Sustainable Design Principles for Refugee Camps *(KB-25-005-005)*

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1. Introduction

Worldwide the number of refugees – and with them – also the number and size of refugee camps, has increased significantly. The latest figures (UNHCR Mid-Year Trends 2015) show that the number of refugees has grown from 10.4 million (2011) to 15.1 million (2015). The expectation for the next decades is that the number of crises events, due to conflicts and natural disasters, will increase rather than decline.

Refugee camps appear to be in fact emerging urban environments, of which the aimed-at temporary status often prolongs into a long-term settlement – with populations often equalling regular cities, ranging from 25.000 to even more than 100.000 persons.

Many of these refugee camps are seen as *transient settlement*, planned according to clear principles. These principles are laid down in technical specifications such as in the UNHCR Handbook (Handbook for Emergencies 3rd edition, UNHCR, 2007). Reviewing the handbook shows that it addresses environmental aspects of transit camps' geographic location and layout in only very limited ways lacking references to relevant matters of sustainability such as waste management, emission control and avoidance, green infrastructure, water retention and waste water recycling as well as self-provisional services such as urban food planning only in very limited ways or not at all.. Consideration of environmental aspects is mostly focused on accessibility and suitability of the terrain, in terms of good access, availability of water, good drainage and adequate conditions for sanitation. There is, however, a general requirement for an environmental impact assessment for new refugee camps.

Liveability on transit camps is frequently under severe pressure due to increasing population numbers and environmental aspects (terrain and climate). Issues at stake are air quality (dust), water pollution, heat (stress), but also the limited possibilities to access or produce fresh food, day-by-day activities and felt security.

This internal report aims at briefly summarizing the state of the art knowledge and insights about planning refugee camps and managing environmental aspects. In relation to the latter, this report aims at briefly reflecting on how (temporary) *sustainability strategies and support measures addressing social, environmental and economic assets as developed by Metropolitan Solutions, can contribute to the strengthening of the liveability and resilience of refugee camps.* A brief overview of key actor organisations will also be given. The research is limited to planned and officially managed refugee camps.

A general observation following this review is that sustainability principles are not or in only very limited ways applied in the planning and running of refugee camps. Refugee Camp dwellers suffer from isolation, insufficient open space providing nature and recreational values, a lack of purposeful occupation and social interaction and a sense of dependency from external support. In this report we will point at opportunities for how to resolve some of these short-comings by making refugee camps more of resource-efficient, climate-proof, socially inclusive, resilient and self-regenerative.

We are aware that introducing sustainability principles to refugee camp design is likely to interfere with the concept of providing only 'temporary solutions'. After all, one could argue that improving life and living in refugee camps might contribute to making them more permanent. At the same time, the burden of environmental and social impacts accompanying non-sustainable camps appears as counter-productive: the impacts of environmental crisis and decay, health and food security risks, economic and social tensions within camps as well as between refugees and the host region appear as a too high price to pay for accepting that temporary camps are by definition unsustainable. Instead, we believe that temporary homes for 65 million people can be both temporary and sustainable at the same time. This report is meant to provide suggestions and guidelines for meeting this goal.

2. Problem statement

The overall problem of increasing refugee and migrants moving and settling across the planet has become a daily news item and must be considered as being widely acknowledged: the UNHCR report, *Global Trends 2015*, notes that on average 24 people were forced to flee each minute in 2015, four times more than a decade earlier, when six people fled every 60 seconds. The detailed study, which tracks forced displacement worldwide based on data from governments, partner agencies and UNHCR's own reporting, found a total 65.3 million people were displaced at the end of 2015, compared to 59.5 million just 12 months earlier. The political and social pressure deriving from these trends are at the top of many countries' political agendas and have tremendous impact on public opinions and governmental actions.

This report's main focus is on the phenomenon of **refugee camps** as one of the most visible and spatially explicit results of refuge and migration movements at the global scale. Given the steadily growing numbers of people on the move and staying in temporary homes and settlements, refugee camps must be considered as a form of highly dynamic and partially ad hoc urbanisation processes. International organizations such as UNHCR, Red Cross, AWH and others are playing a key role in providing strategic, organizational and practical support for the establishment and management of refugee camps. Their experience, dedication, tacit knowledge, technical guidance and cooperation-lines with national governments are of utmost importance for the future of refugees as well as for the situation of host countries and regions where camps and settlement are being set up. While the emphasis is on establishing temporary solutions and to discourage permanent settlements, fact is that many refugee camps last several years or even decades and are – despite international efforts – steadily growing in terms of size and population figures with severe impacts on regional sustainability.

These impacts can be summarized as follows:

- Substantial land use changes with loss of natural and agricultural land
- Soil sealing and erosion
- Water consumption and pollution
- Greenhouse gas emissions due to traffic, supply logistics, heating and energy consumption
- Social isolation and conflicts due to high population density and lack of open space
- Long and frequently instable food supply chains, food insecurity and food waste
- Health, education and quality of life

While this situation is challenging all parties involved – the refugees, the host countries and populations as well as aid organisations, the dynamic and rapidly occurring quasi-urbanisation processes accompanying refugee camp establishments and expansions also offer the opportunity of applying a string of sustainable design principles for refugee camps.

Taking the sustainability principles as developed in the framework of Metropolitan Solutions as a starting point, this report reviews the current situation of refugee camp establishment and management to come up with suggestions for making refugee camps more of resource-efficient, climate-proof, socially inclusive, resilient and self-regenerative.

We have conducted a literature review related to living conditions, livelihood and current planning practices and insights in the development of refugee camps (Section 3). This overview is meant to help establishing a baseline describing the current state of knowledge and practice as input for drafting a set of requirements and guidelines for a 'sustainable refugee camp design'. The information gathered in Section 3 is subsequently confronted with professional opinions and discussions in Section 4. We concluded this report with Conclusions and recommendations (Section 5).

3. Review and baseline

The literature review in this Section is divided into:
- Refugee camps: definitions and current state (Section 3.1)
- Planning and guidelines (Section 3.2)
- Living conditions, livelihood and environmental aspects (Section 3.3)

3.1 Refugee camps: temporary versus permanent status

According to the Master Glossary of Terms (UNHCR 2006), refugee camps are defined as "*plot(s) of land temporarily made available to host refugees fleeing from an armed conflict in temporary homes". UN Agencies, particularly UNHCR, and other humanitarian organizations provide essential services in refugee camps including food, sanitation, health, medicine and education. Following UNHCR, these camps "are ideally located at least 50 km away from the nearest international border to deter camp raids and other attacks on its civilian occupants*." In a more recent UNHCR policy on alternatives to camps they are defined as *"locations where refugees reside and where, in most cases, host governments and humanitarian actors' provide assistance and services in a centralised matter"* (UNHCR policy on alternatives to camps, 2014).

While the UNHCR definition focusses exclusively on armed conflicts as the main cause for leaving a region or country, other and more recent sources such as Amnesty International also point at environmental disaster, poverty and ethnic persecution as reasons for becoming a refugee (http://blog.amnestyusa.org/refugees/forced-to-leave-home/). Walter Cotte, the veteran disaster manager of the Colombian Red Cross, said that because of climate change his country's two rainy seasons now sometimes joined up to make one. During a recent conference, Miriam Chin of the Palau Red Cross told delegates that because of rising sea levels "fifty years from now my country will be gone unless strategies are put in place". Wikipedia defines refugee camps as places that usually accommodate displaced persons who have fled their home country, but there are also camps for internally displaced persons as well as camps housing environmental and economic migrants.

A wide range of refugee camp types exist. In its Global Trend report the UNHCR makes a clear distinction in context (urban or rural) and classifies accommodation types into:
- Planned/managed camp
- Self-settled camp
- Collective centre
- Reception/transit camp
- Individual accommodation (private)
- Various/unknown, if the information is unknown or unclear

The UNHCR reports that in the end of 2015, about 56 per cent of the total refugee population in rural locations resided in a planned/managed camp, compared with 2 per cent who resided in individual accommodation. In urban locations, the overwhelming majority (99 per cent) of refugees lived in individual accommodation, compared with less than 1 per cent who lived in a planned/ managed camp. (Global Trends UNHCR, 2015).

The Camp planning standards (Emergency Handbook 4th edition, 2015) addresses at the very beginning what appears to be a key aspect regarding the temporary character of settlements, namely that '*UNHCR discourages the establishment of formal settlements and (whenever possible) prefers alternatives to camps...".* Please note, as mentioned by Smith (FMO, 2003), that the terms '*camps*' and '*settlements*' tend to be used interchangeably, both in policies and literature. The author also notes that the UNHCR already differentiates between 'permanent camps' and 'camps'. Nevertheless, the overall UNHCR's policy is to avoid the establishment of refugee camps, wherever possible, while pursuing alternatives to camps that ensure refugees are protected an assisted effectively and enabled to achieve solutions (UNHCR, 2014). In fact, they favour three 'durable solutions':
- Repatriation
- Integration
- Resettlement

Table 1. Accommodation of refugees, 2013-2015 (end-year). Source: UNHCR Global Trend Report (2015).

