board (Month 27)</p> <p>Adjustment of the research and dissemination approaches</p> <p>Contacts to donor organisations interested in transferring the B4P research into implementation-orientated projects</p> <p>Managed by WP#7 with input from all other WPs</p>
XI. Build4People Monitoring: Self-Reflection, Internal Evaluation and Learning	<p>Regular rounds of internal monitoring and self-evaluation of project progress and reflexion about lessons learnt</p> <p>Discussion about joint publication strategies</p> <p>Internal discussions (through online meetings)</p> <p>B4P Milestone IR1: Internal Evaluation Report (Month 06)</p> <p>B4P Milestone IR2: Internal Evaluation Report (Month 18)</p> <p>B4P Milestone IR3: Internal Evaluation Report (Month 30)</p> <p>B4P Milestone IR4: Internal Evaluation Report (Month 42)</p> <p>B4P Milestone IR5: Final Evaluation Report: Lessons learnt in regard of B4P Implementation Phase (Month 48)</p> <p>Adjusted B4P research and publication strategies;</p> <p>Information of status quo for funding organization and WP-partners;</p> <p>Critical self-reflection regarding the achieved accomplishments and information on the project progress towards the funding organization;</p> <p>Joint publications at high-ranking journals</p> <p>Managed by WP#7 with input from all other WPs</p>
Strategic Planning of Joint Publications	

Fig. 5: Build4People General Work- and Implementation Plan

(Source: Own design)

4.4. Milestone plan

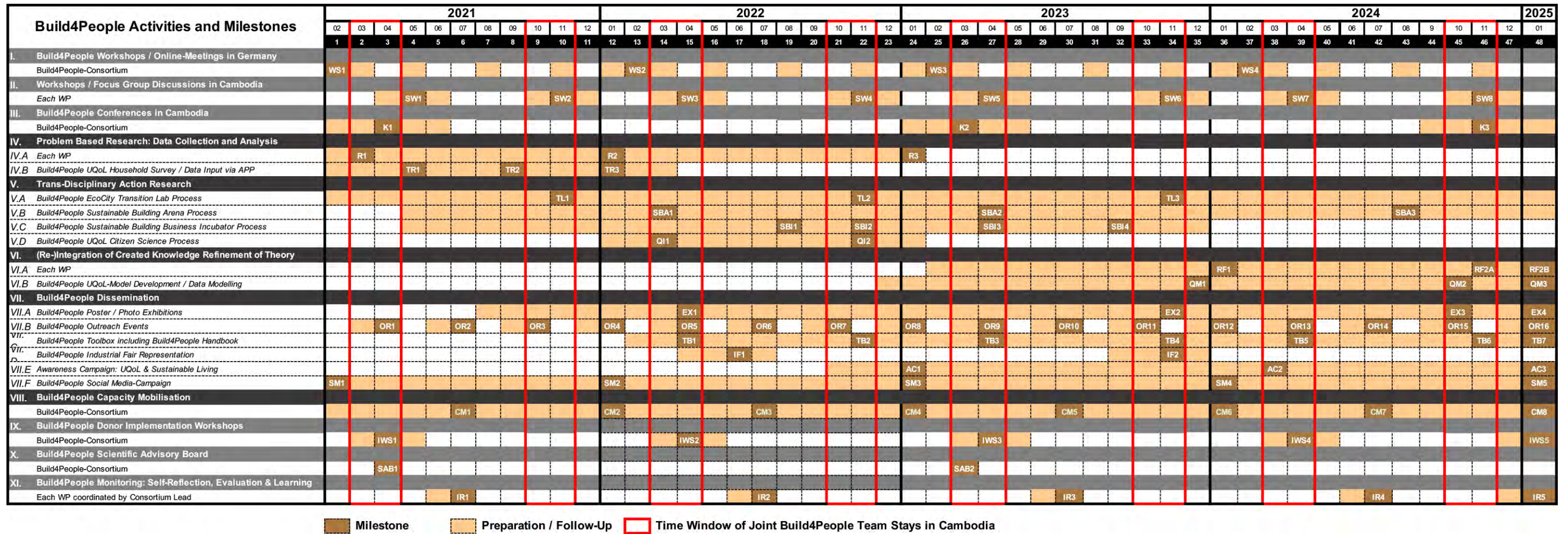


Fig.11: Overview of B4P Schedule: Work Steps and Milestones during RD-Phase
(Source: own design)

4.5. Resource plan WP#3

WP#3 Activities and Milestones		2021												2022												2023												2024												2025
		02	03	04	05	06	07	08	09	10	11	12	01	02	03	04	05	06	07	08	09	10	11	12	01	02	03	04	05	06	07	08	09	10	11	12	01	02	03	04	05	06	07	08	9	10	11	12	01	
		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41	42	43	44	45	46	47	48	
I.	Build4People Coordination Meetings in Germany																																																	
	Build4People-Consortium																																																	
II.	Science / Roundtable Workshops / Focus Group Discussions in Cambodia																																																	
	WPs																																																	
III.	Build4People Conferences in Cambodia																																																	
	Build4People-Consortium																																																	
IV.	Scientific and Societal Problem Based Research: Data Collection and Analysis																																																	
IV.A	WPs																																																	
IV.B	Build4People UQoL Household Survey / Data Input via APP																																																	
V.	Trans-Disciplinary Action Research: Process Facilitation and Product Development																																																	
V.A	Build4People EcoCity Transition Lab Process																																																	
V.B	Build4People Sustainable Building Arena Process																																																	
V.C	Build4People Sustainable Buildings Business Incubator Process																																																	
V.D	Build4People UQoL Process																																																	
VI.	(Re-)Integration of Created Knowledge Refinement and Revision of Theory																																																	
VI.A	Each WP																																																	
VI.B	Build4People trans-disciplinary UQoL-Model Development																																																	
VII.	Build4People Dissemination																																																	
VII.A	Build4People Poster / Photo Exhibitions																																																	
VII.B	Build4People Outreach Events																																																	
VII.C	Build4People Toolbox including Build4People Handbook																																																	
VII.D	Build4People Industrial Fair Representation																																																	
VII.E	Awareness Campaign: UQoL & Sustainable Living																																																	
VII.F	Build4People Social Media-Campaign																																																	
VIII.	Build4People Capacity Mobilisation: Curriculum Development																																																	
	Build4People-Consortium																																																	
IX.	Build4People Donor Implementation Workshops																																																	
	Build4People-Consortium																																																	
X.	Build4People Scientific Advisory Board																																																	
	Build4People-Consortium																																																	
XI.	Build4People Monitoring: Self-Reflexion, Internal Evaluation and Learning																																																	
	Each WP coordinated by Consortium Lead																																																	
	Total Person Months WP3																																																	

Fig.12: WP#3 Person Months Planning
(Source: own design)



5. RISK ANALYSIS

The implementation of the envisaged activities is obviously subject to risks. However, we are confident to implement the original work plan and that we can respond to all challenges effectively. The research structures have already been established during the Definition Phase with reliable partners, namely the School of Architecture and Urban Planning (SAUP) of the Paññāsāstra University of Cambodia as research partner and Phnom Penh Capital Administration (PPCA) as implementation partner.

- Travelling difficulties due to Covid-19 travel restrictions: This is a likely risk, especially during the first 6 months of our RD phase. But possible problems can be resolved, for instance by establishing web-based meetings with the local partners, as successfully applied, and focusing on theoretical parts of the sub-work packages.
- Difficulties with participatory events and workshops due to Covid-19 restrictions, e.g. due to required distances between participants: The experience of the last months is that some participation events could take place with changed formats even within these circumstances. Examples for adapted methodologies are working with a stronger role of then more facilitators and projecting work flows on screens instead of flip-chart writing, while the participants are keeping the distance to each other and the facilitators. Citizens can be informed by streaming of events on the internet. Even stakeholder management processes can be carried out with moderated and interactive video conferences, using also chat functions and software tools that support the splitting up to smaller workings groups. Creative group processes can be promoted via web-based whiteboards for collaborating with remote participants.
- If very unexpectedly one local partner would reduce its planned engagement, there are still remaining options for a successful cooperation. Due to the linkage with two local partners and the intended additional collaboration with developers and consultants, all research activities can still be undertaken, probably with a just slightly changed set-up.

Despite the intended iterative processes, the WP#3 work plan provides the opportunity to work on each of the sub-work packages individually and to achieve the expected high quality research results. Thus, the contributions to transdisciplinary processes and products can also largely be guaranteed, even if one field of activity cannot be carried out exactly as planned.

6. EXPLOITATION PLAN

6.1. Economic Success Prospects

The elaborated contents, methodologies and tools provide a very good basis for an economically successful application:



- Consultancy for city administrations, developers and other consultants based on local strategies and guidelines for sustainable neighbourhoods in order to make projects future proof, resilient and long-term economic (see WP#3.1)
- Minimum and advanced requirements for sustainable neighbourhood development can be used for consulting profound site selection processes and setting-up of specific project goals and profiles (see WP#3.1)
- Assessment of sustainable neighbourhoods and audits for the certification by the German DGNB or a national institution such as the Cambodia Green Building Council (CGBC) in the future (see WP#3.3)
- Studies on eco-town development and comprehensive Masterplans for developers based on advanced integrated and multidisciplinary design approaches (see WP#3.2)
- Facilitation of participation workshops based on the locally adapted and innovative Ecocity Transition Lab methodology and other formats (see WP#3.5)
- Workshop formats and webinars using the Toolbox for Sustainable Neighbourhood Development and the Poster Exhibitions on Green Buildings & Sustainable Neighbourhoods and on the Integrative & Collaborative Masterplan Framework with best-practice examples for education and training purpose (see WP#3.4)

6.2. Scientific Success Prospects

The results of WP#3 will be mainly in the area of action research and will cover very relevant fields of sustainable urban development, which are crucial for climate protection and combatting climate change:

- Further development of multi-layered and collaborative planning strategies and methodologies for implementing sustainable neighbourhood development
- Evaluation of eco-town developments and sustainable neighbourhoods with regard to sustainability criteria and indicators
- Presentation at conferences, publications in leading journals and contribution to the work of the international Green Building Council (GBC)

6.3. Economic and Scientific Connectivity

Good economic and scientific connectivity is given particularly within the following fields of activity:

- Provision of research evidence for policies in the field of sustainable neighbourhoods in Cambodia with strategies and guidelines x
- Provision of mandatory minimum requirements for sustainable neighbourhood development for



the city of Phnom Penh and other cities in Cambodia

- Assessment system with criteria and indicators incl. LCA and LCC supports the identification and implementation of the best solutions
- A certification system as an important part of the quality assurance and for marketing projects with a measurable high sustainability profile
- Education program for city administrations on sustainable neighbourhood development will support the qualification of the staff, which will promote advanced design, implementation and management of neighbourhoods

7. PROPERTY RIGHTS AND EXPLOITATION OF RESULTS

Generally no property rights or property right applications are discernible that would prevent the later exploitation of the project results. The only issue to be resolved is the copyrights of photos and other graphic material for publishing the Poster Exhibitions.

The project is not already the subject of other research/developments/studies and patents.

8. NECESSITY OF THE RESEARCH GRANT

This project is a research and cooperation project on basic research with implementation and transformation-oriented components derived from basic research. An economic benefit cannot be achieved by the research partners during the project period. Above all, the project is based on a pronounced scientific interest and the desire for academic and scientific exchange with the partners in the international research consortium and the wider circle of partners in Cambodia. Furthermore, the project aims at developing a scientifically based contribution to sustainable development in the construction sector and to sustainable urban development in Cambodia and other countries in the region.

Without the funding applied for, the project objectives described above could not be achieved. The funding for this project is absolutely necessary for the architects and urban designer practice Eble Messerschmidt Partner, since no budget, third-party or own funds are available for this project in the required dimension. The project cannot be carried out without the federal funds applied for. As a private SME company, Eble Messerschmidt Partner can cover a part of the project costs, but is dependent on 70% additional funding for this project.



9. EXPLANATIONS HOW WP-ACTIVITIES DURING THE R&D-PHASE CONTRIBUTE TO TRANSDISCIPLINARITY

The WP#3 on Sustainable Neighborhoods is strongly linked to joint activities of the Build4People (B4P) project. Particularly the Toolbox for Sustainable Neighbourhood Development and the Ecocity Transition Labs (ECTL) are two major B4P products and processes. Furthermore the elaboration of an Integrative & Collaborative Masterplan Framework for a case study area in Phnom Penh is another trans-disciplinary key element of the B4P project involving all work packages. Furthermore the two Poster Exhibitions, curated by WP#3 are major contributions to the joint dissemination of B4P contents and results. These activities, which are mutually integrated with the entire project, will be led by WP#3 and will include input from all other work packages.

Beyond this, WP#3 "Sustainable Neighbourhoods" will also be engaged in other transdisciplinary knowledge co-production processes. Valuable input and active participation will be carried out for the Sustainable Building Arena Process, the Sustainable Building Business Incubator Process, and the Build4People Urban Quality of Life Process. WP#3 will support these activities and events giving relevant input from the sustainable neighbourhood development perspective.

10. EXPLANATIONS HOW WP-ACTIVITIES DURING THE R&D-PHASE PREPARE FOR IMPLEMENTATION PHASE

The planned donor implementation workshops will provide a platform to promote the activation of donor organizations. Furthermore the collaborative research and planning methodology involving many different parties from different professional fields will also contribute to this and for investigating implementation projects. At the moment the following potential sub-projects have been identified:

The conceptualization of the Toolbox for Sustainable Neighborhood Development (see WP#3.4) provides the opportunity to a deepened, largely extended and much more interactive toolbox version by the transfer of research results on sustainable neighbourhoods into an advanced and web-based IT tool (incl. strategies, guidelines, criteria and best practice data base). This shall provide different information adapted to different target groups such city administrations, consultants, developers, universities and NGOs. This can also be the starting point for the development of other tools for sustainable design and planning to support the application of sustainability strategies and criteria (e.g. planning and assessment software).

Starting from the identified minimum and advanced requirements for sustainable neighbourhood development, a policy guide can be developed to promote green neighbourhood development in Phnom Penh and Cambodia. The exemplar implementation of such a sustainable neighborhood



could be funded by the Asian Development Bank (ADB) or the Gesellschaft für Internationale Zusammenarbeit (GIZ) project to promote sustainable urban development in Phnom Penh and secondary cities of Cambodia, in cooperation with Phnom Penh Capital Hall (PPCA), other municipalities and local developers.

Based on the Ecocity Transition Lab (see WP#3.5) experiences with PPCA administration, an education program for city administrations could be set-up for the implementation and testing of the newly developed train-the-trainer units. Next to this, the new format can include lecturing, workshops and consultation and would contribute to an increased knowledge and understanding about issues of sustainable neighbourhoods among staff of city administrations and other institutions in Cambodia.

A certification system for sustainable neighbourhoods (see WP#3.3) could be set-up with the Cambodia Green Building Council (CGBC), which is currently established with support of some architects and developers as well as EuroCham. This institution for the certification of sustainable neighbourhoods and buildings could be supported by the cooperation with the German Sustainable Building Council (DGNB) and its experience in developing and marketing certification processes. The green building council can also form the basis for a knowledge platform for the building and construction industry in Cambodia. The outcome could be a report on the implementation of a certification system for neighbourhoods to Cambodia.

The case study area for the Integrative & Collaborative Masterplan Framework (see WP#3.2) on the urban fringe of Phnom Penh could be the location of a demonstration project for urban-rural integration. A new blue-green infrastructure combining farming and urban green, water management and renewable energy sources in an innovative material flow concept with synergetic effects could be funded by the GIZ or ADB. The goal would be create a cutting edge and exemplar project for Phnom Penh, Cambodia and Southeast Asia.



11. ROUGH WORK- AND IMPLEMENTATION PLAN OF IMPLEMENTATION PHASE

The workplan of the implementation phase (2025-2027) will be developed during the B4P Research and Development Phase (see WP#3 Feasibility Study on Implementation Strategies as Milestone RF2). There is a high potential for application-oriented research and for innovative implementation in the field of WP#3. Examples are the further development of the Toolbox and the Assessment System for Sustainable Neighborhood Development.



WORK - AND IMPLEMENTATION PLAN

Work Package WP#4 "Urban Green"

Work Package Leader: Prof. Dr. rer. nat. Jan-Peter Mund, Dipl. Geograph,
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University of Applied Science (HNEE/EUSD)
Faculty of Forest and Environment
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Royal University of Agriculture, RUA,
Faculty for Land Management and Land Administration
(FLMLA)
Phnom Penh, Kingdom of Cambodia (RUA)

WP#4 Associated Research Partners

1. GAF AG Munich
2. Green Infrastructure Solutions Co., Ltd.



WP#4 Guiding research question

What is the actual situation, role and function of urban green (infrastructure) in sustainable urban planning in Phnom Penh and how does transdisciplinary, geospatial and citizen science research methods of B4P (WP#4) can improve urban quality of life in Phnom Penh

Research Sub-Questions

1. What are the spatial dimension, distribution and the inter-connection of urban green space (infrastructure) in the Khans and Sangkats of the Phnom Penh Municipality (core city) and its urban fringe?
2. Is there a spatial relation concerning urban green space distribution and detectable critical hotspots areas of urban heat islands (WP#5) in the Phnom Penh Municipality and the attached urban hinterland or peri-urban area?
3. How can we employ modern technical modern communication devices to gain people centered perspective of perceived greenness in relation to urban quality of life using a transdisciplinary approach by combining different scientific disciplines (WP#1, WP#4 and WP#5)
4. How can we link objective and subjective data gained from UQoL survey and urban green space analysis and relate those to urban quality of life using a statistical model approach?

WP#4 Insights from definition phase

Lessons learned:

- Urban green space (UGS) is essential for the well-being of people living in Phnom Penh and UGS is in the focus of urban planning and sustainable development in the Municipality of Phnom Penh. (Finding from 1st B4P Ecocity Transition Lab)
- Planning, monitoring and management of UGS in Phnom Penh has not yet a formal status in the city planning structures and procedures. (no planning standards, formal regulations or methods are available or applied within the Phnom Penh municipality)
- Assessing, quantifying and monitoring UGS is relevant for the research of urban quality of life as well as for the Phnom Penh Municipality or for land developers from the real estate sector. The suggested Build4People Toolbox for Sustainable Neighbourhoods and Development (WP#3) will contain a UGS assessing and monitoring module
- Phnom Penh Municipality and its land developers tend to take or borrow ideas and concepts for UGS development from other Asian cities but are proud of individual solutions in-cooperating national symbols and icons
- During the preparation phase some research about the spatial distribution and regional dimension of UGS has been started, yet.
- One main difficulty for assessing UGS and considered planning measures are the mismatch between administrative borders of Phnom Penh, the actual urbanized area and the area of the 2030 Phnom Penh Master plan as well as the conceptual heterogeneity of UGS types.
- The latter one is addressed with the UGS typology of UGS in Phnom Penh (expected result of the ongoing definition phase). This generalized UGS typology can be used beyond the scope of this project and will reduce ambiguous heterogeneity of UGS in



sustainable planning and will reduce mismatch of UGS monitoring across cities in future research. (Output of the R&D Phase).

- UGS and its role in the quality of life in urban areas have not yet become a regular content in respective school and university curricula in Cambodia and neighboring Asian cities and countries.
- Modern, innovative medium to large-scale land developers in Asia are recognizing the importance of UGS but interpret its accessibility and openness to the public differently.
- Urban citizen of Phnom Penh are concerned about shrinking UGS per capita and shrinking accessibility of UGS in Phnom Penh due to gated borey developments.

Milestones and main aims from the Definition Phase of WP#4 achieved such as:

- a) Detecting and mapping Urban Green Structures in the municipality in Phnom Penh at District and Sangkat level

Result of DEF-Phase: Milestone achieved with professional support from RUA and the Phnom Penh municipality

Output of DEF-Phase: Spatial database of UGS structures in Phnom Penh is available to all B4P WP's and will be integrated by WP#3 and WP#5 predominately

- b) Drafting a typology of urban green spaces (partly achieved work in progress).**

Result of DEF-Phase: With the new UGS typology for Phnom Penh, WP#4 has successfully contributed to a wider, transdisciplinary understanding of the UGS typology in the B4P team and the Phnom Penh municipality.

Output of DEF-Phase: Catalogue of UGS types in Phnom Penh is available to all B4P WP's and will be integrated by WP#3 and WP#5 predominately.

- c) Testing the Green Index and the Urban Neighbourhood Green Index methodology at various mapping scales.**

Result of DEF-Phase: Both indexes have been successfully tested during the B4P definition phase (Results are work in progress and will be a final

Outcome of DEF-Phase: WP#4 will apply the "urban green neighbourhood index" in the R&D phase across Phnom Penh and at different scales.

- d) Integrating research results of WP # 4 with partnering WPs # 1; 3 and 5.**

Result of DEF-Phase: WP#1 and WP#4 are developing a joint research method to integrate UGS into the urban quality of life.

Outcome of DEF-Phase: WP#5 and WP#4 are spatially linking the topic of urban climatic structures and processes with the spatial dimension of UGS. Together, we aim to create an urban green space assessment decomposing green indicators and users perception of green



space into quantifiable and measurable categories. We will implement a Citizen Science Project using mobile devices.

e) Achieved transdisciplinary WP-activities during the Build4People Definition Phase

Results of DEF-Phase: The Build4People tested their working methods within the definition phase with local research partner and the other WP members. Opportunities to communicate research ideas to a wider audience was the Build4People Ecocity Transition Lab and the 1st edition of the Build4People Poster exhibition both held in March 2020.

Outcome of the DEF-Phase: WP#3, piloted a “Blue Green City” approach. WP#4 adapted their research focus accordingly to this idea and investigates now the spatial dimension of green infrastructure and its inter-connectivity in Phnom Penh (for more details refer to the chapter “State of Art”).

The Build4People Poster exhibition gave great opportunities to show best research practice for our specific WP related topics and allowed to communicate those to a wide public interested in the overall Build4People project goals.

Working experience with our main research partner

The joint research cooperation with RUA as the main research partner of WP#4 has been proven successful, reliable and will be continued and enlarged with faculty staff capacity building, joint curriculum design, organization of online work studios and summer schools and the exchange of faculty staff in the R&D phase.

Joint activities with RUA during the Build4People Definition Phase:

During the definition phase WP#4, in conjunction with RUA – FLMLA, carried out successful field work and training using the mobile app, INPUT APP. The training data was collected to establish “ground-truth points” for a comprehensive land cover classification. During the fieldwork we successfully surveyed and verified 630 out of a proposed 724. Before starting the field work, the research team created attribute data forms and adjusted spatial data layers for the mobile app, according to the B4P project’s needs. In addition, the research team from HNEE wrote a handbook that included a catalogue of different land-cover types to ensure a uniform mapping methodology and a common understanding of the selected land-cover types. The alignment of both data sets resulted in a new urban green space typology, trends and a collection of geotagged photography. It will initially serve as a research tool in the Build4People RD-Phase.



WP#4 Mains aims of the Build4People RD-Phase (main aim + sub-aims)

The main aim of the research phase is to map and to assess urban green (infrastructure), with particular regards to parameters of quality and connectivity of UGS using a geospatial approach in Phnom Penh. Linking the objective spatial results to subjective citizen's perception and gaining insights into UQoL indicators.

1. Compute and operationalize Urban Neighbourhood Green Index (UNGI) parameter to evaluate urban green infrastructure as an important subject for urban planning
2. Developing recommendation maps to stimulate the concept of urban green infrastructure within sustainable urban planning processes in order to enhance Phnom Penh's resilience through landscape diversity in times of climate change.
3. Spatial calibration and refinement of the urban green neighbourhood index for open space planning in PNH.
4. Derive a statistical model to compare the cause and effect from objective and subjective data regarding UQoL

WP#4 State of the Art (Theory)

During the first phase of the RD-Phase: the *societal and scientific problem-based research*, WP#4 will investigate the actual role and function of urban green (infrastructure) in Phnom Penh's sustainable urban planning. We will apply a landscape approach using remote sensing and GIS – based calculation in order to map the spatial dimension of urban green (infrastructure) and its inter-connectivity. The reader will be introduced to the overall concept of green infrastructure (GI) and to the term ecosystem services (ESS) as those elements combine the socio-economic and environmental benefits provided by GI. Urban Green Spaces (UGS) will also be addressed. The integration of the GI concept into strategic policies will be discussed in global, albeit mainly European and Asian, context.

Research evidences that intact ecosystems within cities considerably improves the quality of citizens' lives. UGS or the fabric of Urban green Infrastructure (UGI) such as parks, city forests, green roofs, creeks and streams as well as community gardens provide a broad range of ecosystem services (ESS) (urban heat mitigation, storm water infiltration, local food security, physical recreation, and psychological well-being of residents. Natural environment and open spaces within city boundaries (core city) have been decreasing continuously. According to Lang et al. (2008) urban agglomerations can experience a rapid decline in both the quality and quantity of urban green spaces. This process is accelerated by unplanned densification of inner cities and spontaneous "leap-frog" development of urban agglomerations at their urban fringes. Urban fringes refer to the transition zone between the built-up area and the countryside, constituting the interface between the consolidated urban and rural areas. It is a zone of mixed land uses, where there is often competition for land use EEA (2017a). Lack of knowledge, or wilful disregard, of the importance of urban green spaces in future, progressive urban planning and development will lead to a reduction in the overall quality of life in cities (WHO, 2017). Thus a proper evaluation of UGS, therefore, requires not only information on its relative spatial quantity in any given area of a municipality, but also a closer examination of UGS in terms of quality and related ecosystem services, which can be derived from its land cover composition and spatial structure.



