

THE ROLE OF INFORMAL SYSTEMS IN URBAN SUSTAINABILITY AND RESILIENCE

A Review

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This background document provides an overview of the role of informal systems in urban sustainability and resilience, as well as a detailed regional perspective of informal system operations by sector.

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A REVIEW

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LIST OF ACRONYMS

CDR	Council for Development and Reconstruction
GCC	Gulf Cooperation Council
MENA	Middle East and North Africa
MOE	Ministry of Environment
MOEW	Ministry of Energy and Water
MOF	Ministry of Finance
MOIM	Ministry of Interior and Municipalities
MSW	Municipal Solid Waste
SWM	Solid Waste Management

PREFACE

Various drivers, ranging from rapid urbanization to a lack in public service provision, are contributing to growing informality across urban systems and an increase in dependence of urban residents on the services which these systems provide. The Climate Change and Environment team at the Issam Fares Institute, in partnership with the Lebanon office of the Friedrich-Ebert-Stiftung, a German non-profit institution working for the public interest, are conducting a research project that explores informality in the urban systems of transportation, water and wastewater, energy, solid waste management, and the use of public space.

The main aim of this research project is to identify, map and assess the economic, social and environmental impacts of these informal systems to help establish measures that would reduce their negative impacts, and “institutionalize” or “integrate” some of their aspects into the formal systems for improved overall urban sustainability and resilience. This research project includes two phases, the first phase being an initial background research phase on the role of informal systems in urban sustainability and resilience across the region. This background report lays the groundwork for the second phase of the project, a case study set in Beirut, Lebanon, which seeks to design and apply a sustainability assessment framework specifically designed for informal systems, which could then be applied to study these systems in urban settings across the region. The research conducted will lay the foundation for a set of informed policy recommendations that seek to enhance urban sustainability and resilience to climate change by learning from informal systems in urban settings.

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As part of the efforts involved in the production of this background report, a consultation meeting was held with experts from various fields, ranging from transportation engineers to urbanists and social development experts. The feedback received from guests who were kind enough to give us of their time and attend the consultation meeting was highly valuable. We would like to individually thank each of them: Farouk Merhebi, Gisela Nauk, Jala Makhzoumi, Jaoudat Abou Jaoude, Joy Jadam, Malak El Mousallamy, Marc Haddad, Patrick Ray, Roger Melki, Roland Riachi, Synne Bergby, Thomas Hegarty, Yara Daou, and Yaser Abunnasr. We would also like to extend our gratitude to Rabih Mahmassani, whose efforts were essential in all logistics related to the event.

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1. INTRODUCTION

Cities around the world, home to over 50 percent of the world's population, are at the forefront of the struggle for sustainable development. The Middle East and North Africa region has some of the largest urban areas in the world, with over 60 percent of its population residing in cities (World Bank, 2015; UNDESA, 2014). Cities are complex, made up of numerous systems essential for their functionality, including systems of resource provision, service provision, and transportation systems. When these systems fail to operate effectively, they result in numerous negative economic, social and environmental impacts, ranging from pollution and environmental degradation, to substandard quality of life for urban populations. As urban populations across the world and the region continue to grow, sustainable development challenges will become increasingly focused in urban areas, particularly in low- and middle-income countries where urbanization is occurring at the fastest rates. In addition to the challenges posed by rapid urban expansion, unplanned internal displacement and migration due to issues of security, political and economic instability, will only increase stress on urban systems that in many cases already struggle to meet the needs of their residents (UN-Habitat, 2011). These factors, in addition to the deficit in government provision of services as a result of weak management practices, are the main contributors

to the rise in urban informal systems, complementing or competing with formal services in order to meet the everyday needs of urban residents (UN-Habitat, 2011; Rossis, 2010). As these urban systems are significant contributors to the functions of every day urban life, there is thus a real need to understand the role they play in cities, and whether they contribute to a cities' sustainability and resilience.

The aim of the "Informal Systems in Cities in Lebanon and the Region" research project is to develop an understanding of informal systems and their role in the resilience and sustainability of cities in Lebanon and the region, and to produce policy recommendations that enhance urban sustainability and resilience to climate change. This will be achieved through identifying and mapping systems in water and wastewater, energy, solid waste management, transportation, and the use of public space in urban settings in Lebanon and across the region, and to assess their economic, social and environmental impacts. This document provides a review of informality as it presents itself in the systems of interest across the region, and the methodological approaches used to map and assess the environmental, social and economic impacts of these systems on the communities and urban settings within which they operate, and how they contribute to overall sustainability and resilience to climate change.

