ASIA-PACIFIC NETWORK FOR GLOBAL CHANGE RESEARCH

CAPaBLE Programme Final Report



Project Reference Number: CBA2015-08NSY-Sharifi

Integrated, Resilience-based Planning for Climate Change Mitigation and Adaptation in Asia-Pacific Cities

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"Integrated, Resilience-based Planning for Climate Change Mitigation and Adaptation in Asia-Pacific Cities"

Final Report submitted to APN

OVERVIEW OF PROJECT WORK AND OUTCOMES

Non-technical summary

The project was focused on developing a framework for assessing urban resilience. For this purpose two main activities were conducted. First, a desktop-research that helped developing a theoretical basis for the study. Second, a workshop that was organized to facilitate interaction between scholars with different research backgrounds. The workshop convened scholars from different disciplines and contexts to discuss strategies for incorporating resilience thinking and climate change adaptation and mitigation into urban decision-making and planning process. The workshop was held in December 2015 at The University of Tokyo. Over 30 researchers, including early career scientists and young researchers, and one NGO member participated in the workshop. The project was successful in providing an opportunity for participants to actively engage in discussions about urban resilience. Some of the research outputs have already been published open access in high-profile journals and more publications are expected in the near future. The most important outcome of the activity is establishment of a research network that aims to continue conducting joint research in the field of urban resilience planning.

Keywords

Urban resilience, indicators, criteria, assessment framework, climate change, disaster risk management

Objectives

The main objectives of the project were:

1. Scientific capacity development through developing a framework of trans-disciplinary research, involving researchers with expertise in various fields, which facilitates “co-design”, “co-production”, and “co-dissemination” of knowledge.
2. Developing strategies to adapt existing/future cities to climate- and non-climate-induced disruptions.
3. Developing an assessment toolkit that can be used by planners and decision-makers to mainstream resilience thinking into planning system and increase the response capacity of cities. The toolkit will acknowledge the need for development of easy-t-use bottom-up indicators and assessment metrics that are easily scalable and replicable.

Amount received and number years supported

The Grant awarded to this project was:
US$ 38,000 for Year 1:

Activity undertaken

Two major types of activities were undertaken. First a comprehensive review of urban resilience literature was conducted to identify major resilience criteria and develop an integrated framework for assessing urban resilience. The second activity was centered on a workshop that was organized for learning and capacity building purposes. The workshop was consisted of presentations and practical hands-on sessions allowing the participants to actively engage in discussions related to issues important for the development of the resilience assessment tool. A general framework was prepared by the organizers in advance and participates were asked to update and complete the framework which was focused on the resilience of urban form. In addition to identifying and prioritizing resilience criteria, this

activity intended to specify the interlinkages between the selected criteria and assign each criterion to one or more of the five disaster risk management phases (mitigation, preparedness, response, recovery, and adaptation). Another activity was developed based on the Structured Interview Matrix (SIM) techniques (O'Sullivan et al., 2015) to facilitate discussions about major questions raised during the workshop. Several working groups were established during and after the workshop and are expected to continue to collaborate on producing high-level research related to urban resilience.

Results

- Major criteria related to urban resilience have been identified.
- A framework for evaluating suitability of urban resilience assessment tools has been developed.
- Selected community resilience assessment tools have been assessed using the evaluation framework.
- A workshop on developing tools and indicators for assessing urban resilience has been organized.
- A network of young researchers has been established to continue conducting research on issues related to urban resilience assessment.

Relevance to the APN Goals, Science Agenda and to Policy Processes

The project was effective in enhancing scientific capacity of the leading researchers and helped early-career researchers build their own scientific capacity. Special attention was paid to the developing countries in the region, most of which are threatened by climate-and non-climate induced disruptions and risks. The frequency and intensity of risk that countries in this region are facing, and its monetary and non-monetary implications, warrants an appropriate degree of understanding by decision makers of the vulnerability level of their community. The workshop enhanced interactions between researchers that could result in enhanced scientific capacity. Metrics and the assessment framework that are developed during the activity would be valuable decision support tools that can assist policy makers in their decision making for sustainable development.

Self Evaluation

The project was quite successful in achieving its aims. A framework for developing resilience assessment toolkits has already been developed. An exhaustive list of criteria related to assessment of general urban resilience and urban energy resilience has been developed. Further work is needed to develop criteria for other aspects such as water resilience. Developing criteria related to assessment of urban form resilience proved to be very challenging. Further work on this issue would be required. The workshop was very effective in terms of providing a platform for researchers from different related fields to share their knowledge and experience. It also provided capacity building opportunities for several early-career researchers from different developing countries in the Asia-Pacific region. The most important output of the workshop is establishment of a network of researchers that will collaborate more in the future in order to provide more knowledge on urban resilience assessment.

Potential for Further Work

As was already mentioned, a network of researchers has already been established. This network includes seven working groups that will focus on different resilience issues as

follows:

- Group 1: Urban policies, resilience, and sustainability
- Group 2: Outcome vs. processes
- Group 3: Community issues
- Group 4: Climate change planning and resilience
- Group 5: Resilience assessment focused on urban form
- Group 6: Panarchy
- Group 7: Resilience and disaster risk management

These groups have already started their work. Funding opportunities are thought by these groups in order to facilitate the progress of their research agenda.

Publications

Moloney, S., Olazabal, M., Yumagulova, L., & Chelleri, L. (2016). Challenges in assessing and measuring urban resilience. Retrieved from https://ugecviewpoints.wordpress.com/2016/02/23/challenges-in-assessing-and-measuring-urban-resilience/

Olazabal, M., Sharifi, A., & Yamagata, Y. (2016). Workshop on Tools and Indicators for Assessing Urban Resilience: Workshop Report. Retrieved from http://www.cger.nies.go.jp/cgernews/201604/304004_en.html

Sharifi, A. (2016). A critical review of selected tools for assessing community resilience. *Ecological Indicators, 69*, 629-647. doi:10.1016/j.ecolind.2016.05.023

Sharifi, A., & Yamagata, Y. (2016). Principles and criteria for assessing urban energy resilience: A literature review. *Renewable and Sustainable Energy Reviews, 60*, 1654-1677. doi:10.1016/j.rser.2016.03.028

Sharifi, A., & Yamagata, Y. (2016). On the suitability of assessment tools for guiding communities towards disaster resilience. *International Journal of Disaster Risk Reduction, 18*, 115-124. doi:10.1016/j.ijdrr.2016.06.006

Manuscripts submitted / under preparation:

Sharifi, A., Chelleri, L., Fox-Lent, C., Pathak, M., Grafakos, S., et.al. Manuscript reporting the main findings of the SIM session of the workshop. Manuscript under preparation.

Yamagata, Y., Sharifi, A. (editors). Towards Climate Resilient Urban Planning: Decision Support Tools. A collection of research presented in the workshop to be published by Springer.