In 1999 Niemelä stated, “[...] that understanding the ecological patterns and processes of landscape elements is key to the study of urban ecology.” (Niemelä, 1999). He builds on the conceptual work of Forman et al. (1986) to differentiate between different land use types, “[...] according to the intensity of human influence, [...] pristine natural environments to urban centres highly modified by people.” (Niemelä, 1999). The assessment of GI, already a complex area of research, is further problematized by the effects of long-term natural processes such as climate change, which effect the growth and maturation of living elements (Smaniotto Costa et al., 2008). One aspect of sustainable urban planning, and the one dealt with in this study, is the active development, creation and maintenance of urban green (infrastructure) and its biodiversity in the city core and its urban fringes. Despite the benefits relatively little attention has been paid to the issue of urban green in Cambodia as evidenced by Phnom Penh’s new Master Plan for 2035.

An early definition from Benedict and McMahon (2002) highlighted the importance of UGS networks that provide ecosystem services for people. He refers to GI or blue-green infrastructure, explaining it as a network providing the “ingredients” for solving urban and climatic challenges by building with nature. GI is comprised of a network of near-natural and designed spaces and elements in cities, planned and maintained in such a way that the infrastructure as a whole offers high quality in terms of utility, biodiversity and aesthetic appeal while also delivering a broad range of ecosystem services. Regardless of ownership or origin, all types of sites and individual elements, characterised by vegetation or water, can become components of the GI. These concepts originated in the mid-1980s proposals for best management practices aimed at achieving more holistic storm water quantity management goals for runoff volume reduction, erosion prevention, and aquifer recharge (Elliott et al., 2020). The GI approach has gained increasing importance over the last decades and is by now recognized and implemented in various fields of science, urban policy and city planning (Cvejic et al., 2015). The GI analytic framework allows an analysis of green space in terms of its multi-functionality. According to Dennis et al. (2018) the GI approach considers physical and functional interconnectivity and relates those to the ability of ecosystems to, “[...] deliver multiple valuable ecosystem goods and services [...]” (EEA, 2017c). The inclusion or / integration of diverse social, ecological and economic benefits within the UGI concept strengthens cities’ resilience and adaptability through landscape diversity in the face of climate change.

Researchers use the term UGI to emphasize the particularity of cities in the application of GI. It includes primarily two land cover types, blue and green space. “Blue spaces” refers to surfaces covered by water: oceans, rivers, streams, deltas, lakes, canals, ponds and wetlands. Due to its climate, and its geographical location at the Mekong delta, water is an important environmental feature for Phnom Penh. However, most spatial analysis of UGI concentrate on the vegetated land cover type. The UGI approach considers urban green spaces to be assets that offer multifaceted benefits for citizens and the urban environment. UGS also operates at various scales from single trees (point features) and small linear features (pocket parks) to large natural and semi-natural areas. Private gardens, green roofs and sustainable wastewater treatment systems are all important elements of the urban ecosystem (Cvejic et al., 2015; Haase et al., 2019). The potential of urban green, and blue, spaces to provide benefits to citizens (ESS) depends on whether they are managed as a comprehensive system of UGI, or as isolated patches falling under the responsibility of different stakeholders (Haaland and van den Bosch, 2015). Sustainable urban planning should also consider the citizen centred perspective (Lang et al., 2008), and social features linked to urban green space, (Gupta et al., 2012; Chen et al., 2018).



In general, the literature relates ESS to different strategic frameworks, for example, Elliott et al. (2020) draws their definition from the United Nations Millennium Ecosystem Assessment (MEA), defining ESS very broadly, as, the benefits people obtain from ecosystems. Cvejic et al. (2015) provides a more nuanced definition by highlighting that ESS benefits derive from functioning nature or from ecosystem processes. For cities, researchers use the term urban ecosystem services (urban ESS) which uses a different classification system. According to Cvejic et al. (2015) in most cases they are separated into four categories: provisioning services, regulating services, habitat or supporting services, and cultural services (TEEB, 2011). Elliott et al. (2020) identify the difficulty in linking ESS benefits to certain GI types, however they do recommend that researchers consider "[...] cultural services in future GI research and planning efforts." (Elliott et al., 2020)

On the European Level GI is included in the policies of the EU 2020 Biodiversity Strategy and since 2013 has been adopted as a "[...] successfully tested tool for providing ecological, economic and social benefits through natural solutions" (EC–European, 2013). GI has also become integral to the language of the European Commission and most recently the approach was used in the creation of the Resource Efficiency Roadmap (part of the EU2020 Resource Efficiency flagship) (EEA, 2017b). Nonetheless, municipal practice often lacks the conditions necessary to safeguard and development green spaces and open spaces in sufficient quality and quantity. Parker and Zingoni de Baro (2019) compiled a detailed quantitative review of the GI approach in urban environments and found that there is still a research gap in most parts of the world and importantly for us particularly in Asia. Further, Parker and Zingoni de Baro (2019) state that most research was conducted for regions and cities within temperate and cold climate, hence the outcomes and conclusions are difficult to apply globally.

The regional assessment report on Biodiversity and Ecosystem Services for Asia and the Pacific' (IPBES, 2018), distributed by 'The Intergovernmental Science-Policy Platform on Biodiversity and Ecosystem Services (IPBES) provides a relevant framework for assessing ESS In the Asian context. This report includes a state of the art analysis of Asian countries on "[...] status and trends of biodiversity and nature's contribution to people." (IPBES, 2018). Further, it analyses changes in biodiversity, nature's contributions to people, and the impact that these changes have on their quality of life. It also seeks to, "[...] identify a mix of governance options, policies and management practices that are currently available to reduce the loss of biodiversity and of nature's contributions to people in that region." (IPBES, 2018). This was the framework from which the 'National Green Growth Roadmap' in Asia was developed. The report promotes the economic growth of cities and countries under the provision that they maintain natural resources and environmental services on which the health and well-being of people rely (IPBES, 2018). According to this report Cambodia was, in 2010, the first country in Asia to adapt a National Green Growth Roadmap.

To bridge our theoretical knowledge to the practical approach of the Build4People Project and to our study area Phnom Penh, we refer to the EcoCity-Transition Lab held in March 2020, where B4P, guided by WP#3, piloted a "Blue Green City" approach. Phnom Penh, has grown rapidly in recent years and has a high urban expansion rate (World Bank Group, 2017). This growth has been accompanied by poor urban planning (UNFPA, 2015) that has resulted in both reduced natural areas and agricultural land (Kompheak, 2015). Authorities and citizens of Phnom Penh now recognize that in fast growing cities like Phnom Penh sustainable urban planning is of crucial importance. During the Build4People Ecocity Transition Lab in March 2020, stakeholder discussion on visions and expectations for urban planning in the Chbar Ampov District, and a series of participatory hands-on planning applications, showed that sustainable and participatory urban development, such as recognizing UGS, leads in the direction of sustainable urban development, which recognizes the goals and ideas of SDG11.



The Authorities Recognized this and took it into consideration when drawing up Phnom Penh's specific green growth action plan detailed in the 'Sustainable City Plan 2018-2030'. Moreover, the government's desire to achieve economic growth in an environmentally sustainable manner resulted in the development of the 'Sustainable City Plan 2018 – 2030' for which it collaborated with the 'Global Green Growth Institute' (GGGI, 2019). GGGI connects specific objectives to urban green spaces and summarizes those under the categories 'Public Spaces' and 'Cultural Heritage'. The GGGI (2019) lists four direct actions that cities should take:

- *Increase the green canopy coverage of the city (number of new native trees planted),*
- *Increase public green space in the city (number of hectares from current baseline of 70 ha),*
- *Develop a strategic plan to preserve urban cultural heritage (number of historic buildings inventoried and protected),*
- *Increase in tourism as a result of improved cultural heritage management (number of tickets sold at key urban sites) '*

The Build4People Project, and in particular our WP#4 research group takes these directives as the entry point to promoting the concept of science based UGI and to use the results of GI based research to formulate recommendations and create planning tools in coordination with the Phnom Penh Municipality (PPCH) and other relevant local stakeholders. GI is an approach that requires spatial and regional development planning across different scales, from the citywide level to its urban fringes and its neighbourhoods.

The importance of spatial analysis in the assessment of urban green infrastructure is well developed in the literature. (Gupta et al., 2012; Liu et al., 2016; WHO, 2016; EEA, 2017a; Dennis et al., 2018; Le Texier et al., 2018). Various studies also evaluate the interconnection of ecological networks using remote sensing, geographic information systems and spatial statistics. In addition to general analysis on the kind of nature existing in the study area, they further identify specific green space parameters (indicators), such as accessibility, availability, and usage of green space. The indicator usage is more difficult to analyse as it includes the perceived greenness by citizens, connected to urban quality of life and well-being. Moreover, the report of WHO (2016) offers a detailed literature review of the mentioned parameters and establishes the link to health and well-being of citizens. In general urban green spaces are made for people and thus represent public values (Smaniotto Costa et al., 2008). How the public perceives such spaces depends on their characteristics, the number of trees, the dimensions, etc. This is crucial for the Build4People Project, as one of its main goals is to understand and positively contribute to the enhancement of the overall quality of life in cities in general with a research focus on Phnom Penh. Assessing these by using the above-mentioned spatial applications, we gain a knowledge base on the spatial distribution, connectivity and fragmentation of UGI. Chan and Lee (2019) have evaluated sustainable city indicators for Cambodia. In their research, they linked specific green indicators to the UN Sustainable Development Goal SDG11, the Korea HAN (Han and Lee 2017), and the ASEAN Environmentally Sustainable City. Some of these indicators, in the category 'Public Space and Heritage,' can be linked to the green indicators presented by the WHO (2016) and the GGGI (2019).

Calculating the availability of green space, for example, provides insights into, 'The ratio of public green space compared to the total area of the city' which links to the SG11; ESC; and HAN). The indicator 'accessibility' provides insight into the 'Percentage of residents residing in public and green spaces accessible within a certain distance (here 0,5km)'. This links to



the SDG11 or the 'Number of urban parks', which refers to development goals of the Korean HAN (Han and Lee, 2017). We now try to take all the defined green indicators into consideration and due to our thorough comprehensive literature review during the definition phase of this project and technical test-runs concerning the index calculation, we concluded that the urban neighbourhood green index (UNGI) introduced by (Gupta et al., 2012) is the most suitable for investigating Phnom Penh's UGI. This is true particularly because of its applicability by local administrations, another goal of the project. We aim that outcomes will support the process of building an UGI strategy and further facilitates the search for solutions and new ideas to develop and manage GI and make it to a key role of Cambodian policies in future. However, we also found that certain modifications to the UNGI are needed for the successful implementation of this approach. The main modification foreseen the change of the entry dataset of urban green and will assign different weights per indicator according to the leading expert interviews of the Phnom Peng Municipality and other local stakeholders. The promotion of urban GI requires a cross-disciplinary approach bringing together researchers in science, policy and planning. Using indices for specific purposes certain pre-considerations, for example McKenna (2017) found that a simple model can provide realistic results and, that when faced with a range of solutions, the simplest is often the most feasible choice as the parameterization and calculation can be easier accomplished and the evaluation of results can be more easily shifted to any real-world application. For this reason UNGI is preferred. Furthermore, using the envisaged parameters (accessibility, availability and usage) creates a higher evidence of real world implementation. It facilitates the interpretation of results and the transferability of GI strategies to other cities within Cambodia and Southeast Asia. Finally, derived results may be more easily combinable with other data sources, i.e. heat island maps, urban climate maps and so on to nominate ecologically valuable areas. In general, the UNGI approach emphasises the combination and integration of qualitative results and expert opinions as well as quantitative measurements and numerical data from surveys and fieldwork. As mentioned before We will change the entry data set, and, instead of calculating the 'Normalized Difference Vegetation Index (NDVI) to detect the land cover class urban vegetation, we will process high-resolution imagery applying a support-vector machine approach, a machine learning algorithm that provides a more detailed classification of land cover features. Classical classification methods are k-nearest neighbors, maximum likelihood classifier, minimum distance-to-means and parallelepiped have been investigated and tested in detail in the past. To the new methods account machine learning techniques developed to further improve classification results in the field of pixel based classifications (Engler, 2020). According to Engler (2020) is the support vector machine classifier favourable and has proven to achieve superior classification results. To assure the data quality for the training and validation data, we will therefore create our own data set using modern measurement instruments. Our modified UNGI approach combines remotely sensed information and ground based observation using an innovative mobile phone App in combination with unmanned aerial vehicles for spatial data collection in selected districts of Phnom Penh during the R&D phase. The subsequent calculation of different parameters leads to insights on the spatial distribution of UGS in the neighbourhoods and their built-up structures.



WP#4 Research Plan Urban Neighbourhood Green Index (UNGI)

In this section, we will describe our working steps for the modified UNGI (Gupta et al., 2012) and in the next section the citizen science Input App approach. Within the Build4People project, the concept of Urban Quality of Life is a guiding component of the project's purpose aiming at sustainable urban transformation. For the successful achievement of this objective Build4People organized research method and approaches for the R&D Phase into three different spheres. In this, individual work processes of each working group, are assigned to one of those spheres. The first sphere comprises the societal and scientific problem based research, the second the transdisciplinary action research and the third the reflection, refinement & re-integration of created knowledge.

We list all our main WP#4 milestones for each year and under each milestone, we will provide a short description of how we plan to reach the milestones and describe relevant methods and approaches as well as used parameters. The calculation of the UNGI will help us to determine areas of high quality urban green zones in the core city and urban fringes of Phnom Penh and identify those areas of priority, where action to improvements in accordance with our goals should be implemented.

The method seems most suitable as data availability, accessibility and indicator appropriateness for the measurement of an urban green space based quality of urban life indicator are key aspects for the success of the project. Furthermore, applicability by local agencies will be facilitated with the documentation available within the project, from a feasibility standpoint as well as in view of data access needed for the index.



The flowchart demonstrates all of our working steps

Direct outcomes are recommendation maps indicating critical areas of missing urban green and missing interlinkages between urban green elements.

The applied methodology of the UNGI will be documented and used as planning instrument for administrators and will be integrated into the Buld4People Toolbox for Sustainable Neighbourhoods and Development (WP#3).

The UNGI help us to conceptualize the concept of green infrastructure and to develop and adapt existing greening strategies together with the Phnom Penh City Hall.

YEAR 1 - WP4.1 Conceptualisation of Urban Neighbourhood Green Index (UNGI) and data collection for the UNGI

Monitoring urban expansion and UGS change is an urgent need for planning and decision-making. Sustainable urban planning requires, high resolution and recent state of the art land cover or use classification in order to maintain a continuous land use monitoring in Phnom Penh. The land cover classification is as a transdisciplinary product as additional to our WP, WP#5 uses it as layer to complete the urban climate map. WP#4 will use the improved classification to calculate a modified version of the urban neighbourhood green index (UNGI). In the definition phase WP#4 tested and is currently preparing a first land cover classification using a support vector machine-based approach. In the research phase WP#4 aims to achieve further accuracy improvements of the support vector machine based classification using up to date and comprehensive ground-truthing data by creating training and validation samples.



Ground based samples will be collected using the mobile phone app 'Input APP'. Within the first year we used the app already and evaluated the collected data and will enhance the data collection by improving critical features in the research phase. In addition, we are aiming to take multispectral images of the sample points using unmanned aerial vehicles (UAV's) in the research phase. For the training and validation data collection, we use a random sample design, distributed over the whole research area. The chosen sample design accounts for the spatial heterogeneity of the area. All research steps are following a detailed documentation of the specific requirements for the data preparation and integration which offers insights into the open source software QGIS based methodology.

Summary:

1. New methods for ground based observation will be tested together with the partner universities → Input APP / UAV
2. Land cover classification will be used from WP#4 for UNGI calculation and from WP#5 for the climate map
3. The index calculation will be based on the latest cloud free multispectral satellite high resolution images
4. The study area comprises the complete administrative boundaries and urban fringes of Phnom Penh

UNGI calculation: Roundtable workshops and Science Workshops will be held on the partner Universities to ensure that all research partners have the same level of knowledge. In the first year the main topic of the workshops will be the presentation of the concept of Green Infrastructure and Ecosystems Services linked to the methodical approach from the UNGI.

Data collection: The evaluation and preparation of the collected data will take place in the well-equipped university computer labs in Cambodia and Germany. This deals with georeferencing of multispectral images of UAV and point collection with Input' APP



YEAR 2 - WP4.2 UNGI parameter operationalisation and spatial verification

Based on the research outcomes of the first year, WP#4 team will finalize the land cover classification and start with the calculation of the four main indicators of the UNGI to measure the spatial distribution and quality of green in the urban perimeter of Phnom Penh:

1. Amount of green
2. Proximity to green
3. Density of built-up
4. Height of structures / population density

The results of each parameter inherits a classification of urban green in percentage. Subsequently the weighting of each indicator determines the importance each parameter / indicator will have within the calculation. A pairwise comparison matrix will be developed based on expert's opinion and assigns weight to each indicator. Believing UGI forms an integral part of any urban area and quantity and quality of urban green space is of prime concern for planners and city administrators, the integration of such stakeholders thus may offer valuable insights into the prioritization of each of the indicators used for the final UNGI calculation (Gupta et al., 2012). The discussion with Phnom Penh Municipality will be facilitated through the Build4People Ecocity Transition Labs and the sustainable building arena.

YEAR 3 - WP4.3 Analysis and application of UNGI for assessing selected neighbourhoods

With the stakeholder analysis results leading to weighted parameters for the UNGI, the final product is able to reveal spatial distribution and qualitative aspects of neighbourhood urban green areas in Phnom Penh. These results are used to identify neighbourhoods of priority in terms of best practice examples as well as areas for specific improvements to be proposed according to the ecosystem service functionality discussed earlier and in view of spatial distribution of urban green connectivity.

Furthermore, the gathered data from the Input-App are analyzed in regard to the *B4P UQoL Model Development*.

A detailed process guideline documentation will be created for distribution with the RUA CIDRI and PPCA to enable further local applicability on individual terms. Training material as well as informational guides are established so that the methodology for the creation of the UNGI in Phnom Penh can be conducted at any time.



YEAR 4 - WP4.4 Integration of other UQoL parameters into UNGI

Of interest for our research is Merschdorf et al. (2020) recent study on objective and subjective data. The main goal of their study was to model and understand urban characteristics, and people's perceived quality of urban life (UQoL), using statistical analysis and geospatial modelling. Subjective data was also the concern of Stessens et al. (2020) but instead of trying to model UQoL, they concentrate on the modelling of UGS and the perception of its qualities. Both studies used a multiple linear regression model to predict the cause and effects from dependent and independent variables.

The emphasis of our model approach is twofold;

1. Firstly, we want to find suitable indicators to successfully predict (perceived) UQoL by using subjective data as dependent variables derived from the UQoL household survey.
2. Secondly, we want to gain insights into the relation between the overall quality of UGS, as perceived by citizens, and the way they rate different sub-qualities of UGS (Stessens et al., 2020). The data derived from the citizen science approach is described in the following chapter.

For both research objectives, statistical models will be developed in close cooperation between WP#4 and WP#1. WP#1 is responsible for the household survey and the overall UQoL model process.

WP#4 has now finalized its spatial quantitative analysis of GI and obtained much objective information on urban green characteristics. This information will be used and integrated into a principle component analysis to develop uncorrelated components.

The outcomes will serve as independent variables in a multiple linear regression analysis. As previously mentioned, the dependent variables derive from two different sources, the UQoL household survey and the citizen science project using the Input App. All answers will be put into a GIS-based data model. Subsequent research will follow the established statistical relations between objective data (green indicators), deriving from relevant data layers and describing different UGS characteristics, and subjective data, derived from the household survey of the citizen science project as proposed by the above mentioned authors a Merschdorf et al. (2020) and Stessens et al. (2020). We will also consider the use of a multiple linear regression model which allows the integration of more than one explanatory variable. The outcome of this research should lead to a better understanding of the perceived UQoL in Phnom Penh, from a citizen perspective, and should help us to integrate those results into urban planning and urban design processes in the future.



WP#4 Research Plan for the Citizen Science Input App

This chapter gives an introduction to Citizen Science Input App for what WP#4 will take the technical lead to design and develop the data structure for the mobile phone app. In the research phase following sub-milestone should contribute to the successful implementation of the project

WP#4 Sub-Milestones Citizen Science Project using Input App and Web Platform

- WP4.1.4 Planning, design and implementation of data management concept of objective and subjective data using smartphone App – Input
- WP4.2.3 Adaptation of critical features according to gained practical experience; Distribution and implementation of UQoL Input App
- WP4.3.3 B4P UQoL Input-App analysis and evaluation of first results; B4P UQoL Model Development / Data Modelling
- WP4.4.3 Feasibility study to grasp UQoL by means of Citizen Science Input APP, including budget plan (WP#4) in preparation of Build4People Implementation Phase

Citizen Science Input App/ Mergin

APP-based data survey reflecting user perception of urban green space in Phnom Penh

Believing that urban green spaces directly affect urban climate, biodiversity, general human well-being, as well as people's health - physically, socially and mentally of citizens. Consequently, quality of urban green space is more perceived as a critical factor for quality of life in urban areas and a key component of sustainable urban design and planning.

Input App developed by Lutra Consulting as open source technology and free of charge. The App for field data collection is a simple survey app allowing users to collect and store object attribute data during the mobile mapping activity in field. Forms and data preparation can be done in a QGIS software environment.

Inside the Build4People project, the Citizen Science Input App is a joint activity between different work packages and in specific from WP#1 (Behaviour Change), WP#5 (Urban Climate), WP#4 (Urban Green) and WP#7 (Overall Project-Coordination).

For the elaboration of this application and assuring the integrity referring to the spatial data flow and the quality of the software's source code and the overall security including privacy violations of the survey, the Build4People team will contract Lutra consulting Limited. A detailed work description can be found below.

Main Aim: Using Input App –Citizen Science Input App wants to assess the relative importance residents assign to different qualities of urban green and open spaces in Phnom Penh. During the definition phase of the project three main green indicators are identified, including accessibility of green spaces, availability of green spaces and the use of green spaces. Now, we aim to create an urban green space assessment decomposing green indicators and users perception of green space into quantifiable and measurable categories. In doing so, the project team strives to establish a simple and easily reproducible overall quality indicator for urban green space in Phnom Penh.

Method: Build4People (WP1) conducts a household survey combining subjective and objective factors in regard of UQoL. Based on this survey, we will integrate several questions



on the topic of urban green space from the questionnaire into spatial data forms in the Input App. Using GIS solution like Input and web forms, the Build4People project is enabled to collect, store and present the data into a spatial environments and subsequently analysis the data using geographic software QGIS.

In order to reach a wide range of audience, assure data quality through the collection, avoid bias and exhausting data cleaning, the project team emphasis is to use a hybrid method including two methods on data collection. Conceptualization of methods refer to the work of Stessens et al 2020 and considers a comprehensive data structure and allows to include several meaningful quality aspects and attributes of urban green space.

Method 1: Mobile app (Input App) –Citizen Science Interviews led by students

Use Input App to collect information on the citizen's subjective perception and assessment on the quality of urban green spaces.

Method 1 uses the already existing app infrastructure of the Input App and adapts this according to the specific project needs. For using the Input App it is necessary to:

- users should have some basic knowledge of GIS
- create a user account with the cloud storage to save the data to
- install the app on its mobile device.

Just then each member can start filling the forms and related information for the purpose of the survey. While using the app, any user can view and edit others participants' data and information. This would require a major change in the data security model within the app as in its current form, it could lead to bias in the data and. To work around this problem, we will train and introduce students to the use of the Input App and have them collect data from participants. This data collection will be supported by the WP related local universities mainly RUA and RUPP. Location of the interviews must be determined as the project progresses, e.g. Public Parks, in front of Malls, Public spaces. It is emphasized to record about 300 participants. Participants. The number for participants is for just an estimation and will be adapted according to the project needs and prospects. The sample size (participants) can be scaled down/up depending on the relative size of your study area.

Organization of questionnaires

Cluster green indicators / quality attributes into thematic main categories and sub-categories.

- a) Select a comprehensive and meaningful set of clearly distinct quality aspects of
- b) Cluster quality of aspects into larger themes, themes still have to be discussed
- c) Choose different base maps for the visual orientation (Open Street Map or Bing for the entire city and high resolution images for B4P Ecocity specific study area)

Description of work flow all steps recorded by students

- a) Participants indicate their home location on the map , mark with point
- b) The participant indicate if they go by foot or motorbike
- c) Participant indicate three closest publicly accessible green spaces on the map and mark those with a point
- d) Now, the student starts with the questionnaire, categories Q1, Q2, Q3 including each specific sub-categories and enters the answer of the participant



Timeline: First test-run in the March 2022, exact date tbc

Method 2: Web forms

Use web forms to collect information on the citizen's subjective perception and assessment on the quality of urban green spaces.

For method 2 we will use a simple web form with mapping element to collect data. According to the special needs for the project, Lutra Consulting Limited will develop a customized web application. For the data flow, we will follow the main ideas as described above for the overall assessment but instead of using Input App, we now using the customized web application. Same as Input App the application uses a plugin for QGIS and stores the data into the Mergin server. Opposite to Input App, the web form user interface will be simple and intuitive, this is important by a citizen's science project because not everyone is a GIS practitioner.

Additional to the household survey, WP1 will have a linked data- set from participants who took part in the face -to face interviews and used the web platform as well. The subsequent data analysis takes place using the open source geographic information software QGIS.

Description of work

1. Method 1 will be slimmed down to an attractive, short gamified citizen science based questionnaire
2. Customized web application developed by Lutra Consulting Limited for the specific project needs)
3. The participants will get a QR-code with direct link to the web page where they can fill out the form (optimized for mobile devices)
4. The participant indicate if they go by foot or motorbike
5. The participant indicate the nearest publicly accessible green spaces
6. Participants will answer very short questionnaire
7. Participant will submit his answer and the a new point is added to the map

Timeline: The web platform needs to be ready in **August 2021**

Recruitment of participants

1st year of the project complementary to the face-to face interviews of the household survey

2nd year refinement of critical features and distribution of telegram, face book, B4P consortium and contacts, research partners, local NGO's etc.