Type of accommodation	No. of refgees			Distribution			% women			% children			% urban		
	2013	2014	2015	2013	2014	2015	2013	2014	2015	2013	2014	2015	2013a	2014b	2015c
Planned/ managed camp	3,274,300	3,512,500	3,390,900	34.4	29.3	25.4	50.8	50.5	51.4	56.1	55.7	57.6	7.1	7.0	1.4
Self-settled camp	345,800	487,500	518,600	3.6	4.1	3.9	53.1	52.9	53.3	59.8	56.3	57.1	1.0	0.4	7.6
Collective centre	304,300	302,000	301,900	3.2	2.5	2.3	47.6	47.8	45.0	35.1	54.4	46.8	93.9	95.3	87.1
Individual accommodation (private)	5,559,900	7,578,400	8,949,200	58.4	63.2	67.0	47.5	47.9	47.5	45.8	49.0	48.2	88.3	87.3	87.8
Reception/ transit camp	33,900	111,700	197,600	0.4	0.9	1.5	50.5	51.5	51.3	59.3	51.0	54.3	2.8	15.1	10.7
Sub-total	9,518,200	11,992,100	13,358,200	100.0	100.0	100.0	48.6	49.3	49.2	49.8	50.8	52.2	56.1	61.2	60.0
Unknown	*2,181,100*	*2,393,200*	*2,763,200*												
Grand Total	**11,699,300**	**14,385,300**	**16,121,400**												

a Percentages are based on data available for 9.0 million refugees. Calculation excludes accommodation types which are unknown.
b Percentages are based on data available for 12.2 million refugees. Calculation excludes accommodation types which are unknown.
c Percentages are based on data available for 12.3 million refugees. Calculation excludes accommodation types which are unknown.

The fourth solution can be considered the very existence of camps as representing the normative power of the factual. In factual state interest and UNHCR interests converge when considering camps as being a 'solution' (Napier, 2014). In its policy on alternatives, UNHCR also states clearly that host governments may insist upon the establishment of camps for reasons of public order or security. Camps may be seen as providing better control over the presence and movement of refugees and as a way of easing the potential tension between them and the local communities, for example through competition for limited economic opportunities and scarce resources. According to UNHCR, camps should be the exception, and as much as possible a temporary measure. The UNHCR aims at phasing out camps at the earliest stage possible. However at presence, refugees have an average camp residence time of 17 years.

Dadaab, Kenya: third-generation refugees born in the world's largest refugee camp

2012 was the 20th anniversary of the world's biggest refugee camp: Dadaab in north-eastern Kenya. UNHCR, which manages the Dadaab complex, set up the first camps there between October 1991 and June 1992, to host refugees fleeing a civil war in Somalia culminating in the fall of Mogadishu and overthrow of the central government in 1991. The now five Dadaab camps were originally intended to host up to 90,000 people. Today they host more than half a million refugees and asylum-seekers, including some 10,000 third-generation refugees born in Dadaab. Dadaab has been able to provide refuge for so many years and to so many people due to the generosity and extensive efforts of the Government and the people of Kenya. UNHCR, together with the Government of Kenya and aid agencies has provided protection, shelter and humanitarian assistance, often under difficult and complex circumstances. Chronic overcrowding, risk of disease, and seasonal floods are among the major challenges (UNHCR, Global Trend report 2015).

But an opening is provided, which could influence the opportunities regarding the use of sustainable solutions, by the remark that is set: if phasing out is not possible or practical they will pursue the progressive removal or restrictions on the ability of refugees to exercise their rights and seek to build linkages between the camp and host communities and anchor the camp with the local economy, infrastructure and national social protection and service delivery systems, in order to transform them into sustainable systems. Nevertheless, states do generally tend to argue for camps (Napier, 2014).

In the Global Strategy for settlement and shelter 2014-2018 (UNHCR, 2014) the UNHCR tends to go further. In this strategy the UNHCR focuses on:
- *Enabling refugees to access and live in dignity in secure settlements that improve their social, economic and environmental quality of life as a community*
- Enabling refugees to access shelter solutions that provide privacy, security and protection from the elements, emotional support, and a space to live and store belongings in a dignified matter

In the perspective of our research objective, the elaboration of the first focus point creates relevant opportunities. The Strategy promotes a holistic approach to settlement and shelter responses adapted to the local context. It calls for faster, more effective and innovative solutions. The strategy states that a swift response in emergencies is essential, but that the quality of response is equally important. In this

strategy different enabling actions are called upon. Interesting is that they opt for embedded settlement strategies in contingency planning, including a range of suitable settlement options (settlement design) and of settlement layout for a given location (context). It is noted that the environmental aspect does not only imply minimizing environmental impacts, but also encompasses maximizing opportunities for both the refugee and host population to establish, maintain or enhance livelihood support activities. Again, also in this Strategy the opportunity of ensuring linkages between camp and host settlements is mentioned as an example of various alternative arrangements in camp planning.

Last but not least, the UNHCR calls for good master planning. A 'response master plan', according to the UNHCR, should define the best settlement typologies to be adopted in a given context and should ensure that settlements relate to each other and to the existing habitat. It should be based on a macro, meso and micro scale analysis. Finally, it should contribute to a long-term development objective and consider a potential settlement exit strategy at the very onset of the planning stage. The latter sentence is interesting, as its aim seems to be to reconcile two apparently contradictory things: long term development of settlements versus a settlement exit strategy.

3.2 Planning and guidelines

The UNHCR Emergency handbook (2015) and the Sphere Handbook –Humanitarian Charter and Minimum Standards in Humanitarian Response (2011) provide practical guidelines.

The camp strategy guidance and site planning (UNHCR Emergency Handbook, 2015) sees site selection as a critical factor in the ability to provide safe and healthy environment for persons of concern. Settlement planning is context specific. The guidance focuses on the layout, infrastructure and shelter in providing basic conditions. Camps should be comprehensive with limited size. This minimizes the impact, improves camp management and creates a better social environment. The layout is based on community-building and safety. The guidance mentions developing open community forms and community services, communal areas and fire breaks, for instance. Besides, they urge for a 'bottom up' approach in planning: beginning with the smallest social units, and preserving traditional social arrangements and structures as much as possible.

Table 2. Technical assistance in planning phases (UNCHR, 2015)

Planning stage	Who can help	What they can do
Needs assessment; understand PoC' profile and demographics	Sociologist/economist Anthropologist Architects/engineers	Carry out comprehensive surveys, including market surveys. Evaluate information. Gather background information. Analyse traditional practices and cultural habits.
Site selection	Geologist/hydrologist Water/sanitation engineer Civil Engineer Physical planner Protection Environment Logistics	Carry out surveys and topographic studies. Draw contour lines. Assess the capacity of water sources. Evaluate data and conduct risk analysis. Recommend solutions and most suitable settlement options.
Settlement layout	Physical planner Architect Civil engineer Water/sanitation engineer Protection experts Environmentalist Logisticians	Prepare layout and technical plans. Analyse infrastructure (accessibility and conditions). Estimate costs, and resource requirements.
Implementation	Civil engineer Architect Logisticians	Prepare the work programme and risk management plans. Supervise implementation.

The handbook notes that site selection should be based on consultation with a range of sectors. It also mentions the importance of an adequate site selection: '*developing an inappropriate site or failing to develop a site to standards can result in further displacement causing unnecessary loss and distress to persons of concern and put some people/groups at further risk'*.

The general selection criteria are categorized in topography/drainage/soil conditions, water resources, land rights, accessibility, security and environment/vegetation.

Table 3. Site selection factors of importance (UNCHR, 2015)

Description	Minimum standard
Topography	• easy drainage • above flood level • avoid rocky, impermeable soil • grass coverage to prevent dust • avoid steep slopes, narrow valleys and ravines • slope 2-4%, to avoid erosion and need for earth-moving for constructions • avoid areas that are likely to become marshy or waterlogged during rainy season • subsoil quality in relation to infiltration and pit latrine • groundwater table at least >3m below surface camp site • ***if possible, select a site where land is suitable for vegetable gardens or small scale cultivation***
Water resources	• Reasonably close to adequate source of good water • Near high grounds with good surface water run-off and drainage • At least one water point for 250 people
Land rights	• No purchase of rent • Exclusive use • Agreement local community on entitlement • refugees to carryout given activities
Accessibility	• Ensure adequate road infrastructure • Reliable, also in rain season • Site proximity to services
Security	• Sufficient distance from international borders • (>50km), conflict zones and other potential sensitive zones • **Avoid extreme climate conditions, environmental or other risks** • High winds can damage shelters and increase fire risks • Evaluate seasonal varieties
Environment and vegetation	• **Ensure sufficient ground cover Vegetation provides shade, protects from wind, and reduces erosion and dust** • Avoid sites where dust clouds are common • **Avoid sites within 1 day walk of an environmentally protected area** • Take steps to ensure access to supply of fire wood

Since 1996 the UNHCR also has its Environmental Guidelines. The most recent one dates from 2005. It emphasizes on the aim to reduce or eliminate environmental impacts. Many of the environmental-mitigating measures described in these guidelines are of a technical nature. The Environmental Guidelines emphasizes that the state of the environment, in turn, will have a direct bearing on the welfare and well-being of people living in that vicinity, whether refugees, returnees or local communities.

It also mentions that while traditional UNHCR activities have succeeded in their general objective of sustaining refugee populations, there has been an increasing realisation that the negative environmental impacts associated with refugee situations must be better understood and dealt with. This concerns environmental damage caused by large concentrations of refugees, as well as the lack of a consistent policy covering the rehabilitation of damaged areas once refugees are repatriated. It refers to uncontrolled use of natural resources (fuel wood, water use and poaching). But in this regard, it also concludes that it has become clear that refugee-related environmental impacts can have serious negative implications for the health and well-being of the local population, as well as that of the refugees.

The guidelines note that activities undertaken at an earlier stage of an operation are far more cost-effective than those taken later. By developing site-specific development and contingency plans, irreversible environmental impacts can be prevented, or at least minimised, as well as environmental hazards can be identified which might have an impact on refugee health.

