



Planning a new urban research programme for SEI Africa

A review of current and potential avenues of research on sustainable urbanization

Cassilde Muhoza

Stockholm Environment Institute
Kräftriket 2B
106 91 Stockholm
Sweden
Tel: +46 8 674 7070
Fax: +46 8 674 7020
Web: www.sei-international.org

Author contact:
cassilde.muhoza@sei-international.org
Director of Communications: Robert Watt
Cover photo: © Oliver Johnson

This publication may be reproduced in whole or in part and in any form for educational or non-profit purposes, without special permission from the copyright holder(s) provided acknowledgement of the source is made. No use of this publication may be made for resale or other commercial purpose, without the written permission of the copyright holder(s).

About SEI Working Papers:

The SEI working paper series aims to expand and accelerate the availability of our research, stimulate discussion, and elicit feedback. SEI working papers are work in progress and typically contain preliminary research, analysis, findings, and recommendations. Many SEI working papers are drafts that will be subsequently revised for a refereed journal or book. Other papers share timely and innovative knowledge that we consider valuable and policy-relevant, but which may not be intended for later publication.

Copyright © November 2015 by Stockholm Environment Institute



STOCKHOLM ENVIRONMENT INSTITUTE

Working Paper No. 2015-15

Planning a new urban research programme for SEI Africa

A review of current and potential avenues of research on sustainable urbanization

Cassilde Muhoza

Stockholm Environment Institute

Acknowledgements

I would like to thank all the SEI staff interviewed for this study as well as Christelle Beyers of the Sustainability Institute, University of Stellenbosch, for their valuable insights. I am very grateful to Oliver Johnson and Stacey Noel for their guidance, insightful suggestions and support and for reviewing several drafts. Special thanks also to my SEI colleagues for their input and advice, in particular Philip Osano, Sarah Odera, Othniel Yila, Hannah Wanjiru, Priscyllar Wamiru, Anne Nyambane and Andriannah Mbandi. Finally, I am grateful to Tom Gill and Andrew Mash for their support in editing this report.

CONTENTS

Executive summary	3
Key findings	3
Recommendations	4
Acknowledgements	4
1 Introduction	5
1.1 Urbanization trends in Africa	5
1.2 Urbanization challenges in Africa	6
1.3 Aims and objectives of the scoping study	8
1.4 Structure of the report	8
2 Scoping study methodology	9
2.1 Desk-based research	9
2.2 Interviews with leaders of SEI urban projects and SEI Africa partners	9
2.3 Limitations	10
3 SEI's work at the urban scale	11
3.1 Overview of projects	11
3.2 Partner mapping	18
4 Strengths and gaps in SEI's urban work	23
4.1 Diverse expertise in sustainable urbanization	23
4.2 Cross-centre collaboration and a wide international network of partners and experts	23
4.3 Knowledge gaps in SEI's work on urbanization	24
5 The Way forward for SEI Africa's new urban programme	25
5.1 Recommendations	25
References	29
Appendix: List of project leaders and SEI key partners contacted OR interviewed	32

EXECUTIVE SUMMARY

Africa, particularly sub-Saharan Africa, is experiencing unprecedentedly rapid urbanization coupled with accelerating population growth. Africa is currently the fastest growing and fastest urbanizing continent: its total population is projected to increase from around one billion in 2010 to almost 2 billion by 2040 and eventually reach 4.2 billion by 2100 (UNDESA 2013). The continent's urban population is forecast to increase from 400 million in 2010 to 1.26 billion by 2050 (UN-HABITAT 2014). This demographic change is already posing myriad challenges for African cities. Growing pressure on natural resources combined with weak urban planning and management institutions, and inadequate governance systems hinder attempts to improve basic service delivery, reduce urban poverty and restrict the proliferation of informal settlements. If not addressed appropriately, these challenges will continue to degrade the quality of life and the environment in urban areas. There is a pressing need to research these multifaceted and complex challenges, and to explore opportunities for sustainable urbanization in order to inform Africa's policymakers and urban and regional planners.

To help to identify and support more sustainable urbanization pathways, Stockholm Environment Institute (SEI) Africa is developing a research programme on Managing Urban Change. This scoping study reviews existing SEI expertise on urban issues and identifies the existing and potential research areas and partners that SEI Africa should concentrate on as it develops this new programme. The scoping study methodology involved desktop research to map the SEI projects on urban issues listed on SEI's website and its project monitoring and evaluation and communication (PMEC) system; an Internet search for potential partners working on urban sustainability issues in Africa; and a literature review of urban project-related materials and publications on urbanization in Africa. This was complemented by interviews with SEI's leaders of urban projects and with SEI partners involved in urban issues in sub-Saharan Africa. The study was carried out between October 2014 and April 2015.

Key findings

Three key findings emerged from this scoping study. **First, SEI has diverse expertise in sustainable urbanization.** The review of SEI's urban work indicates that, as of April 2015, SEI had conducted 64 urban projects in both developed and developing countries (Asia, sub-Saharan Africa, Latin America, the U.S. and Europe). These projects covered a wide range of research areas (12) and cut across SEI's four research themes. Recent and current research activities have focused on 10 interrelated areas: water resources, climate change, sustainable sanitation, disaster risk reduction, household energy, green infrastructure, urban air pollution, sustainable urban mobility, the urban environment and human wellbeing, and resource-efficient communities. Overall, SEI's work at the urban scale falls broadly into three categories: scientific research and knowledge development, policy engagement and capacity development.

Second, external partnerships appear to have been prioritized over cross-centre collaboration. Fewer than 10 of the 64 urban projects that SEI has undertaken have been cross-centre collaborations. Although all seven centres appear to have some expertise in sustainable urbanization, there is a wide disparity between centres in terms of the number of urban projects per centre and areas of expertise. However, SEI has developed and conducted research with a wide network of external partners and experts around the world, such as research institutes, academics, NGOs, governments, funding institutions, United Nations agencies and the private sector.

Third, there are some knowledge gaps in SEI's work on sustainable urbanization. There has been little or no research in a number of important focal areas and geographical regions. For instance, our study shows that SEI's research in sub-Saharan Africa has focused mainly on the countries of East and Southern Africa. Little research has been conducted on urban issues in Central and West Africa. At the same time, there has been only limited research on: urban solid waste

management; urban water use in Africa, Europe and North America; urban and peri-urban agriculture; disaster risk reduction in Africa; green infrastructure in Africa, Asia and Latin America; sustainable infrastructure in Africa; and the potential for urban greenhouse gas (GHG) inventories, GHG abatement potential and climate vulnerability assessment in Asia, Latin America and Africa.

Recommendations

Based on the findings of the scoping study of SEI's expertise in sustainable urbanization, we make four key recommendations on the design and focus of SEI Africa's Managing Urban Change programme:

- **Replicate existing SEI urban projects in African countries**, such as those on urban water use (urban metabolism); resilient water, sanitation and hygiene (WASH) systems; social impact assessments of new infrastructure; urban GHG emissions inventories and assessments of GHG abatement potential, climate change vulnerability and adaptation planning.
- **Explore selected strategic research areas**, such as water resources and sustainable sanitation; waste management; household energy; sustainable mobility and urban air pollution; urban governance; urban planning and development; climate change mitigation and adaptation; disaster risk reduction and urban resilience; inclusive and liveable cities; green infrastructure; urban and peri-urban agriculture; and urban-rural linkages.
- **Pursue research in all sub-Saharan African regions** (Central and West Africa as well as East and Southern Africa) **and undertake comparative studies between cities in different regions** of Africa as well as between cities in Africa and Asia, Africa and Latin America, and Africa and Europe/North America.
- **Capitalize on potential partnerships within SEI and externally**. Successful development of the programme will depend on strengthening existing links and fostering new ones with those centres which have expertise in sustainable urbanization. The programme will also serve as a platform for strengthening existing and forging new partnerships with local and international partners and experts actively involved in urban sustainability challenges in sub-Saharan Africa.

1 INTRODUCTION

1.1 Urbanization trends in Africa

Africa, particularly sub-Saharan Africa, is currently undergoing major demographic and urban transitions that pose a number of challenges for its cities. Africa is currently the continent with the fastest growing population and already the world's second most populous continent. Its estimated population of 1.14 billion people in 2014 (UNDESA 2014a) is five times its population in 1950. This rapid population growth is set to continue. According to the Population Division of the United Nations Department of Economic and Social Affairs (2013), the population of Africa is projected to nearly double to almost 2 billion by 2040, and eventually reach 4.2 billion by 2100. This would represent 40 per cent of the world's population (see Figure 1). Population growth in Africa is characterized by an exponential increase in the number of people aged between 15 and 24 years. In 2014, 18 per cent (around 200 million) of the world's adolescents and youth lived in Africa (African Economic Outlook 2012) and this is expected to rise to 30 per cent in 2050 (UNDESA 2014a). The burgeoning youth population in Africa poses the challenge of creating job opportunities for the young, who currently represent 60 per cent of those who are formally unemployed and therefore likely to turn to the informal sector (African Economic Outlook 2012).

In parallel with rapid population growth, sub-Saharan Africa in particular is witnessing unprecedentedly rapid urbanization (see Figure 2). Africa is the world's least urbanized continent, but it is currently the fastest urbanizing continent. Its annual urban growth rate, at 3.6 per cent, is double the world average (UNDESA, 2015a). The urban population in Africa has increased from 19 per cent to 39 per cent past in the past 50 years, and now reaches 455 million (UNDESA 2014 b). According to UN-Habitat's State of African Cities report (2014), the number of Africa's urban dwellers is projected to reach 1.26 billion by 2050. Small and medium-sized cities are expected to absorb 75 per cent of the projected urban population growth. The remainder will add to the population of the so-called million cities. There are, however, wide variations in the patterns of urbanization across Africa's regions. North Africa has a higher proportion of urban dwellers (51 percent) than sub-Saharan Africa (37 per cent). Sub-Saharan Africa has the highest proportion of slum dwellers, at 62 per cent of the urban population (UNDESA 2014b). Urban population growth is driven by both natural population growth and widespread rural to urban migration. This in turn is fuelled by the millions of people fleeing conflict, drought and rural poverty to settle in informal settlements or in the vicinity of cities and towns (UNECA 2014).