WP#4 Milestone and Impact and Sub-Milestones

WP.4.1 Conceptualisation of Urban Neighbourhood Green Index (UNGI) and data collection for the UNGI

Expected Impact: *Understanding the spatial dimension of the UGS in Phnom Penh concerning 4 parameters*

- WP4.1.1 Update of bibliography and detailed literature review of spatial assessment of urban green infrastructure in combination with urban green space qualities: A citizen science approach to incorporate users perceptions on UQoL
- WP4.1.2 Science Workshop at RUA on urban green infrastructure and the data collection for the urban green neighbourhood index (UNGI)
- WP4.1.3 Planning and preparation of data collection for the UNGI and according to demands of all WPs.
- WP4.1.4 Planning, design and implementation of data management concept of objective and subjective data using smartphone App - Input

WP4.2 UNGI parameter operationalisation and spatial verification

Expected Impacts: *Transdisciplinary understanding of UNGI and the concept of urban green infrastructure among urban planning stakeholders in Phnom Penh, UNGI is operational within the B4P Team*

- WP4.2.1 UNGI spatio-statistical classification and verification of UNGI results in Phnom Penh
- WP4.2.2 Product development and calculation of main parameters/ indicators for UNGI
- WP4.2.3 Adaptation of critical features according to gained practical experience; Distribution and implementation of UQoL Input App
- WP4.2.4 Presentation of transdisciplinary application of UNGI results in urban planning activities of the B4P Eco-transition Lab and Phnom Penh municipality; Multi-Stakeholder discussion on the weights of each index

WP4.3 Analysis and application of UNGI for assessing selected neighbourhoods'

Expected Impacts: *Informed planning decisions can be taken, as UNGI support, monitoring urban green module integrated into Buld4People Toolbox for Sustainable Neighbourhoods and Development, UNGI comparison of selected neighborhoods in terms of availability and accessibility of green spaces can be achieved.*

- WP4.3.1 Recommendation maps of UNGI and presentation of such
- WP4.3.2 Assessment of specific neighbourhoods regarding urban green infrastructure and their quality of green
- WP4.3.3 B4P UQoL Input-App analysis and evaluation of first results; B4P UQoL Model Development / Data Modelling
- WP4.3.4 Derive comprehensive methodical approach for the calculation of the UNGI in specific for Phnom Penh.



WP4.4 Integration of other UQoL parameters into UNGI

Expected Impacts: Improved assessment of UNGI is enabled, highlighting challenges and opportunities in urban planning processes.

- WP4.4.1 Design and development of an UNGI planning instrument for administrators and the integration of UNGI process into Build4People Tollbox for Sustainable Neighbourhoods and Development
- WP4.4.2 Development and adaptation of greening strategies and adequate conceptionalization of urban green infrastructure
- WP4.4.3 Feasibility study to grasp UQoL by means of Citizen Science Input APP, including budget plan (WP#4) in preparation of Build4People Implementation Phase
- WP4.4.4 Integration of results of UQoL Input -App in the UQoL and sustainable living and description of the overall use and further implementation of App



WP#4 Work- and Implementation Plan

The following table depicts a detailed, numbered list of all WP#4-Milestones. All procedures (work steps) are listed with respect to the following the categories: Activities, methods, products, aims/results, and transdisciplinary connection to other work packages within the Build4People project.

The timetable depicts the 4 years of the "research and development phase". Trans- and interdisciplinary procedures are labelled with the prefix *Build4people*. Procedures that are labelled with the prefix WP account for the WP#4 work package.

Working package 4 serves trans-disciplinary by giving recommendation for urban green infrastructure. Furthermore, it gives knowledge to governance processes in Phnom Penh. For implementation the guidelines provide a fundamental procedure for urban green infrastructure orientated planning. In principle the work plan makes proposal in which time scale and in which areal scale urban green structures and their interconnectivity can be implemented.

B4P RESEARCH & DEVELOPMENT PHASE	Activities	Methods	Products
Work Steps	Aims / Results	Trans-disciplinary Cooperation	
I. Build4People Coordination Meetings in Germany	Regular exchange within the Build4People project team Ongoing conceptualisation and modelling of Urban Quality of Life (UQoL) Face-to-face meetings in the context of the milestones, in-between regular online-meetings (every two months) Organizing and hosting a workshop for all German Project Partners regarding the data-based transdisciplinary conceptualization and operationalization on of the urban neighbourhood green index (UNGI) and the citizen science data collection via Input App, a smartphone app to store and collect data		
	Presentations, discussions and exchange of the specific WP4 scientific research		
	Presenting results of the UNGI and Input App data collection to the other WP's Preparing a joint scientific dissemination using the achieved results from the UNGI calculation and the B4P UQoL citizen's science project and integrate those into the other WP specific scientific outcomes		
	Milestone B4P WS1: Build4People RD-Phase Kick-off Meeting, Hamburg (Month 01) Milestone B4P WS2: Build4People UQoL-Survey Workshop, Magdeburg (Month 13) Milestone B4P WS3: Build4People UQoL-Processing Workshop, Eberswalde (Month 25) Milestone B4P WS7: Build4People Proposal Writing Workshop, Hamburg (Month 37)		
	Joint general research understanding (WS1) Joint scientific-conceptual work on urban quality of life (WS2 / WS3) Joint agreement of content of Build4People Implementation Phase proposal (WS4) Capacity mobilisation due to insights on urban sustainability best practices in Germany for invited research partners from Cambodia (WS4)		
	Managed by WP#7 with input from all other WPs		



II. Science / Roundtable Workshops / Focus Group Discussions in Cambodia	Regular scientific exchange with local research partners and local stakeholder groups focusing on conceptualization, data collection and operationalization of urban green (infrastructure).parameters in Phnom Penh Understanding the application of the urban green neighbourhood index and its methodology to assess the quality of urban green in Phnom Penh at Sangkat level. Set-up a comprehensive research design for UNGI data collection, Create a knowledge base about the concept of urban green (infrastructure) and its integration into the urban planning process at the Phnom Penh Municipality.
	Presentations, discussions of state of art
	Milestone WP#4 SW1 (Month 04): Scientific Workshop on ground base data collection and the enhanced method on land cover classification Milestone WP#4 SW2 (Month 10): Focus Group Discussion : The use of citizen science approach to collect qualitative data on urban green space Roundtable workshop Milestone WP#4 SW3 (Month 15): Roundtable workshop on the urban neighbourhood green index and its integration into urban planning Milestone WP#4 SW4 (Month 22): Focus Group Discussion on key aspects of urban green infrastructure. Milestone WP#4 SW5 (Month 27): Focus Group Discussion on the urban neighbourhood green index and its integration into urban planning Milestone WP#4 SW6 (Month 34): Roundtable Workshop on the evaluation of results from the urban neighbourhood green Index Milestone WP#4 SW7 (Month 39):Group discussion on UQoL model development / data modelling Milestone WP#4 SW8 (Month 46): Roundtable Workshop presentation and evaluation of UQoL model process
	Increased mutual understanding and enhanced coherence of the project's objectives related to WP#4 specific the concept of urban green Joint agreement with WP1 and WP5 and WP7 in regard of research design and methodologies for the B4P UQoL citizen's science project Insights into opinions of local stakeholder groups Conceptualization and UNGI parameter operationalization Integration of UNGI into urban planning / greening strategies increased transdisciplinary understanding of UQoL Data collection via App Increased understanding about the importance of urban green infrastructure in PP
	Managed by each WP; Exchange with all WPs and research partners and implementation partners Joint preparation and conduction of the workshop with WP1 and WP5; feeding in results to WP2, WP3 & WP6
III. Build4People Conferences in Cambodia	Organisation of Build4People conferences with all German and Cambodian partners and relevant stakeholders
	Presentations / panel rounds / discussions
	Milestone B4P K1: Build4People Research Conference (Month 03) Milestone B4P K2: Build4People Research Conference (Month 26) Milestone B4P K3: Build4People Research Conference (Month 46)
	Increased public awareness and mutual understanding of the different Work Package approaches of the Build4People project Networking with stakeholders from the state, economy and civil society Discussion of model-based planning strategies to foster urban quality of life (K3)
	Managed by WP#7 with input from all other WPs
IV. Scientific and Societal Problem Based Research:	Updated literature review and the status of the spatial assessment of urban green infrastructure in combination with urban green space qualities. Use of citizen science to incorporate users perceptions on UQoL with special regards to urban green space / infrastructure



Data Collection and Analysis	<p>Planning and preparation of data collection for the UNGI</p> <p>Product development and calculation of four parameters/ indicators for the UNGI</p>
<p><i>IV.A. WP-related research</i></p>	<p>Compilation and systemic review of most recent publications</p> <p>Spatial assessment of urban green infrastructure in PP in the Asian context</p> <p>Integration of spatial modelling using objective and subjective data in order to reflect qualitative user perception on green space as an important factor for overall UQoL</p> <p>Apply random sample design to generate training and verification data for the land cover classification using mobile devices Input App and UAV for ground based data collection</p> <p>UAV flight of study area related to Build4People Ecocity Transition Lab</p> <p>Calculation of UNGI index parameters using GIS methods</p> <p>Milestone WP#4 R1 (Month 02): Updated bibliographic research and literature</p> <p>Milestone WP#4 R2 (Month 12): Conceptualisation of UNGI and data collection for the urban neighbourhood green index (UNGI)</p> <p>Milestone WP#4 R3 (Month 24): UNGI parameter operationalisation and spatial verification using mobile devices (Input App and UAV)</p> <p>Increased understanding and knowledge of state of the art of the role and function of urban green (infrastructure) in Asian cities concerning sustainable urban planning of UNGI in Phnom Penh</p> <p>Transdisciplinary, geospatial and citizen science research methods of B4P (WP#4) can improve urban quality of life in cities in South-East Asia?</p> <p>Managed by WP#4</p>
<p>IV. Scientific and Societal Problem Based Research: Data Collection and Analysis</p> <p><i>IV.B. Build4People UQoL Household Survey / Data Input via APP</i></p>	<p>Preparing the Build4People UQoL household survey (collection of relevant questions from all WPs, compilation of questionnaire, pre-testing, etc.)</p> <p>Conducting the survey in cooperation with market research company: data collection and first data analysis</p> <p>Planning, design and implementation of a data management concept for objective and subjective data using a mobile smartphone Input App</p> <p>Statistical analysis</p> <p>Discussing first results on urban quality of life as perceived by citizens of Phnom Penh.</p> <p>Overall planning and designing a Spatial Data Infrastructure (SDI) and data flow for the B4P project in cooperation with Lutra Consulting</p> <p>B4P Milestone TR1: (Month 04): Final version of questionnaire for household survey</p> <p>B4P Milestone TR2: (Month 08): Final version of the <i>Citizen Science Input APP</i> (Integration of subjective evaluation of objective factors);</p> <p>B4P Milestone TR3: (Month 12): First results / analysis of collected data from Citizen Science Input APP and from household survey</p> <p>Insights into objective / subjective factors influencing urban quality of life in Phnom Penh</p> <p>Mutual trans-disciplinary understanding of urban quality of life</p> <p>Increased awareness about the importance of urban quality of life among stakeholders</p> <p>Preparation of survey results in regard of B4P Milestone WS2: Build4People UQoL-Survey Workshop at Magdeburg University (Month 13)</p> <p>First implementation of Citizen Science Input App project using Input App</p> <p>Scientific-conceptual lead WP#1 with support from WP7</p> <p>Data-Management lead WP#4</p> <p>Input from all other WPs</p>
V. Trans-Disciplinary Action Research:	<p>Exploration and application of innovative methodologies of collaborative and participatory planning in the context of an Eco Lab based on a case study site typical for current urban development issues in Phnom Penh</p> <p>WP#4 Supporting and actively participating in the Ecocity Transition Labs</p>



<p>Process Facilitation and Product Development</p> <p><i>V.A. Build4People EcoCity Transition Lab Process</i></p>	<p>Charrette as an integrated design workshop based on community planning approaches Hands-on-planning sessions and report-back sessions Input presentations Intensive stakeholder management process WP#4 Input on the concept of urban green infrastructure; WP#4 Input on UNGI and greening strategies WP#4 Presentation of recommendation maps</p> <p>B4P Milestone TL1: (Month 10): Ecocity Transition Lab I: Masterplan Study Area & Design Strategies B4P Milestone TL2: (Month 27): Ecocity Transition Lab II: Neighbourhood Plans & Guidelines B4P Milestone TL3: (Month 34): Ecocity Transition Lab III: Criteria & Implementation Strategies</p> <p>Deepened understanding of the local planning issues Empirical research and testing of general research findings based on a case study site Improved collaboration between local experts and decision makers Preparation of strategies, guidelines and criteria in regard of the Build4People Toolbox for Sustainable Neighbourhoods and Development Establishing cross-linkages to Build4People Sustainable Building Arena (SBA) Capacity mobilisation at all involved parties</p> <p>Scientific-conceptual lead WP#3 with support from WP#7 Input from all other WPs</p>
<p>V. Trans-Disciplinary Action Research: Process Facilitation and Product Development</p> <p><i>V.B. Build4People Sustainable Building Arena Process</i></p>	<p>Participatory workshop series with front-runners from different stakeholder groups WP#4 Supporting the Sustainable Building Arena Process workshops and participation</p> <p>Preparation, coordination and implementation of a transition management process (incl. interactive knowledge generation, world-café workshops, interviews, questionnaires, participant observation, input presentations, etc.) WP#4 Input on the concept of urban green infrastructure; WP#4 Group discussion on assignation of weight per index used for the UNGI</p> <p>B4P Milestone SBA1: (Month 14): Implementation of first SBA workshop cycle B4P Milestone SBA2: (Month 27): Implementation of second SBA workshop cycle B4P Milestone SBA2: (Month 39): Workshop on Experiment Facilitation</p> <p>Co-development of challenge framing, a spatio-sectoral vision and a transition agenda to support alternative discourses, marginalized actors, social learning, network building and knowledge communication to ultimately inform an urban sustainability transition</p> <p>Scientific-conceptual lead WP#6 with support from WP#7 Input from all other WPs</p>
<p>V. Trans-Disciplinary Action Research: Process Facilitation and Product Development</p> <p><i>V.C. Build4People Sustainable Building Business Incubator Process</i></p>	<p>Facilitation of Sustainable Building Business Incubator Process in cooperation with Phnom Penh Impact Hub Supporting the Sustainable Building Incubator Process workshops and participation</p> <p>Strategic Niche Management: Preparation, coordination and implementation of incubator process (incl. input presentations, mentoring, masterclasses, field trip) WP#4 Input on the concept of urban green infrastructure</p> <p>B4P Milestone SB11: (Month 19): Final conceptualization of the Incubator Design B4P Milestone SB12: (Month 22): Incubator Kick-off B4P Milestone SB11: (Month 26): End of Incubator and pitch to investors B4P Milestone SB11: (Month 32): Incubator reflection report</p> <p>The Sustainable Building Incubator aims to connect the Build4People project to the local entrepreneurs and change makers. Under the guidance of WP#6, Impact Hub Phnom Penh and local mentors, B4P team and insights will be connected to the entrepreneurial ecosystem to realize sustainability-oriented solutions. These shall subsequently be implemented experimentally with third party funding.</p>



	Scientific-conceptual lead WP#6 with support from WP#7 Input from all other WPs
V. Trans-Disciplinary Action Research: Process Facilitation and Product Development	Participatory workshops with different stakeholders and representatives of different target groups, e.g. on sustainable buildings and housing (with new consumers representatives, housing estate management companies, other stakeholders within the case study of the Build4People Ecocity Transition Lab) WP#4 Supporting the Build4People UQoL Process workshops and participation
V.D. Build4People UQoL Citizen Science Process	World café on sustainability + scenario-based methods with the topic: urban quality of life, norms, values. Application of participatory methods, e.g. back-casting WP#4 Adaptation of the Citizen Science Input APP
	B4P Milestone QI1: (Month 14): Multistakeholder Workshop on UQoL (focus application) B4P Milestone QI2: (Month 22): Focus Groups with new consumers (focus on conflicts between individual lifestyle claims and sustainability goals)
	Basis for data-based planning suggestions to increase urban quality of life in Phnom Penh; Reducing the own ethnocentric bias; Further technical development of the Citizen Science Input APP
	Scientific-conceptual lead WP#1 with support from WP#7 Data-Management lead WP#4 Input from all other WPs (workshop preparation and participation) Feeding in results to the other Build4People action research processes
VI. (Re-)Integration of Created Knowledge Refinement and Revision of Theory	Integration of feedback loops from phase of scientific and societal problem-based research and from of action research (Re-)integration of created knowledge Refinement and revision of theory UNGI parameter operationalisation and spatial verification
VI.A. WP-related research	Review of existing theories Connection of theory with results from three research spheres of Build4People RD-Phase Publication of scientific papers Wp#4Recommendation maps of UNGI and presentation of such WP#4Assignment of weight per UNGI Parameter WP#4Assessment of specific neighbourhoods regarding urban green infrastructure and their quality of green
	Milestone WP#4 RF1 (Month 37): Analysis and application of UNGI for assessing selected neighbourhoods Milestone WP#4 RF2 (Month 48): Integration of other UQoL parameters into UNGI
	Refinement and revision of theory Dissemination of research results at Build4People Outlook Conference Preparation for publications WP#4Spatial assessment and transdisciplinary discussion of the UNGI across Phnom Penh WP#4Derive statistical model for investigation of UQoL indicators support to the process of building an urban green infrastructure strategy facilitate the search for solutions and new ideas to develop and manage urban (infrastructure) in an urban context
	Managed by each WP Trans-disciplinary cooperation in regard of publishing joint scientific papers
VI. (Re-)Integration of Created Knowledge Refinement and	Modelling of the Urban Quality of Life concept by integrating subjective and objective data collected by means of the survey, the Citizen Science Input APP and others by other WPs WP#4Integration of other UQoL parameters into UNGI
	Theory-driven and data-based statistical modelling



<p>Revision of Theory</p> <p><i>VI.B. Build4People trans-disciplinary UQoL-Model Development</i></p>	<p>B4P Milestone QM1: (Month 35): 1st draft of Urban Quality of life (UQoL) Model (based on survey + UQoL process; objective data and results from the UQoL Process included)</p> <p>B4P Milestone QM2: (Month 45): Feasibility study to grasp UQoL by means of Citizen Science Input APP, including budget plan (WP#4) in preparation of Build4People Implementation Phase</p> <p>B4P Milestone QM3: (Month 48): Final version of a theory-driven, data-based, and context adapted UQoL Model</p> <p>Preparation of scientific papers introducing the transdisciplinarily developed UQoL Model</p> <p>UQoL Model based planning strategies to foster urban quality of life in Phnom Penh as part of Build4People Toolbox for Sustainable Neighbourhoods and Development (also in preparation of Build4People Implementation Phase)</p> <p>Detailed instructions for software company to develop an UQoL-App</p> <p>Scientific-conceptual lead WP#1 with support from WP#7</p> <p>Data-Management lead WP#4</p> <p>Input from all other WPs</p>
<p>VII. Build4People Dissemination</p> <p><i>VII.A. Build4People Poster / Photo Exhibitions</i></p>	<p>Preparation of poster and photo exhibitions in cooperation with cultural dissemination partner META House Phnom Penh</p> <p>Preparation of WP4 input to poster exhibitions</p> <p>Processing of science-based knowledge for a wide audience</p> <p>B4P Milestone EX1: (Month 15): Green Buildings and Sustainable Neighbourhoods – Case Studies and Best-Practice from Asia</p> <p>B4P Milestone EX2: (Month 34): Results of the Build4People Ecocity Transition Lab</p> <p>B4P Milestone EX3: (Month 45): Photo Exhibition Sustainable Lifestyle Pioneers in Cambodia</p> <p>General information on the people-led transdisciplinary Build4People approach</p> <p>Enablement of networking activities between stakeholders from state, economy and civil society</p> <p>Increased awareness about issues of green buildings, sustainable neighbourhoods and sustainable lifestyles</p> <p>B4P Milestone EX1 / EX2: Scientific-conceptual lead WP#3 with support from WP#7</p> <p>Input from all other WPs</p> <p>B4P Milestone EX3: Conceptual Scientific-conceptual lead WP#7 and WP#1 (based on the Build4People Awareness Campaign: UQoL & Sustainable Living)</p>
<p>VII. Build4People Dissemination</p> <p><i>VII.B. Build4People Outreach Events</i></p>	<p>Management of outreach events to disseminate the results of the Build4People project with two main partners 1) Centre of Khmer Studies CKS) mainly reaching out to the academic / NGO-sector and 2) European Chamber of Commerce (EuroCham) mainly reaching out to the corporate sector</p> <p>Regular presentations of select research results with the support of our dissemination partners, either face-to-face or online (webinar-format)</p> <p>B4P Milestone OR1: (Month 03): WP#7 (CKS)</p> <p>B4P Milestone OR2: (Month 06): WP#5 (CKS)</p> <p>B4P Milestone OR3: (Month 09): WP#2 (Eurocham)</p> <p>B4P Milestone OR4: (Month 12): WP#6 (CKS)</p> <p>B4P Milestone OR5: (Month 15): WP#4 The importance of Urban Green Infrastructure in times of Global Climate Change and its application to Phnom Penh? (Eurocham)</p> <p>B4P Milestone OR6: (Month 18): WP#1 (CKS)</p> <p>B4P Milestone OR7: (Month 21): WP#3 (EuroCham)</p> <p>B4P Milestone OR8: (Month 24): WP#7 (EuroCham)</p> <p>B4P Milestone OR9: (Month 27): WP#7 (CKS)</p> <p>B4P Milestone OR10: (Month 30): WP#2 (Eurocham)</p> <p>B4P Milestone OR11: (Month 33): WP#4 Presentation of results of the spatial data analysis concerning the Urban Green Neighbourhood Index (CKS)</p> <p>B4P Milestone OR12: (Month 36): WP#3 (EuroCham)</p> <p>B4P Milestone OR13: (Month 39): WP#6 (CKS)</p>



	<p>B4P Milestone OR14: (Month 42): WP#1 (EuroCham) B4P Milestone OR15: (Month 45): WP#5 (CKS) B4P Milestone OR16: (Month 48): WP#7 (EuroCham)</p> <p>Increased awareness and knowledge about the research of the different Work Packages of the Build4People project Dissemination about Build4People processes and products</p> <p>Lead by WP#7 with support from other WPs</p>
<p>VII. Build4People Dissemination</p> <p><i>VII.C. Build4People Toolbox including Build4People Handbook</i></p>	<p>Compiling and preparing research results for dissemination; Input to the Handbook for Green Housing and Sustainable Living, a richly illustrated publication targeting a wide audience trying to convince people to implement sustainable housing solutions;</p> <p>Writing chapters and providing graphic material for this publication Writing a chapter on a) data collection and perceived quality of urban green b) UNGI as planning instrument for greening strategies</p> <p>B4P Milestone TB1: (Month 15): First editorial meeting: Joint development of a Handbook content structure together with the local partners; distribution of related tasks B4P Milestone TB2: (Month 22): Second editorial meeting: Presentation of the Handbook inputs by the various partners and joint agreement on the visual design; management of the translation, language editing and the printing procedure B4P Milestone TB3: (Month 27): First editorial meeting to discuss content of Toolbox B4P Milestone TB4: (Month 34): Publication of the Handbook for Green Housing and Sustainable Living during a roundtable workshop (milestone SW6); development of a distribution, dissemination and impact management strategy B4P Milestone TB5: (Month 39): Web-Interface of Handbook ready (with inter-active elements) / first draft of Toolbox ready B4P Milestone TB6: (Month 46): Web-Interface of Toolbox ready B4P Milestone TB7: (Month 48): Build4People Toolbox Executive Summary Report: Science- and societal based strategies to foster urban quality of life in Phnom Penh</p> <p>Build4People Toolbox for Sustainable Neighbourhoods and Development : Criteria among experts Build4People Handbook: Awareness rising, transfer of knowledge, better household decisions in the field of green housing and sustainable living among the general public Mass effects through replication</p> <p>Conceptualisation of Build4People Toolbox for Sustainable Neighbourhoods and Development by WP#3 with input from all other WPs Conceptualisation of Handbook by WP#7 with input from all other WPs Dissemination managed by WP#7 with support from all other WPs</p>
<p>VII. Build4People Dissemination</p> <p><i>VII.D. Build4People Industrial Fair Representation</i></p>	<p>Representing the Build4People project at important industrial fairs in Cambodia Renting of a Build4People booth and dissemination of Build4People PR-materials Participating as presenter at related symposia / panel discussions</p> <p>PR-Work Representation and networking Providing evidence-based scientific research results to foster sustainability solutions in the corporate sector WP#4 Input on the concept of urban green infrastructure and WP#4 perspectives</p> <p>B4P Milestone IF1: (Month 17): Cambodia Architecture & Décor 2022 B4P Milestone IF2: (Month 34): Industrial Fair Representation 2023 (specific event tbd)</p> <p>Dissemination of the Build4People approaches to representatives from the private sector Raised interest in supporting Build4People activities during Implementation Phase from the corporate sector</p>