2. URBANIZATION AND VULNERABILITIES IN THE REGION

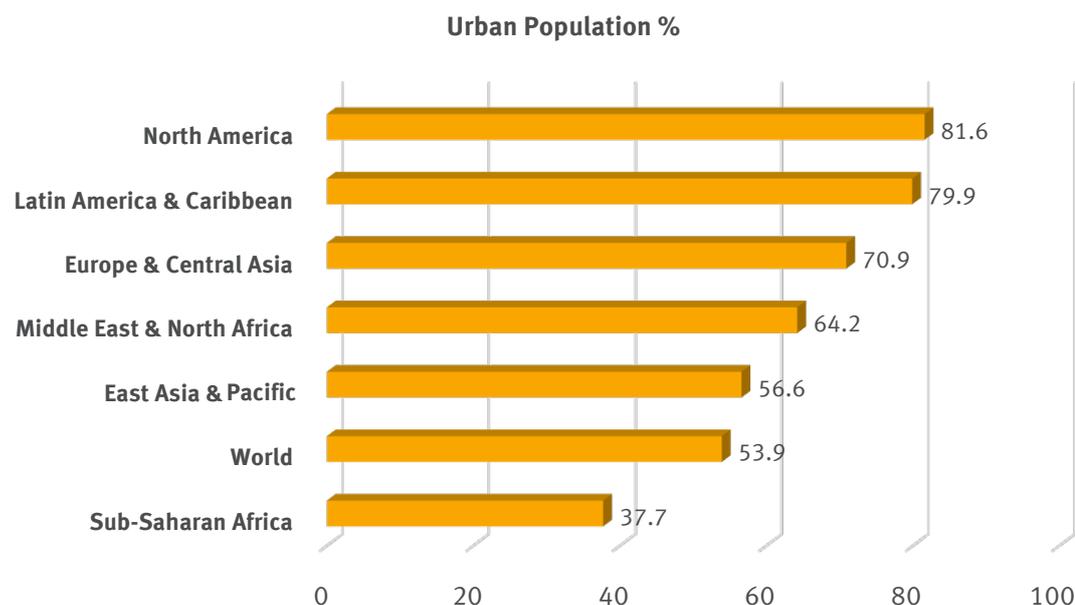
2.1 Regional Trends in Urbanization

Globally, more than half of the world’s population resides in urban areas, and this figure is expected to grow to reach roughly 66 percent by 2050. The extent of urbanization in the MENA region is already well above the global average, with over 64 percent of its population residing in urban areas, and home to some of the largest urban centers in the world (World Bank, 2015; UNDESA, 2014; UN-Habitat, 2012), as presented in Figure 1 below. Percentage of populations living in urban areas varies by country across the region, ranging from 43 percent of total population in Egypt, 75 percent in the West Bank and Gaza, 84 percent in Jordan, and over 90 percent in several of the Gulf Cooperation Council (GCC) countries (World Bank, 2015).

In Lebanon, over 86 percent of the population resides in urban settings, a figure that is projected to reach as high as 90 percent by 2030 (UN-Habitat, 2012; UN-Habitat, 2011). These populations are concentrated in the Greater Beirut region, with an estimated 44.5 percent of the country’s population as of 2010 (UN-Habitat, 2012). Urban sprawl is a major characterizing trend experienced in the country, mainly along coastal cities and the outskirts of Beirut and Tripoli (UN-Habitat, 2016; UN-Habitat, 2012). By 2030, the total urbanized area in the country is expected to be as large as 30,000 hectares (UN-Habitat, 2012). Growth is also being experienced on the peripheries of other large urban centers in the country including Saida, Sour, Jbail, Nabatieh, and Baalbeck (UN-Habitat, 2012; UN-Habitat, 2011). Managing such urban sprawl is critical in order to be able to minimize the negative impacts that often accompany this phenomenon, including impacts on access to adequate water resources, impacts on agricultural lands on the urban periphery, and the ability of authorities to provide adequate public services.

Figure 1

Percentage of population living in urban areas, by region (World Bank, 2016).



Drivers of urbanization vary across the region, but generally migration is the primary vector of urban growth. Migration includes rural-urban migration, as well as a long history of relocation of refugees of various nationalities to different urban areas across the region. In recent years, the fastest urban growth has been occurring not in urban centers, but along urban peripheries. The fastest growing cities in the region are typically along the coast, or are located along major transportation corridors, highlighting the importance of connectivity between urban systems in the region (UN-Habitat, 2012). Economic activity is also another important driver of urban growth, as it is commonly recognized that such activity is centered within urban areas and specifically larger cities. Unemployment and underemployment are a major challenge in rural areas, and rural-urban migration increases as a result. Unemployment of youth in Lebanon, roughly 26 percent, similar to rates across the region, is among the highest rates of youth unemployment in the world (UN-Habitat, 2012). Educational institutions are often centered in urban areas as well, and educational attainment is higher in urban areas across the region, presenting another incentive for urbanization. In addition to these significant drivers, higher quality health, sanitation, and medical services and facilities are often concentrated and more easily accessible in cities, further enhancing the appeal of urban areas (UN-Habitat, 2012).

These drivers, in addition to issues of security and civil strife in the region have highlighted inefficiencies in governance of urban areas, specifically in the lack of coordination between local authorities in urban areas in response to crises. Systems of basic services such as transportation systems, utility networks (water, wastewater, and electricity), public services, and emergency response assistance have struggled to respond to increasing demands in the face of instability in the region. Poor and vulnerable urban communities are often the ones to suffer most from these inefficiencies, and yet are the least engaged in urban sustainability and resilience efforts (Brown et al., 2014). This exclusion is particularly problematic in low- and middle-income countries, where the most climate-vulnerable towns and cities are concentrated (Revi et al., 2014), and where the majority of the urban poor rely on informal income-generating activities. Such activities in vulnerable communities tend to be insecure, unreliable and highly vulnerable to shocks and stresses – both climate- and non-climate-related (Mitlin and Satterthwaite, 2013; Sanderson, 2000). The sustainability and resilience of cities across the region will require significant

improvements of these urban services (UN-Habitat, 2012), and will depend on their ability to respond to existing and anticipated challenges, through various institutional, infrastructural and community-based solutions in a sustainable manner in both formal and informal systems.

2.2 Vulnerability of Urban Systems due to Climate

Urban systems are susceptible to a variety of threats that can be exacerbated if poorly managed, where inequalities, exclusion and vulnerability, especially among marginalized populations, will increase (UNDP, 2016). The vulnerability of cities goes beyond exposure to climate change impacts and extreme events; issues of security and man-made threats are also pressing issues in many urban areas. The urbanization process in developing countries is often unmanaged, resulting in inequitable, exclusionary and fragmented cities, with an increased risk of violence, especially among disenfranchised sections of the urban population that cannot access the formal political system (UNDP, 2016). Cities are highly vulnerable to climate change impacts, due to the fact that many cities are located in highly exposed coastal areas and riverbanks, which are prone to sea level rise, typhoons, storms, flash floods and landslides (UNDP, 2016). Vulnerability to climate and disaster risks in urban areas is also shaped by socio-economic variables like poverty, gender inequality, security of tenure, access to social safety nets, livelihoods and ecosystem services, and other inequities. Decisions to integrate measures such as disaster risk management and climate change adaptation into national development planning are critical for cities to build sustainability and resilience against future climate and disaster risks (UNDP, 2016).

As a largely arid region, the MENA region is particularly vulnerable to climate-induced impacts. Climate change acts as a “threat multiplier” for vulnerable countries and populations (Evans 2008, 2009). Climate change, coupled with demographic growth, will profoundly affect the availability and quality of water resources in the MENA region (Suppan et al. 2008; Alpert et al. 2008; Evans 2008, 2009). Assuming no change in water availability, expected population growth for 2025 will dramatically increase the water stress in the MENA region, as water availability per capita is expected to decrease between 30 percent and 70 percent across the region (Sowers et al., 2011). In addition to a reduction in precipitation, the climate change-induced rising of the Mediterranean Sea is expected to affect coastal communities (Sowers et al., 2011). Rising sea levels will require significant investments in protective structures and disaster response

measures (Dasgupta, 2007). In the absence of such investment it will be difficult to avoid widespread population displacement and the destruction of vital infrastructure. Additionally, the coastal aquifers of the MENA already suffer from seawater intrusion that causes salinization of thousands of groundwater wells (Sowers et al., 2011). Rising temperature is also of concern, especially with respect to energy consumption for cooling and refrigeration in hotter summer seasons. Transportation systems may also be impacted, as the sector can be subjected to a variety of internal and external shocks. Transportation systems serve as a lifeline system for rescuing people and economic values, and for repairing and restoring other infrastructure systems when they are disrupted (Mattsson et al., 2015). This becomes particularly important in extreme weather related disasters that are predicted to increase in frequency according to different climate change scenarios.