Sub-Saharan Africa has experienced significant economic growth in recent years. Between 2000 and 2012, gross domestic product (GDP) grew by an average of 4.5 per cent per year, twice the rate of the 1980s and 1990s (UN-Habitat 2014). The World Bank (2014) estimated GDP growth in the region at 4.7 per cent in 2013 and forecast 5.2 per cent growth in 2014. This economic performance is largely the result of increased investment in natural resources (oil, gas and minerals) and in infrastructure, as well as strong household spending (World Bank 2014). This economic growth, however, has not resulted in significant improvements in living standards or created jobs. As a result, Africa is still experiencing widespread urban poverty. Despite ten years of high levels of economic growth across the continent, around 50 per cent of Africans still live on incomes below USD 1.25 per day, while only 4 per cent receive more than USD 10 per day (UN-Habitat 2014). The lack of formal employment has led thousands of city dwellers to turn to the informal sector, which accounts for 93 per cent of all new jobs and 61 per cent of urban employment in Africa (African Development Bank 2012). Moreover, because most migrants from rural areas are uneducated or unskilled, they often end up unemployed or underemployed in informal, insecure and poorly paid jobs; this is especially the case for women and youth. As a result, these new city dwellers end up living in inadequate housing in slums conditions.

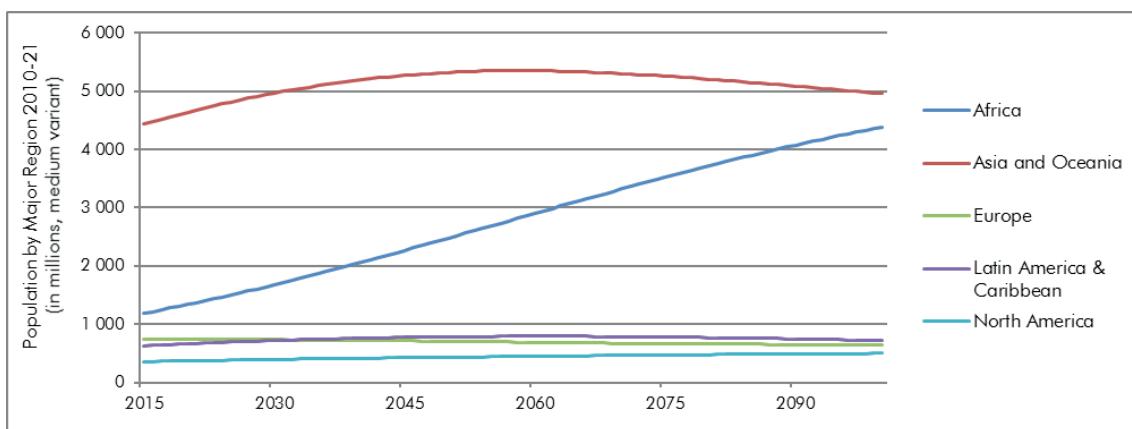


Figure 1: Population by major region 2010-2100 (in millions, median variant)

Source: UNDESA (2015b)

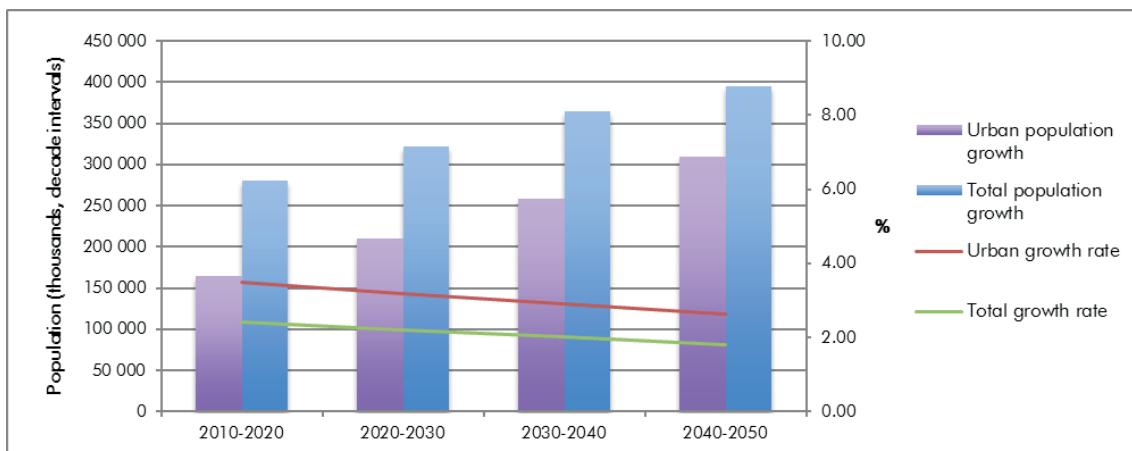


Figure 2: Projected African relative total and urban population growth rates (per cent, thousands, decade intervals)

Source: UNDESA (2014c)

1.2 Urbanization challenges in Africa

The current rapid urbanization in sub-Saharan Africa poses many serious challenges for African cities, such as growing pressure on natural resources and the environment, increasing environmental- and climate change-related vulnerabilities, urban poverty and the proliferation of informal settlements (UN-Habitat 2014; African Development Bank 2012). These challenges are exacerbated by weak urban planning and management institutions, and inadequate urban governance (UNECA 2014; UN-Habitat 2014).

Pressure on natural resources and the environment

A significant number of people have gained access to water supplies and sanitation facilities since 1990, but urban population growth has outpaced the rate of expansion of improved services and the authorities in African cities struggle to provide their growing populations with access to water and sanitation. Moreover, high rates of urban population growth and the related growing demand for water put greater pressure on already scarce water resources. African cities also face the challenge of improving waste management services. Poor or absent solid waste management systems, reflected in the widespread dumping of waste and toxic industrial products in rivers and uncon-

trolled dumps adjacent to informal settlements, pose extreme hazards to public health and water quality through pollution (UN-Habitat 2014). Rapid urban growth will increase the generation of waste, exacerbating this challenge. In addition, accelerating urbanization has resulted in increased urban air pollution in the cities of sub-Saharan Africa, attributable mainly to rapidly expanding vehicle fleets, old or poorly maintained vehicles that lack emissions controls and the increased use of fossil fuels. Rapid motorization coupled with inadequate urban transport policies, integrated land-use policies and poor road discipline have also resulted in chronic traffic congestion (Schwela and Haq 2013). Finally, the expansion of cities and the related chaotic and uncontrolled urban sprawl have led to the destruction of forests and other natural ecosystems.

Growing climate- and environment change-related vulnerabilities

Cities are often the most vulnerable to disasters and climate change due to the large concentration of people, economic activity, infrastructure and services. Climate change will exacerbate existing environmental risks in Africa's growing cities and urban centres by exposing them to temperature increases, changed rainfall patterns, sea-level rises and frequent extreme weather events such as severe droughts, floods and storms. Extreme events will pose increased health and sanitation challenges, intensify water and food scarcity, damage infrastructure and disrupt services (water and energy supplies). In addition, weak institutional capacity, low levels of infrastructure provision and widespread urban poverty, if not adequately addressed, will increase the vulnerability of African cities to disasters and climate change impacts (UN-Habitat 2014).

Urban poverty and the proliferation of informal settlements

Historically, urbanization has been associated with increased economic development, rising incomes and better living standards, as cities are important drivers of economic growth, job creation and poverty reduction. The rapid urbanization of sub-Saharan Africa has not generated inclusive economic growth, however. It has failed to create significant opportunities for formal employment or improve the quality of life of millions of urban dwellers, especially low-income households. As a consequence, the urban transition has led to the proliferation of informal settlements and increased urban poverty and insecurity. According to UN-Habitat (2014), 61.7 per cent of Africa's urban population lives in informal settlements in degraded environments without access to adequate housing, electricity, transport, safe drinking water, sanitation and waste management facilities or other basic services such as health and education. The lack of these basic services has forced the urban poor to resort to unreliable informal service providers.

These challenges are exacerbated by weak urban planning and management institutions, human resource deficiencies and inadequate governance systems. Most municipal authorities lack appropriate urban planning legislation and policies, housing policies, professional capacity (technical and administrative skills) and sufficient resources to effectively plan and manage urban development. As a result, municipalities have typically failed to accommodate the growing urban population by providing adequate housing or basic services and infrastructure, leading to the proliferation of unplanned, underserviced settlements in cities and increased inequality and exclusion among the low-income population.

If not addressed appropriately, these challenges will continue to degrade the quality of life and the environment in urban areas. There is therefore a pressing need to research the multifaceted and complex challenges associated with urban transitions and explore opportunities for sustainable urbanization pathways in order to inform African policymakers, and urban and regional planners. Overcoming these challenges will require the application of holistic systems and approaches to sustainable urban development in order to build liveable cities that are socially inclusive, economically productive, environmentally sustainable, secure and resilient to climate change and other risks.

1.3 Aims and objectives of the scoping study

In order to contribute to identifying and supporting more sustainable urbanization pathways, Stockholm Environment Institute (SEI) Africa is developing a research programme on Managing Urban Change. This programme seeks to explore the challenges related to rapid urbanization in sub-Saharan Africa and provide insights into sustainable urbanization pathways in Africa. To inform the design of the Managing Urban Change programme, this scoping study reviews existing SEI areas of expertise in sustainable urbanization and maps the research areas and partners that SEI Africa should concentrate on as it develops this new programme. The study was carried out between October 2014 and April 2015.

The SEI has undertaken research on environment and development issues at the local, national, regional and global policy levels for more than 25 years. Over the years, SEI has done a range of work on sustainable urbanization, particularly under the research theme on Managing Environmental Systems. The urban work under this research theme aimed to “support sustainable urbanization through systemic analyses of urban infrastructures and their service delivery capacity and consequences for communities in relation to land-use, air quality, water resources, sanitation and solid waste” (SEI 2011). In addition, SEI’s research on environmental and sustainability issues in urban and peri-urban areas also cut across other research themes. Overall, SEI’s work at the urban scale has focused on both developed and developing countries.