A closer look at the site planning itself, leads to the section 'Site planning for camps' of the UNHCR Emergency Handbook, 2015 and SPHERE.

The Emergency Handbook refers to the SPHERE emergency standards (SPHERE handbook, 2011) as the key references when designing planned settlements. Besides, it mentions the importance of dynamic planning. Plans should be adaptable and capable of responding to changes in a crisis situation. It emphases to take in account the characteristics and identity of an area, the environment, and of the people and their habitat. It calls for people-centred, promoting self-reliance and enabling communities to develop suitable solutions themselves. Interesting is that the remark is made that natural features of the site will reduce or affect the amount of usable space.

Table 4: minimum planning standards (Site planning for camps, UNHCR 2015 / Sphere, 2011)

Description	Minimum standard
Covered living area	3.5 m^2 per person minimum (in cold climates and urban areas up to 4.5/5.5 m^2)
Camp settlement size	45 m^2 per person
Fire Safety	30m firebreak every 300m minimum of 2m between structures; ideally 2 times the height of structures
Gradient for camp site	As a guide 1 to 5% (ideally 2 to 4%)
Drainage	Appropriate drainage needs to be put in place, especially relevant in all locations that experience a rainy season

The SPHERE handbook elaborates further on the different conditions and planning principles as mentioned before. In regard to the environmental impact and issues it provides additional insights.

Last but not least, a 'Framework for assessing, monitoring and evaluating the environment in refugee-related operations' (FRAME) has been developed by UNHCR and CARE in 2009. This framework consists of guiding (Rapid) Environmental Assessments towards building an Environmental Assessment and Action Plan (FRAME, 2009). It provides an interesting overview of different expected impacts, threats and benefits; and different more specific checklists and tools. The report includes also an interesting example of an environmental assessment study, including an action plan for the proposed extension of a refugee camp in Sierra Leone. This example shows more specific actions also addressing some concrete spatial green-blue measures in the camp itself, but nevertheless mostly remains in limiting negative effects of the settlement.

Table 5: Environmental impact (SPHERE handbook, 2011)

Guidance notes	
Environmental assessment	• **understanding of environmental risks** or vulnerabilities; essential to inform planning and ensure that **known vulnerabilities including impact of climate change are addressed** as part of the response
Sustainability and management of environmental resources	• **manage natural resources to minimise environmental damage** • sustainable external supplies of fuel and options for **livestock grazing, agricultural production** and other **natural resource-dependent livelihood** support activities should be provided and managed
Mitigating long-term environmental impact	• **management of natural environmental resources considered at all planning levels** • avoid depletion of local environmental resources • possible rehabilitation activities
Sourcing construction material	• assessment environmental impact sourcing natural environmental resources, **including regeneration rates** • **alternative or complementary sources (support local economy and reduce long-term adverse impact)**
Erosion	• **retain trees and other vegetation to stabilise soil and maximizes opportunities for shade and protection from the climate**
Handover	• **natural regeneration of the environment should be enhanced in an around temporary communal settlements**

Nonetheless, a closer look at the proposed measures shows that besides an environmental assessments, location choice, basic facilities and functional layout, most environmental issues are dealt with in non-site technical solutions (shelters). Environmental opportunities and related measures in relation to livelihood and wellbeing are under-represented or even absent. Of course, this can be explained by the wicked problem of the 'temporary' intentions and fragile relation with the host community and local economy. A few examples illustrate intentions, like green projects in Dadaab (Kenya), where refugees and locals worked together to save energy and replenish nature's resources through eco-friendly programs, and different green belt initiatives. But often these projects have problem with sustainability by ongoing pressure on livelihood and liveability. In other words, trees remain a desirable resource. Other initiatives, such as the student research project Rightful Landscape (Robert Kruijt, 2014), show the struggle with the temporary character and regulations. They end up with small scale individual solutions, rather than structural solutions at the basis.

3.3 Living conditions, livelihood and environmental aspects

It has become clear that refugee-related environmental impacts can have serious negative implications for the health and well-being of the local population, as well as that of the refugees (UNHCR, 2005). To provide a better understanding of the actual living conditions and livelihood of refugees in camps, related to environmental aspects we reviewed available literature about possible indicators and additional research.

Table 6. Checklist of typical impacts and possible threats and benefits from refugee-related actions, FRAME 2009

Typical impacts from refugee–related actions	Threats to refugees and host communities
1. Changes in woody vegetation cover (woods and forests where fuelwood might be obtained). 2. Changes to the main habitats and valued species of flora and fauna. 3. Changes in erosion patterns and sediment levels in water bodies. 4. Changes in access to, and local uses of, land and other natural resources (local sedentary communities and pastoralists). 5. Socio-economic changes in host communities and possible range of indirect environmental impacts. 6. Changes to groundwater levels. 7. Changes to surface and groundwater quality. 8. Induced development and subsequent range of impacts. 9. Changes to cultural resources (sites, buildings and valued landscapes or features). 10. Increase in demand for local infrastructure (schools, clinics…).	1. Delivery to refugees of sufficient drinking water and water for other uses is not sustainable. 2. New demands on water reduce access and supply for local people. 3. Soil fertility levels cannot be maintained for agricultural purposes. 4. Non-sustainable supply of woody vegetation. 5. Encroachment on allocated land by host population. 6. Competition for natural resources reduces livelihood potential of local people. 7. Increased indoor air pollution from burning low quality fuel, as available fuelwood resources decline. 8. Restricted access to local infrastructure (schools, clinics…) because of priority given by government to host communities, and resulting impacts on education and health.
	Potential benefits to refugees and host populations
	1. New infrastructure. 2. Increased economic activity, opportunities and jobs. 3. Improved markets. 4. Opportunity for more focused land-use planning.

The UNHCR works with a set of indicators form the Standards and Indicators Initiative (S&I) and a guideline Practical Guide to the Systematic Use of Standards and Indicators. The aim of the S&I is to enhance the assessment, planning, reporting and monitoring capacity in a global and comprehensive manner. The main goal was to establish “a global yardstick” against which to assess and objectively compare the wellbeing of the population of concern. A core set of “readily-quantifiable” standards and indicators was developed. Within the Framework for Assessing, monitoring and evaluating the environment in refugee-related operations (UNHCR/Care, 2009) also an Environmental Indicator Framework has been developed. It consists of a set of core indicators and a set of additional indicators.

In a critical reflection on the use of indicators, Emma Dunlop notes that the large number of indicators puts a burden on capacity, but also does not stimulate positive change or innovations (Dunlop, 2011). For the purpose of this project an overview of the different indicators and few available overall assessments did not provide concrete or more specific insights and evidence to sufficiently sustainable design principles.

Nevertheless, several other research initiatives reveal the relation between the quality of life and camp-based refugees, also mentioning different environmental factors. In 2014 for instance, Thomas M. Crea, Rocio Calva and Maryanne Loughry investigated the differences in health related quality of life (QoL) for urban and camp-based refugees in sub-Saharan Africa, and assessed the influences of both the environment and the perceived environment on refugees’ health related QoL, using the World Health Organization’s Quality of Life scale (WHOQOL-BREF). They mention that compared with non-refugee populations, refugees experience poorer mental health outcomes (Hollander, 2013) linked with prior exposure to violence (Fazel et al, 2012), reduced employment opportunities and satisfaction with accommodations (Campbell, 2012). Similarly, refugees also experience poor physical health outcomes (Hollander, 2013) often related to environmental factors such as overcrowding and poverty (Roberts et al, 2009). The results of the investigation show that refugees living in camps reported lower satisfaction with health, and fared worse on nearly every indicator of physical health and environmental wellbeing than their urban counterparts. They mark that their findings suggest that subjective assessments of

environmental wellbeing are as important in predicting health as the environment itself. They conclude that the domains of physical health and environmental wellbeing are highly correlated and more research is needed on the environmental determinants of refugee health, and to explore how cultural conceptions of physical health and environmental wellbeing also influence health outcomes for this population. In relation to the topic of our research the investigation clearly marks the differences in satisfaction between urban refugees and camp based refugees about the living conditions, respectably 2.6 SD (urban) versus 1.8 SD (camp-based) (SD=standard deviation).

4. Discussion

The above review shows that a wide range of guidelines, indicators and implementation targets have been established to ensure a proper site selection and camp management. However, from many practice examples, literature and professional discussions we still have to acknowledge that major concerns about the effectiveness of these measures persist.

Recent articles from newspapers and online news sites reveal the ongoing environmental impact refugees have to deal with and the effects they cause. Titles such as 'The heat is on: surviving summer in an Iraqi camp' (Irinnews.org, 2015) and 'Jordan grapples with the environmental consequences of its refugees crisis' (The Ecologist.org, 2016) speak for themselves. In this latter article Doug Weir comes to the interesting conclusion that the environment has been dealt with as a crosscutting issue. And indeed, the environment is an integrated aspect of camp design and management – be it transport, waste, energy, health or recreation. However, as Weir has observed, the problem with crosscutting issues is that without affirmative action by stakeholders in the different clusters/sectors, the environmental dimension – especially the functional linkages between resource flows and processes – often referred to as 'ecosystem services' – can fail to be addressed during design and implementation. He notes that many organisations and governments are gradually mainstreaming environmental aspect, but much remains to be done. Again, he also notes the importance of politics within this dossier. In this regard he mentions mainstreaming environment in response and recovery is not a luxury, but a priority!

Also different insights provided by both social and environmental experts as well as architect address the fundamental basics of refugee camps, camp layout and environmental aspects (impact, benefits and concerns).