	Managed by WP#7 with input from all other WPs
VII. Build4People Dissemination	Development of an urban quality of life and sustainable living awareness campaign; exchange with stakeholders and research partners; recommendations for a social marketing campaign WP#4 Supporting awareness campaign activities
<i>VII.E. Awareness Campaign: UQoL & Sustainable Living</i>	Theory-driven and data-based planning and designing of a campaign; participatory process and methods, focus group discussions with different target groups; interviews with stakeholders WP#4 Input on relevant research topics according to WP#4 perspectives
	B4P Milestone AC1: (Month 24): Data-based and theory-driven framework for awareness campaigning in order to foster ecological awareness, pro-environmental social norms and sustainable lifestyles in Phnom Penh B4P Milestone AC2: (Month 38): Implementing a <i>trial</i> of a selected intervention on behaviour change (specific target group in the case area regarded within the ECTL process) B4P Milestone AC3: (Month 48): Final version of a Campaigning Module within the Build4People Toolbox for Sustainable Neighbourhoods and Development
	Increased understanding about people-environment interactions and behaviour change Mass effects through replication
	Lead by WP#1 with input from all other WPs (among others collected through WP1 Milestone SW6 (Month 34): Roundtable Workshop on awareness campaign strategies
VII. Build4People Dissemination	Comprehensive management of Build4People social media activities
<i>VII.F. Build4People Social Media-Campaign</i>	Feeding in information on Build4People activities at Build4People Homepage, ResearchGate and on several social media platforms (Facebook, LinkedIn, Build4People YouTube channel, Instagram) Preparing for Build4People PR-video clips
	B4P Milestone SM1: (Month 01): Build4People Social Media Strategy RD-Phase B4P Milestone SM2: (Month 12): Build4People Social Media Report Year 1 B4P Milestone SM3: (Month 24): Build4People Social Media Report Year 2 B4P Milestone SM4: (Month 36): Build4People Social Media Report Year 3 B4P Milestone SM5: (Month 48): Build4People Social Media Final Report RD-Phase – Lessons learnt in regard of Implementation Phase
	Increased awareness and knowledge about Build4People related activities and products reaching out to different target groups (e.g. experts, professionals, academia, general public, youth)
	Managed by WP#7 with input from all other WPs
VIII. Build4People Donor Implementation Workshops	Organisation of regular workshops with donor organisations thereby introducing the Build4People project to donor organisations with the aim to prepare for Build4People supported projects during the subsequent Implementation Phase WP#4 Supporting the Implementation workshops and participation
	Input on the concept of urban green infrastructure; data collection with Input App
	B4P Milestone SM1: (Month 01): Build4People Social Media Strategy RD-Phase B4P Milestone SM2: (Month 12): Build4People Social Media Report Year 1 B4P Milestone SM3: (Month 24): Build4People Social Media Report Year 2 B4P Milestone SM4: (Month 36): Build4People Social Media Report Year 3 B4P Milestone SM5: (Month 48): Build4People Social Media Final Report RD-Phase – Lessons learnt in regard of Implementation Phase



	Donor-funded projects discussed, elaborated and prepared in regard of the subsequent Implementation Phase Clarification about the role of the Build4People research team in regard of donor-funded projects
	Managed by WP#7 with input from all other WPs
IX. Build4People Capacity Mobilisation: Curriculum Development	Supporting the enhancement of lecturing at our local research partners, particularly in regard of the development of master courses in the field of sustainable urban development / transformation, climate change adaptation / mitigation strategies and environmental psychology
	Consulting and capacity building activities Feeding in results of Build4People research into local curriculum development Bi-annual face-to-face meetings and online-meetings in-between
	B4P Milestone CM1: Capacity Mobilisation Workshop I: Identification of needs; collection of ideas, discussion of a draft curriculum development strategy (Month 06) B4P Milestone CM2: Capacity Mobilisation Workshop II: Presentation of curriculum development strategy; formation of tandem teams to jointly develop specific course units (Month 12) B4P Milestone CM3: Capacity Mobilisation Workshop III: Reporting of tandem teams about their progress in regard of course unit development; collection of feedback (Month 18) B4P Milestone CM4: Capacity Mobilisation Workshop IV: Reporting of tandem teams about their progress in regard of course unit development; collection of feedback (Month 24) B4P Milestone CM5: Capacity Mobilisation Workshop V: Presentation of draft course units material (Month 30) B4P Milestone CM6: Capacity Mobilisation Workshop VI: Reporting on test-trials of draft course unit material (Month 36) B4P Milestone CM7: Capacity Mobilisation Workshop VII: Preparing for certification procedure (Month 42) B4P Milestone CM8: Status report on curriculum development with outlook to Implementation Phase (Month 48)
	Support in developing state of the art local master courses at local research partner institutions Enablement of local lecturers to teach the new course units Increased knowledge about state-of-the-art approaches towards urban sustainability among students and university teachers
	Managed by WP#7 with input from all other WPs
	Organisation of Build4People Scientific Advisory Board Meetings in the aftermath of Build4People Conferences Participation in Build4People-Advisory-Board meetings
	Guidance and advice in regard of scientific quality, adjustment to local context, dissemination opportunities and in regard of enablement of donor-funded projects
X. Scientific Advisory Board <i>Paññāsāstra University of Cambodia</i>	Milestone B4P SAB1: Report of Build4People Scientific Advisory Board (Month 03) Milestone B4P SAB2: Report of Build4People Scientific Advisory Board (Month 27)
	Increase of the scientific quality Adapting research design and measures to the local context.
	Managed by WP#7 with input from all other WPs



<i>XI. Build4People Monitoring: Self-Reflection, Internal Evaluation and Learning</i>	Input for reports; timely submission of the requested inputs for the interim reports and final report; composing scientific profitability reports
	Presenting drafted research reports on the ongoing scientific research process
	B4P Milestone IR1: Internal Evaluation Report (Month 06) B4P Milestone IR2: Internal Evaluation Report (Month 18) B4P Milestone IR3: Internal Evaluation Report (Month 30) B4P Milestone IR4: Internal Evaluation Report (Month 42) B4P Milestone IR5: Final Evaluation Report: Lessons learnt in regard of Build4People Implementation Phase (Month 48)
	Reflection of research and development Information of status quo for funding organization and WP partners; Critical self-reflection regarding the achieved accomplishments and information on the project progress towards the funding organization
	Managed by WP#7 with input from all other WPs

WP#4 Person Month Planning

Build4People-Project: WP#4 Person Months Planning

[illegible]



WP#4 Risk Analysis

The implementation of the envisaged activities incorporates no, respectively little risks, because the research structures have already been tested during the definition phase and because the activities will be based on a mutually agreed research strategy.

Access to local and national spatial data will be facilitated through the National Institute of Statistics in Cambodia. All other necessary data can be provided by the WP4 team themselves. However, a risk collecting enough satisfactory ground-based data for the land cover classification could be substituted based on VHR satellite imagery.

Exploitation Plan

Economic success prospects:

There is no direct economic exploitation, and patent applications planned in WP#4.

It is planned to instigate, test and enhance spatial data analytics and methods based on specific findings during the R&D Phase, and to implement and evaluate these measures during the Implementation Phase. This fits exactly to the scientific research and knowledge transfer strategy of our university regarding scientific findings and their transfer to the society, contributing to relevant ecological and sustainable challenges.

Further economic exploitation could be possible beyond the scope of WP#4 such as:

Urban Neighbourhood Green Index contributes to climate change adaptation and mitigation strategies at the municipality level. UNGI facilitates the development and adaptation of greening strategies and adequate conceptionalization of urban green infrastructure.

Private enterprises such as architectures and urban planning companies will use the produced spatial data and methodical knowledge to enhance their capacities.

New consultation activities and companies could be established and founded at the local or regional level

Scientific success prospects:

Integrating explicit spatial knowledge and structures into local spatial planning and constructive architectural design is not yet, frequently implemented in fast growing cities in South-East-Asia. The inter-/ trans-disciplinary project approach opens new fields and ideas in scientific knowledge with significant effect on publication strategies and technical handbooks for the overall project. The scientific investigation of green infrastructure enables the project to reveal new objectives in supporting the process of building new greening strategies. Further, the spatial analysis of urban green infrastructure will facilitate the search for solutions and new ideas to develop and manage green spaces in an urban context. The results of the spatial will reveal insight on spatial availability, distribution and inter-connectivity of urban green on urban and neighborhoods level. A Citizen Science approach will be implemented to assess the relative importance residents assign to different qualities of urban green and open spaces in Phnom Penh. With this data collection the project team is able to collect subjective and objective data of residents and integrate them those a variables into a geo-statistical model. The results will contribute to bridge the gap of analytical scales and scopes between spatial metrics and individual behavior regarding urban green space structures. The empirical, local investigation, spatial research and the inter-and transdisciplinary approach of the project will produce new knowledge about the nexus of urban green space and structures in a city and their specific perception and use by the local people. Experiences and results will enhance the academic quality of urban planning and spatial data analytics as well as knowledge of



participatory methods at the Royal University of Agriculture in Phnom Penh and at the HNEE in Eberswalde.

The project offers the opportunity of supporting young scientists in Germany as well as in Cambodia with master theses, dissertation, and international scientific exchange.

Scientific and economic connectivity:

- Results of empirical fieldwork and spatial analytics add to existing knowledge in terms of participatory urban planning measures respecting the idea of quality of life at local neighborhoods.
- In terms of scientific and economic connectivity, we expect that local enterprises and consultancy companies might take up some methods or ideas in order to enhance their portfolio with results and ideas of the research consortium.
- Already during the definition phase, some local companies became interested in the topic. They were requesting additional information and knowledge about survey techniques and new methods to improve their capacity.
- The alumni of RUA study programs will extend and foster project results and innovations into the spatial and urban planning sector via the spatial planning departments of the city administration and beyond.



WP#4 *Explanations how WP-activities during RD-Phase contribute to trans-disciplinarity*

1. WP#4 Urban Green studies: the spatial-temporal development of urban green space in Phnom Penh; their distribution and types; and their functional connectivity on district level (Sangkat level). The group will also study the ecological patterns and processes of urban green spaces; their impact on prevailing urban climate conditions (WP#5); sustainable urban planning (WP#3 & WP#2 & WP#6); and the links between urban green space and the health and quality of life for residents (WP#1).
2. A targeted data collection campaign will be designed (WP#1, WP#5, WP#4 & WP#7) to combine subjective data derived from the Build4People household survey with objective data collected via Input APP to assess the relative importance citizens assign to different qualities of urban green spaces and how they value these qualities in visited spaces (INPUT APP)
3. Use mobile devices and unmanned area vehicles for ground base data collection to facilitate the process of land cover classification as a joint activity in conjunction with the local research partner. The detection of heat islands in the city is likewise a joint activity in conjunction with WP#5.
4. A joint activity in conjunction with (WP#5 & WP#3) we will take high resolution images using a unmanned area vehicle to map the study area for the Ecocity-Transition Lab
5. Using high resolution images to deliver an initial ecological assessment of the case study site of the Build4People Ecocity Transition Lab and integrate those into the urban planning process
6. Generate a comprehensive Land Cover Classification of Phnom Penh and its urban fringes using very-high resolution satellite imagery that in turn will be used by WP#5 as a layer for the urban climate map and used as land cover maps for presentation by workshops and conferences
7. Outcomes from the Urban Green Neighborhood Index will be overlaid with urban climate maps (WP#5) and heat island maps (WP#5) to identify specific ecologically valuable areas on an urban level
8. Incorporation of the UNGI into the Buld4People Toolbox for Sustainable Neighbourhoods and Development as a separate module
9. Use the outcomes of the UNGI to support the process of building an urban green space strategy, and to facilitate the search for solutions and the development of new ideas to develop and manage green spaces in an urban context (WP#6 & WP#3).

WP#4 *Explanations how WP-activities during RD-Phase prepare for Implementation Phase*

Green Infrastructure and national policies

The promotion of urban green infrastructure requires a cross-disciplinary approach bringing together researchers in science, policy and planning. The parameterization and calculation of the UNGI is straightforward and provides realistic results. Each parameter of the UNGI is ranked according to expert opinions from administrators and urban planners, derived during stakeholder workshops and the Ecocity Transition Lab. Thus the evaluation of results can be more easily shifted to any real-world application. This "simple" model approach is important for WP#4, as a successful implementation of the results in Phnom Penh will result in a blueprint that can be applied to other cities in Cambodia. In relation to this, the urban green module will be developed as part of the Buld4People Toolbox for Sustainable Neighbourhoods and Development. It contains a set of planning instruments (greening strategies), techniques and recommendation that support the building a GI strategy and facilitate the search for solutions



and new ideas to develop and manage green infrastructure in an urban context. This urban green module could also be transferred into a eLearning Module. It will be designed according to the needs of urban planners and administrators and its use should promote more awareness of the GI concept. The Module is primarily targeted at professional, urban based, planners who are seeking further information on the added value and benefits that urban green spaces can bring to the development of the urban environment. Moreover, the module may facilitate the adaptation of GI to a national level of GI strategies and thus promoting nature based solutions to preserve natural capital and the integration of green infrastructure as key element in Cambodian policy objectives in the implementation phase.

Derive UQoL indicators for Phnom Penh

Using Input App for citizen science survey wants to assess the relative importance residents assign to different qualities of urban green and open spaces in Phnom Penh. During the definition phase of the project WP#4 identified three main green indicators, accessibility of green spaces, availability of green spaces and the use of green spaces. In the research phase, the Build4People project team aims to create an urban green space assessment, combining green indicators and user's perception of green space into quantifiable and measurable categories. In doing so, the project team aims to establish a simple and easily reproducible overall quality indicator for urban green space in Phnom Penh. This will be achieved through a statistical data modelling approach. Further UQoL indicators should derive from WP#1's statistical model, using the results of the household survey. A feasibility study of UQoL through a Citizen Science Input APP will be produced at the end of the citizen science survey. This report is part of the preparation for the Build4People UQoL Citizen Science App, one of the envisaged products/tools for the implementation phase. The main idea of the app is to allow citizens to evaluate a set of specified UQoL indicators. According to their ranking, certain simple statics (median, quartiles, standard deviation, variance, coefficient of variation, standard error) will be calculated. A further and more profound analysis and evaluation of the collected data could be achieved in web mapping software like Mappin (hosted by Lutra Consulting Limited). This would allow the project team to display refined results as detailed hotspot maps to a much wider audience. In addition, Mappin could be used to distribute our results to several mapping portals on behalf of Phnom Penh's Authority.

WP#4 Rough Work- and Implementation Plan of Implementation Phase (basic draft)

The detailed work plan of the implementation phase will be developed during the research and development phase especially in regard to

B4P Milestone QM2: (Month 45): Feasibility study to grasp UQoL by means of Citizen Science Input APP, including budget plan (WP#4) in preparation of Build4People Implementation Phase

and Milestone WP#4 RF2 (Month 48): Integration of other UQoL parameters into UNGI and]

The envisaged activities of the Implementation Phase will be intensively discussed and developed in an iterative process with the other WPs and the local partners. Associated partners and the consolidated network in Phnom Penh will enrich the ongoing intervening of the Build4People project and further planning.



WORK AND IMPLEMENTATION PLAN

Work Package WP#5 “Urban Climate”

Work Package Leaders: Prof Dr. Lutz Katzschner, INKEK
Dipl. Ing Sebastian Kupski, INKEK

Main Research Partners: SE Bunleng (MSc) – Department of Geography and Land Management, Royal University of Phnom Penh (RUPP)
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WP#5 Guiding research question

The overall aim of this study is to identify and evaluate the influence of rapid urbanization on urban heat islands intensity depending on mesoscale climate and urban structure types in Phnom Penh. As climate change has an important influence on the dimension of the urban heat island it will be investigated how this affects energy demand of buildings and thermal comfort. Finally, this will lead to the calibration of climate urban recommendation map for Phnom Penh.

Research Sub-Questions

- What are the main measures and parameters to influence urban climate in Phnom Penh?
- What kind of urban climate recommendations maps will be effective in order to implement urban climate in planning processes and urban design?
- How dominating is the mesoscale climate on urban city structures, and how much can be mitigated by urban design?
- How important is thermal comfort for open space use and behavior of people in Phnom Penh?
- How is urbanization related to the urban heat island effect?

1. WP#5 INSIGHTS FROM THE BUILD4PEOPLE DEFINITION PHASE

Phnom Penh capital was selected as a study site because of the city is strongly influenced by high population density and more rapid urbanization. Phnom Penh is the largest and fastest growing city in the country and serves as the gateway to the world economy (Baker et al., 2017). This development of rapid urbanization and economic development has transformed natural landscapes into impervious surfaces that might increase the absorption of solar radiation, decrease evapotranspiration, increase runoff, increase surface friction, and release



anthropogenic heat, and these phenomena will influence UHI intensity in Phnom Penh.

Phnom Penh is located in the contiguous zone of the four rivers Tonle Sap River, Tonle Bassac River, Upper Mekong River, and Lower Mekong River. Phnom Penh has a typical monsoonal climate with precipitation of about 1493.70 mm per year and average temperature of 29 °C in 2011 (Yen et al., 2017). The maximum temperature difference during daytime was around 4-5 °C and was less than 2 °C during the night-time. This effect is called urban heat island intensity (Furuuchi et al., 2006).

The urban climate is dominated by urban structures, which later can be designed following climate-conscious recommendations.

Beside the existing data evaluation, no map or climatological recommendations could be derived, which is why further research steps are required. The mesoscale conditions in Phnom Penh dominate the seasons, but inside the city urban structure types, orientation of streets and river influence make considerable changes. Therefore, it is of main importance to maintain those streets, which serve air ventilation and which mitigate urban heat in some neighbourhoods. In this respect also the thermal induced circulation by the river influence urban climate.

The geographical department of RUPP gives information about data input by regional and urban climate stations. They work out statistics, so that the urban climate map will get a solid base. Furthermore, the competence in measurements with stations as well as mobile ones of our partner has high quality. The combination of measured data and calculations is guaranteed.

2. MAIN AIMS OF THE RD-PHASE

The overall aim of WP#5 research work is to identify and evaluate the influence of rapid urbanization on urban heat island intensity in Phnom Penh. This has to be linked to the climate change perspective, which can be seen in regional climate analysis. The specific objectives of this study are as follows:

- Methods to evaluate urban climate for areal city development
- Developing tools for climate oriented urban design
- Calibration of thermal comfort indices for open space planning
- To evaluate the contribution of urbanization effect to UHI and air pollution

2.1. Sub-aims

- **WP 5.1 Conducting an urban climate map,**
(measurements, layer definitions, modelling)

impacts: final urban climate map for areal city development judgements



To calculate urban climate maps (Ren et al., 2011), different information is needed to simulate the interaction between buildings and surfaces in the urban canopy layer (UCL) (Oke 2017). From chapter one, input data can be gained for the mesoscale climate. City structure types like building volume for heat storage or openness for roughness are to be added. For Phnom Penh, building and surface data were collected and prepared in a GIS based calculation (Ng 2015).

In this phase for the preparation of the urban climate analysis different layers were tested. In a first step, building volumes are calculated to compute heat storage. Later aspects like openness, greening etc. are added.

From land use maps and the classification of different city structure types, climatopes for Phnom Penh are identified. Figure 6 shows the input data for calculating the information from an air photo. In a first step two cases were chosen in which measurements and modelling can be carried out to calibrate the urban climate map.

Steps: Workshop about science; urban climate and climate change; layer definition, measurements, calculations of areal urban climate, analysis of urban structure types and urban climate, analysis and maps

➤ **WP 5.2 Urban recommendation map**

impacts: areal suggestions for land use development and ventilation

From the urban analysis and function map climatopes can be identified and combined with recommendation clusters. Each cluster will give specific urban climate advice for city development. Additionally, a density structure analysis, a greening map, and a ventilation map will be created.

➤ **WP 5.3 Climate based recommendations for neighborhoods and buildings (microscale modeling)**

impacts: city design and implementation in the planning process, energy demand in buildings and thermal comfort

Neighborhood planning in each area follows the recommendation carried out in WP 5.2. Orientation and materials for buildings will be adopted to urban climate. Main aspect is heat exchange and ventilation. The method comprises numerical calculations in GIS and ENVIMET.

➤ **WP 5.4 Tool and guidelines for climate change program in Phnom Penh**

In order to implement urban climate into the planning context guidelines, further steps and deeper research is needed. International VDI and DIN guidelines are used but need to be adopted to Cambodian circumstances by comparing existing guidelines for tropics and the thermal comfort index for Phnom Penh



3. STATE OF THE ART

More people in the world today live in urban areas than in rural areas, with 30 % of the world's population residing in urban areas in 1950, increased to 55 % in 2018 (UN, 2018) and continued to increase to 68 % by 2050 according to urban population projection (UN, 2018). The growth of urban population has led to the expansion of urban areas that have influenced the urban heat island (UHI) effect (Li et al., 2018). Urbanizing areas are still an attractive place for more people moving to cities leading to more human activities and urban expansion which create UHI effects (Akbari & Kolokotsa, 2016; Kaloustian & Diab, 2015; Mirzaei, 2015). Urbanization resulting in urban growth and development influences the UHI phenomenon (Zhou & Chen, 2018). In recent years, anthropogenic activities have influenced urban climates and become more and more noticeable (Mirzaei & Haghighat, 2010; Mohajerani et al., 2017). With the rapid urbanization, cities are facing more serious climate change challenges, especially the UHI phenomenon. Thus, proper planning and urban design of cities may improve the ventilation of street canyon and change the heat balance in the urban canopy and mitigate the UHI phenomenon (Zhao et al., 2016).

Rapid urbanization usually causes massive changes in the urban surface structure, properties and spatial distribution e.g. decreases in green areas (Ma et al., 2010). These changes inevitably result in changes of incoming solar radiation and influence urban-rural differences of surface radiance and air temperature (Weng, 2003). UHI is the drastic difference in the temperature of urban surfaces and its surrounding rural areas (Howard, 1833; Li et al., 2011; Oke, 1982). The severe effect of UHI not only affects the comfort and health of urban inhabitants in their everyday life, but also restricts the further improvement of quality of life and urban development (Landsberg, 1981; Lu et al., 2015). The UHI is regarded as one of the main problems caused by urbanization and industrialization in the twenty-first century (Lu et al., 2015; Makinde & Agbor, 2019; Rizwan et al., 2008; Shishegar, 2014). The main source of UHI is a large amount of heat absorbed as the result of changes in urban structure (Makinde & Agbor, 2019). Rapid urbanization may lead to a reduction in wind speed, higher anthropogenic heat release (Rizwan et al., 2008), high energy demand (Lee et al., 2019; Qiao et al., 2014), traffic jam of transportation networks (Qiao et al., 2014), changes in relative humidity, and human thermal stress (Lee et al., 2019), and these phenomena exacerbate the UHI effect (Qiao et al., 2014).

While natural landscape is transformed into impervious surfaces, urbanization is likely to increase solar radiation absorption, decrease evapotranspiration, increase runoff, increase surface friction, and release anthropogenic heat (Arnfield, 2003; Bornstein & Lin, 2000; Oke, 1987). Many studies revealed that UHIs are strongly correlated with the urbanization factors including population (Atkinson, 2003; IPCC, 2007; Landsberg, 1981; Oke, 1973), economy (Gusso et al., 2015; Jones et al., 1990), city size (Atkinson, 2003; IPCC, 2007; Landsberg, 1981; Oke, 1973), geometric characteristics (Gusso et al., 2015; Jones et al., 1990) and



building (Atkinson, 2003; IPCC, 2007; Landsberg, 1981; Oke, 1973).

According to Oke et al. (2017), UHIs are divided into three categories: canopy layer heat island (CLHI), boundary layer heat island (BLHI), and surface urban heat island (SUHI). These types of UHIs have different characteristics of different layers of the urban atmosphere and various surfaces. The CLHI and the BLHI, a warming of the urban atmosphere, are considered as atmospheric heat islands whereas the SUHI is considered as the relative warmth of urban surfaces and its surrounding rural areas (Oke et al., 2017; Zhao et al., 2016). Many studies of UHI have shown that urban growth and development caused by urbanization influenced the UHI effect. For example, Li et al. (2009) stated that the extent and magnitude of UHI was correlated with a significant increase of the rapid urban expansion, while the study of Cui & Shi (2012) showed that urbanization was correlated with the increase of air temperature and the decrease of relative humidity. In addition, the continuous increase of buildings, paved roads, buses, population, and gross domestic product (GDP) have driven the growth of UHI. Lu et al. (2015) revealed that daytime heating effect in the urban area was strongly correlated with urban expansion, while the study of Weng et al. (2004) revealed that spatial variability of land surface temperature (LST) was positively correlated with vegetation abundance.

In Cambodia, rural-urban migration increased from 19.5% in 2008 to 21.4% of total population in 2013 (NIS, 2013) and predicted to be 22.1% of total population by 2020 (UNFPA Cambodia, 2014). The increase rate of urban population is accompanied by a high urbanization rate resulting from increased economic activities, migration from rural areas and an influx of foreign labour (UNFPA Cambodia, 2014). Cambodian economic growth rate increased around 7 percent from 2011 to 2018, which made Cambodia the fastest growing country in Asia (WB, 2019). This resulted in an increase in urban area, especially in Phnom Penh, from 3000 ha in 1973 to 4000 ha in 1990 and subsequently increased to 25,000 ha in 2015 (Mialhe et al., 2019). The population of Phnom Penh surged from 1.85 million in 2012 (Baker et al., 2017) to 2.129 million in 2019 (NIS, 2019). Thus, urban expansion and development caused by rapid urbanization and the increased population in Phnom Penh may influence the UHI effect.



4. RESEARCH PLAN

Urban climate and the variation of climate change is analyzed citywide for Phnom Penh. Conceptually there are three phases integrated in a urban climate methodology based on measured and calculated data.

Urban climate modeling has to be adopted to tropical regional climate and to urban structure types characterized by density, materials and open space conditions (first year). Further to the analysis come recommendation aspects. Here the input from other WPs are needed to see the complexity of UQoL, neighbourhood design and buildings. This is developed in workshops and face to face meetings. Layers were used from greenery, sustainable building designs (second and third year).