SEI Africa is one of the seven SEI centres around the world.¹ It currently focuses on two key research programmes: energy and climate change, and water and agriculture for rural livelihoods. The Managing Urban Change programme would constitute a third.

1.4 Structure of the report

Section 2 explains the methodology adopted during the scoping study research. Section 3 provides an overview of SEI’s urban projects and maps SEI’s research partners and funders. Section 4 analyses the strengths and gaps in SEI’s research on sustainable urbanization. Section 5 makes recommendations on the design of the SEI Africa Managing Urban Change programme.

¹ SEI has seven centres in six countries: SEI Africa, SEI Asia, SEI Oxford, SEI Stockholm (Headquarters), SEI Tallinn, SEI U.S. and SEI York.

2 SCOPING STUDY METHODOLOGY

The research had two components. Firstly, a desk-based review was undertaken to map out all of SEI's urban projects, and an Internet search was carried out to identify potential partners working on urban sustainability issues in Africa as well as a literature review of project-related materials and publications on urbanization in Africa. The second component consisted of interviews with SEI's leaders of urban projects and SEI partners involved in urban issues in sub-Saharan Africa.

2.1 Desk-based research

The mapping exercise examined projects that focused on the overarching topic of sustainable urbanization or on specific environmental and development issues in either urban or peri-urban areas in developed and developing countries. Our search within SEI's internal project monitoring, evaluation and communication tool (PMEC) focused on *completed or ongoing urban projects and follow-up projects that have been approved and are waiting for funding*. Many other urban project proposals on PMEC have either not yet been submitted, or have not been awarded funding or are awaiting approval. These projects were not analysed in this study.

The literature review covered publications on urbanization in Africa as well as urban project-related materials (reports, presentations, policy briefs, working papers, etc.) in order to collect additional information on projects (methods, partners, findings) but also to better understand the urban issues addressed. In addition, the 2015 work plans of all the SEI centres were analysed to gather more information on current and future projects. The overarching purpose of this review was to better understand urbanization trends and prospects, the challenges associated with rapid urbanization and the opportunities for sustainable urban planning and management in Africa. The review helped to identify strategic research areas for the new urban programme.

The third step was to identify potential local and international partners working on urban challenges in Africa. In the process of reviewing SEI urban projects and publications on urbanization in Africa, we identified both existing SEI partners and potential partners that SEI Africa could collaborate with in the new urban programme. This was complemented by the Internet search for actors working on urban issues in Africa.

2.2 Interviews with leaders of SEI urban projects and SEI Africa partners

The second component of the scoping study involved interviews with SEI colleagues and external partners. The SEI interviewees were leaders of urban projects or other staff members involved in the projects. The purpose of these interviews was to better understand the background to and scope of the projects. For each urban project, we examined its goals, methods and/or analytical framework, outputs, knowledge gaps and new or future research ideas. After 23 leaders of urban projects were contacted, 10 project leaders/staff were interviewed on Skype between November 2014 and April 2015 in semi-structured interviews which lasted between 20 and 45 minutes. Five other project leaders provided us with project-related materials or information on their projects. A list of project leaders contacted and interviewed can be found in the appendix.

The external interviews focused on SEI's key partners working on urbanization in sub-Saharan Africa, such as UNEP, UN-Habitat, UNDP and the Sustainability Institute of Stellenbosch University, South Africa. A researcher at the Sustainability Institute with expertise in the sustainable infrastructure, development and planning fields was interviewed on Skype in March 2015. We were unable to interview anyone from the UN-Habitat Urban Basic Services Branch, UNEP Headquarters or the UNDP regional office in Nairobi during the course of the study. However, as potentially key local partners, we will engage with them in the next phase of the design of the urban programme in the coming months. The purpose of the interviews was to get an overview of the current work undertaken by these partners on urbanization in sub-Saharan Africa and to

explore the current urban research needs of decision makers in Africa, in order to inform the design and implementation of the Managing Urban Change programme. This phase was conducted between March and April 2015.

2.3 Limitations

The main limitation of this study was that we used PMEC and the SEI website to map the urban projects but not all the projects are recorded on PMEC or on the website. As a result, we might have missed some relevant urban projects. Another challenge was reaching the project leaders of some urban projects, which restricted the information we might have gathered on other existing urban projects or future projects. The findings of this scoping study on SEI's research on sustainable urbanization are therefore mainly based on the information available on PMEC and the SEI website.

3 SEI'S WORK AT THE URBAN SCALE

This section presents an overview of SEI's recent and current urban projects. It also describes SEI partners and funders of urban projects.

3.1 Overview of projects

Our mapping study shows that SEI's research on sustainable urbanization has been diverse, having cut across SEI's four research themes and having focused on both urban and peri-urban areas in developed and developing countries. Most urban projects were carried out under the Managing Environmental Systems theme. However, SEI research conducted under the other three themes also focused on environmental and sustainability issues in urban and peri-urban areas.

All seven SEI centres have carried out research on specific sustainability issues in urban areas. Each centre has its particular areas of expertise. As of April 2015, 64 urban projects² had been planned or undertaken in the seven SEI centres: 46 of these had been completed; 11 were ongoing, three had been approved and were awaiting funding; and four are future, planned projects.³ These projects address urban sustainability issues in Asia, sub-Saharan Africa, Latin America, North America and Europe. Table 1 summarizes SEI's research at the urban scale.

The research activities of SEI's urban projects fall broadly into three categories: research and knowledge development, policy engagement and capacity development. The completed urban projects identified were carried out between 1997 and 2014. Those which were ongoing or awaiting funding as of April 2015 were expected to be completed in the next two to five years.

² It should be noted that these are the urban projects that were found on PMEC and the SEI website. There are probably many more SEI urban projects that are not recorded on PMEC.

³ According to the urban project leaders interviewed, these are projects in the pipeline. They are not yet recorded on PMEC.

Table 1: SEI centres' research at the urban scale

SEI Centres (lead)	Research areas	Regional focus	Projects			
			Completed	Ongoing	Future or awaiting funding	Total
SEI Africa	Household energy	sub-Saharan Africa	-	1	-	2
	Sustainable sanitation	sub-Saharan Africa	1	-	-	
SEI Oxford	Climate change adap- tation	sub-Saharan Africa	1	-	1	4
	Disaster risk reduction	sub-Saharan Africa	2	-	-	
SEI Asia	Climate change adap- tation	Asia	1	1	-	4
	Water resources	Asia	2	-	-	
SEI Stockholm	Sustainable sanitation	Global, sub- Saharan Africa, Asia, Latin America	7	1	-	
	Disaster risk reduction	Global, Europe	1	1	-	
	Household energy	sub-Saharan Africa, Asia	4	1	-	19
	Sustainable urban infra- structure	Asia	1			
SEI Tallinn	Urban-rural linkages	Europe, sub- Saharan Africa	2			
	Resource efficient com- munities	Europe	-	1	-	
	Sustainable urban mobility	EU	2	1	-	4
	Green infrastructure	EU	1	-	-	
SEI U.S.	Climate change	Global, U.S., South America, sub-Saharan Africa	8	-	2	14
	Water resources	Asia, South America	3	-	1	
	Green infrastructure	UK	1	1	1	
	Urban air pollution					
SEI York	Water resources	Asia, sub- Saharan Africa	5	1	1	
	Sustainable urban mobility	UK	1	-	-	
	Sustainable infrastruc- ture	Asia	1	-	-	17
	Climate change mitiga- tion	UK	1	-	-	
	Urban environment and human wellbeing	UK	-	2	-	
	Resource efficient com- munities	UK	1	-	-	

SEI urban projects cover 12 key research areas, which are summarized below. A detailed overview of all the urban projects can be provided on request.

Water resources (7 projects)

SEI's work on water resources investigates the demographic, socio-economic, political and ecological drivers shaping water resources use in urban and peri-urban areas in Asia and Latin America, and provides insights into sustainable water management, governance and planning. This study identified six completed projects led by SEI U.S., SEI Asia and SEI York and one future project.

Urban water use: In its recent projects, SEI U.S. has developed an urban metabolism framework to map the economic, social and demographic factors shaping water consumption and demand in Bangalore and Bangkok; and worked with city planners, local residents and policymakers to explore future scenarios for the planning, management and governance of water resources. SEI U.S. plans to extend the urban metabolism framework to other Indian cities (SEI U.S. 2015). SEI Asia and SEI York have also developed a framework for studying water withdrawals, supply and quality in Phnom Penh, implemented using SEI's Water Evaluation and Planning (WEAP) modelling tool, and worked with city planners and policymakers to develop scenarios to identify water management and service provision policies and strategies that contribute to sustainable urbanization pathways.

Water resources planning under climate change: SEI U.S. has used WEAP to assess and quantify climate change impacts on water resources in Latin American cities (El Alto and La Paz, Bolivia) and, together with governments and urban planners, identified options for adaptation planning for water resources.

Water privatization: SEI Asia and SEI Oxford have investigated the drivers of the privatization of water services in Asian and Africa cities.

Sustainable sanitation (9 projects)

SEI has worked extensively on sustainable sanitation. Research at the urban scale has involved identifying and addressing knowledge gaps on and challenges to sustainable and productive sanitation. There were eight recent or ongoing projects on sustainable sanitation and one future project awaiting funding, mainly led by SEI Stockholm and SEI Africa.

Integrated approaches to link resource-based sanitation with energy and food security: Together with partners, SEI Stockholm has developed and disseminated an integrated approach (the water-energy-food security nexus) to improving the sustainability of sanitation systems in urban and peri-urban settings in sub-Saharan Africa, Asia and Latin America. SEI Stockholm has explored the opportunities available for Swedish resource-based sanitation techniques in the emerging Brazilian market.

Multi-level sanitation governance: Recently, SEI Africa in collaboration with SEI Stockholm examined multi-level sanitation governance in Rwanda, Tanzania and Uganda to better understand the effects, role and importance of strong policy leadership in the performance of the sanitation sector in sub-Saharan Africa.