References

O'Sullivan, T. L., Corneil, W., Kuziemsky, C. E., & Toal-Sullivan, D. (2015). Use of the Structured Interview Matrix to Enhance Community Resilience Through Collaboration and Inclusive Engagement. *Systems Research and Behavioral Science, 32*(6), 616-628. doi:10.1002/sres.2250

Acknowledgments

I would like to acknowledge the financial support from the Asia-Pacific Network for Global Change Research, the National Institute for Environmental Studies, and the Urbanization and Global Environmental Change project. I would also like to thank many individuals who have contributed to this project by their active engagement in preparing the project proposal and organizing the Workshop on Tools and indicators for Assessment Urban Resilience that was held at the University of Tokyo.

Preface

This project aimed to utilize resilience thinking as a guiding principle and bring together scholars from different disciplines to develop an integrated framework for assessing urban community resilience in Asia-Pacific cities. The ultimate objective of the project is to develop a resilience assessment toolkit that can be used by planners and decision makers to lead them to more informed decisions. Resilience criteria and evaluation framework were developed using literature review. Also, a workshop was organized that consisted of presentations and practical hands-on sessions, allowing the participants to actively engage in the development of the resilience assessment tool.

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1. Introduction

A significant share of the world population and economic activities are concentrated in the cities of the Asia-Pacific region. These, mainly low-elevation and coastal, cities are facing various climate-induced threats that may affect the local population and cause various socio-economic and environmental impacts. Addressing this wide range of threats requires having appropriate knowledge. A better understanding of vulnerabilities and development of risk management strategies is necessary for cities around the world. This is particularly important for cities in the Asia-Pacific region, most parts of which are comparatively less understood despite the frequency and intensity of the risks and disturbances that the cities of this region need to deal with. Such understanding is required for providing the decision makers with the knowledge required for creating communities that are more resilient.

Resilience thinking is an approach to stewardship of social-ecological systems that seeks to bring the (often) fragmented diverse efforts and practices under an integrated framework. As a concept with a broad scope, resilience can be utilized to frame various problems related to different climate- and non-climate-induced disruptions in urban areas. In addition, it can provide learning opportunities for transition to a low carbon urban future.

This project aims to utilize resilience thinking as a guiding principle to develop an integrated framework for assessing urban community resilience by analysing resilience literature and bringing together scholars from different disciplines. The ultimate objective is to develop a resilience assessment toolkit that can be used by planners and decision makers to lead them to more informed decisions. This assessment toolkit aims to be developed on an integrative and trans-disciplinary basis and use bottom up indicators suitable for local needs.

Within the past few years several studies focused on assessment of urban resilience have been conducted by scholars around the world. Toolkits developed by entities such as ICLEI and Global Resilience Partnership have tried to enhance the ability of local communities to understand risks and develop resilience building strategies. These types of initiatives address issues related to urbanization, health, climate change, poverty, etc. They have also gained relative success in providing a platform for social learning and guiding communities to develop action plans for enhancing their resilience. These works have made a significant contribution by establishing a theoretical framework for assessment of urban resilience and identifying criteria that can be used for this purpose. However, they are mainly based on single-disciplinary approaches, are focused on either mitigation, or adaptation, and provide generic resilience metrics and are too complex to be used by decision makers and community members. Resilience thinking is still evolving and is yet to be operationalized in an appreciable way. Due to the evolutionary nature of resilience thinking and the changing nature of risks and vulnerabilities, the process of understanding current situations and assessment of urban resilience needs to be iterative. The team working on this project will seek to advance this knowledge base. Plus, the adaptation and mitigation construct is overly reductionist. This research project will try to more comprehensively delve into the issues of adaptation, mitigation, and resilience. To build upon the existing studies, this project seeks to realize the following main objectives:

- Scientific capacity development through developing a framework of trans-disciplinary research, involving researchers with expertise in various fields, which facilitates “co-design”, “co-production”, and “co-dissemination” of knowledge.
- Developing strategies to adapt existing/future cities to climate- and non-climate-induced disruptions.

- Designing a framework for developing an assessment toolkit that can be used by planners and decision-makers to mainstream resilience thinking into planning system and increase the response capacity of cities. To address shortcomings of the existing tools, efforts for development of resilience assessment metrics should pay due attention to the following points:
    - Developing criteria related to different specific sectors such as water, energy, etc.
    - Developing criteria suitable for assessing generic aspects of urban resilience
    - Identifying resilience criteria related to social, human, physical, economic, and institutional capital
    - Specifying disaster management phase to which the criteria are related (i.e. mitigation, preparedness, response, recovery, and adaptation)
    - Using of bottom-up indicators that fit the local needs and reflect the different composition and needs of different contexts
    - Developing assessment metrics that are easily scalable and replicable (while being context-specific). This will make the assessment framework flexible and adaptable and helps local authorities save money and resources
    - Designing a framework that, while simple enough to be used by non-experts and suitable for self-assessment, could take account of the complexities and dynamics of cities as socio-ecological systems
    - Linking vulnerability, mitigation, and adaptive capacity measures in the resilience assessment framework. This should be considered in development of a matrix of synergies and tradeoffs between different measures related to urban resilience. Understanding these synergies and trade-offs between mitigation and adaptation, planners and policy makers could take appropriate measures to maximize synergies and minimize trade-offs.
    - Emphasizing the iterative nature of such toolkits for each of the cities, and the need to continuously re-examine the approach to their climate adaptation planning.
- Applying the developed toolkit to several case studies. Among other things, the organizer is planning to utilize a selected number of criteria from the toolkit for assessing resilience of different urban forms. This would be conducted in collaboration with The World Urban Database and Access Portal Tools (WUDAPT) group (for more information see: http://www.wudapt.org/wudapt/).

1.1. Significance of conducting research on urban resilience assessment

The significance of this study as explained in Sharifi (2016) is as follows: “Measuring community resilience is recognized as an essential step toward reducing disaster risk and being better prepared to withstand and adapt to a broad array of natural and human-induced disasters (Burton, 2014). Various other benefits can be realized by developing and implementing urban resilience assessment tools. These tools transform resilience into a more tangible and measurable concept, and help understand what constitutes community resilience by, among other things, investigating different environmental, social, economic, physical, and institutional elements of a community that are related to resilience. They encourage thinking about future uncertainties, and provide a lens through which complexities of communities as socio-ecological systems can be better understood (Levine, 2014; Sellberg et al., 2015). Conceiving communities as socio-ecological systems implies that ecological factors are coupled with socio-economic factors and multiple

feedbacks, across different spatial and temporal scales, link these different factors together (Evans, 2011). Resilience assessment tools can also be used for benchmarking performance (resilience status) of communities against peers and best-practice standards. This can instigate competition among communities and provide a platform for them to share knowledge and learn lessons from one another (Barkham et al., 2014; TRI, 2012).

As ex-ante decision support systems, assessment tools can help planners and decision makers identify vulnerable areas that need to be strengthened and suggest potential leverage points for intervention (Frankenberger et al., 2013). They can also help identifying areas that are lagging behind and need to be prioritized when allocating limited resources (Khazai et al., 2015; Sellberg et al., 2015; Sempier et al., 2010). As ex-post decision support systems, assessment tools can be utilized by organizations/local authorities that have undertaken resilience and disaster risk reduction activities and need to monitor effectiveness and efficiency of their plans and find out whether they have worked and the community is making progress toward becoming more resilient (Khazai et al., 2015; Renschler et al., 2010b).