Furthermore, it is important to validate results with the survey, measured data and statistics. A refinement of the urban climate map followed by recommendations and proposals for city design is carried out in the last year.

4.1 scheduled FIRST PROJECT YEAR

Urban climate analyses with a climate function map will be calculated on base of measured data and the input from greenery working package. For the layer development, which are the essential part for calculating urban climate functions, transdisciplinary aspects are used. Urban structure types, vertical and horizontal greeneries, linkage of open spaces are analyzed for whole Phnom Penh. Together with the regional climate showing ventilation pattern from existing Phnom Penh studies a complete picture is given.

4.2 scheduled SECOND PROJECT YEAR

Urban recommendation map is evaluated after the input of the household survey for thermal comfort and the greenery potentials evaluated by WP 4. The spatial analyzed recommendations are forwarded to meetings (Incubator) and workshops. At this stage new sites for urban development are judged climatology. Guidance is prepared as method description.

4.3.scheduled third project year

Downscaling from urban climate maps to microclimate conditions. URBAN Climatological view on urban design proposals done within the EcoLab and building planning in chosen neighborhoods. For this step the software ENVIMET is used. This gives the possibility to calculate existing situations and compare it with design proposals, which is needed in EcoLab of WP3.



4.4 scheduled FOURTH PROJECT YEAR

Guidelines are used often in international context. ISO/DIN/VDI have already released informal guidelines for urban climate and urban planning and adaptation methods for climate change in cities. This will be developed for the local situation of Phnom Penh.

Research result will lead in an adaptation of the recommendation map, carried out in the second year. The recommendation will be discussed in the planning process with city hall administration to see how far recommendation can go and how the influence the guideline.



5. WORK- AND IMPLEMENTATION PLAN

The following table depicts a detailed list of all WP 5-Milestones. All procedures (work steps) are listed with respect to the following categories: Activities, methods, products, aims/results, and transdisciplinary connection to other work packages within the B4P project.

The timetable depicts the 4 years of the “Research and Development Phase”. Trans- and interdisciplinary procedures are labelled with the prefix *B4P*. Procedures that are labeled with the prefix WP account for the WP#5 work package.

WP#5 serves trans-disciplinary by giving recommendation for buildings and open space design. Furthermore, it provides knowledge to governance processes in Phnom Penh. For implementation, the guidelines provide a fundamental procedure for urban climate orientated planning. This work plan proposes a time and area scale for the project to be implemented.

B4P RESEARCH & DEVELOPMENT PHASE	Activities	Methods	Products
Work Steps	Aims / Results	Transdisciplinary Cooperation	
I. Build4People Coordination Meetings in Germany	Regular exchange within the Build4People project team Ongoing conceptualisation and modelling of Urban Quality of Life (UQoL) Face-to-face meetings in the context of the milestones, in-between regular online meetings (every two months)		
	Presentations, discussions		
	B4P Milestone WS1: Build4People RD-Phase Kick-off Meeting, Hamburg (Month 01) B4P Milestone WS2: Build4People UQoL-Survey Workshop, Magdeburg (Month 13) B4P Milestone WS3: Build4People UQoL-Processing Workshop, Eberswalde (Month 25) B4P Milestone WS4: Build4People Proposal Writing Workshop, Hamburg (Month 37)		
	Joint general research understanding (WS1) Joint scientific-conceptual work on urban quality of life (WS2 / WS3) Joint agreement of content of Build4People Implementation Phase proposal (WS4) Capacity mobilisation due to insights on urban sustainability best practices in Germany for invited research partners from Cambodia (WS4)		
	Managed by WP#7 with input from all other WPs (WS1 / WS4) Managed by WP#2 with input from all other WPs (WS2) Managed by WP#4 with input from all other WPs (WS3)		
II. Science / Roundtable Work- shops / Focus Group Discussions in Cambodia	Regular scientific exchange with local research partners in regard of the topics of WP#5 Interdisciplinary Workshop on climate comfort		
	Presentations, discussions of state of the art Layer based GIS calculation and classification system from VDI 3787 Bl.1 Exchange about subjective and objective factors of climate comfort		
	WP#5 Milestone SW1 (Month 04): Exchange of research design, data exchange WP#5 Milestone SW2 (Month 10): presentation of urban climatic map to the project WP#5 Milestone SW3 (Month 15): recommendation map consultancy WP#5 Milestone SW4 (Month 22): presentation recommendation map WP#5 Milestone SW5 (Month 27): introduction building and climate methodology WP#5 Milestone SW6 (Month 34): Ecocity Lab exchange of results (microclimate)		



	<p>WP#5 Milestone SW7 (Month 39): guideline development</p> <p>WP#5 Milestone SW8 (Month 46): urban climate and urban planning</p> <p>Scientific understanding of climate change, implementation for planning and regional climate change,</p> <p>Managed by WP 5</p>
III. Build4People Conferences in Cambodia	<p>Organisation of Build4People conferences with all German and Cambodian partners and relevant stakeholders</p> <p>Thematic input from WP#5</p> <p>Presentations / panel rounds / discussions</p> <p>B4P Milestone K1: Build4People Research Conference (Month 03)</p> <p>B4P Milestone K2: Build4People Status Conference (Month 26)</p> <p>B4P Milestone K3: Build4People Outlook Conference (Month 46)</p> <p>Increased public awareness and mutual understanding of the different Work Package approaches of the Build4People project</p> <p>Networking with stakeholders from the state, economy and civil society</p> <p>Discussion of model-based planning strategies to foster urban quality of life (K3)</p> <p>Managed by WP#7 with input from all other WPs; exchange with all WPs, research partners, implementation and dissemination partners</p>
IV. Scientific and Societal Problem Based Research: Data Collection and Analysis <i>IV.A. WP-related research</i>	<p>Updated review of literature and of state of the arts; bibliographical research</p> <p>Conceptualising of methods for layer definition, based on greenery and regional climate</p> <p>Data collection and analysis</p> <p>Development of the research design and methods corresponding to the theory and insights from the definition phase</p> <p>Input layer definitions</p> <p>GIS calculations</p> <p>Measurement and modeling, science workshop, Calculation of city-wide climate map</p> <p>Milestone W 5.1 Urban Climatic Map</p> <p>Milestone W# 5.2 Urban Recommendation Map</p> <p>Understanding urban climate in dependence from urban structure types</p> <p>Spatial urban planning in climate change,</p> <p>Capacity Building; increased understanding about the meaning of climate comfort in PP</p> <p>Basic and areal recommendations for urban planning and design</p> <p>Urban climate and urban planning</p>
IV. Scientific and Societal Problem Based Research: Data Collection and Analysis <i>IV.B. Build4People UQoL Household Survey / Data Input via APP</i>	<p>Preparing the B4P UQoL household survey (collection of relevant questions from all WPs, compilation of questionnaire, pre-testing, etc.)</p> <p>Survey in cooperation with market research company: data collection and first data analysis</p> <p>Statistical analysis</p> <p>Discussing first results on urban quality of life as perceived by citizens of Phnom Penh.</p> <p>B4P Milestone TR1: (Month 04): Final version of questionnaire for household survey</p> <p>B4P Milestone TR2: (Month 08): Final version of the <i>Citizen Science Input APP</i> (Integration of subjective evaluation of objective factors);</p> <p>B4P Milestone TR3: (Month 12): First results / analysis of collected data from <i>Citizen Science Input APP</i> and from household survey</p> <p>Insights into objective / subjective factors influencing urban quality of life in Phnom Penh</p> <p>Mutual transdisciplinary understanding of urban quality of life</p> <p>Increased awareness about the importance of urban quality of life among stakeholders</p> <p>Preparation of survey results in regard of B4P Milestone WS2: B4P UQoL-Survey Workshop at Magdeburg University (Month 13)</p> <p>Scientific-conceptual lead WP#1 with support from WP7; data-management lead WP#4</p> <p>Input WP5 in regard of thermal comfort questions</p>
V. Trans-Disciplinary Action Research: Process Facilitation and Product	<p>Exploration and application of innovative methodologies of collaborative and participatory planning in the context of an Eco Lab based on a case study site typical for current urban development issues in Phnom Penh</p> <p>Input in regard of the topics of WP#5: Definition of input data (meteorology) and design proposals, input of analysis of influence of regional climate and air paths in regard of the ecocity</p>



Development <i>V.A. Build4People EcoCity Transition Lab Process</i>	case study site; presentations Planning recommendations from the perspective of urban climate
	Microclimatic calculations with ENVIMET
	B4P Milestone TL1: (Month 10): ECTL I: Masterplan Study Area & Design Strategies B4P Milestone TL2: (Month 27): ECTL II: Neighbourhood Plans & Guidelines B4P Milestone TL3: (Month 34): ECTL Transition Lab III: Criteria & Implementation Strategies
	Milestone 5.3. Microclimatic Analysis Maps for neighborhoods
	Sustainable and climate orientated design
V. Trans-Disciplinary Action Research: Process Facilitation and Product Development <i>V.B. Build4People Sustainable Building Arena Process</i>	Participatory workshop series with front-runners from different stakeholder groups; co-development of transition challenge framing, vision and transition agenda co-development process; support of experimentation & socio-technical, and socio-institutional innovation, coalition and partnership building and knowledge co-creation and communication Input in regard of the topics of WP#5
	Participatory workshop with climatologists and urban planners
	Lectures and evaluation mapping
	Milestone WP5.4: Guideline Urban planning under climate change conditions (VDI 3787 B.1)
	Basis maps and data based planning suggestion to increase urban quality of life
V. Trans-Disciplinary Action Research: Process Facilitation and Product Development <i>V.C. Build4People Sustainable Building Business Incubator Process</i>	Microclimate method and tools for building design in neighborhoods, data validation and modeling General input in regard of the topics of WP#5
	Participatory workshop with climatologists and architects
	Lectures and evaluation mapping
	Milestone WP5.4: Guideline Urban planning under climate change conditions (VDI 3787 B.1)
	Basis maps and data-based planning suggestion to increase urban quality of life
V. Trans-Disciplinary Action Research: Process Facilitation and Product Development <i>V.D. Build4People UQoL Citizen Science Process</i>	Input in regard of the topics of WP#5
	Practical case study work for thermal comfort
	Training on urban climate, Tested intervention tools
	Implementing methodological knowledge to students and researchers at the RUPP Master Course Climate Change ((driving forces in urban climate) Master Course Geography methods in urban climate analysis and urban planning; software education (microclimate modelling)
	WP#5 Cooperation with WP#1/WP#7
VI. (Re-)Integration of Created Knowledge Refinement and Revision of Theory <i>VI.A. WP-related research</i>	Statistical analyses and hypothesis testing according to layer definitions, integration of feedback from phase of scientific and societal problem-based research and from of action research Integration of created knowledge Refinement and revision of climate map
	Publication of scientific papers
	Face to face meeting with RUPP and City Hall
	Dissemination of research results at Build4People Outlook Conference Preparation for publications
	Managed by each WP Trans-disciplinary cooperation in regard of publishing joint scientific papers
VI. (Re-)Integration of Created Knowledge Refinement and Revision of Theory	Evaluation of urban climate function and recommendation map, layer refinement
	Data comparison and evaluation from planner workshops
	Statistical methods for urban climate classification
	Implementation of local situation of Phnom Penh



<i>VI.B. Build4People trans-disciplinary</i>	Managed by WP#1 with support from all other WPs
VII. Build4People Dissemination <i>VII.A. Build4People Poster / Photo Exhibitions</i>	Providing posters for the joint poster session
	Dissemination: urban climate maps and microscale maps
	Scientific-conceptual lead WP 3 with support from WP 7 Input from all other WPs
	Regular presentations of select research results with the support of our dissemination partners, either face-to-face or online (webinar-format) Presentation on scientific conferences (ICUC 2022; PLEA 2021)
	B4P Milestone EX1 / EX2: Scientific-conceptual lead WP#3 with support from WP#7 Input from all other WPs B4P Milestone EX3: Conceptual Scientific-conceptual lead WP#7 and WP#1 (based on the B4P Awareness Campaign: UQoL & Sustainable Living)
VII. Build4People Dissemination <i>VII.B. Build4People Outreach Events</i>	Management of outreach events to disseminate the results of the Build4People project
	Regular presentations of select research results with the support of our dissemination partners, either face-to-face or online (webinar-format)
	B4P Milestone OR2:(Month 6): Presentation of results urban climate mapping B4P Milestone OR15: (Month 42): Presentation on how to enhance urban climate aspects in urban planning of Phnom Penh
	Increased awareness and knowledge about transdisciplinarity of the research of the different Work Packages of the Build4People project Dissemination about Build4People processes and products
	Lead by WP#7 with support from other WPs
VII. Build4People Dissemination <i>VII.C. Build4People Toolbox including Build4People Handbook</i>	Compiling and preparing research results for dissemination; Input to the Handbook for Green Housing and Sustainable Living, introduction of climate issues and thermal comfort inside and outside; Input to Build4People Toolbox: Elaboration of guidelines for integration of climate-oriented design aspects into sustainable neighbourhood development
	Methods development, Chapter writing
	B4P Milestone TB1: (Month 15): First editorial meeting: Joint development of a Handbook content structure together with the local partners; distribution of related tasks B4P Milestone TB2: (Month 22): Second editorial meeting: Presentation of the Handbook inputs by the various partners and joint agreement on the visual design; management of the translation, language editing and the printing procedure B4P Milestone TB3: (Month 27): First editorial meeting to discuss content of Toolbox B4P Milestone TB4: (Month 34): Publication of the Handbook for Green Housing and Sustainable Living during a roundtable workshop (milestone SW6); development of a distribution, dissemination and impact management strategy B4P Milestone TB5: (Month 39): Web Interface of Handbook ready (with inter-active elements) / first draft of Toolbox ready B4P Milestone TB6: (Month 46): Web Interface of Toolbox ready B4P Milestone TB7: (Month 48): B4P Toolbox Executive Summary Report: Science- and societal based strategies to foster urban quality of life in Phnom Penh
	B4P Toolbox Sustainable Neighbourhood Development: Minimum and advanced requirements as a basis for informed decision-making, awareness-raising, transfer of knowledge; B4P Handbook: Awareness raising, transfer of knowledge, better household decisions in the field of green housing and sustainable living among the general public Mass effects through replication and web platform
	Conceptualisation of Toolbox by WP#3 with input from all other WPs Conceptualisation of Handbook by WP#7 with input from all other WPs Dissemination managed by WP#7 with support from all other WPs
VII. Build4People Dissemination <i>VII.E. Awareness Campaign: UQoL &</i>	Development of an urban quality of life and sustainable living awareness campaign; exchange with stakeholders and research partners; recommendations for a social marketing campaign Input from perspective of WP#5 (thermal comfort and open space usage)
	Theory-driven and data-based planning and designing of a campaign; participatory process and methods, focus group discussions with different target groups; interviews with



<p><i>Sustainable Living</i></p>	<p>stakeholdersComparing recommendation map with usage pattern, comparing measurements with surveys, statistical evaluation dependent from urban climate function map,</p> <p>B4P Milestone AC1: (Month 24): Data-based and theory-driven framework for awareness campaigning in order to foster ecological awareness, pro-environmental social norms and sustainable lifestyles in Phnom Penh</p> <p>B4P Milestone AC2: (Month 38): Implementing a <i>trial</i> of a selected intervention on behaviour change (specific target group in the case area regarded within the ECTL process)</p> <p>B4P Milestone AC3: (Month 48): Final version of a Campaigning Module within B4P Toolbox</p> <p>Increased understanding about people-environment interactions and behaviour change Mass effects through replication</p> <p>Lead by WP#1</p>
<p>VII. Build4People Dissemination</p> <p>VII.F. <i>Build4People Social Media-Campaign</i></p>	<p>Management of outreach events to disseminate the results of the Build4People project Provision of content input from WP#5</p> <p>Feeding in information on Build4People activities at B4P Homepage, ResearchGate and on several social media platforms (Facebook, LinkedIn, B4P YouTube channel, Instagram) Preparing for B4P PR-video clips</p> <p>B4P Milestone OR2: (Month 18): Presentation of results from urban climate mapping B4P Milestone OR15: (Month 42): Presentation on how to enhance sustainable building design in climate change</p> <p>Increased awareness and knowledge about the research of the different Work Packages of the Build4People project Dissemination about Build4People processes and products</p> <p>Lead by WP#7 with support from other WPs</p>
<p>VIII. Build4People Capacity Mobilisation</p>	<p>Supporting the enhancement of lecturing at our local research partners, particularly in regard of the development of master courses in the field of sustainable urban development / transformation, climate change adaptation / mitigation strategies and environmental psychology Courses within Geographical Department of RUPP and in global climate changes master course, Master of Geography (RUPP), Master of Sustainable Urban Transformation (School of Architecture and Urban Planning at PUC) Feeding in to curriculum development from the topics of WP#5 Course in microclimatic modeling (ENVIMET),</p> <p>Consulting and capacity building activities Feeding in results of B4P research into local curriculum development Bi-annual face-to-face meetings and regular online-meetings in-between Course unit / curriculum development in a co-design way Practical case study and software training</p> <p>B4P Milestone CM1: Capacity Mobilisation Workshop I: Identification of needs; collection of ideas, discussion of a draft curriculum development strategy (Month 06) B4P Milestone CM2: Capacity Mobilisation Workshop II: Presentation of curriculum development strategy; formation of tandem teams to jointly develop specific course units (Month 12) B4P Milestone CM3: Capacity Mobilisation Workshop III: Reporting of tandem teams about their progress in regard of course unit development; collection of feedback (Month 18) B4P Milestone CM4: Capacity Mobilisation Workshop IV: Reporting of tandem teams about their progress in regard of course unit development; collection of feedback (Month 24) B4P Milestone CM5: Capacity Mobilisation Workshop V: Presentation of draft course units material (Month 30) B4P Milestone CM6: Capacity Mobilisation Workshop VI: Reporting on test-trials of draft course unit material (Month 36) B4P Milestone CM7: Capacity Mobilisation Workshop VII: Preparing for certification procedure (Month 42) B4P Milestone CM8: Status report on curriculum development with outlook to Implementation Phase (Month 48) Guideline for intervention training on urban climate, tested intervention tools, Curricula for global climate change and fundamentals in urban climate for architecture</p> <p>Support in developing state of the art local master courses at local research partner institutions Enablement of local lecturers to teach the new course units Increased knowledge about state-of-the-art approaches towards urban sustainability among students and university teachers Implementing methodological knowledge to students and researchers at the RUPP</p>



	<p>Master Course Climate Change (driving forces in urban climate) Master Course Geography methods in urban climate analysis and urban planning; software education (microclimate modelling)</p> <p>Managed by WP#7 with active participation and input from all other WPs</p>
<p>VIII. Build4People Donor Implementation Workshops and Courses</p>	<p>Input from the perspective of urban climate to regular workshops with donor organisations thereby introducing the Build4People project to donor organisations with the aim to prepare for B4P supported projects during the subsequent Implementation Phase</p> <p>Presentations / exchange / discussions</p> <p>B4P Milestone IWS1: Implementation Donor Workshop I (Month 03) B4P Milestone IWS2: Implementation Donor Workshop II (Month 15) B4P Milestone IWS3: Implementation Donor Workshop III (Month 27) B4P Milestone IWS4: Implementation Donor Workshop IV (Month 39) B4P Milestone IWS5: Report on Implementation Preparation (Month 48)</p> <p>Donor-funded projects discussed, elaborated and prepared in regard of the subsequent Implementation phase Clarification about the role of the B4P research team in regard of donor-funded projects</p> <p>Managed by WP#7 with active participation and input from all other WPs</p>
<p>X. Scientific Advisory Board</p> <p><i>Paññāsāstra University of Cambodia</i></p>	<p>Organisation of Build4People Scientific Advisory Board Meetings in the aftermath of Build4People Conferences</p> <p>Guidance and advice in regard of scientific quality, adjustment to local context, dissemination opportunities and in regard of enablement of donor-funded projects</p> <p>B4P Milestone SAB1: Report of Build4People Scientific Advisory Board (Month 03) B4P Milestone SAB2: Report of Build4People Scientific Advisory Board (Month 27)</p> <p>Adjustment of the research and dissemination approaches Contacts to donor organisations interested in transferring the Build4People research into implementation-orientated projects</p> <p>Managed by WP#7 with input from all other WPs</p>
<p>XI. Build4People Monitoring: Self-Reflexion, Internal Evaluation and Learning</p>	<p>Regular rounds of internal monitoring and self-evaluation of project progress and reflexion about lessons learnt Discussion about joint publication strategies</p> <p>Internal discussions (through online meetings)</p> <p>B4P Milestone IR1: Internal Evaluation Report (Month 06) B4P Milestone IR2: Internal Evaluation Report (Month 18) B4P Milestone IR3: Internal Evaluation Report (Month 30) B4P Milestone IR4: Internal Evaluation Report (Month 42) B4P Milestone IR5: Final Evaluation Report: Lessons learnt in regard of Build4People Implementation Phase (Month 48)</p> <p>Adjusted Build4People research and publication strategies; Information of status quo for funding organization and WP-partners; Critical self-reflection regarding the achieved accomplishments and information on the project progress towards the funding organization; Joint publications at high-ranking journals</p> <p>Managed by WP#7 with input from all other WPs</p>

5.1 Risk Analysis

The implementation of the envisaged activities incorporates no respectively little risks because the research structures have already been established during the preparation phase and because the activities will be based on a mutually agreed research strategy.

Further, we have already clarified the access to relevant data needed for our work package during preparation phase



5.2 Application potential

Economic success prospects:

An adapted Urban Climate Map – calculation model which can be used in different climate zones brings along the opportunity to find new application possibilities and potential research and development contracts.

Urban heat island problems will increase because of climate change, therefore any new development needs advice and climatological guidance

Scientific success prospects:

Through the inter-/ trans-disciplinary approach new fields in scientific knowledge are opened with significant effect on publication strategies and handbooks/ guidelines

In the field of research new inputs are given through interviews and local investigations.

- a) thermal comfort of tropical conditions - outdoor and indoor,
- b) studies of the urban canopy layer, horizontal and vertical in tropical cities with recommendations for urban development

Scientific and economic connectivity:

The results of our empirical fieldwork add to existing knowledge in terms of urban climate modelling and contribute to a more thorough knowledge of urban climate patterns within a highly dynamic urban environment under tropical climate conditions.

In terms of economic connectivity, we expect that due to our activities in Cambodia our company INKEK will get the opportunity to receive additional contracts and enter the local market. Already during preparation phase local developer companies requesting our expertise approached INKEK.

Input guidelines for WP 1 and 3 how to design and define UQoL and neighbourhoods give a perfect base for future urban neighbourhood planning and open space planning

5.3 Feasibility Study on Implementation Strategy

- To develop a strategy to transfer research results into specific policy making
- Feasibility Study on an Implementation Strategy in the field of promoting energy-efficient urban planning and the use of passive ventilation in the field of housing structure
- Increased knowledge and understanding how to transfer research results into policy making given institutional constraints

5.4 Contribution to transdisciplinarity



- Joint survey and measurement campaign (conceptualization of urban quality of life)
Climate measurements – simultaneous local measurements of the most important values/thermal comfort - subjective perception and level of stress
- Exhibitions on green buildings and sustainable neighborhoods
Schematic urban climate basic for southeast Asia (different scales), examples
- Consultancy to General Housing Department
Schematic urban climate guideline for southeast Asia (different scales)
- Pilot Study on district/regional level of Capital City Hall
Ventilation study (local wind system) and heat island effect -> results of UCM PP, adapted to local context
- Quality of life city index
Physiological Equivalent Temperature (PET) as Indicator for impacts of Climate Change on thermal comfort of humans



6. OUTLOOK IN REGARD OF BUILD4PEOPLE IMPLEMENTATION PHASE

The climate function map and the climate recommendation map as basic urban wide instrument followed by design tools for neighbourhoods and buildings can be integrated in the planning procedure of Phnom Penh. City Hall as well as architecture companies can use methodologies and tool, which were developed in the project. Methods and tools can be used inside the legal procedures. Statistical and numerical model can be applied according to planning scales for Phnom Penh.

Build4People-Project: WP#5 Person Months Planning

[illegible]



WORK- AND IMPLEMENTATION PLAN

Work Package #6 Sustainable Urban Transformation (SUT)

Work Package Leader:	Dr. Michael Waibel, Universität Hamburg (UHH)
Local Research Partner:	Royal University of Phnom Penh
Associated Partners:	NCSD/MoE (Dissemination & Anchoring)
	Phnom Penh Impact Hub (Implementation & Dissemination)
	Centre for Khmer Studies (Dissemination)
	Paññāsāstra University of Cambodia (Capacity Building)

Guiding Research Question:

How can transformative and collaborative governance approaches be developed, employed and analysed in Phnom Penh to support processes of transformative urban and sectoral change in the building sector?

Sub-Questions

- How can the current socio-techno-political system of the building sector in Phnom Penh be characterized? Which drivers and barriers for an urban sustainability transition can be identified? (Sengers and Raven, 2014; Raven et al., 2017; Mejía-Dugand et al., 2013; Kern and Rogge, 2018)
- How can local sustainability and liveability discourses be characterized in Phnom Penh? How can de-politicized low-carbon green urbanism and urban liveability discourses then be employed to support transformative change towards urban sustainability in Phnom Penh? (Rosol et al., 2017; Noboa et al., 2019b)
- How can a *sectoral* transition of the building sector be brought together with a sustainable *urban* transformation in Phnom Penh? (Späth and Rohrer, 2012; Wolfram et al., 2016)
- How does the socio-political and socio-institutional context of Phnom Penh influence transition pathways and to which degree can SUT frameworks from the Global North be applied in this context and how can they be adapted? (Hansen et al., 2018; van Welie and Romijn, 2018; Ramos-Mejía et al., 2018; Noboa and Upham, 2018)

Insights of the Definition Phase

Work Package 6 (WP#6) engages in both an analytical and a normative dimension. During the Build4People Definition Phase (DEF-Phase) our research focused on the analytical dimension in order to gain insights for the research plan design for the upcoming Research and Development Phase (RD-Phase). This exploratory analysis will be deepened as part of the societal and scientific problem based research during the first year of the RD-Phase (Lang et al., 2012). During the DEF-Phase we reviewed the existing literature, gained



information through discussions during several workshops organized by WP#6 and conducted a first round of explorative interviews with local stakeholders and experts.