Menstrual Management and Sanitation Systems: SEI Stockholm has examined the interactions between sanitation systems and menstrual management, mainly related to the issue of the disposal of used menstrual blood absorption materials.

Disaster-resilient water, sanitation and hygiene (WASH) systems: SEI's research is also investigating the linkages between urban WASH systems and disaster risk reduction in order to enhance the resilience of urban WASH systems to extreme water events (e.g. floods) in both developed and developing countries. To this end, SEI Stockholm in partnership with SEI Asia have developed a risk assessment that takes a more holistic approach, which takes account of broader social and environmental factors. Building on this research, SEI will develop a decision support tool in the form of a freely available online application that can be accessed by end-users (practitioners, policymakers, academics, donors) from a smart phone. This tool will facilitate the practical application of resilience and disaster risk reduction in WASH.

Disaster risk reduction (4 projects)

The research found three completed disaster risk reduction projects and one project currently being conducted jointly by SEI Stockholm and SEI Asia.

Disaster risk assessment and management: SEI's research on urban disaster risk reduction involves conducting risk assessments of cities, and assessing local government action on disaster risk reduction and resilience in order to inform policy and mainstream disaster risk reduction into urban and regional development planning. SEI Oxford, in collaboration with local partners, conducted a sea-level rise risk assessment for the city of Cape Town and identified possible adaptation measures. In a related study, SEI Oxford investigated the potential for collaborative governance in managing urban risks associated with flooding and sea level rise in Cape Town. SEI Stockholm has also assessed local government action on disaster risk reduction and resilience, through an analysis of the first cycle of the Local Hyogo Framework for Action (HFA),⁴ in order to inform policy and mainstream disaster risk reduction into urban and regional development planning.

Role of culture in disaster risk reduction: SEI Stockholm in partnership with SEI Asia are currently investigating the role of culture (cultures, sociocultural networks and practices) in disaster risk reduction in European cities.

Climate change (15 projects)

SEI's research on climate change focuses on the role of cities in climate change mitigation and on climate vulnerability assessments and adaptation planning in both developed and developing countries. There are 12 completed or ongoing urban projects, one approved project awaiting funding and two future projects. Research on climate change at the urban scale is led by SEI U.S., SEI York and SEI Asia.

Urban scale greenhouse gas emissions: SEI has worked extensively on the role of cities in climate change mitigation. SEI U.S. has conducted GHG emissions inventories for cities in the U.S. (city of Seattle, King County) and used SEI's Long-range Energy Alternatives Planning (LEAP) modelling tool to develop a carbon neutral scenario that outlines low-carbon pathways. SEI U.S. recently assessed the GHG emissions abatement potential of global mega cities (C40 cities) in the years 2020 and 2030 and identified criteria for a robust framework for assessing GHG reductions at the city scale. SEI U.S. also developed a detailed low-carbon programme for the current Central City Development Strategy for Cape Town in order to support Cape Town's existing Energy and Climate Change Action Plan. Building on its recent work on urban GHG abatement, SEI U.S. will extend its urban-scale GHG abatement analysis and tool to several countries (Brazil, Canada, China and the U.S.). In 2015, SEI U.S. will also develop a GHG emissions scenario-planning tool for cities using LEAP. SEI York has worked on the economics on low carbon cities through city-scale mini-“Stern reviews” of existing low carbon measures across different sectors in the city of Leeds and its wider region.

⁴ The Local Government Self-Assessment Tool for disaster resilience

Climate change vulnerability and adaptation: In a recent study, SEI Asia together with local research institutes and local authorities assessed current climate vulnerabilities in the peri-urban areas of Bangkok and Phnom Penh and explored existing knowledge and adaptation practices. SEI U.S. conducted a climate vulnerability study for Quito and provided key information and guidelines to support the Municipality of the Metropolitan District of Quito with adaptation planning. SEI Asia is currently examining the drivers of vulnerability of women and men to climate-related water stresses in three selected peri-urban case study areas in Vietnam, Thailand and the Philippines, and their adaptive responses to these stresses. This study aims to advance research and professional development for integrated adaptation planning. SEI Oxford has also investigated the barriers to and opportunities for the update of long-term climate information in decision-making on urban adaptation in sub-Saharan African coastal cities.

Urban air pollution (7 projects)

SEI's research on urban air pollution has been conducted mainly by SEI York. It focuses on urban air quality management in Asia, Europe and sub-Saharan Africa. There are six completed or ongoing projects and one future project is awaiting funding.

Air quality management: SEI York has developed a Strategic Framework for Air Quality Management in Asia comprised of five parts: air quality policies and governance, sources of emissions, air quality monitoring and modelling, health, environmental and economic risk assessments, and the financing of air quality management; and conducted a benchmarking study of air quality management in 20 Asian mega cities to assess the current status of urban air quality management practices in Asian cities. In addition, SEI developed an online Foundation Course on Air Quality Management in Asia in order to increase the capacity of governments, city authorities, academic organizations and NGOs to deal with urban air pollution issues. SEI York also developed the Geographic Information Systems for Participation (GIS-P) methodology to facilitate public involvement in policy debates on air pollution and noise issues in York, Sheffield and Bristol in the United Kingdom. More recently, SEI York helped establish and is leading the Transport and Environment–Science Technology (TEST) Network, which aims to support six countries in sub-Saharan African (South Africa, Tanzania, Uganda, Zimbabwe, Mozambique and Zambia) in formulating and implementing sustainable transport policies. SEI has developed a quality-assured web-based knowledge database of research capacities, networks and activities, research needs, technology needs and best practices related to traffic congestion, air pollution and road safety in the six countries. In 2015 SEI York will extend the TEST network to East African countries such as Burundi, Rwanda, Kenya and Ethiopia. SEI York is currently developing National Action Plans for reducing emissions of short-lived climate pollutants (SLCP) for seven African countries: Ghana, Cote d'Ivoire, Togo, Ethiopia, Liberia, Morocco and Nigeria. These SLCP Action Plans have components on transport, household energy and waste management, as areas of intervention to mitigate urban air pollution.

Sustainable transport and urban mobility (4 projects)

SEI provides support and policy guidance to cities, transport authorities and urban planners on the development and implementation of sustainable urban transport strategies and urban mobility plans in Europe. The research found three completed projects and one ongoing project led by SEI York and SEI Tallinn.

SEI Tallinn has provided technical support and policy guidance to urban planners, city officials and mobility professionals in Estonia on how to develop and implement sustainable urban mobility plans. SEI Tallinn is current assisting cities and regions across the EU to develop Sustainable Urban Mobility Plans (SUMPs) by facilitating networking, mutual learning and the sharing of experience and best practice across countries. SEI Tallinn recently evaluated the fuel consump-

tion and environmental impacts of diesel, ethanol, biodiesel and hybrid buses and gauged the potential costs and benefits of adopting biofuels for Tallinn buses. SEI York has also developed tools to help local transport authorities in the UK overcome barriers to the effective development and delivery of sustainable urban transport and land use strategies.

Household energy (6 projects)

SEI's research on household energy use examines the barriers to and opportunities for the adoption and use of biofuels and improved cooking stoves in sub-Saharan Africa and the electrification of the homes of low-income households in sub-Saharan Africa. Our study identified four completed and two ongoing projects led by SEI Stockholm and SEI Africa.

Access to biofuels and improved cooking stoves: SEI Stockholm in partnership with SEI Africa conducted a household energy economic analysis in Addis Ababa, Dar es Salam and Maputo to investigate the theoretical dimensions of switching from conventional biomass cooking stoves to modern energy efficient stoves and assess the role of socio-economic factors and product-specific factors as determinants of cooking stove choice. More recently, SEI Stockholm conducted a study to demonstrate the feasibility of using ethanol produced locally from waste for household cooking in order to displace the traditional use of biomass for cooking in Addis Ababa. SEI Stockholm also undertook a qualitative study in Kibera slum, Nairobi, to identify key drivers of behaviour linked to energy use and the adoption of improved cooking stoves in households in Kibera. SEI Stockholm and SEI Africa are currently evaluating the impacts of biofuel production and use on ecosystem services, human wellbeing and poverty alleviation in three sub-Saharan African countries: Malawi, Mozambique and Swaziland. In addition, this research investigates the links between urbanized regions and rural areas.

Household electrification: SEI Stockholm has explored low cost electrification in Pamodzi, a low-income township in Ndola, Zambia, by investigating low-cost methods for connection and wiring (ready-boards), in combination with a deferred payment scheme for the connection fee.

Green infrastructure (4 projects)

SEI's research on green infrastructure involves assessing the co-benefits of green infrastructure in cities in the UK and providing policy guidance to urban planners on how to integrate biodiversity into urban planning in Estonia. Two projects have been completed, one, conducted by SEI York and SEI Tallinn, is currently ongoing and one is planned.

Co-benefits of green infrastructure: As part of a project funded by the Department for the Environment, Food and Rural Affairs (Defra), on the Victoria Business Improvement District (BID) Clean & Green initiative, SEI York recently assessed the impact of green infrastructure on residents, businesses and workers in an area of central London. SEI evaluated co-benefits such as changes in environmental behaviour and purchasing decisions by people and businesses in areas with increased amounts of green infrastructure. SEI York is currently examining how green space (woodlands) can reduce perceived stress and improve mental wellbeing in deprived urban communities in Scotland.

Integrating biodiversity into urban planning: SEI Tallinn together with the city planning authorities in Estonia recently compiled guidance on how to integrate biodiversity considerations into urban planning decision-making processes.

Sustainable urban infrastructure (2 projects)

SEI's research analyses the population displacement and resettlement issues associated with large infrastructure and development projects in Asian cities. SEI has also developed tools to facilitate more inclusive and sustainable infrastructure for tourism and urban regeneration in the UK. Two projects have been completed, one each by SEI Stockholm and SEI York.

Social impact assessment of infrastructure: In a recent study, SEI Stockholm conducted a social impact assessment of new infrastructure (road transport, electricity, water systems) in Da Nang City, Vietnam. SEI analysed the economic and social situation of stakeholders and the impacts on their livelihoods of the new and enlarged infrastructure facilities.