James Kennedy states that 'camps should somehow mimic the living conditions of the people from before they got displaced'. He hence argues in favour of a full involvement of refugees in the layout and arrangements of their (temporary) stay. Also Kennedy emphasises the short term versus long term perspective as a crucial issue. He advocates the cycle of intervention, towards gradual development, although this implicates certain uncertainties. Herz also mentions the limitations of the present planning system for refugee camps. He includes the social component even more and the demographic consequences. He mentions two camps that are becoming permanent settlements, each which 15000 inhabitants. In spite of their large size, the structures that are emerging are not of an urban character. Because of homogeneity and low density, resulting from the camp planning, enormous areas of suburbia have been created - without the existence of a corresponding city. He argues for moving away from what he calls 'bad politics', by creating space for permanent solutions that are based architectural approaches. In the essay 'The failure of refugee camps' (2015), Elizabeth Cullen Dunn calls for creating *real cities*, commitment to durable housing and functional communities, instead of continually underfunded temporary camps. "The solution is not to fence them out or trap them in their home countries but to help them resettle in ways that benefit local economies and urban environments". She quotes a refugee in Georgia: 'this isn't living; it's just existing'. She states 'camps keep refugees alive, but they prevent them from living'.

Simon Turner gives an interesting, perhaps opposing, perspective by exploring the limits and effects of camps. The most interesting part in his review is the fact that camps can be seen as places of social dissolution and disillusion on the one hand, but on the other hand also places of new beginning. He argues for exploring the precariat of life in the camps by exploring relations to the future in this temporary space. Refugees need to be able to imagine a meaningful future for themselves – however miserable their present-day situation is. Finally, Mac McClelland gave insight in the development of refugee camps in Turkey. These camps are run by the Turkish government, unlike almost all of the other refugee camps in the world that are managed by the UNHCR. The Turkish government elaborated further on the guidelines of the UNHCR and set a high standard. Besides a better standard of shelter, the outdoor space is kept clear and furnished. Most interesting is that Turkey actively pursues building up a functional relationship between local economy and the camps. But operating these camps comes at a cost. And again questions are drawn on the sustainability if the crisis last longer and more influx is generated.

Figure 1: A Bhutanese refugee carries food supplies at the Timai Refugee Camp, some 300km south-east of Kathmandu on September 11, 2008. The refugees have languished in United Nations camps in southern Nepal for nearly 20 years.

Refugees in Uganda have been given access to land for cultivation, and local government leaders agreed to extend to refugees whatever public services are available in the surrounding villages. The Ugandan government called the refugee camps "settlements" in order to communicate this integrationist policy intention. It is partly for this reason that UNHCR has commended Uganda on its "friendly" refugee policy (UNHCR 2002). Refugees had been given small plots of land to cultivate in order to promote self-sufficiency. The settlement system was intended by UNHCR and the government of Uganda to create sustainable refugee communities that eventually could be integrated into the local economy and government. However, the full integration of the refugees into local communities failed due to property rights issues and lack of political support.

From the above reflections and insights we can learn that there is to assume a close link between sustainability and self-sufficiency and in the case of food also between self-sufficiency and health as external food supply to camps is vulnerable to supply chain failures. Currently, camp food is being provided is a system of rations that are being given out once or twice per month. Many refugees could not get the food they needed doe to bottleneck situations at the distribution centres, shortage of certain goods etc. One improvement has been the introduction of ‘food credit cards’ as in the case of the Nu Po camp at the Thai-Burma Border (Karen News 2016). With these cards, refugees are now free to shop at designated sites at any day of the year. This is only one example how certain forms of innovation can affect the life in and the management of refugee camps.

5. Conclusions and recommendations

5.1 Conclusions

The examples have demonstrated that self-organisational structures and self-sufficiency as a principle of camp life can be considered as a way of helping refugees to take up responsibilities, develop new skills and knowhow, open economic opportunities and to even teach or educate other refugees. This way, refugees are likely to be better prepared for leaving camps, going back to their places of origin (if possible) and taking up life and professions in non-camp situations. Linking these newly learned abilities to issues such as waste and water management, climate-smart food production and planning, non-fossil energy production and park/green space management for recreation and nature will make refugee camps more sustainable in an inclusive and innovative way.

Reviewing the state and trends of refugee camps at the global level makes clear that there are a number of parallels to be drawn between the overall urban development perspectives towards more smart, climate-friendly and resource-efficient cities on the one hand and the dynamics that drive the establishment and management of refugee camps. Extremely dependent on fossil fuels, far from being self-sufficient and resource-efficient and lacking inclusive societal structures, most cities are facing great challenges of meeting sustainability standards of the future. This has prompted researchers, business and policy join forces when developing new approaches that can guide and facilitate the necessary transition processes. Among the obstacles that are hindering smooth transitions are the existing administrational and organisation structures (*orgware*) as well as existing production facilities, infrastructure and land use (*hardware*) which require substantial reorganisation and renewal. Both the *orgware* and *hardware* of most already established ("real") cities as we know them and live in tend to substantially underperform with regard to sustainability targets. Refugee Camps, on the other side, can be considered as offering unique opportunities for co-developing prototype installation of future sustainable cities: being designed from scratch, situated at spatial-environmentally well selected locations and managed by dedicated and highly professional small teams should offer clear advantages for strategic environmental planning and evidence-based decision-making.

This is where the concept of Metropolitan Solutions (see details in Annex 3) is coming in. Together with Delft University of Technology and the Massachusetts Institute of Technology, Wageningen University Research has developed a string of scientific concepts to explore and develop new urban life systems. Trans-disciplinary research, in which several disciplines and local knowledge are combined, is a keyword. Bridging concepts, models and fundamental insights which can lead to new practical solutions are needed. For instance, concepts such as ecosystem services, resilience, adaptation, urban metabolism, industrial symbiosis, urban symbiosis, tipping points, life cycle, ecosystem services, etc. need to be furthered and developed into solutions. This new and inter-sectoral approach is using urban nature to enhance the life of the urban poor. In refugee camps living conditions can be very poor. Metropolitan Solutions looks into the options to translate knowledge into applications for refugee camps.

There are good reasons to believe that sustainable design principles as developed by Metropolitan Solutions can provide scientific-practical guidance in creating refugee camps of the future.

5.2 Recommendations

The overall recommendation of our research is that refugee camps could substantially decrease their environmental and social impacts while maintaining their temporary status by taking up sustainable design principles such as circular economy, nature-based solutions, inclusiveness and ecosystem-services.

Looking at the operational processes that characterise refugee camps is becomes clear that issues such as sanitation, waste management, infrastructure, food chain design, water management and energy production are highly qualified for applying the rules of circular economy. This means that resource-flows of camps should be strictly directed towards re-cycling and re-use, targeting at higher value chains and economic benefits. Such an approach includes setting up food growing facilities on roofs, side-ways and green spaces dedicated to dust reduction and improvement of micro-climate. Aquaponics systems can help to produce fish and vegetables, bio-refineries can turn biomass into energy and higher value

products, water cleaning and storage facilities can reduce the amount of water consumption and also human faeces can become the source of valuable nutrients.

The overall approach should follow the six main directions of Metropolitan Solutions (see for further specifications also Annex 1):

(1) Creating liveable and healthy refugee camps by developing innovative approaches based on ecosystem functions that are linked with the overall landscape of the site;
(2) Develop climate-resilient refugee camps by making use of waste heat, non-fossil energy, LED-light systems, smart grid facilities and biomass-energy-technology, preferably by employing means of frugal innovation methods;
(3) Increase the resource efficiency of refugee camps by making use of vertical (within sector) and horizontal integration (between sectors);
(4) Food secure refugee camps by developing sustainable and stable food chains, self-production and food processing units, provide access to agricultural land and effective distribution services;
(5) Introduce new forms of governance based on triple-helix processes that includes refugees, aid organisations and host country governments as well as business inside and outside of the camps;
(6) Provide transparency by monitoring urban metabolism processes inside and outside the camp and my making data available for all partners.

Like in any other city, sustainable design principles can stimulate economic growth by making money, creating jobs, making products, providing food security without overexploitation of the natural resources in and around the camp area. Supported by aid organisations, research and governments, camp dwellers can themselves create an environment for creativity and for innovative solutions. Metropolitan Solutions can offer design, planning and assessment tools as well as guidelines and concepts on how to apply the different aspects of urban green in the refugee camp effectively.

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Annex 1: **A student's view on refugee camps**

In the framework of this project, six Wageningen University master students have elaborated on the topic of integrating refugee camps with their social and natural environments (Huibers et al., 2016). The students had different scientific backgrounds, including Management, Economics and Consumer Studies; Development Economics and International Development; and Environmental Sciences. In this section, we will first give an overview of their discourse (section A1.1). Next, we will briefly reflect on their work and its application perspectives (section A1.2).

A1.1 Adapting and applying metropolitan solutions to refugee camps

People like to see refugee camps as temporary. Yet, the majority of camps exist much longer than they were planned to. In many cases, one can speak of semi-permanent settlements which share many social and environmental problems and challenges with (unplanned) metropolitan areas, in particular slums. What are the main problems and challenges – also as perceived to refugee camp residents themselves – and how can we prioritize them in relation to basic human needs? How to improve the liveability for refugees while at the same minimising the environmental impact of a refugee camp? How can Metropolitan Solutions be adapted and implemented in refugee camps in order to improve the liveability of those camps and reduce their environmental impact? Metropolitan Solutions are not initially designed for this purpose and therefore need to be translated into more suitable solutions to be implemented into refugee camps. Finally, how can the results best be communicated to international organisations and governments? How can the aim of temporariness of refugee camps be reconciled with improvements of quality of life and sustainability? These were the main aspects covered by the students' research. Below, we will elaborate on these issues by quoting from the students' report (Huibers et al., 2016).