A number of challenges in the field of urban development and buildings are frequently discussed in the Cambodian context. Frequently mentioned sector-related problems are the overburdening of waste, water, electricity and transport infrastructures (see also Baker et al., 2017). A number of policies and initiatives that engage with these deficiencies and challenges were analysed during the DEF-Phase, too. This includes the work of the Global Green Growth Institute (GGGI) and its Green Urban Planning Methodology (NCSD and GGGI, 2016), the Phnom Penh Sustainable City Plan 2018-2030 (PPCA et al., 2019) and the advocacy efforts of the European Chamber of Commerce (EuroCham) among others by means of their annual White Books (EUROCHAM, 2019).

A major problem that has been observed during the DEF-Phase is related to institutional fragmentation. Administrative responsibilities of sustainable urban development and sustainable buildings are scattered among many different national-level ministries and Phnom Penh City Administration (PPCA). The PPCA has very limited financial and human resources and is generally considered to be in a relatively weak position between a) the central state and b) powerful private developers in a “disjointed nature of urban governance” (Paling, 2012, p. 2895). PPCA’s weak position manifests for example in the non-compliance with the municipal masterplan. Private developers usually conduct their own planning relatively independent from PPCA’s municipal masterplan. Additionally, projects with more than 3.000m² receive their building permit from the national level, not from the level of the municipality. Project implementation however requires some form of “buy-in from the local elite”, i.e. a project-based and negotiated relationship between private sector developer and local state actors (Nam, 2017a, p. 626). Paling argues that even though “the strength and centrality of the Cambodian state in planning and developing the city are undeniable”, its actual role is much more unclear, as “[i]nternal power are shrouded in ambiguity, overlapping with the private business interests of political elites, financial enticement for both individuals and institutions, and informal networks of political power” (2012, p. 2906). The high level of building activity (Nam, 2017b, 2017a; World Bank Group, 2019; CBRE, 2019) and capital investment that were observed during the DEF-Phase resemble processes of property-led development and have been discussed as a “construction boom” (Brickell et al., 2018, p. 23) and “speculative urbanism” (Nam, 2017a), in a context of “neoliberalism with Cambodian characteristics”, i.e. “nepoliberalism” (Springer, 2017, p. 244), “political oligarchy” (Mialhe et al., 2019), “illiberal democracy” (McCarthy and Un, 2017) and “neopatrimonial politics” (Un and So, 2011).

Alternative forms of housing provision such as community-driven or non-profit tenure systems, which often have a stronger emphasis on quality of life and sustainability as they



are not driven by profit but by the inhabitants and their needs hardly exist in the formal Cambodian context.

Furthermore, several deadlocks were observed during the DEF-Phase. For example, a deadlock with regards to sustainable building materials and practices was detected between a lack of demand and a lack of supply. In this regard, a lack of specialized skills and human resources have been observed as well. Besides the market deadlock, an institutional deadlock was observed too: Private sector driven green building institutionalization processes – the establishment of a Green Building Council as a NGO – were met by state opposition. Therefore, no body such as a Cambodian Green Building Council has been officially established yet. In addition, most of the interviewees noted, that a lack of state regulation and incentives and particularly a lack of enforcement of the existing regulation have been holding back potential processes of urban and sectoral transformation.

Another issue that many interviewees noted was the absence of incentives for sustainable practices. This could include higher charges or taxes on unsustainable practices and products, or the subsidization of sustainable practices and products or subsidised interest rates for sustainable building projects, all of which do not exist in Cambodia, yet. There exists, for example, no national energy efficiency regulation for the building sector in Cambodia yet. Building owners are also not required to obtain obligatory energy certificates for buildings which would indicate the individual energy performance of a residential unit and may influence decisions to invest into energy efficiency.

Also, the application of voluntary industry self-regulation initiatives such as Green Building certification schemes is very uncommon: Only seven buildings have received a LEED-certification to the present day (July 2020) (GBIG, 2020). None of these are residential buildings – the most common urban building type and the focus of the Build4People project. Finally, the absence of a platform for connecting and coordinating front runners, innovative sustainability minded actors within and beyond the sector was mentioned by several interviewees as a constraining factor. Such spaces are considered of importance for the co-development of knowledge, capabilities, social capital, alternative discourses and policy alternatives - particularly in illiberal contexts (Noboa and Upham, 2018).

A number of these actors articulated interest in academic support and transdisciplinary cooperation towards transformative change. The DEF-Phase thus showed that sustainability-minded actors do exist in the local context, but that they are rather isolated and in a relatively marginalized position.

This marginalization and the socio-political and institutional barriers described above can be connected to the literature on *governance for transition* which argues, that (urban) sustainability transitions are not primarily challenged by the need for technological innovations but innovations in the field of governance and institutions (Rohracher, 2001;



Rink et al., 2018). This highlights the relevance of WP#6 and its guiding research question of how to identify, adapt and implement governance approaches that can support an urban transformation in Phnom Penh while also increasing the quality of urban life. Based on the literature review and a first analysis of the local context, we thus argue that in order to support a sustainable urban transformation in Phnom Penh, the application of a transformative governance approach would be promising that:

- supports networking, coalition building, the visibility of front-runners,
- integrates experimental and transdisciplinary elements,
- supports innovation (particularly socio-institutional and socio-political).

Such an approach would address the observed marginalization of niche actors and sustainability minded regime actors from various actor groups, incl. industry, state, academia and civil society. Socio-institutional and socio-political innovations that might result of this support could then strengthen developments towards an urban sustainability transition in Phnom Penh.

WP#6 MAIN GOAL

To co-develop and implement a transformative and collaborative governance approach with local stakeholders that is tailored to the local context of Phnom Penh in order to support processes of transformative urban and sectoral change in the building sector towards sustainability and a better urban quality of life

WP#6 Sub Goals of the RD-Phase

- In-depth understanding of local transition dynamics, the socio-techno-political system of Cambodia’s building sector and Phnom Penh’s urban development regime, and ongoing transformative processes (Year 1)
- Participatory problem framing & development of a shared vision (Year 2)
- Development of an Urban Transition Agenda (Year 3)
- Facilitation and analysis of transformative experiments (Year 4)



Literature Review

The complex interdependencies and internal contradictions, the absence of unambiguous „right“ or „wrong“ solutions, long-term investments and long life spans make urban (un)sustainability as encountered in Phnom Penh a „wicked problem“ according to Ernst et al. (2016). Scholars argue that such “wicked problems” as evident in Phnom Penh’s current urban development path and the building sector’s practices are best addressed by transformational sustainability research (Frantzeskaki et al., 2012; Ernst et al., 2016; Rink et al., 2018). Transformational sustainability research aims to develop “solution options for sustainability problems and eventually to transform the status quo towards sustainability” (Wiek and Lang, 2016, p. 38).

Based on an extensive review of the literature on sustainability transitions and sustainable urban transformations a range of different but related approaches were identified that exist “to ‘steer’ in the midst of uncertainty” (Frantzeskaki et al., 2018a, p. 20) and to support incremental steps for change towards urban sustainability.¹ Most of the transformational research approaches highlight the need of **experimentation** and policy learning to initiate transformative change (Wiek and Lang, 2016; Raven et al., 2019; Sengers et al., 2019; Engler et al., 2019). In fact, experimentation is considered “a key concept for the governance of sustainability transitions” (Wirth et al., 2019, p. 229). Here, experiments are defined as „inclusive, practice-based and challenge-led initiatives designed to promote system innovation through social learning under conditions of uncertainty and ambiguity“ (Raven et al., 2019, p. 260). Most of the studies in the field of urban sustainability transitions also draw on the concept of **transdisciplinarity**. This involves the inclusion of a variety of actors in the research process (incl. academia, and non-academia stakeholders of government, business, civil society), through community-based, interactive, or participatory approaches (Wiek and Lang, 2016). It is argued that a successful transformation requires input from all communities of knowledge and their respective epistemics. As the research aims to reach beyond analysis and actually lead to implementation, the role of non-academics or practitioners is crucial. This then also enables higher ownership and legitimacy of the transition process (Lang et al., 2012, p. 26). To design the most suitable research approach for WP#6’s R&D Phase, a number of epistemological and ontological questions are to be considered.

¹ These transition processes are “purposive transition” according to the classification of Smith et al. (2005, p. 1499) – in contrast to “endogenous renewal”, “reorientation of trajectories”, or “emergent transformation” – as they tend to come with a high level of coordination and an external resource locus. The B4P team however acknowledges the relevance, the coexistence and the interactions of different transformational processes.



1. Different transformational approaches

The literature review has identified a wide range of research approaches that aim to analyse and support transformative change towards sustainability. This includes approaches that centre *niches*, as protected spaces for innovation and their support as *Strategic Niche Management* (Schot and Geels, 2008; Kemp et al., 1998); encompassing concepts of *Transition Management* (TM), that connect long-term thinking with short term steps within a reflexive and participative governance framework that involves participatory forms of envisioning, negotiating, experimenting and learning (Loorbach, 2010; Frantzeskaki et al., 2018b); approaches that focus on the *backcasting* element of transition management (Robinson et al., 2011; Wieners et al., 2015); or approaches that extend the transition management concept to "illiberal democratic" contexts in *transdisciplinary transition management arenas* (Noboa and Upham, 2018); and those concepts that highlight the collaborative generation of knowledge for transitions (Preller et al., 2014). Furthermore, scholars have combined and applied these and other transformational methodologies in the TRANSFORM-framework (Wiek and Lang, 2016), or forms of experimental *labs* such as *T-Labs* (Pathways Network, 2018), *Urban Transition Labs* (Neuens et al., 2013), *Urban Living Labs* (Voytenko et al., 2016; Bulkeley et al., 2015), or *real world laboratories* (Schäpke et al., 2018).

Most of these approaches apply the conceptual tool of the *multi-level perspective* (MLP) on transitions (Geels, 2005, 2014). According to the MLP transitions are fundamental changes of socio-technical or socio-political (Swilling et al., 2016) regimes that have developed around key technologies or sectors such as the building industry (Loorbach et al., 2017). The transition itself is understood as the result of dynamics between (a) the regime, (b) external pressures (i.e. *landscape* pressures), and (c) emerging and innovative *niches* (Loorbach et al., 2017).

A common theme of these transformational approaches is furthermore a series of intervention phases (from here on *transition management phases*) (see for example Loorbach, 2010, p. 173) These commonly include a first phase of in-depth analysis and the development of a shared problem understanding or framing (strategic phase); in a second phase then, having establishment a platform or arena, multi-stakeholder collaboration and the development of a transition agenda becomes crucial. Thirdly, the operationalisation of both vision and agenda in experiments and projects takes centre stage. These three are complemented by a reflective phase in some cases (Wittmayer et al., 2018; Loorbach, 2010). The multiplicity of transformational governance approaches highlights the shift from an analysis of the governance *of* transitions to governance *for* transitions.



WP#6/B4P follows this change and aims to develop a transition approach that allows to both analyse and actively support transformative change towards urban sustainability in Phnom Penh.

2. Governance for Transitions

Initially not much attention was paid to questions of power, agency, politics and governance within sustainability transition studies (Bulkeley et al., 2015). An early intervention in the debate however came from Smith et al. (2005) who argues that “system-level change is, by definition, enacted through the coordination and steering of many actors and resources, whether these are intended or emergent features of transformation processes” (Smith et al., 2005, p. 1492). Subsequently a number of studies have dealt with the governance of and for urban transitions, focusing on questions such as

- a) the extent to which actors are (in-)capable of drawing upon and mobilizing different resources;
- b) whether they reproduce, challenge or develop alternate institutions;
- c) the capacity of creative (or innovative) power of niche practices;
- d) and the extent of (democratic) legitimacy and politics of systemic change (Bulkeley et al., 2015, p. 9).

There are then significant moves within the field to recognise the importance of governance, power and politics to the development of niches, the constitution of regimes and the formation of socio-technical transitions. Questions of power are particularly recurring.

While differing understandings of power exist within the transition literature, one of the most encompassing understandings has been developed by Avelino (2017; see also Avelino and Wittmayer, 2016; Avelino and Grin, 2017; Avelino et al., 2016; Avelino, 2009). She defines power as “the (in)capacity of actors to mobilize resources to achieve a goal” (Avelino, 2017, p. 515). Avelino argues that with power being understood as a capacity, its analysis should focus on the exercise of power. Therefore, she has developed a framework that distinguishes different levels and ways in which actors are mobilising resources. Her “Power in Transition” framework (POINT) indicates innovative, transformative, destructive, reinforcing, transformative, and systemic ways of exercising power.

Bulkeley et al. (2015) claim that the “key current dilemma within the transition studies research community is how to marry a concern with the power of agents (derived in large part from the concern to identify where the capacity for transformative change might come from) with a recognition of the distributed or relation nature of power” (Bulkeley et al., 2015, pp. 12–13). The authors caution that a focus on power as attached to one actor neglects the regime’s structuring power, while human-centred understandings neglect the more-than-human and socio-material means of power co-constitution (Bulkeley et al., 2015). Therefore



they propose the development of relational power conceptualizations that understands power as a “distributed property, such that it neither resides with individual agents nor is structurally determined” (Bulkeley et al., 2015, p. 14). Referring to both Foucault’s governmentality framework and neo-Gramscian understandings of hegemony, they highlight the “dispersed nature of rule”. They thus consider purposive transition initiatives as strategic projects and focus on the “dynamic qualities of power as a set of capacities that are constituted through the formation of strategic projects designed to intervene in the city in relation to particular goals which have some degree of authority and legitimacy” (Bulkeley et al., 2015, p. 14). Questions of power and its distribution will thus be important considerations for WP#6’s research activities and the final design of its action research processes.

Moving to the scale of the individual household, questions of intra-household power dynamics are also highly relevant. This relates to the (re)configuration of the household as a political terrain “where not only questions of sustainable resource use but also other socio-political questions of urban development, such as segregation or a just distribution of infrastructure costs, are fought out” (Rohracher and Köhler, 2019, p. 2375). In her recent study on the Cambodian home, Katherine Brickell has highlighted the gendered dimension of household decision-making, domestic violence, and insecurity and calls for an understanding of “the domestic sphere as a critical, yet overlooked, vantage point for understanding the trajectory of Cambodia” (2020, p. 1). WP#6 will therefore support WP#1 in their considerations of these everyday life household decision making processes, and social practices of households in the analysis of possible transition pathways and their barriers and triggers. The transdisciplinary UQoL process lead by WP#1 will regard the gender perspective in respect of how people perceive and interact with the urban environment. As Fadda (2003) suggests, the concept of UQoL needs to be understood as a social construct, which is in relation with gender and the environment, we aim to be sensitive to the gender aspect within our research.

3. Spatiality of transitions I: Urban transitions

Researchers have recently also started to consider the spatiality or geography of transition dynamics (Truffer et al., 2015; Hansen and Coenen, 2015). In this regard, space specific factors, such as localized (informal) institutions and networks, particular consumer demands, etc. and spatial variations of regime formations that lead to place-specific transition processes have been discussed (Köhler et al., 2019; van Welie et al., 2018; Fastenrath and Braun, 2018). Within this line of research, the analysis of *urban transformations*, or urban sustainability transitions has assumed a prominent role. Urban transformations are considered to be multi-level and multi-scalar, i.e. span across governance levels, levels of the multi-level perspective and across spatial scales (Späth and Rohracher, 2012; Nevens



et al., 2013). Wolfram et al. (2016) distinguish three different standpoints on the engagement with urban transformations, claiming that some studies aim at a) system change or new systemic configurations, b) urban change, or new urban configurations, or, c) urban/system relations. While all of these come with their own insufficiencies, their combined use is considered a “rich epistemological spectrum by Wolfram et al. (2016, p. 20). When considering *urban* sustainability transitions in Cambodia’s building sector, contradictions or alignments between socio-technical regimes and their priorities and those of urban or territorial systems must thus be considered. It is to be asked to which extent “the territorial priorities of an urban governance network – and the social interests that produce them – are able to actively manage socio-technical regime change” (Hodson and Marvin, 2010, p. 481). In this regard, the *multi-level governance* perspective is of utmost importance (Ehnert et al., 2018). Therefore, WP#6 brings together the literature on sustainability transitions, their geography and urban governance to analyse and support the context-specific processes of sustainable urban transformation in Phnom Penh’s building sector.

4. Spatiality of transitions II: Transitions in the Global South

With most of the transformational research being rooted firmly in the Global North, few applications of the concepts have been applied in the Global South – none were found for the Cambodian context. Authors have discussed differing **degrees of regime (in)stability** in the Global South. Hansen et al. (2018) and Wieczorek (2018) argue that both regime instability and diversity are higher in the Global South. Noboa et al. (2018) however claim that state capture, oligopolies, authoritarianism, etc. are increasing the stability of the status quo in many contexts of the Global South. Another question is the relation between **formal and informal institutions**. Here, many scholars argue that informal institutions have a much larger influence on regimes and transitional processes than in the Global North. Feola (2019) posits that these informal institutions tend to be informed by “traditional” principles and ontologies”. Scholars furthermore question whether states can play an active role in supporting socio-technical niches or similar transition initiatives in contexts with a prevailing focus on short-term development objectives and curtailed state capabilities of enforcing rules and providing public services (Hamann and April, 2013). Other authors deal with the **implicit assumptions** that the Western-developed ideas of transition research entails. These include the prevalence of market mechanisms, particular governance arrangements and “the greater good” (Feola, 2019; Kenis et al., 2016).

Considerations of a “just transition” have also emerged in the discourse on transitions in the Global South. This includes questions on equity and justice and trade-offs between different groups of current and future generations (Newell and Mulvaney, 2013; Swilling et al., 2016;



Onsongo and Schot; Cai, 2019). Swilling et al. (2016, p. 650) argue that a “just transition” would involve the “dual commitment to human well-being (with respect to income, education and health) and sustainability (with respect to decarbonisation, resource efficiency and ecosystem restoration)”. Other factors affecting the **decision-making process** are also debated in this stream of literature. It is argued that a number of factors are playing a more significant role in Global South contexts; this includes differing value priorities and other power relations such as ethnicity that exist alongside – partly in contradictory manner – to those logics of profit maximisation and competitiveness.² Another peculiar aspect to be considered when dealing with transition-inspired initiatives in the Global South are the particular conditions of postcoloniality (Pereira et al., 2020). Sustainability transition projects have been commonly associated with developmentalist interventions. As many Governments in the Global south – influenced by scholarly critics of capitalist and mostly Northern development models – have initiated development in their own terms, non-reflective transition initiatives in the Global South “risk the reproduction of Western ideals of progress and modernity and might be perceived as a **new form of colonisation**” (Feola, 2019, p. 5).

The Build4People team will thus practice this reflectivity and consider their own positionality during the research process. The insights from the emerging literature on transitions in the Global South will be important for the analysis of possible transition pathways, barriers and drivers in the context of Phnom Penh and the conceptualization of regimes, niches and the distribution of power.

5. Socio-Technical considerations of the building and urban development sector

Besides its bias towards the Global North, the transition literature also has a sectoral bias towards energy and mobility; others, such as the building sector have seen less scholarly interest despite their significant environmental impacts (Fastenrath and Braun, 2018; Affolderbach and Schulz, 2018). In fact, Green (or Sustainable) buildings can arguably be identified as “one of the most significant, cheapest and fastest approaches to reduce greenhouse gas emissions at the local scale” (Preller et al., 2017, pp. 217–218; OECD and IEA, 2013; UNEP and Global ABC, 2016).

Meanwhile, the challenge of a sustainability transition of the building sector is not primarily considered to be a question of better technological solutions; instead it is argued that “much more challenging is the social embedding and the socially interactive process of designing, constructing and using buildings” (Rohracher, 2001, p. 139). According to Rohracher, “[t]he way we construct buildings and the way we live in buildings, are deeply intertwined with the

² This does not imply that these do not also exist in the Global North.



way we organize our social world and its interaction with nature" (2001, p. 137). Transformative strategies therefore rely on an understanding of household behaviour and consumption within the context of the built environment (McCormick et al., 2013, p. 5). This will be addressed by collaborative research efforts of WP#1, WP#2 and WP#6 and the transdisciplinary action research.

The construction industry is conventionally considered to have low degrees of innovation and mass production, while being shaped by high levels of labour intensity and regionalism, and a separation of design and construction (Rohracher, 2001). A Green Building or Sustainable Building sector in contrast has to integrate high-tech components, requires specialized companies, including different services and consultancy firms. Therefore, new forms of intense cooperation between specialized actors have to emerge. This also includes the creation of new firms and the reorientation of existing ones. Moreover, an overall increase of innovation dynamics is to be expected. Green or sustainable buildings commonly lay at the intersection of multiple sectoral policy fields including climate policy, energy and environmental policy and economic and regional policies. This further complicates a transition in contexts such as Cambodia where disjointed governance can be observed. Besides building materials, energy usage, etc. Sustainable Building aspects can include flexibility of usage, organisation of buildings and their design and planning processes, land use planning (DGNB, no date). Næss and Vogel argue that new technologies in the building sector will coexist over much longer periods than in other (historical) cases of transitions (2012).

The review of the literature on transitions in the building sector highlights the sector-specific features that will be considered for the research process. Due consideration of these is crucial for the design of the action research and the development of promising transition strategies. Of particular relevance is here the need for new forms of cooperation that are required in the development process towards a sustainable building sector.



Research Plan

The research design of WP#6 follows the Build4People structure and thus focuses on societal and scientific based problem research in the first year before turning towards transdisciplinary action research processes in the second and third year, and finally moving towards the refinement of theory in year 4. Based on the literature review and the insights from the definition phase, WP#6 will draw on the work on collaborative governance, including

- Urban Transition Labs – an adaptation of transition management to the urban realm (Nevens et al., 2013),
- Transdisciplinary Transition Management Arenas – an extension of transition management to contexts of illiberal democracy (Noboa and Upham, 2018; Noboa et al., 2018) ,and
- the literature on collaborative and intermediary organizations (Hodson and Marvin, 2010).

Building upon this “assemblage of frameworks” (Pereira et al., 2020, p. 175) WP#6 engages with the knowledge co-production in the policy-science interface for urban governance (Frantzeskaki and Kabisch, 2016). In order to support and empower sustainability oriented but relatively marginalized policy makers, citizens, activists, entrepreneurs, scholars and other actors and city-makers to transform the urban development pathway towards urban sustainability, WP#6 and WP#2 will jointly initiate and facilitate a transdisciplinary multi-stakeholder process within a co-creative space in order to co-create knowledge and identify and develop transformative approaches for the urban built environment – the Sustainable Building Arena (SBA). SBA will be the process (see below), the co-creative space and the network of actors which will be brought together into that co-creative space by regular events, side events and networking possibilities.

SBA aims to support and empower sustainability-minded but marginalized urban and building actors by

- identifying and developing innovative and sustainable (governance) practices;
- empowering actors by offering and facilitating co-production of knowledge; and by
- facilitating interaction, cooperation, and coalition building

in order for them to initiate and drive transformative change towards urban sustainability and to support the development of alternative discourses and the pluralisation of knowledge (Noboa, 2019a) (see Figure 1). In the Cambodian context it is of utmost importance to ensure that the co-creative space of the SBA process is also a “safe[r] space” in which the participants can speak relatively freely (Pereira et al., 2015; Pereira et al., 2020).



Core element of SBA is a series of SBA workshops, side events and continuous networking and collaboration possibilities as well as a communication and dissemination platform (for the integration of side events see Rach et al., 2019). WP#6 will facilitate the SBA in joint-leadership with WP#2, which will complement the multi-stakeholder knowledge co-production that aims at socio-institutional and socio-political innovations with technical consultations that focus on technical feasibility, socio-technical innovation and the development of a technological roadmap. The Impact Hub Phnom Penh will support the implementation based on its rich experience with the facilitation of innovative workshops. The SBA process consists of different phases that are preceded by an analytical phase (see Figure 2). The science-policy interface of the SBA will be complemented by a science-business interface, a Sustainable Building Incubator (SBI). In the following, the research plan will present the

- I. Analytical phase (*societal and scientific problem-based research*)
- II. Sustainable Building Arena (SBA) and its constituting phases (*transdisciplinary action research*),
- III. Sustainable Building Incubator (SBI) (*transdisciplinary action research*), and a
- IV. Summary and Outlook (*reflection, refinement & re-integration of created knowledge*).



I. Exploring local dynamics (2021) (WP#6 Milestone R1 & R2)

In this phase of societal and scientific problem based research, WP#6 will engage in a substantial analysis of a) the socio-techno-political system of the building sector, b) the urban development regime, and c) ongoing or emerging transformative processes within the Cambodian/Phnom Penh context. This includes the analysis of experiences and strategies of sustainability-minded actors that are currently marginalized. Subsequent transition strategies that will be developed during the action research process shall build upon their experience.

The analysis will include semi-structured expert interviews with stakeholders, analysis of local sustainability and liveability discourses, stakeholder mapping, an analysis of the building delivery process (Klotz et al., 2009) and its supply chain (UNEP, 2014). Following the literature on urban sustainability transitions, this analysis aims at a solid understanding of the prevailing regime and niche characteristics. Subsequent transition strategies will be considering these analytical insights for promising entrance points (Ghosh and Schot, 2019; Rogge and Reichardt, 2016). Particularly important is also the integration of the sectoral and the spatial perspective in this phase to account for the “rich epistemological spectrum” that is proposed by Wolfram in the combination of systemic, urban and urban/system relations standpoints on urban transformations (Wolfram et al., 2016, p. 20).