Tools for public participation in urban regeneration: SEI York developed an innovative application of GIS-P to widen local community participation in the leisure- and tourism-led regeneration of urban areas that are economically disadvantaged but rich in built heritage in York.

Urban environment and human wellbeing (2 projects)

SEI's research explores how the urban built environment influences the mobility and wellbeing of older people in the UK. Two projects are ongoing, led by SEI York.

SEI York is currently exploring how places affect behaviour and mood and how they can be designed collaboratively to make mobility easier, more enjoyable and more meaningful for older people in Scotland. SEI York is developing neural imaging methods (mobile electroencephalography, EEG, recordings of brain activity) to explore real-time emotional responses to place. SEI York is also investigating the links between mobility and wellbeing among older people. This research will use participatory mapping approaches with different stakeholders in York, Leeds and Hexham, UK, to identify options for improving the health and wellbeing of older people.

Resource efficient communities (2 projects)

SEI is investigating approaches to building resource efficient and resilient communities in low-income neighbourhoods in the UK and Sweden. This research seeks to better understand what enables and motivates people at the local level to take on more sustainable lifestyles. One project has been completed and another is ongoing.

SEI York recently investigated different approaches to building community resilience in relation to sustainability issues in a low-income neighbourhood on the outskirts of York, focusing on improved use of resources, increased knowledge leading to lower carbon emissions and improving community connections to encourage shared action. SEI Stockholm has also developed and tested behavioural methods and models for creating inspiring and replicable examples of how resource efficiency can be achieved within a neighbourhood, Hökarängen in Sweden, by involving and enabling the individuals who live or work there to put their lifestyles on a more sustainable path. This research involved using the Resources and Energy Analysis Programme (REAP) Petite Sweden to conduct a “zero measurement” of the environmental footprint and environmental awareness of selected groups in Hökarängen.

Urban-rural linkages (2 projects)

SEI's research has explored urban, peri-urban and rural land use relationships in Europe and changes in urban-rural interrelations in sub-Saharan Africa.

SEI Stockholm has worked with partners to develop methods and tools to assess the environmental, social and economic impacts of land use change; and identified strategies to promote the

sustainable development of land use systems in rural-urban regions, especially the peri-urban in Europe. SEI Stockholm has also explored changes and transformations in the urban-rural inter-relations of Ethiopian towns. This research involved investigating urban-rural mobility structures, changes to livelihood systems and changes in formal and informal institutions and economies. SEI's work at the urban scale has also focused on sustainable urbanization in China. In the SEI China Cluster, SEI Stockholm explored the challenges and opportunities of urbanization during the transition towards sustainability.

It is important to note that despite our efforts to categorize projects according to research area for easy legibility, most of them are cross-cutting. Projects in one research area, such as climate change, could also fit within other research areas.

3.2 Partner mapping

SEI research partners

SEI has collaborated with a wide range of national and international partners and experts across the globe. These include research institutes, academics, funding institutions, UN agencies, NGOs, the private sector, and national and local government. Figure 3 maps SEI's partners.

SEI funders

SEI's urban research has been funded by different funding institutions, depending on the research area and the SEI centre. Table 2 shows the funding institution by research area and the project size in terms of project value in Swedish Krona. The project value indicated in Table 2 is based on the information available on PMEC. We could not find any data related to the budgets of projects that are not recorded on PMEC. The purpose of this table is therefore to provide an overall picture of the value of urban projects in each research area. Some projects on water resources, sustainable sanitation, climate change and sustainable urban mobility were funded or co-funded with Programme Support funds from Swedish International Development Assistance (Sida) or internal matching funding. The majority of projects on water resources, sustainable sanitation and household energy are funded by Sida.

Table 3 provides an overview of urban project funders per research theme for each SEI centre.

- SEI Africa projects are funded by Sida and Ecosystem Services for Poverty Alleviation (ESPA).
- SEI Asia projects are funded by Canada's International Development Research Centre (IDRC) and Sida.
- SEI Stockholm's work is funded by a wide range of funding institutions: Sida, the European Commission, the Swedish Civil Contingencies Agency, the Swedish Energy Authority, UNEP, UN-Habitat, United Nations International Strategy for Disaster Reduction (UNISDR), the Bill and Melinda Gates Foundation, Climate Development Knowledge Network (CDKN), and so on.
- SEI Tallinn's research is funded by the national government, local government in Tallinn, the Tallinn Bus Company and the European Commission.

- SEI York projects are funded by UK funding agencies (the Engineering and Physical Sciences Research Council (EPSRC), the National Institute for Health Research (NIHR) and the Economics and Social Research Council (ESRC)), the UK government (Defra, DFID), UN agencies (UNEP, UN-Habitat), UK local government (Leeds City Council), UK research institutes (Centre for Low Carbon Futures, Centre for Climate Change) and the European Commission.
- SEI Oxford projects are funded by UK government (DFID) and the IDRC.
- SEI U.S. projects are mainly funded through Programme Support and by U.S. local government (e.g. the City of Seattle), CDKN and Climate Investment Funds–Pilot Program for Climate Resilience (PPCR).

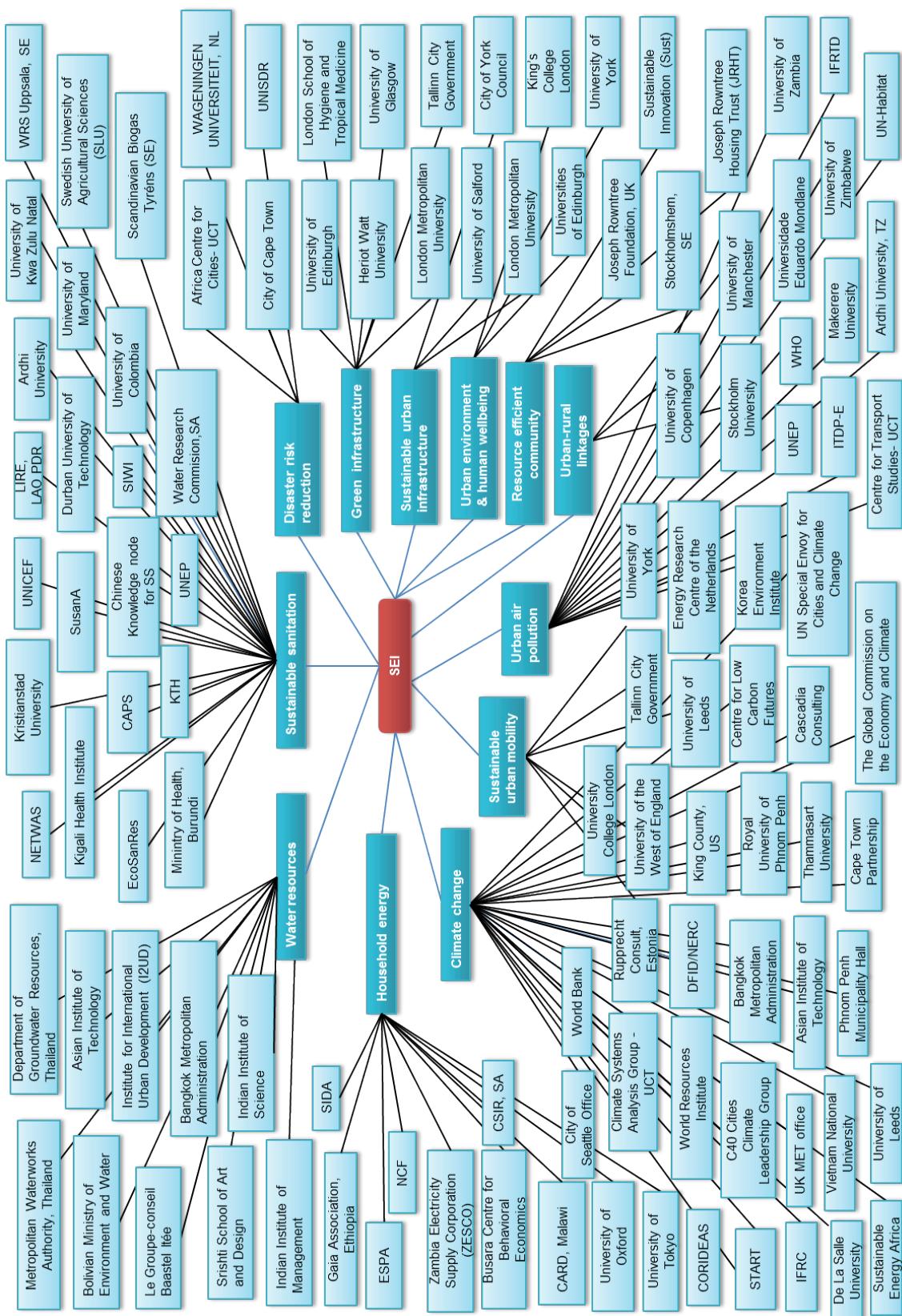


Figure 3: A network of SEI partners

Table 2: SEI project funders and project value

Research area	Funders	Project value (SEK)
Water resources	Sida Climate Investment Funds-PPCR	1.2M–1.7M
Sustainable sanitation	Sida Swedish Civil Contingencies Agency (MSB) VINNOVA-ECO-INNOVATIONS UNEP UN-Habitat Bill and Melinda Gates Foundation CDKN IWMI	98k–7.7M
Disaster risk reduction	DFID IDRC UNISDR European Commission	198k–1.7M
Climate change	IDRC CDKN City of Seattle, King County, U.S Centre for Low Carbon Futures Centre for Climate Change Economics and Policy Leeds City Council DFID/NERC City of Cape Town	60k–4M
Urban air pollution	Sida UNEP UK ESRC EU EU Asia Pro Eco Programme EU ACP UN-Habitat	1M
Sustainable urban mobility	UK EPSRC European Commission Intelligent Energy Europe (IEE) Tallinn City Government Tallinn Bus Company, Estonia	70k–183M
Household energy	Sida Nordic Climate Facility World Bank Project Gaia Inc. Programme Support UK ESPA	1M–3.7M
Sustainable infrastructure	UK EPSRC Sinclair Knight Merz pty Ltd	220k
Green infrastructure	UK Defra Estonian Environmental Investment Centre (KIK) Tallinn City Government UK NIHR	54k–189k
Urban environment and human wellbeing	UK EPSRC	1.6M
Resource efficient community	Stockholms hem Swedish Energy Authority Sustainable Innovation AB	3M
Urban-rural interrelations	Sida European Commission	—