Source: Evers, David. *Cityscape in Cairo*. 2008. Wikimedia Commons, Cairo.

3. INFORMALITY IN CITIES

The concept of the “informal sector” first appeared in the early 1970’s, when Hart (1973) introduced the term in his work on informal employment in Ghana. Hart identified the distinction between the formal and informal, basing his distinction on types of employment. The variation between the formal and informal was mainly defined based on the degree of rationalization of the work, and whether labor was recruited on a permanent and regular basis for a fixed reward (Hart, 1973). The International Labour Organization (ILO) adopted a similar dichotomous approach in defining the informal and formal. This dualistic perception gained traction in the years that followed, but this seemingly ambiguous definition, which was focused on unorganized, self-employed individuals has become subject to serious scrutiny.

The definition of the ‘informal’ has been developed further in recent years. De Soto (1989) does not restrict informality to individuals operating in the labor market, but suggests that it is the actions and activities of these individuals that are in fact informal. Furthermore, De Soto acquires a legalist approach to informality, and consequently sees informal activity as a means of breaking down legal barriers. He introduces the term “informal entrepreneur”, describing individuals involved in the informal sector as economic heroes who manage to survive and prosper despite the state’s controlling interventions. This approach tends to neglect the inequity that results of dependence on services provided by an informal sector, especially when the government is unable or neglects its responsibility to provide such public services; urban dwellers are therefore forced to engage in activities and interactions that might be perceived to fall outside of what is recognized as “legal”. This results in a scenario where certain entities become effectively territorial monopolies and hold a disproportional and unchecked amount of power over individuals who are forced to engage in these informal transactions. In turn, this creates a logic of resource allocation, accumulation and authority where services come at the cost of political and electoral loyalty (Simone, 2004; Roy, 2009).

As the definition of informality evolved, it shifted from a dualistic definition, to one where informality is not necessarily defined as a separate sector, but rather a series of transactions that connect different economies and spaces to one another (Roy & Al Sayyad, 2004; Roy, 2005; McFarlane et al., 2012). Roy

(2009) provides a more comprehensive definition of this relationship between the informal and the formal, describing it as an “ever-shifting relationship between what is legal and illegal, legitimate and illegitimate, authorized and unauthorized”. It is important to note that defining or describing informality as involving no or insufficient coverage by formal arrangements might seem to suggest that formalization is inherently desirable. But informality may arise because the prevailing formal arrangements and regulations that are being applied are poorly designed or discriminate against certain segments of society. In this sense, informality is defined by people’s needs, it is not designed by planners, architects or bureaucrats at a city level who plan, predict and design for what they believe the city and its inhabitants will need into future years (Revell, 2010). The most recent revisions of the definition distinguish informality around three core concepts (Chen 2007, 2012; Meagher 2013):

- ▶ The informal sector, which refers to production and employment in unregistered enterprises;
- ▶ Informal employment, which focuses on employment outside of the labor protection regulations of a given society, whether formal or informal enterprises; and
- ▶ The informal economy, which covers all enterprises, workers, and activities that operate outside the legal regulatory framework of society, and the output that they generate.

Informality has many attributes; most notable is its ability to change and adapt in order to meet people’s needs in a reduced or non-bureaucratic manner. Informal sectors are nimble, flexible and adaptable, allowing for rapid transformation in response to changing variables, pressures and needs (Revell, 2010). Informal systems can in many cases be highly resilient, because they can continue to meet the unanticipated needs of cities when varying degrees of shocks occur. Also, informal networks may in many cases be quite ordered, but not necessarily through the regular channels or organizations such as governments or the legal system, but within the informal network itself (De Soto, 1989). It is important to note that while informal systems can be viewed as adaptable, flexible, responsive and even necessary; there are issues of concern stemming from growing informality, including issues of social injustice, environmental degradation, and economic impacts, which also cannot be ignored.

Informality, as it is used within this report and project, refers to informality within an urban service provision sector, i.e., the activities, actions, interactions and processes that occur at various stages in the sectors of water and wastewater, electricity, municipal solid waste, transportation and urban space. The term “informal systems” will be used when referring to the cumulative network of informal activities within each urban sector. These informal systems are considered as a functioning component of the whole service provision system, where they interact with formally recognized systems, either in direct competition with the formal systems or complementing the formal systems.

4. SUSTAINABILITY AND RESILIENCE IN CITIES

4.1 Sustainability

The concept of sustainability, as it was initially popularized by the United Nations, was defined as a development process “that meets the needs of the present without compromising the ability of future generations to meet their own needs” (Brundtland, 1987). Despite the flexibility of the concept, several principles of sustainability are commonly emphasized. These principles include (Drexhage and Murphy, 2010, p. 6):

1. “Commitment to equity and fairness, in that priority should be given to improving the conditions of the poorest and decisions should account for the rights of future generations;”
2. “A long-term view that emphasizes the precautionary principle;” and
3. “Integration, understanding, and acting on the complex interconnections that exist between the environment, economy, and society.”

The concept and its applicability have been highly contested since it was first defined, with various interpretations contingent on the purposes for which the concept is applied and the values of those using it (Drexhage and Murphy, 2010; Giddings et al., 2002). Even with variation among the definitions of sustainable development, it is generally accepted that the concept calls for a convergence between the three main sectors of economy, environment and society (Drexhage and Murphy, 2010; Folke et al., 2002; Giddings et al., 2002). Sustainable development is often presented as aiming to balance the benefits and costs of development across these sectors, with equal importance given to each sector. Depending on the interests and primary concerns of the specific country, urban setting, or community, either economic or environmental interests have been given priority in debates on sustainable development. This has resulted in the neglect of the social development aspects of sustainability, and some argue that since the acceptance of the term by the global development community, little progress has been made in implementing programs that improve the lives of the world’s poor and marginalized communities (Drexhage and Murphy, 2010; Bousquet et al., 2016). The economic, social and environmental sectors are frequently considered in isolation of one another, when in fact there are numerous and complex links between them (Drexhage and Murphy, 2010; Giddings et al., 2002).