The research in this phase aims to answer questions about the characterization of the current socio-techno-political system of the building sector and drivers and barriers for an urban sustainability transition. The research however also targets local sustainability and liveability discourses and potential discursive coalitions (Rosol et al., 2017; Noboa et al., 2019b). In both cases however, the academic insights, will be complemented by transdisciplinary knowledge co-production in the subsequent action research phase. This



Pre-SBA process is often framed as the first phase of a transition management process, or as “Setting the Scene” (Roorda et al., 2014), and “Exploring local dynamics” (Frantzeskaki et al., 2018c; Silvestri et al., 2018). Here, WP#6 and WP#2 and their local partners will start the SBA process by assembling a transition team. This will comprise WP#6, its partners and local stakeholders that fully support the idea of transformational change towards urban sustainability.³

II. SBA Process (2022-2024)

Building upon the extended knowledge basis that includes a substantial multi-level stakeholder mapping, the transition team – led by WP#6 – will then establish the SBA process and prepare the first SBA event. A fundamental task at this point is the design of the SBA as a “governance niche”, i.e. a “safer space”, where participants, i.e. change agents can discuss and co-design ideas, problems, strategies and actions “without immediate ‘control’ of regime actors that may have dominantly business-as-usual conceptions” (Nevens et al., 2013, p. 117). The SBA process involves a set of workshops. These workshops will be connected to Build4People conferences to make use of synergies and maximize participation of both local stakeholders and the Build4People team. This will furthermore open the possibility for SBA side events that can be initiated by stakeholders and other WPs. The SBA will furthermore be established as a communication, dissemination and collaboration platform. The SBA process thus fulfils three functions: a) the workshop series, b) a governance niche, and c) a communication, dissemination and networking platform. SBA functions will be closely integrated with the work of other WPs and other transdisciplinary research activities, particularly the Build4People Ecocity Transition Lab (WP#3-led) and the technological consultations and roadmap development processes led by WP#2. Outcomes of the different activities are directly fed into the design of subsequent activities.

As proposed in Figure 2 and Figure 3, the SBA includes two cycles of the first three transition management phases (**Milestones SBA1 & SBA2**). In the first cycle a key role is given to so-called **front runners** who are understood as “visionary people [...] that are able and willing to engage in a creative process of out-of-the-box thinking with regards to a desirable long-term future for a sustainable city (cf. the urban sustainability time-scale challenge) [and can be both] out-of-regime pioneers, but also change-inclined regime agents” (Nevens et al., 2013, p. 119). They are thus considered to be part of the SBA

³ This could involve interested WPs and their local partners, key administrative people like Vannak Seng (PPCA), Nokhai Sop (NCSD), progressive local architectural offices (Urban Living Solutions, Archetype, Niron Housing, Kongny Hav, etc.), socially innovative institutions such as the Impact Hub Phnom Penh, CKS, CDRI, or eco-business associations such as the Green Business Sector Committee of the EUROCHAM. Getting the right team together is of significant importance as the transition team is „considered as the ultimate driver” of the transition process” (Nevens et al., 2013, p. 116).



process rather as individuals with an intrinsic motivation than as representatives of their respective institution and are expected to „work autonomously or ‘protected’ from the regime, in mutual trust and at an initially low visibility for the outside world“ (Nevens et al., 2013, p. 120).

The first phase of the workshop cycle, **SBA-P1** (see Figure 3), aims at the **development of a participatory framing of the transition challenge**. Interactive, transdisciplinary knowledge generation and interaction between researchers and stakeholders generates new and differentiated knowledge at this point that benefits both researchers and stakeholders, cross-fertilizes, stimulates self-reflection and connects theoretical discourses and practitioners and thus supports a sustainability transition (Preller et al., 2014). SBA-P1 starts with brief inputs from the WPs that are based on their research findings. In this transdisciplinary action research phase, the SBA participants will then co-develop a framing of the transition challenge based on the inputs and their rich experience and thus extend the expert-led analysis of the previous phase that focused on societal and scientific problem based research.

The second phase, **SBA-P2**, will then focus on the development of a **common vision** for Phnom Penh's building sector and the built environment. Here, SBA-participants shall co-develop and express their key priorities and principles for their envisioned future spatio-sectoral system as well as images and narratives of the future. This process can contribute to the alignment of perspectives and a positive group dynamics. Important aspects are the internalisation of the narratives and the diffusion of narratives and visions beyond SBA. The internalisation should then not only include the vision itself, but also the awareness of the necessity for fundamental change as well as its understanding as an experimental and open-ended processes.

In the third phase, **SBA-P3**, backcasting methodologies will be applied to connect the future scenarios and narratives to the present in order to develop concrete transition pathways and strategies. Hereby, a first **draft version of a “transition agenda”** will be established. At this point, the role of the transition team moves to the background, as SBA-P3 aims at “a number of emerging self-organizational processes” (Nevens et al., 2013, p. 120).

A **second cycle of the three transition management phases** will then be implemented in the subsequent year. Here, the results of the first cycle will be validated and new research results of the other WPs will be infused. In the second cycle, the front-runners will be joined by a wider group of participants. Based on the updates of the challenge framing (SBA-P1) and vision (SBA-P2), the participants will co-develop an encompassing transition agenda document. This process shall then also integrate the research results of the other WPs, Neighbourhood Plans & Guidelines that will have been developed within the Ecocity Transition Lab Process led by WP#3 and the results of the technological roadmap development of WP#2.



The fourth workshop phase (**SBA-P4**) which will be implemented in the fourth year then aims at the initiation of real-life experiments that are based on the previous steps of problem analysis, vision and agenda development. This requires even more autonomy and active engagement of the SBA-participants and their wider networks. Experiments should come with new forms of collaboration between actors. Besides the experiments that are expected to be emerging during the previous phase, WP#6 and WP#2 will propose a number of experiments to be discussed within SBA that are based on the literature and previous findings of WP#6 and the other WPs. This includes the Facilitation of a Green & Smart Campus for the Cambodian Development Research Institute⁴, the development of a Sustainable Building Webtool, the implementation of Constructive Technology Assessments and co-development of innovative Green Building Finance mechanisms. The implementation of the proposed experiments will be based on the discussion with local partners, the transition team and SBA. These experiments shall be engaging with already ongoing initiatives that have been analysed during the pre-SBA phase in an “appreciative enquiry” (Nevens et al., 2013, p. 119).

The SBA will be complemented by a WP#6-led Sustainable Building Incubator (SBI). It complements the SBA process with knowledge co-production and strategic niche management activities at the science-business interface. The SBI will be implemented between the two SBA cycles in order to channel insights from the science-policy interface, i.e. the first SBA cycle to the science-business interface of the SBI and to then feed the insights of the SBI back to the second SBA in order to co-develop a comprehensive transition agenda.

⁴ The Cambodian Development Resource Institute is one of the key private research institutes and think tanks in Cambodia. Being committed to transformative change towards sustainability, the CDRI has declared their interest in the development of a Green & Smart Campus for CDRI as a B4P pilot project. The support of this campus development process allows the B4P team to apply their expertise and their research findings to a real world and experimental setting. The facilitation process of the campus would then however also be subject to WP#6 analysis (Doyon and Moore, 2019; Raven et al., 2016).



III. The Sustainable Building Incubator

The SBI is planned in cooperation with Impact Hub Phnom Penh, a local “change leader”, and social venture and enterprise builder. The program's intention is to support early-stage entrepreneurs in sustainable buildings to improve their entrepreneurial way of thinking and to support their innovation process. Many early-stage entrepreneurs in Cambodia struggle to transition into fully functioning SMEs and MMEs, and by running this program and providing tailored, immersive support, we hope that more innovative, sustainable businesses emerge that support the transition of the building and urban development sectors in Phnom Penh as part of a sustainable urban transformation. The participants will be equipped with the network, soft skills, and business acumen and mindset to launch and grow a startup related to the sustainable building industry. Through online promotion of the startups and their goals, the SBI can inspire the next generation of entrepreneurs and changemakers to start their own initiatives. The SBI furthermore provides deeper insights into the sustainable building startup sector through thorough and valuable data collection and impact measurement. The SBI processes and outcomes can be conceptualized and analysed from a multi-level perspective on transitions as innovation processes in relatively protected spaces, i.e. *niches* and as strategic niche management (Schot and Geels, 2008; Quitzau et al., 2012; Wolfram, 2018).

The Build4People Sustainable Building Incubator involves two phases - ‘pre-incubation’ of 1 month and intensive ‘incubation’ of 6 months. It features a mini hackathon to kick-off and a range of learning approaches: structured group learning sessions (‘innovation bootcamp’



and ‘masterclasses’), flexible, 1-on-1 tailored sessions (mentoring and coaching) and facilitated interpersonal skills development sessions (‘peer-to-peer coaching circles’) plus experienced-based learning through self-led ‘field work’. The program will also include a field trip where the start-ups will together conduct an on-site visit in Cambodia, in order to gain a deeper understanding of their industry and its challenges and opportunities.

The “masterclasses” within the structured group learning sessions allow for input of different B4P work packages. The expertise and preliminary research findings of the other WPs as well as the results of the Participatory Challenge Framing Workshop can be channelled into these classes. The “masterclasses” will be complemented by an IHPP-led “innovation bootcamp”. Partners of the B4P network can additionally assume mentorship positions and offer field trips. The overall design of the final SBI will be co-developed by IHPP and WP#6 of B4P to reflect latest insights from the academic literature, previous B4P research results and the local experience in incubator facilitation (IPHH). An extended SBI (> 20,000 Euro) might be implemented in case of third party funding from industry partners. IPHH has reported interest from the private sector in funding additional SBI elements, including seed financing for start-ups that are to be incubated within the SBI process.

The SBI will be integrated into the SBA process that applies the transition management literature to the local context. The integration of the SBI into the SBA and the co-facilitation of SBA and SBI by the B4P-Impact Hub-team yields significant synergies. To maximize the cross-fertilization of the academia-policy interface (SBA) and the academia-business interface (SBI), the SBI will be implemented between the two SBA cycles (see Figure 3).

IV. Overall principles of the process and beyond

Whereas other projects dealing with urban sustainability transitions frame the important processes of **reflection, monitoring, evaluating and learning (RMEL)** as a separate phase, Build4People proposes to understand these as ongoing processes, i.e. feedback loops. This shall include ex-ante interviews before the workshop cycles, participant observations during the arena workshops, and post-hoc questionnaire after the sessions (see Figure 3). This procedure allows to gather insights into (a) the process, (b) the generated actionable knowledge, and (c) information about future applications of the methodology (Noboa, 2019a). The reflexive process will thus also inform the conceptualization of the second cycle of the SBA, SBA-P4 and future applications in the subsequent Implementation Phase and beyond (see also Figure 3).

The facilitation of the SBA and the SBI allows WP#6 to critically analyse the development of a collaborative and supposedly transformative governance approach. It will allow the team to gain insights into the applicability and adaptability of the urban sustainability transition and transformation frameworks that have been developed in the Global North.



The analysis shall then allow the team to refine the theory on urban sustainability transition and guide future interventions in the Implementation phase and beyond.

The SBA and SBI processes are complemented by “**Engaging & Anchoring**” (E&A) activities. These E&A activities shall support the integration and connection of SBA, SBI and the wider B4P project to ongoing initiatives, processes of policy formulation and wider networks. Of particular importance are the integration into the NCSD-led Technical Working Groups (TWG) and its policy development process as well as to the work of the PPCA. Channelling the results, innovations and narratives of SBA into the Sustainable Building TWG and supporting the capacity development process within PPCA will support transformational processes within the formal arena.

The SBA process brings together various stakeholders of the urban regime with those of the building delivery process and the supply chain that are commonly disconnected. A holistic integration of stakeholders shall also include households and users of potential green buildings, bring them together with designers, and institutionalize their cooperation. The initial composition of the SBA with front-runners supports processes of networking, trust building, coalition forming and social capital development (Hess, 2014; Hodson and Marvin, 2010; Noboa, 2019a) that is enabled by the arena shall then support the organizational and institutional restructuring of the socio-technical system (Rohracher, 2001). This can include advocacy or discursive coalitions (Köhler et al., 2019, p. 6) that link the urban transformation to increases in liveability and the depoliticized liveability discourse, that might lead to policy innovations and ultimately in a change in the socio-technical-urban building regime (Köhler et al., 2019; Swilling et al., 2016). SBA and SBI thus aim to support a Sustainable Urban Transformation in Phnom Penh and its building sector through (a) the creation of a protected space, (b) collective action, and (c) the development of actionable knowledge (see Figure 4).





1.1 WP#6 Sub-Work Packages and Activities

The activities of the WP#6 sub-work packages are well in line with the rest of the activities of the project. It is planned to transfer the results and analyses generated into the joint activities and products.

WP#6.1 ANALYSIS OF THE LOCAL TRANSITION CONTEXT	
<i>Expected impacts</i>	<i>Understanding of prevailing regime and niche characteristics → foundation for the design and content of the transdisciplinary action research processes of the Sustainable Building Arena and the Sustainable Building Incubator</i>
scheduled	first project year
WP#6.1.1	Analysis of the socio-techno-political system and ongoing and emerging transformative processes (actor mapping (Rohracher, 2001), analysis of building delivery process (Klotz et al., 2009) and supply chain (UNEP, 2014), causal loop diagrams (Tang and Ng, 2014))
WP#6.1.2	Analysis of the urban development regime (literature review, semi-structured interviews, stakeholder mapping)
WP#6.1.3	Integration of different analytical dimensions into one holistic framing
WP#6.1.4	Composition of the Transition Team for the Sustainable Building Arena
WP#6.2 FACILITATION OF THE SUSTAINABLE BUILDING ARENA I & SUSTAINABLE BUILDING INCUBATOR	
<i>Expected impacts</i>	<i>Transdisciplinary knowledge co-production, coalition building, networking, socio-institutional and socio-political innovations</i>
scheduled	second project year
WP#6.2.1	Co-development of a participatory framing of the transition challenge and a spatio-sectoral vision
WP#6.2.2	Development of first draft of transition agenda
WP#6.2.3	Reflection of the first SBA cycle
WP#6.2.4	Sustainable Building Incubator preparation and kick-off



WP#6.3 FACILITATION OF SUSTAINABLE BUILDING ARENA II & SUSTAINABLE BUILDING INCUBATOR II	
<i>Expected impacts</i>	<p><i>Extended transdisciplinary knowledge co-production, coalition building, networking, socio, technical, socio-institutional and socio-political innovations, founding of sustainable building start-ups</i></p> <p><i>→ the outcome of the second SBA cycle, i.e. the transition agenda, can support the formation of alternative discourses; the incubated start-ups can operationalize the co-produced knowledge for an urban sustainability transition of the building sector</i></p>
scheduled	third project year
WP#6.3.1	Facilitation of SBI's final stage: preparation of sustainable building business cases and pitch to investors
WP#6.3.2	Updated Framing & Vision Document
WP#6.3.3	Co-development of Transition Agenda
WP#6.3.4	Reflection on SBI process and second SBA cycle and outlook to Implementation Phase
WP#6.4 SUSTAINABLE BUILDING ARENA III: FACILITATION OF EXPERIMENTS	
<i>Expected impacts</i>	<p><i>Experiments can operationalize the previously developed transition agenda; reflection on the experimental process allows for improved operationalization of the agenda during the Implementation Phase</i></p>
scheduled	fourth project year
WP#6.4.1	Implementation of Workshop on experimentation: Co-Design of Experimental operationalization of transition agenda
WP#6.4.2	Facilitation and reflection on experiments
WP#6.4.3	Reflection on whole SBA process and analysis of implications for Implementation Phase
WP#6.4.4	Extracting content for reporting, dissemination, capacity building; contribution to Build4People Handbook; Contribution to Build4People Toolbox



WP#6 Work- and Implementation Plan

Following table gives an overview of the work- and implementation plan of Work Package #6 during the RD-Phase. The table is structured along the different work steps of the Build4People project which are subdivided into activities, methods, aims / results and transdisciplinary cooperation.

The work- and implementation plan of Work Package #6 refers to all milestones as indicated in the milestone timetable matrix (figure 4 of Build4People consortium proposal). It contains detailed information on the specific Work Package#6 related milestones.

B4P RESEARCH & DEVELOPMENT PHASE	Activities	Methods	Products
Work Steps	Aims / Results	Trans-disciplinary Cooperation	
I. Build4People Coordination Meetings in Germany	Regular exchange within the Build4People project team Contributions from the field of sustainable urban transformation to the ongoing conceptualisation and modelling of Urban Quality of Life (UQoL) Face-to-face meetings in the context of the milestones, in-between regular online meetings (every two months)		
	Presentations, discussions and exchange Planning of joint scientific dissemination		
	B4P Milestone WS1: Build4People RD-Phase Kick-off Meeting, Hamburg (Month 01) B4P Milestone WS2: Build4People UQoL-Survey Workshop, Magdeburg (Month 13) B4P Milestone WS3: Build4People UQoL-Modelling Workshop, Eberswalde (Month 25) B4P Milestone WS4: Build4People Proposal Writing Workshop, Hamburg (Month 37)		
	Joint research understanding in the field of sustainable urban transformation UQoL-Model includes component of sustainable urban transformation Agreement on a cooperative publication strategy		
	Managed by WP#7 with input from all other WPs (WS1 / WS4) Managed by WP#2 with input from all other WPs (WS2) Managed by WP#4 with input from all other WPs (WS3)		
II. Science / Roundtable Workshops / Focus Group Discussions in Cambodia	Regular scientific exchange with local research partners and local stakeholder groups Multi- and transdisciplinary workshops on the theory of sustainable urban transformation, possible sustainability transition pathways, barriers & drivers, transition team workshops, sustainable building arena side events Managing feedback loops e.g. by discussing outcomes of action research with the local scientific community		
	Presentations, discussions, management of feedback loops Exchange about the conceptualisation of sustainable urban transformation		
	WP#6 Milestone SW1 (Month 04): Science Workshop: Conceptualizing Sustainable Urban Transformation in the case of Cambodia WP#6 Milestone SW2 (Month 10): Roundtable Workshop: Stakeholder Mapping WP#6 Milestone SW3 (Month 14): Science Workshop: SBA1 results workshop WP#6 Milestone SW4 (Month 22): Roundtable Workshop: SBA1 review and preparation Workshop (connected to WP#2's Technical consultations) WP#6 Milestone SW5 (Month 27): Science Workshop: Review of SBA2 outcomes, lessons learnt and consequences in regard of conceptualisation of sustainable urban transformation in Cambodia WP#6 Milestone SW6 (Month 34): Roundtable Workshop: Operationalization of the		



	<p>Transition Agenda through Experimentation</p> <p>WP#6 Milestone SW7 (Month 39): Science Workshop: Overall SBA & SBI reflection and refinement</p> <p>WP#6 Milestone SW8 (Month 46): Roundtable workshop on implementation strategies and transition pathways</p> <p>Output- und impact management strategy</p> <p>Increased mutual trans-disciplinary understanding and enhanced coherence of the project's objectives related content</p> <p>Joint agreement in regard of research design and methodologies</p> <p>Capacity Mobilisation</p> <p>Insights into views of local stakeholder groups</p> <p>Increased understanding of the socio-techno-political system and its possible transition pathways</p> <p>WP#6 Publication strategy</p> <p>Exchange with all WPs and research partners and implementation partners</p> <p>Integration and further discussion of other WP's results into own research praxis</p> <p>Joint Management of Build4People SBA Process with WP#2</p>
III. Build4People Conferences in Cambodia	<p>Participation at the Build4People conferences with all German and Cambodian partners and relevant stakeholders</p> <p>WP#6 Technical Sessions on Sustainable Urban Transformation and Transition Pathways with local stakeholder participation</p> <p>Presentations / panel rounds / discussions</p> <p>Milestone B4P K1: Build4People Research Conference (Month 03)</p> <p>Milestone B4P K2: Build4People Status Conference (Month 26)</p> <p>Milestone B4P K3: Build4People Outlook Conference (Month 46)</p> <p>Increased mutual understanding of the different Work Package approaches of the Build4People project</p> <p>Increased public awareness and understanding of the relevance of the topics of WP#6</p> <p>Managed by WP#7 with input from all other WPs; Exchange with all WPs, research partners and implementation partners</p>
IV. Scientific and Societal Problem Based Research: Data Collection and Analysis <i>IV.A. WP-related research</i>	<p>Updated review of literature and of state of the arts</p> <p>Development of the research design and methods adapted to the Cambodian context and corresponding to the theory and insights from the Build4People DEF-Phase</p> <p>Implementation of the socio-techno-political system analysis and its integration with an analysis of the urban development regime; analysis of ongoing transformative processes</p> <p>Compilation of most recent publications and methods, desktop data collection, semi-structured expert interviews, actor mapping tools, data and discourse analysis</p> <p>WP#6 Milestone R1 (Month 02): Updated bibliographic research and literature</p> <p>WP#6 Milestone R2 (Month 12): Report on Local Transition Dynamics, the Socio-techno-political system of the building sector and the urban development regime in Phnom Penh</p> <p>WP#6 Milestone R3 (Month 24): Mid-term reflection report on the transdisciplinary processes SBA, SBI and ECTL</p> <p>Increased understanding and knowledge of state of the art for Cambodian context and relevant conditions of the research activities in Phnom Penh</p> <p>Identification of possible transition pathways and entrance points</p> <p>Input to all other WPs and transdisciplinary processes, particularly Sustainable Building Arena and Build4People Ecocity Transition Lab</p>
IV. Scientific and Societal Problem Based Research: Data Collection and	<p>Preparing the Build4People UQoL household survey (collection of relevant questions from all WPs, compilation of questionnaire, pre-testing, etc.)</p> <p>Conducting the survey in cooperation with market research company: data collection and first data analysis</p> <p>WP#6 will support this process with conceptual input on the urban sustainability-</p>



Analysis <i>IV.B. Build4People UQoL Household Survey / Data Input via APP</i>	liveability nexus from perspectives of human geography, urban studies and urban governance
	Statistical analysis Discussing first results on urban quality of life as perceived by citizens of Phnom Penh.
	B4P Milestone TR1: (Month 04): Final version of questionnaire for household survey B4P Milestone TR2: (Month 08): Final version of the Citizen Science Input APP (Integration of subjective evaluation of objective factors); B4P Milestone TR3: (Month 12): First results / analysis of collected data from Citizen Science Input APP and from household survey
	Insights into objective / subjective factors influencing urban quality of life in Phnom Penh Mutual trans-disciplinary understanding of urban quality of life Increased awareness about the importance of urban quality of life among stakeholders Preparation of survey results in regard of B4P Milestone WS2: Build4People UQoL-Survey Workshop at Magdeburg University (Month 13)
	Scientific-conceptual lead WP#1 with support from WP7 Data-Management lead WP#4 Conceptual input and input on local contextualization from WP#6; input to all other WPs
V. Trans-Disciplinary Action Research: Process Facilitation and Product Development <i>V.A. Build4People EcoCity Transition Lab Process</i>	Supporting and active participation in the Build4People Eco-City Transition Lab
	Input from the perspective of transition studies, human geography & urban governance; Input on main results of the surveys, co-moderation Establishing cross-linkages to the Build4People Sustainable Building Arena (SBA) and to the Build4People Sustainable Business Incubator (SBI)
	B4P Milestone TL1: (Month 10): Ecocity Transition Lab I: Masterplan Study Area & Design Strategies B4P Milestone TL2: (Month 27): Ecocity Transition Lab II: Neighbourhood Plans & Guidelines B4P Milestone TL3: (Month 34): Ecocity Transition Lab III: Criteria & Implementation Strategies
	Deepened understanding of the local planning issues Empirical research and testing of general research findings based on a case study site Improved collaboration between local experts and decision makers Preparation of strategies, guidelines and criteria in regard of the Build4People Toolbox Capacity mobilisation at all involved parties
	Scientific-conceptual lead WP#3 with support from WP#7 Feeding in results from socio-techno-political system analysis of the building sector and the urban development regime supporting WP3
V. Trans-Disciplinary Action Research: Process Facilitation and Product Development <i>V.B. Build4People Sustainable Building Arena Process</i>	Conceptualization and implementation of a participatory workshop series with front-runners from different stakeholder groups; support of experimentation & socio-technical, and socio-institutional innovation, coalition and partnership building and knowledge co-creation and communication
	Transition management and strategic niche management: Preparation, coordination and implementation of a transition management process based on the sustainability transition literature Process analysis and reflection through interviews, participant observation & questionnaires
	Milestone B4P SBA1: (Month 14): Implementation of first SBA workshop cycle Milestone B4P SBA2: (Month 27): Implementation of second SBA workshop cycle Milestone B4P SBA3: (Month 39): Implementation of Workshop on Experiment Facilitation
	Co-development of challenge framing, a spatial-sectoral vision and a transition agenda to support alternative discourses, social learning, network building and knowledge communication to ultimately inform an urban sustainability transition