Table 3: SEI centres and their project funders, by research area

SEI Centre	Funders	Research Area
SEI Africa	Sida	Sustainable sanitation
	ESPA, Sida	Household energy
SEI Asia	IDRC	Climate change
	Sida	Water resources
SEI Oxford	IDRD, DFID	Disaster risk reduction
	DFID, NERC	Climate change
SEI Stockholm	Bill and Melinda Gates Foundation, European Commission, Sida, IWMI, CDKN, MSB, UNEP, VINNOVA-ECO-INNOVATIONS	Sustainable sanitation
	Sida, SPA, Nordic Climate Facility, World Bank BEIA, Project Gaia Inc.	Household energy
	Sinclair Knight Merz pty Ltd	Sustainable infrastructure
	European Commission UNISDR	Disaster risk reduction
SEI Tallinn	European Commission Sida	Urban-rural linkages
	Stockholms hem, Swedish Energy Authority, Sustainable Innovation AB	Resource efficient community
	IEE Intelligent Energy Europe, Tallinn City Government, Tallinn Bus Company	Sustainable transport and urban mobility
	Estonian Environmental Investment Centre (KIK)	Green infrastructure
SEI U.S.	City of Seattle, King County (U.S.), City of Cape Town, CDKN, Sida	Climate change
	Climate Investment Funds-PPCR	Water resources
SEI York	Centre for Low Carbon Futures, Centre for Climate Change, Economics and Policy Leeds, UK	Climate change mitigation
	EU ACP, UNEP, EU, UN-Habitat, UK ESRC	Urban air pollution
	UK Defra, UK NIHR	Green infrastructure
	UK EPSRC	Sustainable infrastructure
	UK EPSRC	Urban environments and human wellbeing
	UK EPSRC	Sustainable transport and urban mobility
	Sida	Water resources
	Joseph Rowntree Foundation	Resource efficient community

4 STRENGTHS AND GAPS IN SEI'S URBAN WORK

This section highlights the strengths and gaps in SEI's research on sustainable urbanization. It focuses on three areas: diversity of expertise, collaborations and knowledge gaps.

4.1 Diverse expertise in sustainable urbanization

SEI's work on sustainable urbanization covers a wide range of research areas. However, recent and current research activities have focused on 10 interrelated areas:

- Water resources
- Climate change
- Sustainable sanitation
- Disaster risk reduction
- Household energy
- Green infrastructure
- Urban air pollution
- Sustainable urban mobility
- Urban environment and human wellbeing
- Resource efficient communities.

Although all seven centres have worked on sustainable urbanization, the research indicates that there is a great disparity between centres in terms of the number of urban projects per centre and areas of expertise. Some centres have worked extensively on urban sustainability issues and therefore have expertise in a wider range of areas than others. For instance, SEI York has 17 projects related to 8 research areas; SEI Stockholm has 19 projects in 6 areas; SEI U.S. has 14 projects concentrated on 2 research areas; and SEI Africa has 2 projects in 2 research areas. This is perhaps not surprising given the relative size of the different centres.

Overall, SEI's work at the urban scale falls broadly into three categories. The first category is scientific research and knowledge development, whereby SEI provides integrated knowledge, data and analytical frameworks for decision makers involved in environmental and sustainability issues at the urban scale. The second is policy engagement, in which SEI provides technical support and policy advice to policymakers, urban planners, local authorities and practitioners to guide them towards pathways to sustainable urban development. SEI has also developed decision-support tools for integrated analysis and sustainable urban planning, such as WEAP and LEAP. The third category is capacity development. SEI has helped to strengthen the capacity of stakeholders engaged in environmental and sustainability issues at the urban scale through the development of networks and platforms for knowledge sharing and engaging stakeholders, and the development of professional training programmes.

4.2 Cross-centre collaboration and a wide international network of partners and experts

Within SEI's research on urban issues, external partnerships appear to have been prioritized over cross-centre collaboration. Fewer than 10 of the 64 urban projects that SEI has undertaken have been cross-centre collaborations. SEI U.S. and SEI Asia have collaborated on water resources projects; SEI Stockholm and SEI Africa on sustainable sanitation and household energy projects; and SEI Stockholm and SEI Asia on disaster risk reduction projects. Most projects, however, have involved only one SEI centre.

At the same time, SEI has developed and conducted research with a wide network of partners and experts around the world. SEI has collaborated with research institutions, academics, NGOs,

governments, financial institutions, UN agencies and the private sector, among others, in Europe, Asia, Latin America, North America and Africa.

4.3 Knowledge gaps in SEI's work on urbanization

Even though SEI's research at the urban scale has tackled myriad urban issues in developed and developing countries, our study identifies some knowledge gaps in the sense that there has been little or no research in a number of important focal areas and geographical regions. In terms of geographical scope, our study shows that SEI's research in sub-Saharan Africa has focused mainly on East and Southern Africa. Little research on urban issues has been conducted in Central or West Africa. At the same time, there has been only limited research on:

- *Urban solid waste management*: Although SEI urban projects on urban air pollution and climate mitigation have implicitly addressed the issue of urban solid waste management by identifying opportunities for cities to reduce GHG emissions associated with urban waste management, we did not identify any urban project focused mainly on solid waste management in either developed or developing countries.
- *Urban water use in Africa, Europe and North America*: SEI's work on urban water use is concentrated in Asian and Latin American cities. Our findings indicate that no research has been conducted so far on urban water use in Africa, Europe or North America.
- *Urban and peri-urban agriculture*: Little research on peri-urban agriculture has been conducted by SEI. Only projects on sustainable sanitation have analysed the benefits that productive sanitation systems can provide for peri-urban agriculture productivity (fertilizer). This study did not find any projects focused mainly on how urban and peri-urban agriculture can contribute to food security, improve urban livelihoods and enhance ecosystem services and climate change resilience.
- *Disaster risk reduction in urban Africa*: Research on disaster risk reduction has focused on a very small number of sub-Saharan African cities. Most disaster risk reduction projects have conducted their case studies in South Africa.
- *Green infrastructure in Africa, Asia and Latin America*: SEI's research on the co-benefits of green infrastructure and the integration of biodiversity considerations into urban planning has focused on European countries; there were no projects on green infrastructure conducted in Africa, Asia or Latin America.
- *Sustainable infrastructure in Africa*: There is no project on sustainable infrastructure in Africa countries.
- *Urban GHG inventory and abatement potential, and climate vulnerability assessment in Asia, Latin America and Africa*: SEI's work on urban GHG emissions inventories and abatement potential has mainly focused on North America; little research has been done in Latin America, Asia or Africa. Moreover, there has been little work on climate vulnerability assessments in Africa.

It is important to note that these knowledge gaps were identified based on the information on urban projects available on PMEC and the SEI website. These gaps in the research on urbanization could be explored in the new urban programme that SEI is developing.

5 THE WAY FORWARD FOR SEI AFRICA'S NEW URBAN PROGRAMME

African cities are facing challenges associated with their rapid population growth and rapid urbanization. The findings of this scoping study indicate that SEI has extensive expertise and experience in working on environmental and sustainability issues at the urban scale in both developed and developing countries. This could support the development of SEI Africa's new urban programme, Managing Urban Change. Through this new programme, SEI Africa, in partnership with other SEI Centres and local and international partners and experts, will explore the challenges related to rapid urbanization in sub-Saharan Africa, and provide insights into the opportunities for sustainable urbanization in Africa. The urban programme will also serve as a platform for SEI Africa and SEI in general to foster networks and partnerships with key stakeholders involved in urban environmental and sustainability issues in sub-Saharan Africa.

The objective of the new urban programme fits well with the mission of the SEI Strategy, 2015–2019 to “support decision-making and induce change towards sustainable development around the world by providing integrative knowledge that bridges science and policy in the field of environment and development” (SEI 2015). The urban programme is also in alignment with the objectives of SEI's new flagship initiatives, such as addressing water and sanitation, disaster risk reduction, household energy, climate change mitigation and air pollution. Building on this scoping study, the next phase for SEI Africa will be to design the urban programme and develop a strategy for its implementation.

5.1 Recommendations

Building on the findings of this scoping study of SEI's expertise in sustainable urbanization, this section makes recommendations on the design of SEI Africa's Managing Urban Change programme.

Firstly, we recommend replicating existing SEI urban projects in African countries. We have selected a few examples of existing urban projects conducted in other parts of the world (Asia, Europe and North America) that could be replicated in African cities.

- *The urban metabolism for water resources use in cities:* The urban metabolism framework used to analyse water resource use patterns in Asian cities could be applied to the African context. The Asian cities examined have similar characteristics to most African cities. Both of the cities explored are experiencing high rates of population growth and urbanization coupled with growing pressure on water resources and inadequate systems of urban water provision. In the specific sub-Saharan African country context, SEI could use the urban metabolism framework to analyse the socio-economic and ecological drivers of water resources use patterns in growing African cities, the complex challenges of urban water service provision, and the upstream and downstream linkages to identify opportunities for integrated water management and planning in sub-Saharan Africa.
- *Resilient WASH systems:* SEI's work on the resilience of urban WASH systems to extreme water events could be extended to African countries, especially coastal cities facing risks of flooding and sea-level rise.
- *Co-benefits of green infrastructure:* SEI Africa could investigate the impact of green infrastructure in sub-Saharan African urban areas on local businesses (economic benefits, staff wellbeing), and residents' health and wellbeing, as well as the sustainability of green infrastructure in developing countries and the perceptions of residents and workers.
- *Social impact assessment of new infrastructure (transport, energy, water):* The social impact assessment of new infrastructure in Vietnam could be applied to African cities. Such a project could investigate the socio-economic and environmental impacts of sustainable

urban infrastructure and development programmes in sub-Saharan African cities, looking at the issues of involuntary displacement and the resettlement of local communities, and the impact of new urban infrastructure on the living standards of urban dwellers and their livelihoods.