With ambiguity surrounding the concept of sustainability and its application, the concept has found its footing in climate change, through the links between response to climate change and sustainable development (Drexhage and Murphy, 2010; Eriksen and Brown, 2011; Matthew and Hammill, 2009; Robinson and Herber, 2001). The various threats posed by climate change have numerous impacts across the social, economic and environmental sectors of global communities, thus making sustainable development extremely difficult. The ways in which societies respond to the challenges posed by climate change matter for future development, and should be designed to ensure social, economic, and environmental sustainability (Drexhage and Murphy, 2010; Eriksen and Brown, 2011; Matthew and Hammill, 2009).

4.2 Resilience

Resilience, a concept with varying definitions across disciplines, most commonly used in the field of ecology then spreading to the social sciences, is defined in its simplest form as the ability or capacity of a system and its components to absorb and recover quickly from shocks and disturbances, while maintaining or improving its basic structure and function (Ahern, 2011; Brown and Williams, 2015; Folke, 2006; IPCC, 2012; Leichenko, 2011; Walker and Salt, 2006). As knowledge of the depth and significance of the complex interactions between the social and ecological systems evolved, application of the concept of resilience shifted from the sphere of purely ecological systems to social-ecological systems. When applied to social-ecological systems, resilience includes several dimensions (Brown and Williams, 2015):

1. “The amount of disturbance the system can absorb and still remain within a stable state;”
2. “The degree to which the system is capable of self-organization;”
3. “The degree to which the system can build and increase the capacity for learning and adaptation.”

More recently, the concept of resilience has taken hold in the field of international development, with increasing interest in exploring how resilience can aid in coping with the challenges of climate change, political and economic instability, and social injustice, with a focus on the needs of those most vulnerable. Applied in the field of development, ‘development

resilience' is defined as the capacity of individuals, households, communities, urban areas, countries etc., to manage change by maintaining or transforming living standards when faced with shocks and stresses, while ensuring a certain level of livelihood over the long-term (Barrett and Conostas, 2014; Bousquet et al., 2016). The use of resilience varies across these fields, as one focuses on the resilience of the most vulnerable members or entities in a community, while the other focuses on the resilience of ecosystems and the social systems that rely on them.

The concept of resilience has also been gaining prominence in the discourse on urban areas and climate change. Enhancing resilience to climate change, as well as numerous other stressors and shocks, has become a major goal in many cities and urban areas across the world (Ahern, 2011; Leichenko, 2011; UN-Habitat, 2012). Resilience, as it applies to urban areas, or 'urban resilience' is defined as the ability of a city or urban system to withstand a wide range of stressors and shocks, while retaining urban identity, structure, key functions and systems processes (Ahern, 2011; Leichenko, 2011). It is important to note that when considering the resilience of urban communities, poor and marginalized communities are often the most vulnerable within these settings, and that these communities need to be able to sustain a certain acceptable level of livelihood, and their ability to do so is reflective of the resilience of cities within which they work and live (Bousquet et al., 2016; Da Silva, 2013; UN-Habitat, 2012). There are several identified descriptive characteristics of resilience that can be applied in urban policy and planning, and urban design strategies. According to Ahern (2011), these include multi-functionality of urban systems, allowing for redundancy to reduce risk, encouraging diversity in social, biological, physical, and economic systems, connectivity across systems and scales, and adaptability. Da Silva (2013) presents seven main qualities of resilient urban systems, which include reflectiveness, robustness, redundancy, flexibility, resourcefulness, inclusiveness, and integration.

5. LINKING SUSTAINABILITY, RESILIENCE, AND INFORMALITY

The ability of urban systems to adapt and transform over time is important for their continued survival and success in a dynamic environment where conditions are constantly shifting and changing, and where the impacts of climate change are eminent. Resilience is an important characteristic of any urban system that seeks to be sustainable, as it allows for evolution and growth (Leichenko, 2011; Revell, 2010). Resilience plays a role in sustainable development, by increasing the capacity of systems to cope with the unpredictable challenges and threats that they may face, making the sustainability of such systems dependent on their resilience (Fiksel, 2006; Folke et al., 2002; Perrings, 2006). One of the most noted characteristics of informal systems, which as mentioned previously play a significant and growing role in urban function, is the resilient nature of these systems. Thus if resilience is an important trait of sustainable urban systems, one may make the assumption that informal systems play a certain role in sustainability due to their resilient nature. However this assumption cannot be made lightly, as the resilience of informal systems does not necessarily equate with the sustainability of these systems, and the communities they support over the long term. In order for cities to be sustainable, they must operate in a manner that provides for equitable livelihoods for all including present and future generations, while maintaining prosperous social, environmental, and economic dynamics (Ahern, 2011).

It has become evident that the main mode of urbanization in developing countries is informality to the extent that now, more than half of the population can be classified as informal (Yiftachel, 2009; Revell, 2010). Informal systems are often left out of policy and planning research, and the urban planning process due to the difficulty of gathering data and information about them, or because the informal actions themselves may not be viewed as undesirable (Yiftachel, 2009). However, in order to provide meaningful policy and planning recommendations for better resilience and sustainability of these systems, the connections between the informal and formal systems need to be better understood, mapped and assessed. There are doubtless lessons that policy-makers and planners may learn from informality and its ability to be dynamic and responsive to the needs of urban residents, qualities which urban systems in order to be able to respond in a similar fashion

to meet the needs of their residents. While learning from informal urban systems may be valuable for urban planning, a cautious examination of the true drivers of informality should not overlook the often politicized aspects of existing informal systems (Roy, 2009). In order to do so, an understanding of the drivers of informal systems, the manner within which they operate in relation to the formal systems, and an assessment of the impacts these systems have, both positive and negative, on social, economic and environmental aspects of urban communities is necessary.