The wish for temporariness of refugee camps

For host countries, i.e. the country where the refugee camps are located, hosting refugee camps can have both positive and negative consequences. Refugees can for instance contribute to economic growth especially in countries where the labour markets are tight (Save the Children, 2016). However, since most camps are located in poorest nations on earth, their presence puts more pressure on the already existing social, environmental, economic and political challenges. One could think of the competition for scarce resources between refugees and local citizens, for example.

So even though governments are obliged by international law to absorb refugees when necessary (UNHCR, 2010); domestically they often face fierce resistance when sheltering refugees. The policies of host countries therefore will tend to be inclined towards controlling the influx of refugees; camps perhaps are the "only solution" in this rationale. Within receiving societies, on an individual level, anti-immigrant attitudes are often linked to both economic insecurity and fear of cultural conflict. These effects are known to be even stronger for inhabitants who personally do not know any refugees, (Schneider, 2008) or are solely informed by populist frames of the mass media. The media might, by covering immigrant minorities in a certain way, promote or restrain social cohesion. "Media effects might also have substantial political consequences (...) and anti-immigration attitudes for instance are known to be strong predictors of support for extreme-right parties" (Boomgaarden & Vliegenthart, 2009, p.537). These dynamics are known to exist around the world. In Jordan for example, reports indicate that the Jordanians do not want Zaatari to become a permanent settlement, because they fear both importing religious extremism, permanent alteration of the demography of Jordan (Ledwith, 2014, p.72) and environmental damage even after refugees would be relocated (UNHCR Standing Committee, 1997).

De facto persistence of refugee camps

The majority of camps exist longer than they were planned to. Some camps developed during the Palestinian Exodus in 1948 still exist today, the Saharawi refugee camps in Algeria were created in 1975 and some Burmese refugees in Thailand have been there since 1986. These are only a few examples of a common trend; the average time a refugee stays in any given camp is 17 years (Rescue, 2016). A refugee camp is constructed in an emergency phase and the basic needs such as water, food, health and shelter are first covered. These needs are prioritized over livelihood improvement programs which can result in low liveability of refugees and a negative environmental impact.

Similarities between (semi-)permanent camps and emerging cities

Since refugee camps are temporary by definition but tend to grow out to become more permanent establishments, one could see them as emerging cities that face similar challenges as cities. Killian Kleinschmidt, one of the world's leading authorities on humanitarian aid, even calls them “the cities of tomorrow” (Moohdin, 2015). The most pressing issues in camps are food security, heat stress and the availability of water. Cities also face similar issues and they have created sustainable solutions to overcome these problems, called Metropolitan solutions. The Metropolitan Solutions are made for cities to deal with six broad topics: climate, food production, health, green cities, water and sanitation, waste management and social-political education. Due to the similarity in challenges, the Metropolitan Solutions are especially suitable to consider when improving the environmental impact and liveability of a camp.

Refugee camps around the world are in need of new integrative approaches towards planning that involve all stakeholders affected by decisions, and consider the socio-political, economic, and environmental conditions surrounding the camp. Particularly for well-established camps, after the emergency phase, involvement of the local community is essential for the sustainable urban and environmental planning of any developing situation. This was shown by Duchhart (2007), in her application of a landscape planning approach to “physical development in Kenya that integrates ecological and social processes”. Like in urban slums in Kenya, an integrated planning approach could greatly contribute to the sustainable development of refugee camps. Unplanned development, such as in urban slums, shows similar conditions to those in refugee camps in transition to urban environments.

Problems and challenges common to both refugee camps and emerging metropolitan areas

Globally, urbanization is an ongoing process; more and more people move to cities and this is likely to continue in the near future. At the moment more than half of the world’s population is living in cities (Gehrels, 2016) and this will be 70% in 2050, which is why the Metropolitan Solutions were created (WUR, 2016). At the same time more than in any moment of history, people have worldwide fled their homes to seek for a better home; forty percent are forced to live in refugee camps (UNHCR, 2016). Due to a relatively high birth rate inside camps and future displacement of people due to ongoing violent conflict and climate change, this number is expected to at least remain stable or even increase. In many ways, refugee camps and cities face similar population dynamics, social issues and environmental challenges such as the sustainability of resources, food security, sanitation and water management, sustainable energy, and waste disposal (ICLEI, 2016).

In terms of size, population numbers and density, and environmental challenges cities and refugee camps are very similar. They however differ strongly in terms of available solutions to overcome their social and environmental challenges and their depiction in the (political) discourse of host countries. For refugee camps solutions are scarce because camps lack the capital, technology and legal permits to overcome them.

In this respect, two aspects are stressed by Huibers et al. (2016). First, there is a need to involve all stakeholders – including refugee camp residents - in identifying and applying solutions for the improvement of quality of life. Kruijt (2014) applied the Green Town Workshop method (Duchart, 2007) to the Zaatari refugee camp in Jordan. His approach allowed to identify problems, needs and wishes of people who are dependent on external aid.

Second - in spite of stakeholder involvement being essential for decision making, survival and safety of individuals should be prioritized. As described by Maslow´s Pyramid (Figure A1.1), which hierarchizes population issues, physiological needs required for survival - such as high quality water and sufficient food - should be secured with priority. Following in hierarchical order are safety needs, love needs, esteem needs and self-actualization. The challenge of creating a healthy community does not end with physical needs; rather it is only complete when the whole pyramid has been addressed.

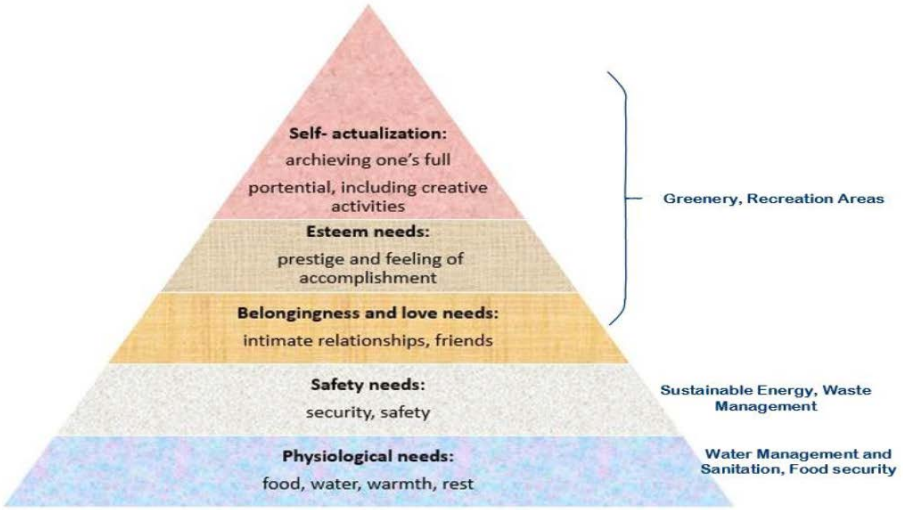

Figure A1.1. Maslow´s Pyramid showing hierarchy of needs. Taken from Huibers et al. (2016).

Table A1.1. Overview of metropolitan solutions for refugee camps as presented by the students.

Topic	Solutions	Benefits	Challenges
Greenery and heat stress	Trees alongside the road Rooftop gardens Little gardens next to tent/shelter/buildings	Reduce heat stress, insulation, filter air pollution, food production, rainfall retention, increase in health and wellbeing	Water management
Sanitation and water management	Communal sanitation facilities	Less complex, community involvement, use of waste, improved security and flexible	System maintenance and waste treatment by local community
	Grey water re-use	Reduce health risks, can be used for vegetation and agriculture, sense of ownership, reduce heat stress	Local involvement and education
	Swales	Reduce flooding, rain water use, can be used for vegetation and agriculture, reduce heat stress	Local involvement and education
Waste management	Compressed solid waste	Easy, bio-degradable, earthquake resistant, deals with plastic waste	Requires factory and knowledge
	Plastic bottle bricks	Easy, strong, deals with plastic waste	Requires training
	Liter of Light	Easy, stimulates social entrepreneurship	Applicability
Sustainable energy	Smart grid	Efficient transmission, relatively low costs, can integrate renewable energy, improved security	Setting up the system Sharing energy
	Solar panels	Sustainable, short payback period, easily deconstructed and relocate	Optimal usage and meeting demand
	Bike creating energy	No emission, independent of other factors - just needs one hour to cycle a day	Cycling in a warm climate and cultural appropriateness
	Cooking stoves	Energy efficient, easy, safe	Cultural habits
Sustainable food systems	Vertical gardening Multi-story gardens Rooftop gardens	Food security, less dependency on outside assistance, helps with waste and water management, gardening activities, thermal benefit, water efficient	Water scarcity
Recreation	Recreational areas	Education, entertainment, reduce anti-social behaviour, learning environment, made out of waste	Land scarcity

How Metropolitan Solutions can be adapted for application to refugee camps

UNHCR has developed design guidelines for the creation of refugee camps. These guidelines tend to be rather general; reaching their full implementation is often problematic in practical reality. Even though existing guidelines are especially useful for the initiation phase of refugee camps, they fall short when addressing long term urban/city-like issues.