- *Urban GHG emissions inventory and abatement potential:* SEI's work on urban GHG emission inventories and abatement potential could be replicated in African cities. Drawing on SEI U.S. expertise, SEI could help African cities to assess their emissions and inform policymakers and city planners on low carbon pathways.
- *Climate change vulnerability assessment and adaptation planning:* The Quito vulnerability study could be extended to African countries. SEI could also help African cities assess their vulnerability to climate change in order to better inform urban adaptation planning. SEI Africa could collaborate with SEI Oxford on the new project Future Resilience for African CiTies And Lands (FRACTAL) under the DFID/NERC Future Climate for Africa programme, which will focus on adaptation planning in sub-Saharan African cities. The ongoing research on socially differentiated vulnerabilities and adaptation to climate-related water stresses in peri-urban areas in Southeast Asia could also be replicated in African coastal cities.
- *Urban-rural linkages:* SEI's research on urban-rural linkages could be replicated in the sub-Saharan Africa context to examine the urban, peri-urban and rural land use relationships in the current context of rapid urbanization and unplanned urban sprawl.

Secondly, we recommend exploring selected strategic research areas. Building on this study, we identify below some potential strategic research areas that the urban programme could explore. These are areas in which SEI has considerable expertise and which are relevant to the context of urbanization in Africa. This list could be refined in collaboration with other SEI centres in order to select the highest priority areas:

- *Water resources and sustainable sanitation:* Access to safe water and sanitation services; water management and planning in African cities; and building resilient urban WASH systems. Research conducted under these research areas will support the ongoing research on urban water use and initiatives on sustainable sanitation and the water-energy-food nexus.
- *Waste management:* Trends and challenges in solid waste management in African cities.
- *Household energy:* Energy poverty in informal settlements, electrification in low-income households, household energy use. Research under this research area will support ongoing research on energy access and household energy in sub-Saharan Africa.
- *Sustainable mobility and urban air pollution:* Air quality management in sub-Saharan African cities and the promotion of sustainable mobility.
- *Urban governance:* Barriers to and opportunities for good urban governance in African cities; the dynamics of informal and formal systems in service provision (the cases of electricity and water provision, and waste management in informal settlements).
- *Urban planning and development:* Challenges and opportunities in sustainable urban planning and development (national and urban planning policies); housing and slum upgrading.
- *Climate change mitigation:* GHG emissions inventories and abatement potential, and opportunities for low carbon pathways.

- *Climate change adaptation:* Climate vulnerability assessment and adaptation planning; community-based adaptation.
- *Disaster risk reduction and urban resilience:* Disaster risk assessment and mainstreaming disaster risk reduction in urban planning and development strategies.
- *Inclusive and liveable cities:* The social sustainability of cities; how to build liveable cities for all age categories in an African context; the urban economy; the informal sector and urban poverty.
- *Green infrastructure:* The use and management of green spaces in African cities; ecosystem services of green spaces and the impacts of green spaces on businesses' and residents' behaviour and awareness.
- *Urban and peri-urban agriculture:* The role of urban and peri-urban agriculture in enhancing food security and climate change resilience in sub-Saharan African cities.
- *Urban-rural linkages:* Urban/peri-urban and rural land use relationships; labour market linkages; rural-urban migration; services and resources.

Thirdly, we recommend pursuing research in other regions of sub-Saharan Africa (Central and West Africa, Southern Africa) and undertaking comparative studies between regions of the world (African-Asian cities, African-Latin American cities, and African-European/U.S. cities). This study shows that there has been little research conducted in Central and West African countries. The new programme could extend urban studies to the Central and West African regions, and strengthen research in East and Southern Africa. Furthermore, SEI Africa could conduct comparative studies of African cities and Asian cities or African cities and European/U.S. cities to analyse, and compare urban issues common to cities in developing countries; and also draw lessons from and disseminate best practices on sustainable urban planning in cities in developed countries cities.

Finally, we recommend a policy of deliberately seeking to develop cross-centre collaborations and external partnerships to support the programme as it develops. Successful development of the programme will depend on strengthening existing and fostering new links with other centres that possess urban development expertise. At the same time, however, creating this programme is likely to increase the incentives to collaborate with the Africa centre, since it will be able to act as a hub for SEI's urban research in Africa. Figure 4 illustrates areas of potential collaboration with SEI centres based on their respective areas of expertise.

As noted above, SEI has worked with a number of stakeholders involved in environmental and development issues. The Managing Urban Change programme will also serve as a platform for strengthening and forging partnerships with local or international potential partners as well as experts actively involved in urban sustainability challenges in sub-Saharan Africa. These partners would include UN agencies, funding institutions, universities, research institutes, multilateral organizations and NGOs. Throughout the programme, SEI will form new partnerships with local partners, particularly local universities and research institutes. SEI will also build partnerships with local government in the countries in which research will be undertaken. This will contribute to the SEI's aim to develop and deepen partnerships in sub-Saharan Africa.

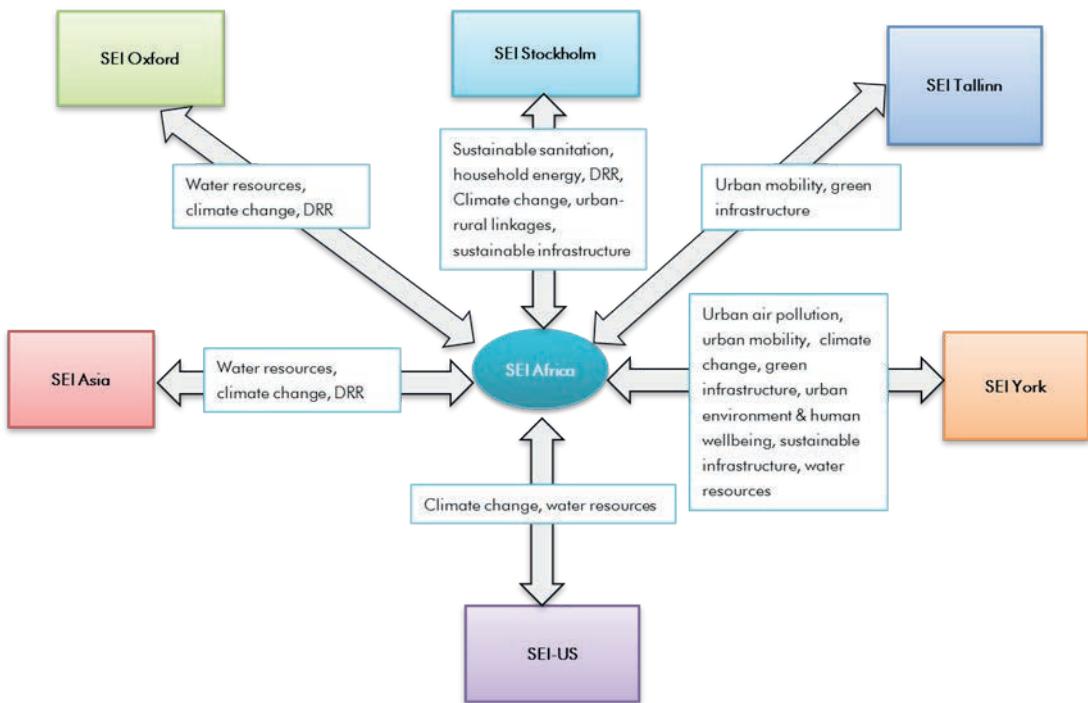


Figure 4: Potential SEI cross-centre collaboration on the Managing Urban Change programme

REFERENCES

- African Development Bank (2012). *Championing Inclusive Growth Across Africa: Urbanization in Africa*. <http://www.afdb.org/en/blogs/afdb-championing-inclusive-growth-across-africa/post/urbanization-in-africa-10143/>
- Cartwright, A. (2008). *Phase three: A Sea-Level Rise Risk Assessment for the City of Cape Town*. Stockholm: SEI. Prepared for the City of Cape Town: Global Climate Change and Adaptation – A Sea-Level Rise Risk Assessment, proposal no. R030800032. Final Report. <http://www.sei-international.org/publications?pid=1042>
- Cinderby, S. (2014). Defra Green Victoria Evaluation of the Victoria Business Improvement District (BID) ‘Clean and Green Programme’. Final Report 2014.
- Cinderby, S., Forrester, J., Jones, M., Schofield, P., Shaw, S., Snell, C. and Owen, A. (2007). *Leisure and Tourism Spaces: Facilitating Inclusive Design Using GIS-P*. York: SEI. InSITU report.
- Cinderby, S., Haq, G., Cambridge, H. and Lock, K. (2014). *Practical Action to Build Community Resilience: The Good Life Initiative in New Earswick*. Project Report. York: Joseph Rowntree Foundation.
- Ekane, N. (2013). *Sanitation Policy and Practice in Rwanda: Tackling the Disconnect*. SEI Policy Brief. Stockholm, Sweden. <http://www.sei-international.org/publications?pid=2289>
- Ekane, N., Nykvist, B., Kjellén, M., Noel, S., Weitz, N. (2014). *Multi-level sanitation governance: Understanding and overcoming the challenges in the sanitation sector in sub-Saharan Africa*. SEI Working Paper No. 2014-04. Stockholm, Sweden. <http://www.sei-international.org/publications?pid=2547>
- Erickson, P. and Lazarus, M. (2012). Revisiting Community-Scale Greenhouse Gas Inventories. *Environmental Science & Technology*, 46(9). 4693–94. DOI:10.1021/es301366b.
- Erickson, P., Stanton, E. A., Chandler, C., Lazarus, M., Bueno, R., Munitz, C., Cegan, J., Daudon, M. and Donegan, S. (2012). *Greenhouse Gas Emissions in King County*. Stockholm Environment Institute with Cascadia Consulting Group. Report commissioned by King County, Wash., Seattle, WA.
- Erickson, P.A., Lazarus, M., Chandler, C. and Schultz, S. (2013). Technologies, policies, and measures for GHG abatement at the urban scale. *Greenhouse Gas Measurement and Management*. doi:10.1080/20430779.2013.806866.
- Forrester, J. (2008). *DISTILLATE Guide to Cross-sectoral and Intra-organisational Partnership Working for Sustainable Transport Decision Making*. York: SEI. DISTILLATE Product D1.
- Gill, T., Erickson, P., Mehta, V., Han, G., Purkey, D., Roe, J. (2014). *SEI Research Synthesis: Sustainable Urbanization*. Stockholm, Sweden. <http://www.sei-international.org/publications?pid=2505>
- Gouldson, A., Kerr, N., Topi, C., Dawkins, E., Kyulenstierna, J.C.I., Pearce, R. (2012). *The Economics of Low Carbon Cities: A Mini-Stern Review for the Leeds City Region*. Centre for Low Carbon Futures report.
- Haq, G., Han, W., Kim, C., Vallack, H. (2002). *Benchmarking Urban Air Quality Management and Practice in Major and Mega Cities of Asia Stage I*. APMA Project Report.
- Johannessen, Å., G. Han, A. Rosemarin, A. Panda. (2013). *Urban Disaster Risk Reduction (DRR) and resilient cities – Progress of 121 Local governments*. An UNISDR and SEI report. Draft final report submitted to UNISDR October 2013.