Conducting assessment and effectively disseminating the results is important for enhancing transparency of the planning process and improving accountability of authorities (Pringle, 2011; Tyler et al., 2014). If developed and implemented in collaboration with different stakeholders, the assessment process can also empower citizens and enhance their role in decision-making process (Cox and Hamlen, 2014). In addition, stakeholder involvement can enhance risk communication to community members and help them understand what resilience means to them and where their community stands in terms of resilience (Khazai et al., 2015; White et al., 2014). Collaboration in the process can also lead to establishment of social networks that are deemed to be essential for enhancing resilience (Frankenberger et al., 2013).

Despite the existence of many urban resilience assessment tools, few researchers have studied them and they have only focused on providing an overview of the existing tools and their structure. Irajifar et al. (2013) investigated eight selected assessment frameworks and found that they lack specific variables and attributes suitable for measurement purpose at the community level. Monaghan et al. (2014) provided a list of six urban resilience assessment toolkits and explained the main features of them. Pfefferbaum et al. (2014) studied six different urban resilience assessment tools and outlined their similarities and differences. Their work shows that existing tools have achieved considerable success in promoting resilience assessment and further research is needed to provide communities with more resilient development pathways. Larkin et al. (2015) provide an overview of resilience assessment efforts undertaken by various agencies across the United States. Their study highlights major characteristics of seven assessment frameworks. The study argues that the frameworks can help communities in identifying their weaknesses. However, more work is needed in terms of specifying guiding standards for use at the local scale (Larkin et al., 2015). To date, the most detailed investigation has been made by Cutter (2015) who provides an overview of 27 assessment tools. She discusses commonalities and differences between these tools in terms of their spatial orientation, main dimensions addressed in each tool, and the approaches they have adopted towards assessment. She argues that existence of multiple solutions to the assessment issue can be explained by the fact that the concept of resilience is interpreted differently depending on the context and assessment proponents have different motivations. She also emphasizes the need for assessment tools that are co-designed and acknowledge social dynamism of communities.

The issue of urban resilience assessment deserves further consideration. This study is important because urban resilience assessment is a relatively new and still developing field. Urban resilience assessment can provide a platform for involvement of different agencies and stakeholders, within and beyond the community, in the planning and preparation processes. This in turn makes it possible to better address different socio-economic and environmental challenges faced by communities. Urban resilience assessment can also contribute to making resilience a "governable strategy" through developing iterative and quantifiable frameworks for resilience implementation (Larkin et al., 2015). Urban resilience assessment tools merit further investigation to identify their weaknesses and limitations and shed light on potential improvements needed in order to make them more effective for planning towards disaster-resilient communities".

2. Project Methodology

The broader research project was developed based on a mixed-methods approach. Here, only those methods used to obtain the results presented in this study are explained. Before explaining the research methodology, it is essential to clarify what is meant by the term 'resilience' in this paper. Resilience is a contested concept and various definitions can be found for it in the literature (Sharifi, 2016). The definition provided by the National Academies was adopted for this research project. It defines "resilience is the ability to prepare and plan for, absorb, recover from, and more successfully adapt to adverse events" (TNA, 2012, 14).

Urban community is the unit of analysis in this study. It is also essential to explain what is meant by this term. "Community is a contested notion that has been defined in a variety of ways and there is still no single, universally accepted definition for it in the literature (Mulligan et al., 2016). An often used definition is a diverse group of individuals in a shared geographical area, who have common interests, are linked by dynamic socio-economic interactions, and engage in collective action (Alshehri et al., 2014; Frankenberger et al., 2013; MacQueen et al., 2001; Miles, 2015; Twigg, 2009). Defining community boundaries remains an issue of debate. Boundaries can be defined using functional measures such as catchment area of services (Chandra et al., 2011), psychological measures such as residents' perceptions (UNDP, 2014a), and political measures such as administrative boundaries (Frankenberger et al., 2013). Community boundaries can also be blurred. Mulligan et al. (2016) argue that it is difficult to draw community boundaries with certainty and, given the constant changes in the mobility and communication technologies, the community boundaries are likely to change over time. A community can be nested within larger communities (Mulligan et al., 2016). It is also possible that overlaps exists between communities and people belong to more than one community (Mulligan et al., 2016). Elaborating on the meaning of community resilience, Mulligan et al. (2016, 9) continue that community is a "multi-layered" notion. Dynamic interactions occur between communities and they "can operate simultaneously across multiple scales". For the purpose of this study, community is defined as a location-based entity that can be as small as a neighbourhood or as large as a county. It is acknowledged that community is not a static entity and dynamic interactions exists across different scales. Assessing resilience of "imagined" and "virtual" communities (Mulligan et al., 2016) is beyond the scope of this paper. It is argued that community should be defined on a "case-by-case basis" (Sherrieb et al., 2010) and different scales (ranging from neighbourhood to county) can be used as a suitable units of analysis for resilience assessment (Sherrieb et al., 2010). Adopting such a broad and flexible definition makes it possible to include various relevant tools in this critical review.

It should be noted that tools and frameworks examined in this study are mainly focused on communities in the context of urban environments. However, some tools refer to communities beyond the city scale which may be located in rural settings. Therefore, it is decided to use the term community in general and avoid drawing distinction between urban and rural communities. It is also worth noting that tools and frameworks specifically designed for only assessing rural community resilience are not analysed here and should be analysed in the future" (Sharifi, 2016).

As one of the main objectives was to identify a comprehensive list of criteria that can be used for assessing urban resilience, an extensive literature review was conducted. A broad review protocol was developed in order to include criteria related to various aspects of urban resilience. As a result, research from various fields including, but not limited to, sociology, economy, environment, infrastructure, governance, water, and energy was included in the study. Further details about the review protocols can be found in Sharifi and Yamagata (2016) and Sharifi (2016).

In addition to identifying resilience criteria, the review was also used to extract a set of measures that can be used for developing urban resilience assessment tools. A framework for assessing suitability of resilience assessment tools was developed based on these measures. This framework was later used to critically analyse selected existing resilience assessment tools. Thirty six tools were selected for this purpose. Content analyses of manuals and other documents related to these tools were conducted to find out if they comply with the measures outlined in the framework.

As resilience is a normative concept, any research related to it should also involve participatory methods to obtain knowledge from a diverse array of stakeholders. Although it is intended to engage stakeholders from different sectors in the project, until this stage this has mainly been limited to researchers and few members from NGOs. For this purpose a four-day workshop was organized at The University of Tokyo in December, 20151. This workshop provided the opportunity for various researchers and practitioners from different countries to share their knowledge and actively participate in discussions related to urban resilience assessment. During the third day of the workshop the participants were assigned the task of identifying different urban form criteria that enhance resilience of communities.