When looking at refugee camps as cities, the existing UNHCR existing guidelines can be complemented by metropolitan solutions which address the environmental challenges of a growing urban population by proposing (practical) solutions for sustainable urban development.

The number of metropolitan solutions is abundant and expected to grow as innovation provides new opportunities. New technologies will become available in the future and old ones will become redundant. Most existing solutions were not designed for refugee camps and therefore they need to be adapted before they can be implemented. The solutions presented are a selection of options to make refugee camps more sustainable and increase liveability. Camps often lack the capital, technology and legal capabilities to construct long term metropolitan solutions. The main challenge is to adapt the metropolitan solutions in such a way that they become easy to (de-)construct, suit the local context, and are preferably made from local materials and by the local population. These requirements were used as guiding selection criteria for metropolitan solutions. In Table A1.1, an overview of the proposed solutions is given, while Figure A1.2 shows how they are interlinked according to the students.

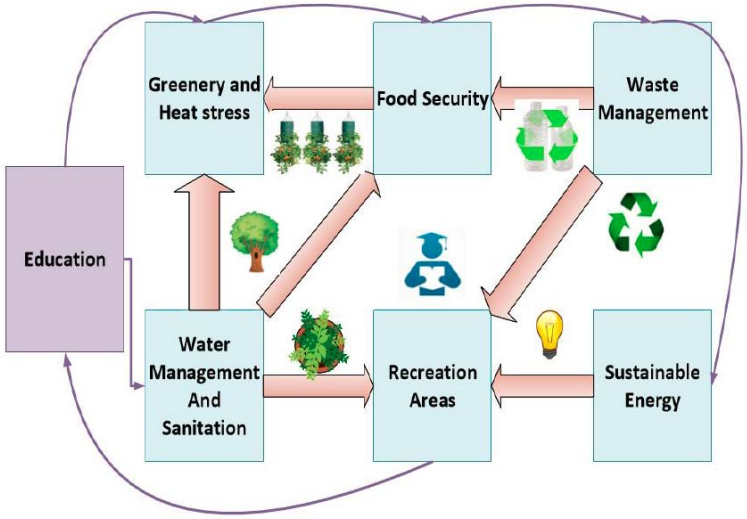

Figure A1.2. Interlinkage model of the metropolitan solutions for refugee camps proposed by Huibers et al. (2016).

Communicating about metropolitan solutions for refugee camps

Not all stakeholders involved in refugee camps are in favour of seeing refugee camps as cities and therefore Huibers et al. (2016) discuss how proposed solutions could be communicated to these stakeholders. In order to have practical effects, a communication strategy is recommended that (1) frames solutions in such a way that their temporariness and flexibility is stressed; (2) is congruent with individual camp rules and needs; and (3) is culturally appropriate and involves camp residents as much as possible (Figure A1.3).

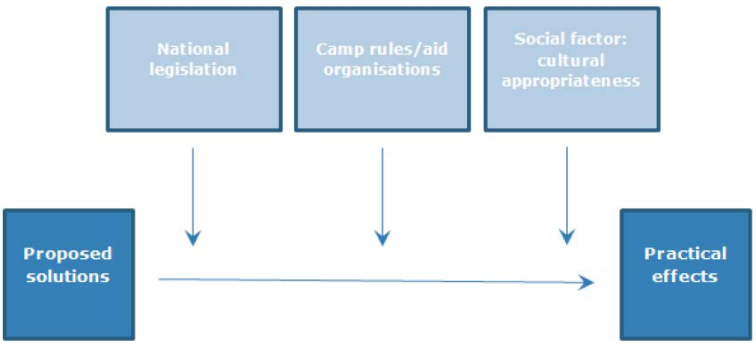

Figure A1.3. Factors influencing the relation between proposed metropolitan solutions and practical effects.

A1.2 Reflection and application perspectives

The student's work, summarized in the previous section, was discussed with a group of Wageningen University & Research staff with different scientific backgrounds. Issues raised included:

- The degree in which refugee camp residents are familiar with farming practices was discussed in relation to small-scale metropolitan crop-growing solutions. In the example of the Zaatari refugee camp, surprisingly few refugees have a background in practical farming or agrarian sciences. In relation to practical farming, this may be due to the possibility that farmers stay longer than average to their land – because they are directly dependent on it. Perhaps it may also be due to cities being particularly heavy targeted in armed conflicts when compared to rural areas.
- In relation to the (semi-)permanent character of many refugee camps, it was argued that it would be good for engagement and self-esteem if camp residents themselves could help and instruct newcomers more instead of Western aid and staff being flown in. This relates to camp rules and national and UNHCR policies.
- It was discussed how to handle the dilemma of improving quality of life without making refugee camps too attractive. It was suggested that a camp rule could (bottom-up) be put in place stating that anyone who wishes to stay longer in the camp should be more engaged in actively contributing to good living conditions in the camp, e.g. by sharing their knowledge, experience and abilities to help and instruct newcomers.
- The consensus was that it is important that refugees in camps are – to a larger degree than at present - enabled to establish a local economy, also linking the camp with the outside world. Engagement of refugees should be organised. This is not only a point of particular interest for host country governments and international aid organisations, which currently tend to be rather restrictive in this respect. It is also a task for refugees themselves. Kruijt (2014) carried out a workshop with Syrian refugees in the Zaatari camp in Jordan and concluded that initially, refugees did not feel like investing in the camp at all because their wish was to return to Syria as soon as possible. On the other hand, they proved to be very inventive and willing to pick up initiatives for a better camp environment.

To conclude, metropolitan solutions can contribute to the quality of life in refugee camps and their application offers a possibility for increased engagement of camp residents; a way to take their life more in their own hands. However, major challenges are to reconcile the perspectives that metropolitan solutions offer with the aim of temporariness of refugee camps as adhered to by many host country governments and international aid organisations. A constructive dialogue on camp reality and residents' needs between all stakeholders involved, including camp residents, seems to be the best way forward towards application of greening solutions in refugee camps.

Annex 2: **Key actor organisations**

The Netherlands

Dutch Coalition for Humanitarian Innovation (DCHI)

DCHI strives for break-through innovations to overcome the challenges faced by the humanitarian sector. Each year our board sets the innovation agenda for the upcoming year; a set of challenges which require innovation to meet the changing conditions of the sector is jointly selected. Current partners and new partners are engaged to uncover the main issues within these challenges. Partners jointly commit to the projects during our workshops. DCHI projects are led and conducted jointly by several partners. Progress is monitored, insights captured, lessons learned and results shared within the coalition by the DCHI support office to facilitate the activities in the following year.

DCHI consists of governmental actors, knowledge institutes, academia, businesses (incl. small and medium sized enterprises (SME's)) and humanitarian organizations in the Netherlands. They bring together a combination of resources, expertise and capabilities. Their approach is based on the concept of 'W3innovation'; striving for a win-win-win to be achieved for all partners.

Contact: +31 (0)30 689 64 56.

Red Cross Netherlands

Contact: Mr. Juriaan LAHR (Director International Operations)
Leeghwaterplein 27
2521 CV The Hague
Tel: (31) (70) 4455666 / 4455613 (International Department)
Email: contactcenter@redcross.nl
Web: http://www.rodekruis.nl/

Care Netherlands

In the Netherlands in the early nineties, the need for an organization that could bridge the gap between emergency aid and structural aid emerged. Thus, in a joined effort by leading Dutch developing organizations, the Disaster Relief *Agency (DRA) was established on December 2, 1993. In 2001, CARE Nederland took its present form, when the former DRA joined CARE International.*
CARE International has become one of the largest organizations in the world that focuses on the global strive against poverty and its causes. CARE is an inspirator, guide, motivator and facilitator to make real changes happen. For the poorest. On the most difficult places. With a specific focus on empowering women and girls. We support millions of people around the world in more than 80 countries to build a more dignified life.

Contact: Parkstraat 21, 2514 JD Den Haag
Telefoon 070 – 310 50 50
e-mail general@carenederland.org

UNHCR Vluchtelingen Werk

With 13.000 volunteers and a few hundred paid employees we offer refugees practical support during their asylum procedure and their integration in the Dutch society. In addition, we provide members of the Parliament with information concerning refugee issues and policy and we carry an active lobby for refugee rights. Another important part of our work is to supply information and advice to asylum lawyers. We also develop various projects to promote the integration of refugees in the Netherlands. Furthermore, we are committed to increasing public support for refugees.

Contact: Landelijk Bureau VluchtelingenWerk Nederland
Surinameplein 122, 1058 GV Amsterdam
Email: info@vluchtelingenwerk.nl

International Organisations

United Nations High Commissioner of Refugees (UNHCR)

UNHCR is committed to the importance of evaluation and its role in supporting organizational accountability, learning and the continual improvement of UNHCR's performance in addressing the protection, assistance and solutions needs of refugees, stateless persons, IDPs and other persons of concern.
The UNHCR Evaluation Policy 2016 provides for a strengthened evaluation function in UNHCR based on the principles of independence, impartiality, credibility and utility. The Policy incorporates United Nations evaluation norms and standards and introduces evaluation quality assurance provisions as fundamental to produce high quality evidence-informed and credible evaluation products. The Policy applies to all evaluations commissioned and managed by UNHCR.