- Jüssi, M., Poltimäe, H., Aru, B. (2012). *Alternative fuels for Tallinn Bus Company buses: Feasibility and environmental impact of diesel, bioethanol, hybrid and biodiesel alternatives*. Study commissioned by Tallinn Bus Company, Civitas Mimosa project.
- Kjellén, M., Pensulo, C., Nordqvist P. Fogde, M. (2012). *Global Review of Sanitation System Trends and Interactions with Menstrual Management Practices*. SEI Project Report. Stockholm, Sweden. <http://www.sei-international.org/publications?pid=2044>
- Lambe, F. and Johnson, F.X. (2009). *Household Energy in developing countries: a burning issue*. SEI Policy Brief. Stockholm: SEI.
- Lazarus, M., Chandler, C. and Erickson, P. (2013). A core framework and scenario for deep GHG reductions at the city scale. *Energy Policy*. 57: 563–74. doi:10.1016/j.enpol.2013.02.031.
- Lee, Carrie M., Erickson, P. (2014). *What impact can local economic development in cities have on global GHG emissions? Assessing the evidence*. New Climate Economy contributing paper.
- Schwela, D. and Haq G. (2012). *Transport and Environment in sub-Saharan Africa*. Report. Stockholm, Sweden. <http://www.sei-international.org/publications?pid=2197>
- Schwela, D. and Haq G. (2013). *Transport and Environment in sub-Saharan Africa*. SEI Policy Brief. Stockholm, Sweden. <http://www.sei-international.org/publications?pid=2317>
- SEI (2014). *Unravelling biofuel impacts on ecosystem services, human wellbeing and poverty alleviation in sub-Saharan Africa*. SEI Project Brochure. Stockholm: Stockholm Environment Institute.
- SEI (2015). SEI Strategy, 2015–2019. Stockholm, Sweden. <http://www.sei-strategy.org>.
- SEI Africa (2015). SEI Africa Centre Work Plan, 2015.
- SEI Asia (2015). SEI Asia Work Plan, 2015.
- SEI Stockholm (2015). Stockholm Centre Work Plan, 2015
- SEI Tallinn (2015). SEI Tallinn Centre Work Plan, 2015.
- SEI York (2015). SEI York Centre Work Plan, 2015.
- SEI U.S. (2015). SEI U.S. Centre Work Plan, 2015.
- Steynor, A., C. Jack, C., Padgham, J., Bharwani, S. (2015). *Using climate information to achieve long-term development objectives in coastal Ghana and Mozambique*. Future Climate For Africa policy brief. CDKN.
- UN-Habitat (2014). *The State of African Cities 2014: Reimagining Sustainable Urban Transitions*.
- United Nations, Department of Economic and Social Affairs, Population Division, UNDESA (2013). World Population Prospects: The 2012 Revision, Volume II, Demographic Profiles (ST/ESA/SER.A/345).
- UNDESA, Population Division (2014a). World demographic trends: Report of the Secretary-General. E/CN.9/2014/3.
- UNDESA, Population Division (2014b). World Urbanization Prospects: The 2014 Revision, Highlights (ST/ESA/SER.A/352)
- UNDESA, Population Division (2014c). World Urbanization Prospects: The 2014 Revision, CD-ROM Edition.

UNDESA, Population Division (2015a). World Urbanization Prospects: The 2014 Revision. (ST/ESA/SER.A/366).

UNDESA, Population Division (2015b). World Population Prospects: The 2015 Revision, DVD Edition.

World Bank (2014). Africa's Growth Set to Reach 5.2 percent in 2014 with Strong Investment Growth and Household Spending. Press Release. <http://www.worldbank.org/en/news/press-release/2014/04/07/africas-growth-set-to-reach-52-percent-in-2014-with-strong-investment-growth-and-household-spending>.

APPENDIX: LIST OF PROJECT LEADERS AND SEI KEY PARTNERS CONTACTED OR INTERVIEWED

Table 4 lists the SEI staff and leaders of SEI urban projects who were contacted for this research. Those who were interviewed either on Skype or by email are shown in bold.

Table 4: List of leaders of SEI projects/ staff contacted and interviewed

Project leader/other staff	Research area	Date of interview
Dr Steve Cinderby, SEI York	Green infrastructure	10.10.2014
Ms Madeleine Fogde, SEI Stockholm	Sustainable sanitation	24.11.2014
Ms Stacey Noel, SEI Africa	Water resources, sustainable sanitation	04.12.2014
Mr Nelson Ekane, SEI Stockholm	Sustainable sanitation	08.12.2014
Ms Åse Johannessen, SEI Stockholm	WASH and Disaster risk reduction	28.11.2014
Dr Kevin Hicks, SEI York	Urban air pollution	30.01.2015
Dr Dieter Schwela, SEI York	Urban air pollution	02.02.2015
Dr John Forrester, SEI York	Sustainable infrastructure, sustainable urban mobility	14.11.2014
Ms Eva Lindskog, SEI Stockholm	Sustainable infrastructure	25.11.2014
Dr Michael Lazarus, SEI U.S.	Climate change mitigation	29.01.2015
Mr Kevin Tempest, SEI U.S. (Seattle)	Climate change mitigation	05.02.2015
Dr Babette P Resurrección, SEI Asia	Socially-differentiated vulnerabilities and climate change adaptation	15.01.2015
Dr Sukaina Bharwani, SEI Oxford	Climate change adaptation	27.01.2015
Ms Fiona Lambe, SEI Stockholm	Household energy	03.03.2015
Dr Åsa Gerger Swartling, SEI Stockholm	Sustainable planning and building	30.03.2015
Ms Katarina Axelsson, SEI Stockholm	Resource efficient community	09.04.2015
Dr Eric Kemp-Benedict, SEI Asia	Water resources	—
Dr Vishal Mehta, SEI U.S. (Davis)	Water resources	—
Dr Marisa Escobar, SEI U.S. (Davis)	Water resources, climate change adaptation	—
Mr Peter Erickson, SEI U.S.	Climate change mitigation	—
Ms Mari Jüssi, SEI Tallinn	Sustainable transport and urban mobility	—
Dr Jenny Roe, SEI York	Urban environment and human wellbeing; green infrastructure	—
Mr Anton Cartwright, SEI Oxford	Climate change adaptation, Disaster risk reduction	—

SEI - Headquarters

Kräftriket 2B

Stockholm

SE -106 91

Sweden

Tel: +46 8 674 7070

Executive Director: *Johan L. Kuylenstierna*

info@sei-international.org

SEI - Africa

World Agroforestry Centre

United Nations Avenue, Gigiri

P.O. Box 30677

Nairobi 00100

Kenya

Tel: +254 20 722 4886

Centre Director: *Stacey Noel*

info-Africa@sei-international.org

SEI - Tallinn

Lai str 34

10133 Tallinn

Estonia

Tel: +372 627 6100

Centre Director: *Tea Nõmmann*

info-Tallinn@sei-international.org

SEI - Asia

15th Floor

Witthayakit Building

254 Chulalongkorn University

Chulalongkorn Soi 64

Phyathai Road, Pathumwan

Bangkok 10330

Thailand

Tel: +(66) 2 251 4415

Centre Director: *Eric Kemp-Benedict*

info-Asia@sei-international.org

SEI - U.S.

Main Office

11 Curtis Avenue

Somerville, MA 02144

USA

Tel: +1 617 627 3786

Centre Director: *Charles Heaps*

info-US@sei-international.org

Davis Office

400 F Street

Davis, CA 95616

USA

Tel: +1 530 753 3035

Seattle Office

1402 Third Avenue, Suite 900

Seattle, WA 98101

USA

Tel: +1 206 547 4000

SEI - Oxford

Florence House

29 Grove Street

Summertown

Oxford, OX2 7JT

UK

Tel: +44 1865 42 6316

Office Director: *Ruth Butterfield*

info-Oxford@sei-international.org

SEI - York

University of York

Heslington

York, YO10 5DD

UK

Tel: +44 1904 32 2897

Centre Director: *Lisa Emberson*

info-York@sei-international.org

SEI - Stockholm

Kräftriket 2B

Stockholm

SE -106 91

Sweden

Tel: +46 8 674 7070

Centre Director: *Jakob Granit*

info-Stockholm@sei-international.org

The Stockholm Environment Institute

SEI is an independent, international research institute. It has been engaged in environment and development issues at local, national, regional and global policy levels for more than a quarter of a century. SEI supports decision making for sustainable development by bridging science and policy.

sei-international.org

Twitter: @SEIresearch, @SEIclimate