On the last day selected participants were engaged in an exercise to discuss answers for four major questions that were identified cooperatively based on the presentations and discussions from the first three days of the workshop. Structured Interview Matrix (SIM) is a technique that has been used by several researchers to map community assets in a participatory process (Tracey L. O'Sullivan, Corneil, Kuziemsky, & Toal-Sullivan, 2015; T. L. O'Sullivan, Kuziemsky, Toal-Sullivan, & Corneil, 2013). The exercise was conducted in three stages. The participants were divided into four groups and each group was assigned a question. The three stages as outlined by T. L. O'Sullivan et al. (2013) were as follows: "The first phase is a series of one-on-one interviews where each participant spends 5 min with a participant from another table and asks them to respond to a specific question. The participant who is the interviewer writes down the response in the form of field notes, whereas the participant being interviewed voices his/her thoughts about the question without the pressure of speaking in front of the whole group. The process is repeated until each participant has interviewed one person from each of the other tables and also

[1] Details about the workshop are available at: http://www.cger.nies.go.jp/gcp/workshop-on-tools-and-indicators-for-assessing-urban-resilience.html.

responded to the questions from each table. The facilitator guides the group so participants knowhow to proceed through the matrix. Following the interview matrix, the participants return to their assigned table for the small group deliberation phase, to review and summarize the data from the interviews. Data during this phase is in the form of conversations as the people at each table discuss the responses they received to their question during the interview phase. Each group identifies 3 main findings to present to the larger group during the next phase, which is a facilitated plenary discussion with all the participants" (T. L. O'Sullivan et al., 2013, 240).

3. Results & Discussion

3.1 Different dimensions, criteria, and qualities related to urban resilience

As discussed above, the project aims to create of a database of criteria related to different aspects of urban resilience. Criteria related to general urban resilience and urban energy resilience have already been identified. For general urban resilience, a total number of 122 criteria have been identified and categorized into five groups, namely, environmental, social, economic, physical, and institutional. It is beyond the scope of this article to provide a complete list of these criteria. Interested readers are referred to Table 5 of Sharifi (2016). Also, 196 criteria related to urban energy resilience were extracted and divided into five categories, namely, infrastructure; resources; land use, urban geometry and morphology; governance; and socio-demographic aspects and human behaviour. A complete list of these criteria can be found in Tables 3 through 7 of Sharifi and Yamagata (2016). Further analysis of these criteria showed that they provide various sustainability benefits (in terms of availability, accessibility, affordability, and acceptability), and can also enhance resilience abilities in terms of planning, absorption, recovery, and adaptation (Sharifi & Yamagata, 2016).

Review of the extensive resilience literature also revealed that there are various qualities (principles) that should be met in order to appropriately achieve urban resilience. These qualities are namely, robustness, stability, flexibility, resourcefulness, coordination capacity, redundancy, diversity, foresight capacity, independence, interdependence, collaboration, agility, adaptability, self-organization, creativity, efficiency, and equity (Sharifi & Yamagata, 2016). Possible linkages between these qualities with sustainability dimensions and resilience abilities have been explored (Sharifi & Yamagata, 2016). Figure 1 shows these linkages in a simplified way.

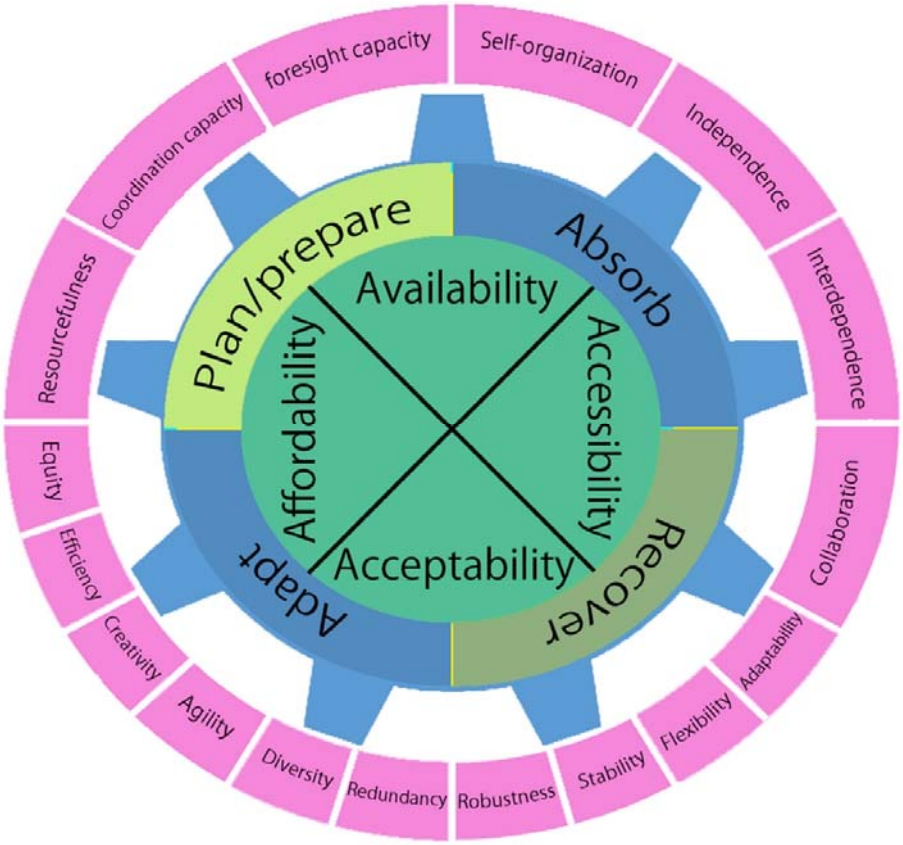

Figure 1. Different factors to be consider for assessing urban energy resilience. Designed based on Figure 2 of Sharifi and Yamagata (2016).

3.2 Framework for evaluating suitability of urban resilience assessment tools

The evaluation framework includes six main components and several sub-components. These are briefly explained below. Further information can be found in Sharifi (2016). 'Comprehensiveness' implies that various resilience dimensions and criteria should be integrated into the assessment framework. 'Cross-scale dynamism' and 'temporal dynamism' components should be considered in order to be able to track changes and influences over time and across space. Addressing 'uncertainties' requires using methods such as modelling and scenario-making in the assessment process. Assessment tools should be developed and implemented through 'participatory' approaches that can enhance accuracy and applicability of the assessment results and provide learning opportunities for both citizens and local authorities. Finally, 'action plans' should be developed based on assessment results (Sharifi, 2016). These components are shown in Figure 2.

Figure 2. Various factors that should be integrated into resilience assessment frameworks (designed based on information presented in Sharifi (2016)).

3.3 Examination of performance of the tools against the evaluation framework

Thirty six selected assessment tools were selected and examined against the six main factors displayed in Figure 2. Complete list of these tools and their structure can be found in Sharifi (2016). In terms of comprehensiveness, it was found that more work is needed in order to provide a balanced account of different resilience dimensions. Analysed tools have, on average, paid more attention to the institutional dimension of resilience. It is necessary to better acknowledge the significance of the environmental dimension (Sharifi, 2016). Average percentage distribution of the frequency of the criteria related to the five resilience dimensions is shown in Figure 3.