Contact: Case Postale 2500
CH-1211 Genève 2 Dépôt, Suisse.
Tel: +41 22 739 8111 (automatic switch board)

International Red Cross Red Crescent Societies

The International Federation of Red Cross and Red Crescent Societies (IFRC) is the world's largest humanitarian organization, providing assistance without discrimination as to nationality, race, religious beliefs, class or political opinions.
Founded in 1919, the IFRC comprises 190 member Red Cross and Red Crescent National Societies, a secretariat in Geneva and more than 60 delegations strategically located to support activities around the world. There are more societies in formation. The Red Crescent is used in place of the Red Cross in many Islamic countries.
The IFRC vision: To inspire, encourage, facilitate and promote at all times all forms of humanitarian activities by National Societies, with a view to preventing and alleviating human suffering, and thereby contributing to the maintenance and promotion of human dignity and peace in the world.

Contact: P.O. Box 303, CH-1211 Geneva 19, Switzerland
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Annex 3: **Metropolitan solutions**

The human population is urbanising at a tremendous rate. In 2050, 66% of the human population will 1 live in cities. Currently 72% of the European population lives in urban areas. Cities increasingly face challenges of sustainability and quality of life, challenges that put at risk resource and food security, 2 mobility and logistics, water and waste management, health and wellbeing. On the other hand cities as administrative areas can also be part of the solution for these kind of problems and sources of innovation.

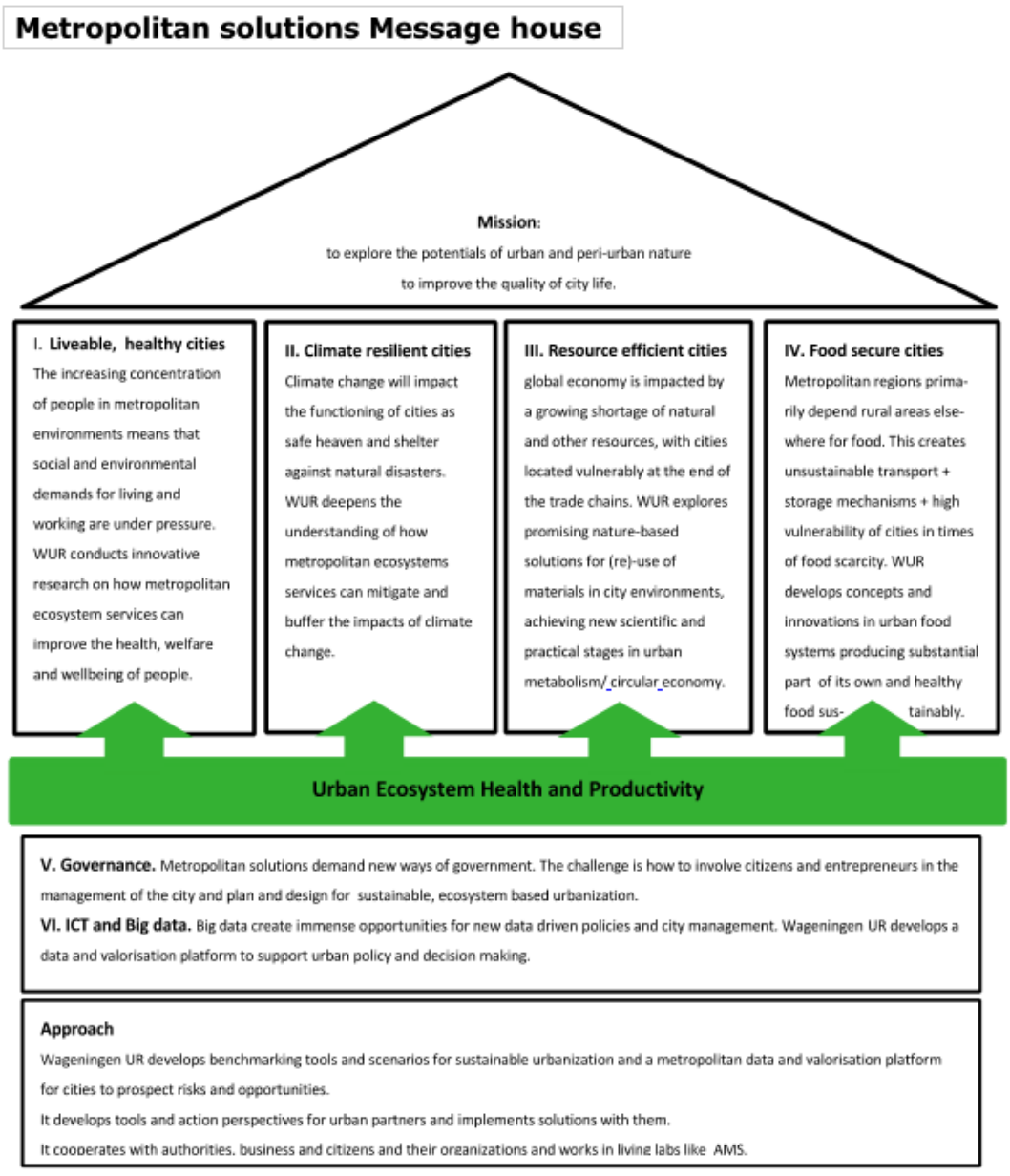

Figure A3.1: Overview on Metropolitan Solutions building blocks

New metropolitan solutions are needed. Such solutions are made possible by today's revolution of new technologies, new designs and new ways of governance and innovation. The methods used to generate new 'green' solutions in the urban realm, are focused on deepening our understanding of the functioning of green and sustainable cities by integrating the knowledge of the different fields in which the above challenges exist through planning and design and by co-developing and applying new solutions with local initiatives by companies, cities and citizens. Some general developments are the following.

Spatial developments:

• While more people are living in cities, urban areas typically grow faster than the population, with declining (but still high) population densities as a result. Urban expansion and urban sprawl change the transport patterns and needs for people (and goods) in cities.
• Multi-functionality of parts of urban areas is increasing, after decades of more mono-functional urban developments. Substantial parts of cities stay mono-functional.
• Changes in the governance and management of the city. Urban development paradigms such as the "smart city" are an appealing perspective for many cities.
• Urban and rural areas are increasingly interrelated.
Social developments:

• Cities are marked by high concentrations of people, activities and relations, which support a multiplicity of local cultures and lifestyles. These include increasingly different urban lifestyles, intensifying migration, aging populations, in-/exclusion of specific age groups, and social and racial segregation, and aggression. In cities, these trends appear to correlate with different degrees of economic vulnerabilities (income and jobs), levels of exposure to environmental risks and hazards, and access to environmental amenities and decision-making across groups of urban citizens.
• In Europe, China, Japan and the US the population is ageing. Ageing means that many elderly people have to be cared for by fewer young people. Individualisation in cities is reported many times, but also countertrends have been seen. In other countries, developing countries, rural youth migrates to cities, which puts a pressure on slumps, lack of sufficient work, etc.
• The lack of access to fresh food results in health problems for certain groups. Demand for diversification of food for these specific groups. As a response many cities are developing food policies.

Economic developments:

• The world per-capita income growth will lead to changing consumption patterns and urban lifestyles: both fresh and sustainable produced food and recreation possibilities.
• Change from a 'grey' economy to a bio-based economy in several sectors. This requires new forms of logistics (e.g. green ports).
• Metropoles need to adapt to the continuous stream of technological innovations to allow global competition.
• More data and information is available, new techniques to handle these are coming up.
• Food: changing diets, convenience food, increasing quality and 'on demand access' require a change in urban food systems and its infrastructure. Adaptive food supply chains need to be embedded in the urban situation. - Concerns about the food system lead to grass-root development of local-for-local food systems. - The need for higher quantities and improved quality of fresh food in or near cities leads to transition towards smart-tech production systems. - In highly urbanized environments, concepts of vertical farming and indoor farming are found to be (economically) viable systems to produce fresh vegetables and herbs.
• Due to the population size and density, it is expected that the freedom of choice becomes more and more flexible. Present thinking in consumer groups, consumer segmentation and consumer profiles becomes obsolete and could shift towards the setup of flexible food supply systems.
• Logistics: the increasing complexity of the flow of goods and information in the metropolis need to be controlled and bundled to match increasing demand criteria: planning, efficiency, processing and control.

Developments in governance:

• Developments in European policy, especially in the aftermath of the financial crisis, seem to find a balance between economic growth objectives and social and ecological sustainability concerns. Since 1997, sustainable development has become a key objective for European policies
• The importance of cities has grown as sites for policy making, implementation and horizontal integration of sectorial measures.
• Non-governmental actors have gained importance in new modes of interactive, network governance. These include stakeholder engagement processes both vertically in a multi-level governance mode, and horizontally, coordinating between government and other actors, e.g. through public-private partnerships. This development introduces a new kind of dynamics in cities.

• The empowerments of citizens.
• The emergence of entrepreneurial and citizen initiatives taking responsibility, undertaking actions and creating multiple values related to liveable cities and heathy food.
• More data and information is available, giving an impulse to citizens' science and influence on policies.
• The importance of cities in national policies is growing all over the world. The balance between city governments and national governments is changing.

Besides these developments of the last decades, several new concepts or brandings of cities arise. For instance: smart cities, urban metabolism, sharing city, share economy, social innovation, the third technological revolution, circular economy, big data, etc.