6. THE URBAN SYSTEMS

6.1. Water and Wastewater

The MENA region is one of the most water scarce regions of the world. As the region's population increases and climate change alters weather and water cycles pressure is rising on water resources and consequently on water availability. Water availability issues are not only linked to natural and physical existence, but may be attributed to management of water resources. As such water scarcity can be the product of a physical inexistence of water as well as deficient governance of the water resources (Emtairah, Echavarria, & Hamann, 2005). A key reflection of governance is the quality of water and wastewater services in urban and rural areas. In the MENA region, governance of the water sector is central in nature with few countries allowing for

some role for local authorities and stakeholders. For example, even though Tunisia and Jordan have a very centralized form of water governance – thus a dominant formality – with the Ministry of Agriculture, Hydraulic Resources and Fishing in the former and the Ministry of Water and Irrigation in the latter tasked with managing the water sector, both countries allow a role for water users associations (WAUs), private companies and local communities – a “regulated” type of informality. Figures 2 and 3 show the organization of the formal water sector in two countries in the region. Lebanon on the other hand has a highly centralized water governance approach with no role for local authorities or WAUs.



Photo credit: Nadim Farajalla

Figure 2
 Formal water management in Tunisia (Haydamous et al., 2016)

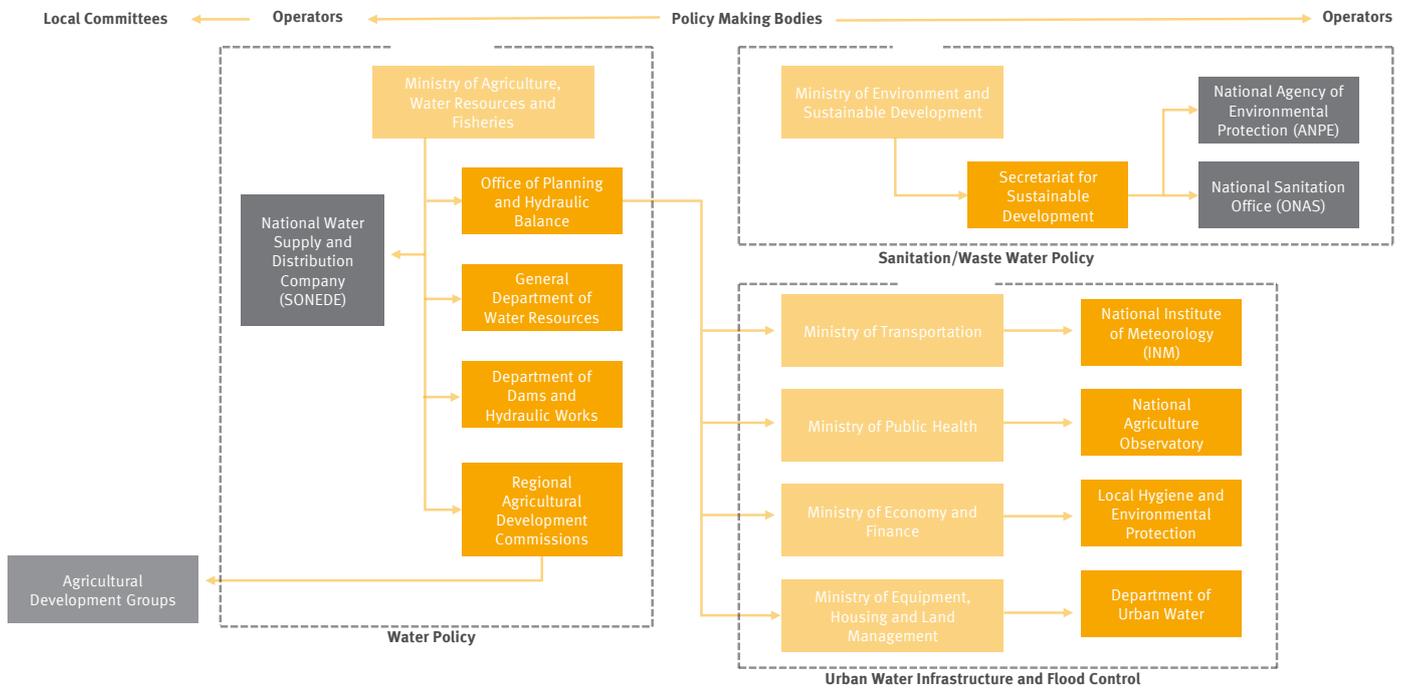
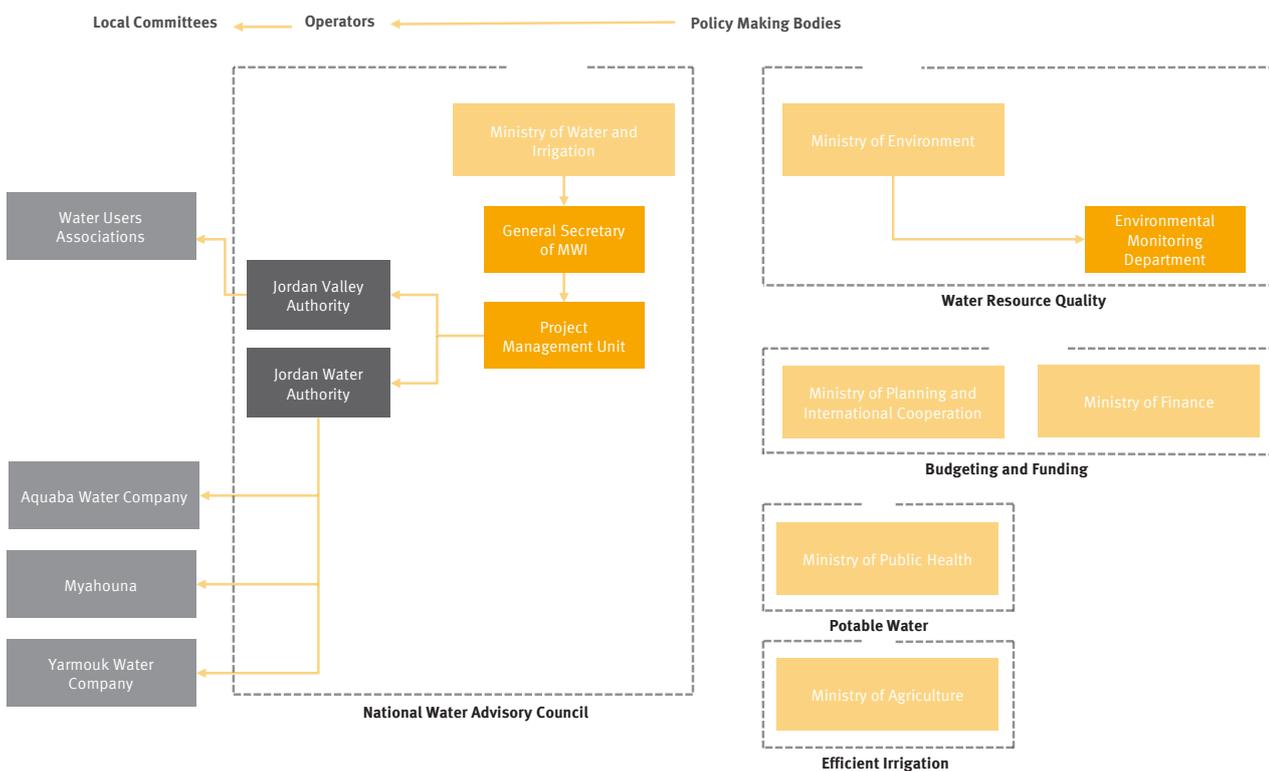