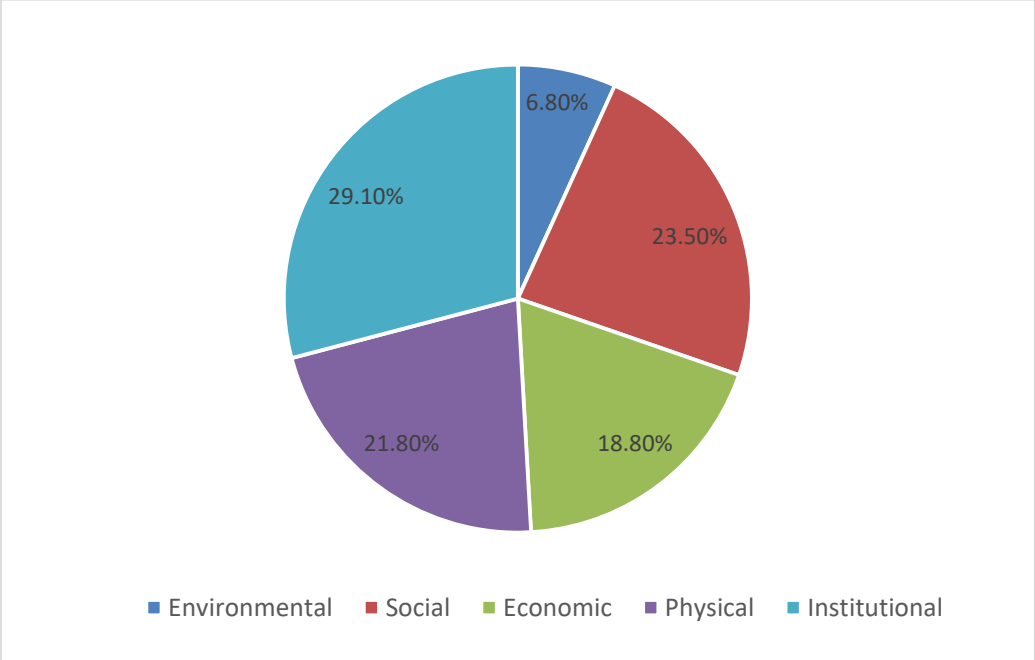

Figure 3. Average inclusion of resilience criteria in selected community resilience assessment tools (developed based on data presented in Sharifi (2016)).

Results showed that assessment tools do not perform well in terms of reflecting cross-scale and temporal dynamism in their framework. More attention has been paid to the status quo of the focal scale. In order to better address uncertainties, more work should be done with respect to developing alternative scenarios, adopting an iterative approach, and utilizing modelling and simulation in the process. Limited success has been achieved in terms of addressing participator approach. Further improvements are needed, particularly regarding engaging stakeholders in the process of developing assessment tools. The same arguments applies to performance with respect to development and implementation of action plans (Sharifi, 2016).

3.4 Workshop on Tools and Indicators for Assessing Urban resilience

"The Workshop on Tools and Indicators for Assessing Urban Resilience was held on 7–10 December 2015 at The University of Tokyo. It was organized by the Global Carbon Project-Tsukuba International Office in collaboration with APN, NIES, UGEC, WUDAPT (http://www.wudapt.org/wudapt/) and IR3S. The event brought together a group of experts from different disciplines (engineering, planning, environmental sciences, social sciences…), with different interests and backgrounds (practitioners, NGOs, research and academia) and from different developed and developing parts of the world (Europe, USA, Asia and Oceania) (See Figure 4). Main objectives were to reflect on the concept of urban resilience; examine the adequacy and feasibility of resilience management tools, particularly, indicator assessment; and develop a collaborative framework for building a global urban information and knowledge network supporting an open source, community based infrastructure for planning resilient cities. The workshop consisted of 2 and half days of presentations by participants and 1 and half days of activities (practical hands-on sessions) and discussion" (Olazabal et al., 2016).

"The format of the workshop allowed participants to conveniently present their views on urban resilience and describe the approach they propose to enhance decision making by planners and policy makers.

Opening the workshop Ayyoob Sharifi offered “an overview of existing tools for assessing urban resilience”. His analyses gave a quite interesting perception on how the current assessment tools are built on and the main advantages and disadvantages of them.

Figure 4. Group photo of the participants in front of the venue.

We had interesting presentations from the Asian experience on urban resilience practice from Rajib Shaw (Climate Disaster Resilience Indexing of Asian Cities: An Action Based Approach), Pakamas Thinphanga (Building urban climate resilience — lessons learned from Thailand and the Mekong region), Vu Kim Chi (Coastal urban climate resilience planning in Quy Nhon, Vietnam), and Kensuke Fukushi (Vulnerability and resilience of cities in developing countries on health risk caused by climate change and urbanization). This was enriched by Jamal Namo’s presentation on NGO-based experiences in The Solomon Islands

Social and community issues (barriers and engagement tools) were specially brought by Lilia Yumagulova (Resilient institutions = vulnerable people? A longitudinal case study of flood management institutions in marginalized settlements in Russia), Stephen Sheppard “Empowering Communities: Visualization Tools for Building Climate Change Awareness and Resilience” and Christian Dimmer (Linking Knowledge to Action — Urban Resilience, Social Innovations, and Community Energy).

Experiences from the disaster risk management community were highlighted in cases described by Cate Fox-Lent (Urban Resilience: Methodological Foundations and Resilience Matrix Approach) and Judd Schechtman (A System for Evaluating the

Resilience Value of Disaster Recovery Projects: The Case of Hurricane Sandy and Irene in New York).

Insights on the influence of urban design, urbanization and spatial parameters in urban resilience assessments were put on the table by Paul Stangl (Urban Morphology: Applications, Issues and Prospects for Resiliency Assessment), Akito Murayama (Development and Application of Web-based Geographical Information System to Assess Urban Resilience: Land Use and Infrastructure Planning for the Greater Nagoya Region, Japan), Peter Marcotullio (Future Urbanization and the Management of Urban Heat Risk) and Yoshiki Yamagata (Land Use Scenarios for Assessing Urban Resilience). Linked to this, Linda See and Johannes Feddema presented the "WUDAPT initiative: overview, data collection and progress to date" and "Applications of WUDAPT" allowing discussion on the use of Local Climate Zones (LCZ) for the assessment of resilience and for the comparability of cities and about the future applications of this tool in this domain.

Issues such as how to fit with the sustainability agenda, how to include the concept of transformation and how to deal with uncertain scenarios were discussed by Lorenzo Chelleri (What's under the city resilience umbrella? Aligning Resilience and the Urban 2030 Agenda), Marta Olazabal (Urban Resilience and Transformation: Implications for assessment indicators) and Minal Pathak (Approach to mainstreaming climate change resilience in urban planning and development: Case of Ahmedabad, India).

Presentations by Md. Humayun Kabir (Enhancing urban resilience through energy efficiency measures in the residential buildings of Dhaka city) and Perry P. J. Yang (Energy Resilient Urban Systems: A Design Perspective) highlighted the need for paying due attention to urban energy resilience.

On the challenges related to planning and monitoring climate change and on integrating this with the resilience agenda, we had interesting presentations from Ashish Shrestha (Framework and indicators for climate compatible urban development) and Susie Moloney (Monitoring and evaluating progress towards becoming a more adaptive and resilient region: lessons from Melbourne).