	<p>Scientific-conceptual lead WP#6 & WP#2 with support from WP#7</p> <p>Feeding in results from surveys, focus groups, workshops, supporting WP#6 and WP#2; Integration of participants and ideas of other transdisciplinary processes (i.e. ECTI & SBI)</p>
<p>V. Trans-Disciplinary Action Research: Process Facilitation and Product Development</p> <p>V.C. Build4People Sustainable Building Business Incubator Process</p>	<p>Facilitation of an innovation-oriented Sustainable Building Incubator at the business-science interface</p> <p>Strategic niche management: Preparation, coordination, implementation and evaluation of the incubator process</p> <p>Process analysis and reflection through interviews, participant observation & questionnaires</p> <p>Milestone B4P SBI1: (Month 19): Final conceptualization of the Incubator Design</p> <p>Milestone B4P SBI2: (Month 22): Incubator Kick-off</p> <p>Milestone B4P SBI1: (Month 27): End of Incubator: Presentation of Green Business Cases (pitch to investors)</p> <p>Milestone B4P SBI1: (Month 32): Incubator reflection report</p> <p>Under the guidance of WP#6 and Impact Hub Phnom Penh, the SBI aims to connect the B4P project team, its transdisciplinary processes and insights to the entrepreneurial ecosystem to realize sustainability-oriented solutions at the science-business interface. These shall subsequently be implemented experimentally with third party funding.</p> <p>Scientific-conceptual lead WP#6 with support from WP#7</p> <p>Input from all other WPs</p> <p>Dissemination and integration of SBI participants and ideas to other transdisciplinary processes (ECTI & SBA) and other actors</p>
<p>V. Trans-Disciplinary Action Research: Process Facilitation and Product Development</p> <p>V.D. Build4People UQoL Citizen Science Process</p>	<p>Participatory workshops with different stakeholders and representatives of different target groups, e.g. on sustainable buildings and housing (with new consumers representatives, housing estate management companies, other stakeholders from the case study site of the Build4People Ecocity Transition Lab)</p> <p>Input from the perspective of transition studies, human geography & urban governance;</p> <p>Transition management;</p> <p>World café on sustainability + scenario-based methods with the topic: urban quality of life, norms, values;</p> <p>Application of participatory methods, e.g. back-casting;</p> <p>Adaptation of the Citizen Science Input APP</p> <p>B4P Milestone QI1: (Month 14): Multistakeholder Workshop on UQoL (focus application)</p> <p>B4P Milestone QI2: (Month 22): Focus Groups with new consumers (focus on conflicts between individual lifestyle claims and sustainability goals)</p> <p>Basis for data-based planning suggestions to increase urban quality of life in Phnom Penh;</p> <p>Reducing the own ethnocentric bias;</p> <p>Further technical development of the Citizen Science Input APP</p> <p>Scientific-conceptual lead WP#1 with support from WP#7</p> <p>Data-Management lead WP#4</p> <p>Input from all other WPs (workshop preparation and participation)</p> <p>Feeding in results to the other Build4People action research processes</p>
<p>VI. (Re-)Integration of Created Knowledge Refinement and Revision of Theory</p> <p>VI.A. WP-related research</p>	<p>Hypothesis testing according to research questions and theory-based assumptions, i.e. has the extension of transition management, strategic niche management and knowledge co-creation approaches to the Phnom Penh context been successful? What does the analysis of the SBA/SBI processes mean for the theoretical framework of transition studies in general? How can conceptualizations of power, agency, informality, niches, socio-techno-political regimes and transition pathways be extended based on the observations made?</p> <p>(Re-)integration of co-created knowledge based on reflective processes and feedback loops, i.e. questionnaires, interviews and participant observation</p>



	<p>WP#6 Milestone RF1 (Month 36): Transformative strategies for an urban sustainability transition in Phnom Penh</p> <p>WP#6 Milestone RF2A (Month 46): Urban sustainability transition strategies for Phnom Penh's building sector: Reflection and Outlook to the Implementation Phase</p> <p>WP#6 Milestone RF2B (Month 48): Extending sustainable urban transformation approaches to the Cambodian Context: Implications for urban sustainability transition studies</p> <p>Refinement and revision of theory and management of feedback loops</p> <p>Dissemination of research results at Build4People Outlook Conference</p> <p>Preparation for publications</p> <p>Discussion and integration of results of other WPs and input of own results to others</p>
<p>VI. (Re-)Integration of Created Knowledge Refinement and Revision of Theory</p> <p><i>VI.B. Build4People UQoL-Model Development / Data Modelling</i></p>	<p>Modelling of the Urban Quality of Life concept by integrating subjective and objective data collected by means of the survey, the Citizen Science Input APP and others by other WPs;</p> <p>WP#6 will support this process with conceptual input on the urban sustainability-liveability nexus from perspectives of human geography and urban studies as well as with input from the perspective of urban governance</p> <p>Theory-driven and data-based statistical modelling</p> <p>B4P Milestone QM1: (Month 35): 1st draft of Urban Quality of life (UQoL) Model (based on survey + UQoL process; objective data and results from the UQoL Process included)</p> <p>B4P Milestone QM2: (Month 45): Feasibility study to grasp UQoL by means of Citizen Science Input APP, including budget plan (WP#4) in preparation of Build4People Implementation Phase</p> <p>B4P Milestone QM3: (Month 48): Final version of a theory-driven, data-based, and context adapted UQoL Model</p> <p>Preparation of scientific papers introducing the transdisciplinarily developed UQoL Model</p> <p>UQoL Model based planning strategies to foster urban quality of life in Phnom Penh as part of Build4People Toolbox (also in preparation of Build4People Implementation Phase)</p> <p>Detailed instructions for software company to develop an UQoL-App</p> <p>Scientific-conceptual lead WP#1 with support from WP#7</p> <p>Data-Management lead WP#4</p> <p>Input from all other WPs, input to all other WPs</p>
<p>VII. Build4People Dissemination</p> <p><i>VII.A. Build4People Poster / Photo Exhibitions</i></p>	<p>Preparation of poster and photo exhibitions in cooperation with cultural dissemination partner META House Phnom Penh</p> <p>Theme-related input of WP#6 to poster exhibitions</p> <p>Preparation of input to poster exhibitions</p> <p>Processing of science-based knowledge for a wide audience</p> <p>B4P Milestone EX1: (Month 15): Green Buildings and Sustainable Neighbourhoods – Case Studies and Best-Practice from Asia</p> <p>B4P Milestone EX2: (Month 34): Results of the Build4People Ecocity Transition Lab</p> <p>B4P Milestone EX3: (Month 45): Photo Exhibition Sustainable Lifestyle Pioneers in Cambodia</p> <p>General information on the people-led transdisciplinary Build4People approach</p> <p>Enablement of networking activities between stakeholders from state, economy and civil society</p> <p>Increased awareness about issues of green buildings, sustainable neighbourhoods and sustainable lifestyles</p> <p>B4P Milestone EX1 / EX2: Scientific-conceptual lead WP#3 with support from WP#7</p> <p>Input from all other WPs</p> <p>B4P Milestone EX3: Conceptual Scientific-conceptual lead WP#7 and WP#1 (based on the Build4People Awareness Campaign: UQoL & Sustainable Living)</p>
<p>VII. Build4People Dissemination</p>	<p>Management of outreach events to disseminate the results of the Build4People project with two main partners 1) Centre of Khmer Studies (CKS) mainly reaching out to the academic / NGO-sector and 2) European Chamber of Commerce</p>



VII.B. Build4People Outreach Events	(EuroCham) mainly reaching out to the corporate sector WP#6 will prepare presentations in regard of two outreach events
	Regular presentations of select research results with the support of our dissemination partners, either face-to-face or online (webinar-format)
	B4P Milestone OR4: (Month 12): WP#6 (CKS): Insights into the socio-techno-political system of the building and urban development sector in Phnom Penh B4P Milestone OR13: (Month 39): WP#6 (CKS): Transformative strategies for an urban sustainability transition in Phnom Penh
	Increased awareness and knowledge about the research of the different Work Packages of the Build4People project Dissemination about Build4People processes and products
	Lead by WP#7 with support from other WPs
VII. Build4People Dissemination VII.C. Build4People Toolbox including Build4People Handbook	Compiling and preparing survey and research results for implementation; Input for the Handbook of Green Housing – a publication targeting a wide audience trying to showcase the benefits of sustainable housing solutions; WP#6 input on good urban governance criteria and best practice examples
	Writing chapters in easy-to-understand language (thus being accessible to non-experts) and preparing for graphic material; Developing input for Build4People toolbox: sustainability criteria for neighbourhood development
	B4P Milestone TB1: (Month 15): First editorial meeting: Joint development of a Handbook content structure together with the local partners; distribution of related tasks B4P Milestone TB2: (Month 22): Second editorial meeting: Presentation of the Handbook inputs by the various partners and joint agreement on the visual design; management of the translation, language editing and the printing procedure B4P Milestone TB3: (Month 27): First editorial meeting to discuss content of Toolbox B4P Milestone TB4: (Month 34): Publication of the Handbook for Green Housing and Sustainable Living during a roundtable workshop (milestone SW6); development of a distribution, dissemination and impact management strategy B4P Milestone TB5: (Month 39): Web-Interface of Handbook ready (with inter-active elements) / first draft of Toolbox ready B4P Milestone TB6: (Month 46): Web-Interface of Toolbox ready B4P Milestone TB7: (Month 48): Build4People Toolbox Executive Summary Report: Science- and societal based strategies to foster urban quality of life in Phnom Penh
	Increased understanding about people-environment interactions and behaviour change Mass effects through replication
	Input to Toolbox (Conceptualisation of Toolbox by WP#3) Input tot Handbook (Conceptualisation of Handbook by WP#7) Support of Dissemination (managed by WP#7)
	Representing the Build4People project at important industrial fairs in Cambodia Renting of a Build4People booth and dissemination of Build4People PR-materials Participating as presenter at related symposia / panel discussions
	PR-Work Representation and networking Providing evidence-based scientific research results to foster sustainability solutions in the corporate sector from the perspective of sustainable urban transformation
VII.D. Build4People Industrial Fair Representation	B4P Milestone IF1: (Month 17): Cambodia Architecture & Décor 2022 B4P Milestone IF2: (Month 34): Industrial Fair Representation 2023 (specific event tbd)
	Dissemination of the Build4People approaches to representatives from the private sector Raised interest in supporting Build4People activities during Implementation Phase from the corporate sector



	Managed by WP#7 with input from all other WPs
VII. Build4People Dissemination	Development of an awareness campaign; exchange with stakeholders and research partners; Recommendations for a social marketing campaign
<i>VII.E. Awareness Campaign: UQoL & Sustainable Living</i>	Theory-driven and data-based planning and designing of a campaign; participatory process and methods, focus group discussions with different target groups; interviews with stakeholders
	Milestone B4P AC1: (Month 24): Data-based and theory-driven Framework for Awareness Campaigning in order to foster ecological awareness, pro-environmental social norms and sustainable lifestyles in Phnom Penh Milestone B4P AC2: (Month 38): Implementing a Trial of a selected intervention on behaviour change (specific target group in the case area regarded within the ECTL process) Milestone B4P AC3: (Month 48): Final version of a Campaigning Toolbox within the Build4People Toolbox
	Increased understanding about people-environment interactions and behaviour change Mass effects through replication
	Lead by WP#1 with input from all other WPs
VII. Build4People Dissemination	Input from WP#6 to inform about project activities; input from WP#6 for Social Media Report
<i>VII.F. Build4People Social Media-Campaign</i>	Feeding in information on Build4People activities at Build4People Homepage, ResearchGate and on several social media platforms (Facebook, LinkedIn, Build4People YouTube channel, Instagram) Preparing for Build4People PR-video clips
	B4P Milestone SM1: (Month 01): Build4People Social Media Strategy RD-Phase B4P Milestone SM2: (Month 12): Build4People Social Media Report Year 1 B4P Milestone SM3: (Month 24): Build4People Social Media Report Year 2 B4P Milestone SM4: (Month 36): Build4People Social Media Report Year 3 B4P Milestone SM5: (Month 48): Build4People Social Media Final Report RD-Phase – Lessons learnt in regard of Implementation Phase
	Increased awareness and knowledge about Build4People related activities and products reaching out to different target groups (e.g. experts, professionals, academia, general public, youth) Increased awareness and knowledge about WP#6 related activities and products
	Managed by WP#7 with input from all other WPs Support of and exchange with WP#7
VIII. Build4People Donor Implementation Workshops	Organisation of regular workshops with donor organisations thereby introducing the Build4People project to donor organisations with the aim to prepare for Build4People supported projects during the subsequent Implementation phase Integrating the topic of sustainable urban transformation into the discussion
	Presentations / exchange / discussions
	B4P Milestone IWS1: Implementation Donor Workshop I (Month 03) B4P Milestone IWS2: Implementation Donor Workshop II (Month 15) B4P Milestone IWS3: Implementation Donor Workshop III (Month 27) B4P Milestone IWS4: Implementation Donor Workshop IV (Month 39) B4P Milestone IWS5: Report on Implementation Preparation (Month 48)
	Donor-funded projects discussed, elaborated and prepared in regard of the subsequent Implementation Phase Clarification about the role of the Build4People research team in regard of donor-funded projects
	Managed by WP#7 with input from all other WPs Support of and exchange with WP#7



IX. Build4People Capacity Mobilisation: Curriculum Development	Continuous input from the perspective of sustainable urban transformation Supporting the development of respective course units
	Evaluation of on-going consultation / lectures on key topics of sustainable urban transformation / workgroups with practical examples; real and online meetings, providing lectures, exchange of literature, and methods Co-design of course units
	B4P Milestone CM1: Capacity Mobilisation Workshop I: Identification of needs; collection of ideas, discussion of a draft curriculum development strategy (Month 06) B4P Milestone CM2: Capacity Mobilisation Workshop II: Presentation of curriculum development strategy; formation of tandem teams to jointly develop specific course units (Month 12) B4P Milestone CM3: Capacity Mobilisation Workshop III: Reporting of tandem teams about their progress in regard of course unit development; collection of feedback (Month 18) B4P Milestone CM4: Capacity Mobilisation Workshop IV: Reporting of tandem teams about their progress in regard of course unit development; collection of feedback (Month 24) B4P Milestone CM5: Capacity Mobilisation Workshop V: Presentation of draft course units material (Month 30) B4P Milestone CM6: Capacity Mobilisation Workshop VI: Reporting on test-trials of draft course unit material (Month 36) B4P Milestone CM7: Capacity Mobilisation Workshop VII: Preparing for certification procedure (Month 42) B4P Milestone CM8: Status report on curriculum development with outlook to Implementation Phase (Month 48)
	Support in developing state of the art local master courses at local research partner institutions Enablement of local lecturers to teach the new course units Increased knowledge about state-of-the-art approaches towards urban sustainability among students and university teachers
	Managed by WP#7 with input from all other WPs
X. Scientific Advisory Board	Active participation in Build4People-Advisory-Board meetings
	Guidance and advice in regard of scientific quality, adjustment to local context, dissemination opportunities and in regard of enablement of donor-funded projects
	B4P Milestone SAB1: Report of Build4People Scientific Advisory Board (Month 03) B4P Milestone SAB2: Report of Build4People Scientific Advisory Board (Month 27)
	Adjustment of the research and dissemination approaches Contacts to donor organisations interested in transferring the Build4People research into implementation-orientated projects
	Managed by WP#7 with input from all other WPs
XI. Build4People Monitoring: Self-Reflection, Internal Evaluation and Learning	Regular rounds of internal monitoring and self-evaluation of project progress and reflection about lessons learnt Discussion about joint publication strategies
	Internal discussions (through online meetings)
	B4P Milestone IR1: Internal Evaluation Report (Month 06) B4P Milestone IR2: Internal Evaluation Report (Month 18) B4P Milestone IR3: Internal Evaluation Report (Month 30) B4P Milestone IR4: Internal Evaluation Report (Month 42) B4P Milestone IR5: Final Evaluation Report: Lessons learnt in regard of Build4People Implementation Phase (Month 48)
	Adjusted Build4People research and publication strategies; Information of status quo for funding organization and WP-partners; Critical self-reflection regarding the achieved accomplishments and information on the project progress towards the funding organization;

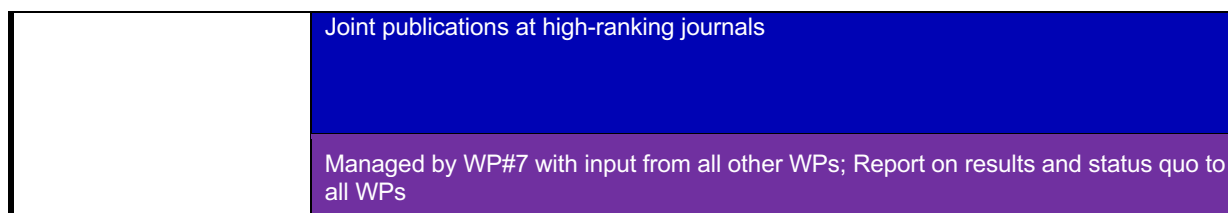


Figure 5: Work- and Implementation Plan of WP#6

WP#6 Risk Analysis:

The implementation of the planned research activities involves little to manageable risks that are primarily related to the global COVID-19 pandemic. In a scenario of ongoing travel restrictions, WP#6 will be able to conduct most of its research and implementation activities digitally and via its local partners, at least during the phase of societal and scientific problem-based research. Having established a solid cooperation structure and research framework little other risks are foreseen. The experimental operationalization of the transition agenda in year four comes naturally with the risk of partial failure. This is however part of the transdisciplinary and experimental research process and incorporated in the research framework.

Economic success prospects:

The WP#6-led transdisciplinary Build4People Sustainable Building Incubator aims at the support of impact-oriented early-stage entrepreneurs in the building and urban development sector. The SBI is thus expected to lead to a number of sustainability oriented startups that might yield economic and socio-environmental benefits. Here are also opportunities to promote the market-entry of German companies, globally leading in this field. The development of sustainability oriented startups is however highly dependent on external seed-funding for the first round of financing after the end of the SBI.

Scientific success prospects:

The research plan of WP#6 allows the team to significantly extend the literature on urban sustainability transitions, a highly active and relevant field of research with increasing importance. The application and adaptation of such frameworks in the Global South and the particular setting of Cambodia is highly relevant for the transdisciplinary research community and its underlying goal of addressing scientific and societal problems, i.e. sustainability challenges.

Scientific and economic connectivity:

Team members of WP#6 are part of the Sustainable Transitions Research Network (STRN), the Network of Early Career Scholars in Sustainability Transitions (NEST), the School of Integrated Climate and Earth System Science at the Cluster of Excellency of the University of Hamburg. Through its intensive engagement with local stakeholders, the transition team and its local partners, WP#6 is profoundly connected to local actors. This includes the National Council for Sustainable Development (NCSD) with its headquarter at the Ministry of Environment, the Center for Khmer Studies (CKS), the Impact Hub Phnom Penh, the



European Chamber of Commerce (EuroCham) and many more. With its observer role in the NCSD-led Technical Working Group, the team is formally connected to all key national level institutions.

WP#6 Explanations how WP-activities during RD-Phase contribute to transdisciplinarity

WP#6 facilitates two transdisciplinary processes during the R&D Phase, namely the Build4People Sustainable Building Arena (SBA) and the Build4People Sustainable Building Incubator (SBI). Within these processes, WP#6 will call for the transdisciplinary integration of research activities and findings of the other WPs. Most prominently, this will include the integration of research results at the kick-off of both the SBA and the SBI. In both cases the research findings shall be discussed by the participants at the respective workshop and integrated and further discussed in the context of their challenge framing. This particularly calls for the integration and discussion of the Build4People Ecocity Transition Lab results (led by WP#3) and the technical consultations (technological roadmap development) (led by WP#2). The results of the SBA & SBI will then however inform the processes of the other WPs, including an updated technological roadmap, subsequent Ecocity Transition Labs and the development of the Build4People Toolbox. Furthermore, the SBA and SBI process shall lead to the facilitation of experiments in the fourth years. These experiments will be transdisciplinary by nature and involve the input from other WPs based on the nature of the respective experiment.

Finally, it has to be mentioned that WP#6 will support the modelling process of Urban Quality of Life with conceptual input on the urban sustainability-liveability nexus and with perspectives on questions of urban governance.



WP#6 Explanations how WP-activities during RD-Phase prepare for Implementation Phase

Based on its research activities during the first year that aim at a better system understanding, WP#6 will facilitate its action research activities in the subsequent years as described above. These will involve the co-generation of actionable knowledge (and a transition agenda) and its application in experiments. The analysis of these experiments during the fourth year will then pave the way to refined applications of the co-produced knowledge and possibly the mainstreaming of successful experiments funded e.g. by donor organisations during the Build4People Implementation Phase.



Person Months Planning WP#6

WP#6 Activities and Milestones		2021												2022												2023												2024												2025			
		02	03	04	05	06	07	08	09	10	11	12	01	02	03	04	05	06	07	08	09	10	11	12	01	02	03	04	05	06	07	08	09	10	11	12	01	02	03	04	05	06	07	08	9	10	11	12	01				
		1	2	3	4	5	6	7	8	9	10	11	12	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41	42	43	44	45	46	47	48			
I.	Build4People Workshops / Online-Meetings in Germany																																																				
	Build4People-Consortium	0,10						0,05						0,10						0,05							0,10						0,05					0,10						0,05									
II.	Workshops / Focus Group Discussions in Cambodia																																																				
	Each WP		0,05	0,10	0,05										0,05	0,10	0,05									0,05	0,10	0,05								0,05	0,10	0,05															
III.	Build4People Conferences in Cambodia																																																				
	Build4People-Consortium			0,10																							0,10																				0,10						
IV.	Problem Based Research: Data Collection and Analysis																																																				
IV.A	Each WP	0,50	0,50	0,25	0,50	0,50	0,50	0,50	0,50	0,40	0,40	0,35		0,10	0,10	0,05	0,05	0,10	0,20	0,15	0,10	0,15	0,20	0,10	0,10																												
IV.B	Build4People UQoL Household Survey / Data Input via APP	0,10	0,10	0,10	0,10	0,10	0,10	0,10	0,20	0,20	0,10	0,10		0,10	0,10	0,05																																					
V.	Trans-Disciplinary Action Research																																																				
V.A	Build4People EcoCity Transition Lab Process										0,05	0,10	0,10		0,10	0,10	0,10	0,05	0,10	0,10	0,10	0,10	0,10	0,10	0,10	0,10	0,10	0,10	0,05	0,10	0,15	0,15	0,15	0,10	0,20	0,15	0,15	0,15	0,15														
V.B	Build4People Sustainable Building Arena Process										0,05	0,05	0,05		0,10	0,10	0,20	0,20	0,20	0,15	0,10	0,20	0,20	0,10	0,10	0,20	0,15	0,15	0,15	0,15	0,15	0,15	0,20	0,15	0,20	0,20	0,20	0,20	0,25		0,15	0,15	0,10	0,10	0,15	0,15	0,15	0,15	0,15	0,15	0,15	0,15	0,10
V.C	Build4People Sustainable Building Business Incubator Process											0,05								0,10	0,10	0,10	0,10	0,10	0,10	0,10	0,10	0,20	0,20	0,10	0,15	0,10	0,20	0,10	0,20	0,15	0,10	0,15	0,10														
V.D	Build4People UQoL Citizen Science Process													0,05	0,05	0,05	0,05	0,10	0,05	0,10	0,05	0,05	0,05	0,05	0,05	0,10																											
VI.	(Re-)Integration of Created Knowledge Refinement of Theory																																																				
VI.A	Each WP																																																				
VI.B	Build4People UQoL-Model Development / Data Modelling																							0,05	0,05	0,05	0,05	0,05	0,05	0,05	0,05	0,05	0,05	0,05	0,05	0,05	0,05	0,10		0,25	0,15	0,05	0,05	0,20	0,20	0,20	0,20	0,20	0,20	0,20	0,20	0,20	
VII.	Build4People Dissemination																																																				
VII.A	Build4People Poster / Photo Exhibitions													0,05	0,05	0,10	0,05																	0,05	0,05	0,10	0,10																
VII.B	Build4People Outreach Events											0,05		0,10																																							
VII.C	Build4People Toolbox including Build4People Handbook																0,05	0,05	0,05	0,05	0,05	0,05	0,05	0,10	0,05		0,10	0,15	0,05	0,15	0,15	0,15	0,15	0,15	0,10	0,10	0,15	0,20	0,20		0,10	0,10	0,05	0,05	0,10	0,10	0,10	0,10	0,10	0,10	0,10	0,10	
VII.D	Build4People Industrial Fair Representation																																																				
VII.E	Awareness Campaign: UQoL & Sustainable Living																							0,05	0,05	0,05																											
VII.F	Build4People Social Media-Campaign																																																				
VIII.	Build4People Capacity Mobilisation																																																				
	Build4People-Consortium	0,05	0,10	0,10	0,10	0,10	0,05	0,10	0,05	0,05	0,05	0,05		0,05	0,05	0,05	0,05	0,05	0,05	0,05	0,05	0,05	0,05	0,05	0,05	0,05	0,05	0,05	0,05	0,05	0,05	0,05	0,05	0,05	0,05	0,05	0,05	0,10	0,05	0,05	0,05	0,10	0,10	0,10	0,10	0,10	0,10	0,05	0,10	0,05			
IX.	Build4People Donor Implementation Workshops																																																				
	Build4People-Consortium			0,10												0,10													0,10																								
X.	Build4People Scientific Advisory Board																																																				
	Build4People-Consortium											0,05																									0,05																
XI.	Build4People Monitoring: Self-Reflection, Evaluation & Learning																																																				
	Each WP coordinated by Consortium Lead					0,05	0,10											0,05	0,10																															0,05	0,10		
	Total Person Month WP6 (36 Months)	0,75	0,75	0,75	0,75	0,75	0,75	0,75	0,75	0,75	0,75	0,75	0,75	0,75	0,75	0,75	0,75	0,75	0,75	0,75	0,75	0,75	0,75	0,75	0,75	0,75	0,75	0,75	0,75	0,75	0,75	0,75	0,75	0,75	0,75	0,75	0,75	0,75	0,75	0,75	0,75	0,75	0,75	0,75	0,75	0,75	0,75	0,75	0,75	0,75			