Figure 3
 Formal water management in Jordan (Haydamous et al., 2016)



Water Supply Systems

A formal water distribution system is typically composed of three components. The first one is water sources, and it comprises of groundwater and surface water sources (Davison et al., 2004). The second component includes conveyance and distribution systems where water is usually carried through a network of pipes, stored intermittently and pumped where necessary, in order to meet the demands and pressures in the system (Trifunović, 2006). The main difference between the conveyance and distribution systems is that the former includes the main transmission lines of large and fairly constant capacities, and the latter consists of a network of smaller pipes with numerous connections that supply water directly to the users. The conveyance and distribution system is dependent on its pumping. The final component of the system includes the storage capacity. Water storage facilities are a part of any sizable water supply system. They can be located at the source, at the end of the conveyance system or at any other favorable location including underground level, ground level or at an elevated level using water towers (Trifunović, 2006). The formal water distribution system covers the entire system from the source to the end-users' delivery, including conveyance, distribution and storage.

Drivers of Informal Urban Water Systems

The efficiency of the formal water supply systems is impacted by different global and local drivers including climate change, population increase, and mismanagement. Climate change is affecting water resource availability through an expected reduction in rainfall which is coupled with increasing rates of evaporation and evapotranspiration due to rising temperatures. This combination of significantly drier and substantially warmer conditions will result in an extended hot and dry climate (MOE 2011). Moreover, water demands are expected to increase as a result of population growth accentuated by internal migration (Makdisi & El-Khalil 2013), and more recently the influx of Syrian and Iraqi refugees in the region (Jordan, Lebanon and Turkey) driven by the turmoil in Syria and Iraq. For example in Lebanon, the inflow 1.2 million refugees, has increased the country's resident population by more than 30% (UNHCR 2014). Diminishing water resources coupled with the increase in water demand are adding more pressure on available water resources (Amery & Wolf 2000; Yamout & El-Fadel 2005; Jiménez & Asano 2008). Even though Lebanon seems to have sufficient water resources to meet its needs compared to its neighbors (Frenken 2008; Halwani 2009; World Bank 2013), future projections on water availability are

less optimistic (Bou-Zeid & El-Fadel 2002; Vörösmarty et al. 2002; Nimah 2008; Shaban 2011; Issam Fares Institute et al., 2014; ECODIT 2015). Finally, mismanagement within the formal distribution system exacerbates the situation even further as it contributes to an imbalance between water supply and demand in Lebanon (World Bank, 2009). These factors are leading to inadequacies in water supply in terms of quality, quantity, and continuity of service, forcing consumers to resort to the use of alternative water sources (Yamout & Jamali 2007; World Bank, 2009; Smiley, 2013; Kooy, 2014; and Misra, 2014), and establishing a system composed of a mix between both formal and informal activities.

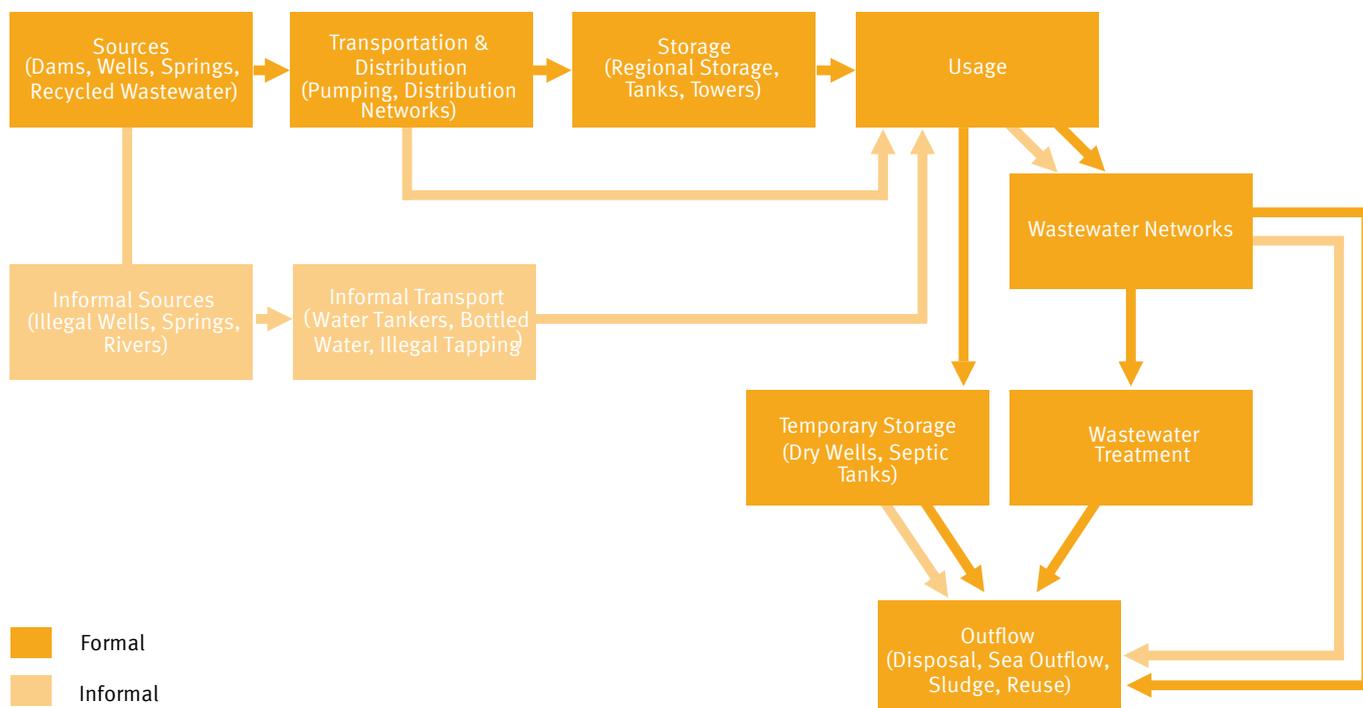
Informal Water Systems

The multiple elements that make up water supply systems make defining informal water systems complex. Some components may be informal and while others are formal. In some cases the formal and informal complement each other, where for example the informal system extracts water from wells and uses the infrastructure of the formal system for conveyance and distribution (Cleaver 2002; Moretto 2007; Ahlers et al. 2014; Cheng 2014; Kooy 2014; Misra, 2014). In other cases the informal system is not only used as a necessity to meet the needs of users, needs that are not met by the formal system, but also as a choice, based on perceptions of poor quality of water provided through the formal piped networks (Kjellén & McGranahan 2006; Kooy, 2014; Farajalla et al. 2015; Liddle et al. 2016).