Eventually, interesting innovative and practitioner-oriented approaches on resilience assessment frameworks were discussed by Stelios Grafakos (Towards the development of an integrated Sustainability and Resilience Benefits Assessment (SRBA) framework of urban interventions), Fanni Harliani (Identification of Human & Economic Resilience Indicators in Climate Resilience Review) and Hiroshi Maruyama (Systems Resilience: Taxonomy and General Strategies)" (Olazabal et al., 2016).

"The presentations of the first two days facilitated engagement of participants in discussions about the feasibility of developing resilience assessment frameworks that can lead to better-informed decision making.

The most profound discussions emerged around the question of resilience being an outcome or a process and around the trade-offs in applying a unique approach to the understanding and management of urban resilience in different contexts such as those found in developed in contrast to those in developing urban regions.

Participants seemed convinced that resilience is a process and that this must be taken into account when implementing an assessment exercise; however, the question on how to reflect this idea into real practice was not accordingly resolved. On the other hand, many interesting thoughts and ideas were exposed when discussing about the feasibility of considering distinct urban contexts under the same resilience criteria. The most illustrative case was raised in a hands-on exercise when participants discussed the adequacy of a selection of urban form indicators. As argued, some indicators might not be so adequate

in the context of informal settlements, where many other basic problems prevail. Can in a context like this, resilience of the urban form be assessed without consideration of social and institutional contexts? Can in any context resilience be assessed without adequate consideration of the specific social and institutional issues? This leads to argue that although contextual particularities in urban areas might be different and thus interpretation of results may vary, challenges in the development of urban resilience assessment frameworks are the same in developed and developing urban environments.

Regardless of the academic and professional background of the participants, conversations and key issues relied on expectedly similar topics: (i) the importance of communities as beholders, key agents of change and knowledge "reservoirs" and (ii) the critical role of institutions in providing resources and infrastructures (in its wider understanding) to recover from and adapt to punctual and gradual changes, through processes of awareness raising, collaboration, reorganisation, autonomous adaptation and coproduction of solutions.

Regarding the practical questions around the pure idea of assessing, some questions emerged:

- Which state or process do we intend to assess?
- Which is our desirable scenario? Is it a sustainable and resilient city? Are the agendas connected? Are we building silos?
- When do we intend to measure? What is the purpose of measuring resilience?

Firstly, using socio-ecological resilience theory as a guiding principle, this could be responded by questioning the well-established argument of "resilience of what to what". This means on one hand, setting boundaries to our assessment process. Not only in terms of spatial scale (district, city or regional level), but also in terms of time scale (past, current or future resilience) and in terms of sectoral focus (water, energy, urban form…. etc. or a combination of them). On the other hand, establishing which shocks or gradual changes we do consider is critical (resource scarcity, pluvial or sea-level rise floods, earthquakes …. or a combination of them).

Secondly, it would be necessary to link the assessment process with the planning and policy making process. That is, for example, are we using this assessment to diagnose how resilient a city is right now? Or, do we intend to track/monitor the progress of a particular strategy or measure and assess how much is this strategy helping to make a city more resilient?" (Olazabal et al., 2016).

"Two main important themes around which discussions were focused both from a scientific and from a practitioner point of view can be highlighted: (i) barriers to the implementation of a urban resilience agenda (rigid institutions, corruption, poverty and environmental degradation, cultural issues…) and (ii) the opportunities that it may bring (build response to change, community engagement, adaptation to climate change, resource efficiency…)" (Olazabal et al., 2016).

3.4.1 The hand-on sessions

During the workshop the participants were asked to complete a checklist survey on the linkages between criteria related to urban form and resilience. The objective of this activity was to clarify how each criterion is related to different disruptive events such as flooding, hurricane, earthquake, drought, power outage, etc. It was also intended to calculate the relative importance of each criterion. This exercise helped the participants engage in heated debates on the issues such as synergies and trade-offs between the criteria. It was

found that more time would be needed to complete the exercise. This activity will be continued in the future.

The SIM session was cantered on answering the following questions by the participants:

a) What elements of the built environment influence resilience and how is urbanization process related to resilience?
b) How is urban resilience framed in the context of adaptation, recovery, and sustainability?
c) What institutional elements contribute/detract from building resilience?
d) What would be the main challenges regarding development and implementation of assessment tools and integrating the results into the decision-making process?

Figure 5. Engagement of the workshop participants in the activity designed based on the SIM technique.

Participants were divided into four groups as shown in Figure 5. This exercise provided an opportunity for participants from different related fields to share their knowledge and learn from one another. Major points emerged from this activity are as follows. Regarding the elements of built environment that are most related to resilience, participants listed many elements, including, robustness of the infrastructure, accessibility of facilities, urban typology and morphology, density, and street layout. It was discussed that other socio-economic issues should also be considered in addition to these physical elements. On the second question, it was emphasized that resilience, adaptation, recovery, and sustainability are interrelated concepts. Any resilience planning approach should integrate all these concepts in the process. Potential synergies and trade-offs between these concepts need to be further investigated. Main themes with respect to governance and institutional elements included the necessity for a flexible system that features both bottom-up and top-down approaches, and the need for dealing with the issues of multi-level governance and interlinkages between different entities. Participants also emphasized the significance of transparency and accountability for resilience planning. The issue of trade-offs was again raised. Participants also mentioned the need for context-specific resilience planning. In response to the last question, various challenges were identified. These challenges include, but are not limited to, access and availability of data needed for resilience assessment, difficulties related to communication and dissemination of results, the boundary issues and multiplicity of factors that should be taken into account in order to define the optimal unit of

analysis, and problems related to context-specificity and standardization of the assessment process.

Overall, the activity was very significant for enhancing the awareness of participants. As stated by the early-career participants from the Asia-Pacific region, it was a social learning activity, effective for enhancing their capacity. The evaluation framework and resilience criteria developed throughout this project could be considered as valuable materials for informing decision making by planners and policy-makers in the region.

4. Conclusions

Resilience is a topic of interest to planners and policy makers as they prepare to meet the consequences of climate change. This report summarized the main findings related to a research project focused on developing criteria and indicators for assessing various aspects of urban resilience. It was discussed that resilience is a multi-faceted concept and any efforts to assess it should pay attention to various environmental, social, economic, physical, and institutional dimensions. A framework for evaluation of resilience assessment tools was developed that emphasizes the significance of meeting six factors, namely, comprehensiveness, cross-scale dynamism, temporal dynamism, uncertainties, participation, and action planning. Evaluating selected tools using this framework showed that they are still far from being optimal.

The report also summarized the results of activities that involved participation of researchers from different fields. It was emphasized that resilience assessment should fit the local needs and be capable of informing decision making process. Assessment process should enable various stakeholders to better understand the complexities of the urban system. This process should be duly integrated into the planning system. Such an integration will also be essential for implementation of assessment findings. The SIM activity proved very useful for facilitating discussions between participants with various backgrounds. It provided the participants with the opportunity to share their knowledge and experience.

This study emphasizes that further research is needed to gain better understanding of the synergies and trade-offs between various resilience criteria. It is also necessary to conduct more investigations on the relationship between resilience and related concepts such as vulnerability, mitigation, and sustainability.