Figure A3.2: Example for mobile, low-impact greenhouse solution

Approach: Working on the boundaries of knowledge, Metropolitan solutions require new scientific concepts to explore urban life systems. Trans-disciplinary research, in which several disciplines and local knowledge are combined, is a keyword. Bridging concepts, models and fundamental insights which can lead to new practical solutions are needed. For instance, concepts such as ecosystem services, resilience, adaptation, urban metabolism, industrial symbiosis, urban symbiosis, tipping points, life cycle, ecosystem services, etc. need to be furthered and developed into solutions. Different funding possibilities are combined to finance a long term development of Metropolitan Solutions (see figure): from governments, companies, international organizations, non-governmental organizations, and citizens organizations. Possibilities for crowd sourcing and in-kind co-operations are also considered. Academics and applied partners of different scientific fields in and outside Wageningen UR cooperate with business, citizens and governments in demonstration projects. We hope to realize a multiplier between 2 and 4 for the Metropolitan Solutions programmes. Public-private partnerships test and develop new concepts and tools in practice. We maintain and pursue strategic positions in relevant research, policy and practice networks. Education, fundamental research, applied research and consultancy are combined in a solution oriented approach to achieve the Wageningen UR ambition on metropolitan solutions and to enhance the position of Wageningen UR on the market.

Themes, problems and actions

I Healthy, liveable cities

The increasing concentration of people in urban environments means that social, economic and environmental demands for living and working are increasing. Wageningen UR can conduct innovative research on how metropolitan green areas and food systems can contribute to the health, prosperity and wellbeing of people. Population benefits from healthy lifestyles: healthy food, exercising and relaxation and inspiration through recreation. The urban environment has to invite people to do so. Greening the city works preventively for a number of diseases both physically and mentally. Wageningen UR will

address the added value of green areas for: disease prevention, cure and care, connecting humans with nature, environmental quality of air, soil and water, living and working environment, economic climate.

Green can increase the quality of the air, reduce noise nuisance, seduce people to be physically active (walking, cycling, gardening), reduce stress, increase social cohesion and reduce aggression. But it can also hamper circulation of fresh air. Especially the dominant car transport system has a very negative impact on urban environment, such as in terms of noise, air pollution, sealing, urban heat and land consumption. Wageningen UR develops theory and methodology for supporting decision making processes on transport infrastructure innovation from an integrated environmental, social, ecological and spatial point of view.

Illustrating how green areas contribute to create the right social, environmental and economic conditions in cities, and present insight how such areas should be planned, designed and managed to deliver an optimal performance in co-creation with stakeholders. Wageningen UR will provide missing scientific information on the ecosystem service performance of urban Green Infrastructure for health.

Urban environmental inequality is a political issue that is potentially dangerous for social cohesion. To inform decision-makers to identify problematic disparities, accommodate needs in the limited urban space and develop policies to tackle related problems, Wageningen UR will develop further insight in the implications of both global and local environmental changes leading to inequalities. It will map and analyse basic patterns of environmental, economic and social inequality in European cities. Wageningen UR will identify and advice on good practices for avoiding such inequality. An analytical framework is already developed in cooperation with the European Environment Agency.

Green initiatives can stimulate economic growth by making money, creating jobs, making products, providing food security without overexploitation of the natural resources in rural areas across the globe. Cities provide an environment for creativity and for innovative solutions. Green Economic Urban Growth has received worldwide attention in the context of Rio +20, and has been explored in many ways as a tool to address the financial crisis as well as sustainable development.

It will develop planning, design and assessment tools, guidelines and concepts on how to apply the different aspects of urban green in the city effectively; presenting societal and economic CBA on the application of nature based solutions for liveable and healthy cities.

II Resilient, climate-proof cities

Climate change will impact the functioning of cities as safe heaven and shelter against natural disasters. Wageningen UR can deepen the understanding of how metropolitan nature can mitigate and buffer the impacts of climate change, enabling urban actors and the urban environment to adapt to flooding, storm water events, drought and heat stress. Wageningen UR will especially develop knowledge for urbanized delta regions, originating from its Dutch experience. The adverse effects of intensifying climate extremes - floods, droughts and extreme heat- combined with increasing urbanisation call for a new planning and management paradigm for: one that maximizes ecosystem services, minimizes environmental footprint (mitigation) and increases the cities' adaptive capacity to changing climate, social and economic conditions. The new paradigm calls for rethinking existing ways of planning, designing, constructing, operating and maintaining urban water systems (blue assets) and urban vegetated areas (green assets), not as separate systems as is the case today, but in combination.

Wageningen UR can make a contribution to climate-proofing metropolitan areas by deepening the understanding in the conditions under which the metropolitan ecosystem (vegetation, soil, water) effectively support climate adaptation. It can develop innovations in bringing stakeholders together and linking blue-green assets at various scales across urban areas, including both existing and newly developed green spaces together with urban water infrastructure and amenities in order to exploit their synergies and to obtain a wide range of additional co-benefits. Wageningen UR can develop ecosystem-based planning and design tools, approaches and guidelines to support climate-proofing the city. Wageningen UR contributes to adaptive capacity building of metropolitan regions by exploring ecosystem-based options, such as developing new, adaptive land and water management approaches, while dealing with the uncertainty that climate change brings with it.

Natural characteristics of river deltas make them vulnerable to complex problems such as flooding, subsidence, and salt water intrusion. Human impacts increase this vulnerability by reducing natural resilience, introduce additional problems, and devastate vital ecosystems. Both natural and human- built capital are at risk in river delta regions, making their protection essential. Wageningen UR could contribute to the climate-proofing of metropolitan areas.

III Resource-efficient cities

Global, EU, national, and regional economies are more and more impacted by a growing shortage of natural and other resources, with cities located vulnerably at the end of the trade chains. Wageningen UR will explore promising nature-based solutions for (re)use and production of materials and energy in city environments, in view of closing nutrient cycles and improving the urban environment. By tracing flows of energy, materials and waste through urban systems as a whole, changes and alterations can be made to close the loops to create circular metabolisms where resources are recycled and almost no waste is produced. To contribute to economic resource-efficient cities, Wageningen UR can develop monitoring tools, scenarios and strategies to track and record levels of sustainability in cities and regions around the world. It can develop designs and design tools to create greener and more sustainable infrastructure.

Smart technologies have the capacity to make urban life more eco-efficient in areas of energy, transport and water supply and sanitation. New services will be adopted quickly, if they respond to social practices and every-day needs. The smart use of buildings, public space and green infrastructure has a vast potential to enhance the liveability of urban areas and local economy. ICT provides opportunities for new interactive monitoring and learning systems. Wageningen UR should be a forerunner in interdisciplinary research of the interaction between smart technological solutions, housing, green infrastructures, ecosystem services and human behaviour.

Sharing knowledge is an essential component in smart urban development. Open-access data will enable new services, business opportunities and citizen participation. Extensive databases also permit new research and modelling that helps to optimise complex urban interactions. Forecasting and preparing for the future through scenario work are also important applications.

The (peri)urban Green and Blue infrastructure provides natural products such as water and biomass (urban forest, grassland, ...). The natural processes can also contribute to biological degradation of waste and pollution of soils and water. Wageningen UR can develop a better understanding of these capacities and translates these in technologies that are of interest to urban business, citizens and authorities while helping to reduce the ecological footprint of cities.

IV Food-sufficient cities

Metropolitan regions primarily depend on rural areas elsewhere for their food. Such relation creates unsustainable transport and storage mechanisms, and determines the high vulnerability of cities in times of food scarcity. Wageningen UR will develop new concepts such as Metropolitan Food Clusters and practical innovations that enable urbanized regions to produce a substantial part of its food demand in a sustainable way. The rapid urbanization and population growth of our world translates into an ever-growing demand for healthy, safe and high-quality food. However, on the production side, a series of challenges results from this very urbanization: Stress on the capacity to produce more efficiently and profoundly more sustainably while at the same time securing that a higher quantity of safe, healthy, high-quality and convenient food products can accommodate the urban demand. Meanwhile, these developments take place in a context in which prime agricultural land is absorbed by cities. This requires new adaptive solutions for the metropolitan food system.

Adaptive production systems require:

• Smart logistics: new food logistical concepts for local-4-local supply. New logistics concepts are required to make the metropolitan food supply more flexible and to link up with other flows of goods.

• Business and market development for companies that produce higher quality food (ranging from location selection to water- and nutrient supply and points of sales)

• Introduction of knowledge and expertise to produce and value quality food products (taste- references, production and supply-chain expertise, etc.)

• Process- and stakeholder management as well as understanding of the business sense to initiate and steer the development of MFC's to reach enough critical mass.

• Designing systems for the local environment as well as training local partners to successfully employ and improve on the systems.

The Metropolitan Food Cluster concept provides a solution by an approach to the facilitation and organization of the transition- and development process towards sustainable, highly productive, smart and high-quality food supply chains which allow the urban populations of the world to be fed in the future. Metropolitan solutions program investigates options for upscaling through research by design with multiple actors, horizontal integration, intelligent agro-logistics, and integrated design of hardware, org-ware and software. Since the 1990's Urban Agriculture has found itself a new role in helping "greening" cities in the western world, as well as continuing its usage in supporting many of the urban poor in the global South. It can become part of the new urban fabric, while including micro inner city initiatives to commercial peri-urban enterprises.

The environmental impacts of modern food chains, the marginalization of small-scale farmers, as well as climate change and military conflicts prompting large-scale refugee and migration movements, are putting food security in many regions and cities of the world severely at risk.

Foodmetres considers metropolitan regions around cities as places where socio-economic transitions, cluster-development and new agro-food value propositions are driven by urban demand and dynamics. Applying a string of metropolitan footprint assessment tools is essential for making food chains more sustainable and for optimizing metropolitan food supply in terms of volume and diversity. Metropolitan Solutions develops and integrates findings between these core approaches to urban food provision.

V and VI Crosscutting themes

Metropolitan solutions require integration on the above themes. This includes innovations in system and chain designs, spatial designs, governance and decision making. Smart cities and data driven planning and management are main ingredients of Metropolitan Solutions projects