Studies in various cities of the Global South have shown that the informal water system is multifaceted and includes alternative water sources and distribution systems. Informal activities exist in parallel to the formal system, as illustrated in Figure 4. The system is composed of different actors and actions that can combine both formal and informal practices. The first set of actors includes the bottled potable water companies. In the case of Lebanon, these companies extract fresh water from aquifers in the mountainous regions, filter, bottle and sell it in different sizes, ranging from 0.5 L to 19 L (World Bank 2009; ECODIT 2015). Most of these types of companies are licensed; however in some cases, they are unlicensed and some use questionable water sources – especially in terms of quality. These unlicensed companies use the same distribution methods as the licensed companies (selling water in various bottle sizes) through some of the same vendors. The main risk in this case, is that, since these companies are unlicensed and unmonitored, they may be selling water of questionable quality, potentially exposing consumers to health risks (Semerjian, 2011).

Figure 4

Informal activities within formal water provision systems



Another set of informal actors includes fresh water tankers, as shown in Figure 5. The tankers distribute water that is either extracted from private wells or illegally from public wells. When households face water shortages, they resort to these tankers (Iyer 2010; ECODIT 2015). In some cases the wells may have been legally drilled and the tankers may have permits to transport water while in others either the wells or the tankers, or even both, may not have the proper permits to operate. A final set of actors are individuals that either extract freshwater from “private” wells that are located directly under their buildings (Yamout & Jamali 2007; Saadeh 2008; World Bank 2009; ECODIT 2015), or connect illegally to the existing water supply infrastructure. Other activities include illegal extraction from surface water (from ephemeral or permanent streams) (Moretto 2007; Allen et al. 2014; Kooy 2014; Cheng 2014; Misra 2014; Liddle et al. 2016), and illegal tapping of the public networks (Moretto 2007; Cheng 2014; Kooy 2014; Misra 2014; Iyer 2010; ECODIT 2015).

Figure 5

Image showing a water tanker truck in Beirut, Lebanon



Taha El Baba, Jad. 2016. Beirut.

These cases are not restricted to Lebanon but are also present in other countries throughout the MENA region. The severity of water shortage has pushed some countries to resort to non-conventional water sources such as seawater desalination, reuse of treated wastewater, and the use of non-renewable fossil groundwater (Barghouti, 2010). For example, in Yemen, the response to water scarcity has been the emergence of informal water markets and informal water user groups (Jagannathan et al., 2009). In Palestine, farmers are resorting to informal systems, by purchasing water by tankers because of water shortages (Stephen, 2010).

Impacts

The inability of the formal system to meet water demands pushes consumers to resort to their entrepreneurial shrewdness (Moretto 2007; Ahlers et al. 2014; Cheng 2014; Kooy 2014; Misra 2014; Liddle et al. 2016) and develop informal “alternative” water systems, including extraction, treatment and distribution (Moretto 2007; Ahlers et al. 2014; Cheng 2014; Kooy, 2014; Misra 2014). The informal water system alleviates the immediate water needs of many communities (Moretto 2007; Cheng 2014; Kooy 2014), and improves water accessibility to neighborhoods that are not connected to the piped infrastructure (Kooy 2014; Liddle et al. 2016). In some case it is recognized as an important source of resilience, particularly for communities who either cannot afford or cannot secure water solely through formal systems (Ahlers et al. 2014; Cheng 2014; Liddle et al. 2016). The informal system is also characterized by being decentralized and small (Solo 1998; Kjellén &

McGranahan 2006; Moretto, 2007; Ahlers et al. 2014; Cheng, 2014; Kooy 2014; Liddle et al. 2016).

Informality in the water sector, is unregulated by its nature (Misra 2014), and can have numerous impacts on the environmental, social and economic aspects of urban communities. Seawater intrusion is a major impact of the informal water sector in Lebanon due to over extraction from coastal aquifers (Saadeh 2008; ECODIT 2011; ECODIT 2015). This process is very difficult to reverse and also damages the formal water supply network, residential plumbing and utilities. One of the main economic and social impacts is the added financial cost of acquiring additional water sources provided through the informal system. Despite the fact that informal solutions are often shown to be financially feasible for some low-income communities, studies have shown that they can result in higher costs and tariffs to end-users (Cheng 2014). For example, in Beirut, Lebanon, the average household subscriber is charged 0.6 USD per 1m³, according to the formal water utility subscription terms. However, effectively the water is supplied at less than a third of the promised amount, resulting in residents effectively paying between 10 USD and 15 USD per 1m³ to satisfy their needs by supplementing with bottled water and water provided through tankers (Yamout & El-Fadel 2005; Yamout & Jamali 2007). Moreover, the cost of water tankers increases in the dry season and in droughts in part due to price gouging by distributors. Finally, impacts can include possible risks to public health, as most of these informal sources are not monitored or regulated, and therefore the quality of water provided is unknown and may be contaminated (World Bank, 2009; Yamout & Jamali 2007; Iyer 2010; Cheng 2014; Liddle et al. 2016).

Case Box 1. The Case of Water Governance in Tunisia

As is the case in many countries in the MENA region, Tunisia suffers from some of the common threats to effective water governance. A national assessment of the water sector in Tunisia identified the most pressing risks and challenges, which include but are not limited to: fragmentation in the decision-making process, a general lack of coordination among relevant institutions and stakeholders, poor allocation strategies, weak enforcement of anti-pollution and environmental quality legislation, and a lack of transparency in permitting and water quality monitoring requirements.