5. Future Directions

Valuable ideas collected during the length of this project will be used for further development of research frameworks related to urban resilience. A network of researchers has already been established and will continue conducting research on resilience assessment. This network is consisted of seven working groups and will also develop research proposals and seek for possible funding sources. As for collaboration with WUDAPT, a framework was designed that aims to provide infrastructure for developing more resilient cities with reduced carbon footprints and enhanced quality of life. Specific goals would be to build data capacity to identify and characterize neighbourhoods and map individual cities, build application capacity on how to use the data to develop scenarios and assessment frameworks, and build capacity by enabling cities to exchange information. Two papers have already been published and we are aiming to publish other results in due course. Also, our proposal to publish the papers presented during the workshop has been approved by Springer and the edited book is expected to be published by the end of 2017.

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Appendices

Conferences/Workshops

Workshop on Tools and Indicators for Assessing Urban Resilience

7-10 December, 2015
The University of Tokyo
Organized by Global Carbon Project-Tsukuba International Office
In collaboration with NIES, APN, UGEC, WUDAPT and IR3S

Background

The workshop on Tools and Indicators for Assessing Urban Resilience aims to utilize resilience thinking as a guiding principle and bring together scholars from different disciplines to develop an integrated framework for assessing urban community resilience in Asia-Pacific cities. The ultimate objective of this four-day workshop is to develop resilience assessment frameworks that can be used by planners and decision makers to lead them to more informed decisions. The workshop will consist of presentations and practical hands-on sessions, allowing the participants to actively engage in the development of resilience assessment frameworks. In addition, there will be sessions on resilient urban form that will elaborate on metrics that should be used for assessing resilience of urban form and data that are needed for this purpose.

Day 1, December 7, 2015

Morning: Measuring Urban Resilience

The morning sessions provide background information and set the context for the workshop. General issues of assessing urban resilience will be discussed during this session.

Morning (Chairs: Ayyoob Sharifi and Yoshiki Yamagata)		
9:00-9:10	Opening remarks by the hosts	Yoshiki Yamagata, Kensuke Fukushi
	Workshop outline/rationale	Ayyoob Sharifi
9:10-9:35	An overview of existing tools for assessing urban resilience	Ayyoob Sharifi
9:35-10:00	Climate Disaster Resilience Indexing of Asian Cities: An Action Based Approach	Rajib Shaw
10:00-10:25	Urban Resilience: Methodological Foundations and Resilience Matrix Approach	Cate Fox-Lent and Igor Linkov
10:25-10:45	*Coffee break*	
10:45-11:10	Towards the development of an integrated Sustainability and Resilience Benefits Assessment (SRBA) framework of urban interventions	Grafakos Stelios et al.
11:10-11:35	Urban Resilience and Transformation: Implications for assessment indicators	Marta Olazabal
11:35-12:00	What's under the city resilience umbrella? Aligning Resilience and the Urban 2030 Agenda	Lorenzo Chelleri
12:00-12:15	Discussion and wrap up	All

Afternoon: Resilience planning in the Asia-Pacific region

This session will be focused on studies that have used tools and indicators for measuring resilience in the cities of the Asia-Pacific Region.

Afternoom (Chairs: Rajib Shaw, Darryn McEvoy)		
13:30-13:50	A System for Evaluating the Resilience Value of Disaster Recovery Projects: The Case of Hurricane Sandy and Irene in New York	Judd Schechtman
13:50-14:10	Building urban climate resilience – lessons learned from Thailand and the Mekong region	Pakamas Thinphanga
14:10-14:30	Resilient institutions=vulnerable people? A longitudinal case study of flood management institutions in marginalized settlements in Russia.	Lilia Yumagulova
14:30-14:50	Approach to mainstreaming climate change resilience in urban planning and development: Case of Ahmedabad, India	Minal Pathak
14:50-15:10	Enhancing urban resilience through energy efficiency measures in the residential buildings of Dhaka city	Md. Humayun Kabir
15:10-15:20	*Coffee break*	
15:20-15:40	Coastal urban climate resilience planning in Quy Nhon, Vietnam	Vu Kim Chi
15:40-16:10	Assessment of vulnerabilities and adaptation actions in the Solomon Islands.	Jamal Namo
16:10-16:30	Identification of Human & Economic Resilience Indicators in Climate Resilience Review	Fanni Harliani
16:30-16:-50	Framework and indicators for climate compatible urban development	Ashish Shrestha
16:50-17:15	Discussion and wrap up	All

Day 2, December 8, 2015

Morning: Resilience planning in the Asia-Pacific region (continued)

Discussions from the last session will be continued.

Morning (Chairs: Yoshiki Yamagata, Susie Moloney)		
9:00-9:25	Empowering Communities: Visualization Tools for Building Climate Change Awareness and Resilience	Stephen Sheppard
9:25-09:50	Monitoring and evaluating progress towards becoming a more adaptive and resilient region: lessons from Melbourne	Susie Moloney
09:50-10:15	Vulnerability and resilience of cities in developing countries on health risk caused by climate change and urbanization	Kensuke Fukushi
10:15-10:45	*Coffee break*	
10:45-11:10	Systems Resilience: Taxonomy and General Strategies	Hiroshi Maruyama, Kazuhiro Minami
11:10-11:35	Urban Morphology: Applications, Issues and Prospects for Resiliency Assessment	Paul Stangl
11:35-12:00	Development and Application of Web-based Geographical Information System to Assess Urban Resilience: Land Use and Infrastructure Planning for the Greater Nagoya Region, Japan	Akito Murayama et al.
12:00-12:15	Discussion and wrap up	All

Afternoon: Hands-on session on assigning weights to a set of criteria contributing to resilience of urban form

Participants will be divided into several working groups in order to discuss different criteria contributing to resilience of urban form. The main purpose of this session is to prepare a list of important criteria that can contribute to resilience of urban form and categorize these

criteria into several main groups. The possibility of using these groups of criteria for developing an AHP analysis will also be discussed.

Day 3, December 9, 2015

Morning: Concluding session on Urban Resilience indicators

The morning session will wrap up the presentation sessions on assessing urban resilience. A timeframe will be developed for completing workshop tasks and discussions will be made on the possible outputs to be published in scholarly journals.

Morning (Chairs: Perry Yang, Yoshiki Yamagata		
9:00-9:25	Land Use Scenarios for Assessing Urban Resilience	Yoshiki Yamagata
9:25-9:50	Energy Resilient Urban Systems: A Design Perspective	Perry P. J. Yang
9:50-10:15	Future Urbanization and the Management of Urban Heat Risk	Peter Marcotullio
10:15-10:40	Linking Knowledge to Action — Urban Resilience, Social Innovations, and Community Energy	Christian Dimmer
10:40-11:00	*Coffee break*	
11:00-12:00	Discussion and wrap up	All

Afternoon: WUDAPT project development in collaboration with URCM

WUDAPT group will present about their work in this session and the organizer is planning to utilize a selected number of criteria from the toolkit for assessing resilience of different urban forms. In addition, the necessity, benefits, and challenges of developing a global city database would be discussed.

Afternoon (Chairs: Linda See, Johannes Feddema)		
13:30-13:50	The Urban Knowledge Network (UKAN)	Xuemei Bai
13:50-14:30	The WUDAPT initiative: overview, data collection and progress to date	Linda See
14:30-15:20	Applications of WUDAPT	Johannes Feddema
15:20-15:45	*Coffee break*	
15:45-16:00	The WUDAPT agenda	Johannes Feddema / Linda See
16:00-16:40	Panel discussion	All
16:40-17:00	Wrap up	

Day 4, December 10, 2015

Morning (9:00-12:00):

Participants will be divided into two groups. A selected number of participants (GCP and WUDAPT) will meet to discuss strategies for future collaboration on developing a global city database initiative and possible contribution of both groups to the Urban Knowledge Action Network of Future Earth. The second group of participants will get involved in another hands-on practice focused on addressing several major research questions related to the topic of measuring urban resilience. Participants will be divided into several groups and the Structured Interview Matrix technique will be used to engage participants in this activity.

Afternoon (13:30-17:00):

The session on addressing questions related to measuring urban resilience will be continued. All workshop participants will attend this session. Before the coffee break, each group will synthesize their work to be reported to all participants. The session will close by listing main themes drawn from the discussions, reaching consensus on a list of priority research questions, and preparing a list of action items for post-workshop tasks and activities.

Workshop organizers

Ayyoob Sharifi, *GCP-Tsukuba International Office*
Yoshiki Yamagata, *NIES*
Kensuke Fukushi, *IR3S*
Linda See, *WUDAPT*
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Funding sources outside the APN

Name of institution	Type of support
Global Carbon Project	In-kind support, administrative work
National Institute for Environmental Studies	7,581.77 USD
Urbanization and Global Environmental Change Project (UGEC)	4,958.46 USD

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Cate Fox-Lent	Workshop design, Presentation, hand-on activities, post-workshop	Environmental Lab, US Army Corps of Engineers	catherine.Fox-Lent@usace.army.mil
Lilia Yumagulova	Presentation, hand-on activities, post-workshop	The University of British Columbia	lily.yumagulova@gmail.com

Messages from young scientists

Humayun Kabir
I have been involved in research relating to disaster management and climate change since 2000. I have had an experience of working with the mainstream of disaster management particularly with the academic programs. I was asked to apply for the workshop on measuring the resilience by one of the colleagues who has been involved in disaster related activities for long. However, it has been an immense and rare opportunity to learn from the active participation and interaction with the stalwarts those who are the pioneers and think tanks of resilience study in the world. The workshop has really helped me to guide to the right direction of the study on resilience particularly in our case.
Minal Pathak
The workshop on Tools and Indicators for Measuring Resilience was closely aligned to my recent research focus, which has been to look at integrated approaches to addressing climate change and sustainability in the Indian context. The funding provided me the opportunity to share my work with a diverse range of professionals from varied disciplines. The diversity and depth of expertise in the group led to dynamic discussions during the course of the workshop. The insights from these discussions have benefitted me immensely to broaden my

perspective, enrich research capabilities and improve communication. It gave me an opportunity to interact and discuss my work with experts with a strong base in community engagement. The workshop generated several interesting questions and challenges around the concept of urban resilience including the similar and contrasting evidences from different geographical regions. A group of researchers from the workshop have taken the discussions forward and initiated collaborative research. I see long, sustained positive benefits to my work being part of this group of researchers. I plan to take these learnings to wider application of my work in India by engaging with stakeholders including communities and policymakers. In summary, the methodology and insights from the program including the experience of interacting with experienced professionals provided a unique opportunity for scientific capacity development and contributed a global perspective to my research. This has also opened up future possibilities for collaborative engagements.

Kim Chi Vu

It was great opportunity for me to attend the workshop. I have learned much about urban resilience from all the participants, who come from different parts of the world. Even after the workshop, we still talk and share our ideas to each other. I think the workshop has created a great network of researchers, who have common interests in urban resilience, so that we certainly go for further cooperation in the future.

Jamal Namo

“MY experience, truly a learning opportunity.”
I am extremely fortunate to participate in the urban resilient workshop. At first seen the names of the participants with title of Phds and academia just almost struck me off, but with much encouragement from an Australian friend and a colleague sustain my determination to go on and part of this unique opportunity.
The opportunity was an eye opener- the first ever kind of high level conference I had attended. It was a lot of learning for me and found myself completely amazed by the level of experience and sharing. Listening to many presentation, although many of which are more scientific and scholarly based I learned a great deal of new ideas. The word resilient became clearer as many explicit explanation and discussion had enriched my understanding. I believe as someone from a small Island developing state picking up what is relevant to my context is important. An example, integrating those scientific know how with the local knowledge would surely build a resilient community as far as disaster and climate change threats are concern for our small islands state like those in the Pacific region.
I also got the chance to meet and make new friends and I was as passionate about this network of friends as it opens new other opportunities to discover.

Ashish Shrestha

I feel honored to be part of this methodical workshop, be among the researchers from different parts of the world and gain knowledge from their research and experience. As a young researcher, with academic background in environmental engineering / urban water engineering, I have been keen on researches related to climate change and its interrelation with urban water and energy systems. I have recently been part of research study on climate compatible development in cities and this forum gave me opportunity to share our research. More importantly I also get to learn thoroughgoing aspects of building resilience in different sectors.

Fanni Harliani
My involvement in the project is defined the relationship between urban form and lists of hazard. In the second day session of the workshop, we divided into 4 small groups and I'm in the third group discussing about relationship between accessibility to amenities, land use mix, and green space to each of hazards (energy security, water security, food security, etc) in the matrix with positive (+), negative (-), and neutral (0) relationships. Furthermore, in other session of the workshop we discussed about several major research questions related to the topic of measuring urban resilience using the Structured Interview Matrix technique. All of activities in this workshop develop my capacity and my knowledge about urban resilience concept and how to measure urban resilience and this is very useful for my project in my country. In this workshop I realized that when we want to measure urban resilience we have to understand and have a clear definition about the urban resilience itself. We should be careful not to mingled resilience concept with other development concept and we need to clearly clarify the scope of urban resilience measurement.
Cate Fox-Lent
My existing work in resilience metrics and assessment development had largely focused on coastal communities within the United States. Participating in the workshop was a great opportunity to gain valuable feedback from an international panel of researchers on the framework as well as engage in discussion about the critical issues affecting other coastal communities, both large and small. In addition, I gained exposure to experts in the field of urban form, a concept that had not been fully considered within my own agency's work. My involvement continues beyond the workshop as a contributor to the workshop summary paper on the section of continuing challenges.

Glossary of Terms

GCP: Global Carbon Project
UGEC: Urbanization and Global Environmental Change Project
WUDAPT: The World Urban Database and Access Portal Tools (WUDAPT)
NIES: National Institute for Environmental Studies

Further information including workshop reports and PowerPoint slides

For more information please see:
Agenda and slides: http://www.cger.nies.go.jp/gcp/workshop-on-tools-and-indicators-for-assessing-urban-resilience.html
Report (English): http://www.cger.nies.go.jp/cgernews/201604/304004_en.html
Report (Japanese): http://www.cger.nies.go.jp/cgernews/201604/304004.html