As part of the Regional Capacity Building Programme on Water Integrity for the MENA Region, a program implemented by the UNDP Water Governance Facility at SIWI, Tunisia is making the effort to address the challenges to the water governance

sector in the country. Several recommendations for improvement of national water governance may have implications for the informal water sector, particularly efforts that seek to target and include all actors, stakeholders and users of water resources. Recommendations for improvements include assessing local water management schemes in order to map priorities, challenges, and local solutions, improving monitoring and regulation of groundwater extraction, as well as supporting the development of sustainable water management frameworks that utilize available water resources effectively while including all relevant stakeholders (SIWI et al., 2016). With the implementation of these and other similar recommendations in countries across the region, it will be critical that all stakeholders in the water sector are involved, including both formal and informal entities, if such recommendations are to be truly effective.

Wastewater Systems and their Impacts

Once water is used, it can essentially be categorized as wastewater outflow. The formal wastewater system is composed of three stages, including wastewater collection, treatment and discharge (MEW, 2010), as illustrated in Figure 5. Informal wastewater systems follow similar pathways and characteristics as the water distribution systems. Informal wastewater systems develop, when urban areas either lack wastewater collection or sewage treatment (or both), and wastewater treatment and collection services are difficult to access or too costly to subscribe to (Kjellen & Mcgranahan 2006; WHO 2006; Raschid-Sally & Jayakody 2009; Scheierling et al. 2011; Raschid-Sally 2013; Dreschel et al. 2015). These deficiencies are sometimes the result of rapid and unregulated urbanization that surpasses the development capacity of the formal system (Barkey et al. 2011). In many cases the informal systems may be larger in size than the formal systems in developing countries, reaching as high as ten times the levels of formal reuse (Scott et al., 2010).

The most common informal wastewater solution is the use of septic tanks that need to be regularly emptied by suction tankers (Kjellen & Mcgranahan 2006). Some systems are limited to illegal connections to the formal sewage systems by households. Other informal wastewater systems include sewer systems that are installed by the residents of informal settlements and that connect either to the city-mains or to a nearby river. For example, Pakistan holds the world's largest community-managed sewer construction program, which was stimulated and supported by a local NGO, the Orange Pilot Project (UN-Habitat, 2003). Another example of self-help systems are found in Lebanon in the neighborhood of Hayy el Sellom, Beirut. In the 1970s and 1980s, through several self-help projects the community extended the sewer networks, and dumped the wastewater in the Ghadir River, which runs close to the neighborhood (Fawaz & Pellin, 2003).

Informal wastewater systems relieve communities of the generated wastewater; however since they are unregulated, this may be done at a significant cost to public health. Septic tanks rely on regular suction truck services that are sometimes unregulated, as they rely on operation licenses and often times these licenses are not obtained (Kjellen & Mcgranahan, 2006). This poses a significant threat to water quality and health (Barkey et al., 2011). Improper disposal of wastewater exposes communities to waterborne illnesses, an issue that is of even more concern in congested urban areas (Barkey et al., 2011; UN-Habitat, 2003).

6.2 Electricity *Electricity Systems*

Electricity sectors can vary from vertically integrated monopolies with a single electricity provider (usually the government utility) to open competitive markets with multiple buyers and retailers. A vertically integrated utility is often a state-owned monopoly that performs most or all functions of the power market including generation, system operation and maintenance, transmission, distribution and collection (World Bank, 2008). In the MENA region most of the power markets are vertically integrated monopolies; however, few markets in the region are at different stages of liberating their electricity markets. Tunisia, Morocco and Jordan among others are starting to separate the various components of the vertically integrated utility into smaller groups or functions. In these countries, where the unbundling process took off, the private sector is able to penetrate the electricity sector at different stages of the energy sector. In all cases, whether in the case of a government-run monopoly or an open electricity sector, informality can occur at every stage of this service provision sector.

Electricity systems are under various threats that can cause disruption; climate change is one of these threats that is not yet fully accounted for in planning efforts (IPCC, 2013). In Lebanon, extreme weather events, in addition to man-made threats like an Israeli war, are both threats which are perceived as equally imminent. For example during the most recent Israel-Lebanon War of the summer of 2006, the Jiyeh power plant was targeted resulting in the leakage of between 10,000 to 15,000 tons of fuel oil into the Mediterranean, the worst in the sea's history (Service, 2006). Nonetheless, threats from climate change vary when considering different power options. Rising sea level and storm surges directly threaten thermal power plants that are usually located near water bodies making them vulnerable to coastal flooding (U.S. Department of Energy, 2013). Higher ambient air and water temperatures could also affect thermal power plants by reducing the efficiency of electricity conversion (Mideksa and Kallbekken, 2010). Hydropower is not immune to climate change, as changes in precipitation patterns and temperature could alter the amount of river flows, thus negatively affecting hydroelectricity production (Wilbanks et al., 2007). Solar power could also be negatively affected, resulting in reduced efficiency due to higher temperatures, while an increase in clouds would affect the incident solar radiation (European Commission, 2013a). Climate change does not only affect electricity generation but also distribution and transmission. Substations and underground electricity networks

can be inundated during floods and overhead cables can be destroyed in violent storms (Peters et al., 2006; Walliman, 2012). Lastly, consumption is also affected, rising temperatures coupled with population growth are expected to seriously increase electricity consumption (Mideksa and Kallbekken, 2010). It is also predicted that the frequency and intensity of heat waves will in turn increase peak demand periods of sustained high electricity usage especially in summer seasons (Nierop, 2014).

Drivers of Informal Electricity Systems

Regionally, and in many countries in the Global South, entire electricity sectors are failing for various reasons, forcing urban residents to turn towards alternative power sources. In these cases informality dominates the electricity provision sector; in Nigeria 60 million people own their power generators (Energy Commission of Nigeria, 2009); in Iraq the national grid struggles to provide more than six hours of electricity a day. Most Iraqis turned to private generators but with time have switched to private generator operators who, for a fee, provide power to an entire neighborhood when the national grid is down (Daily Star, 2013; Aljazeera, 2016). In Lebanon, informal electricity is predominant. It is estimated that private diesel generators provide a 37% share of the total supply of electricity (Ministry of Environment, 2015). The limited generation capacities and the increasing demand prevents Electricite du Liban (EDL) from meeting the entire electricity demand and the gap between EDL's electricity production and total electricity consumption grows bigger every year. This resulted in ongoing power shortages and long hours of blackouts; local communities responded by reverting to alternative power supply systems such as private power generators, backup tools such as UPS's for computers and informal localized power generators subscription (Lebanon UN Habitat, 2011).

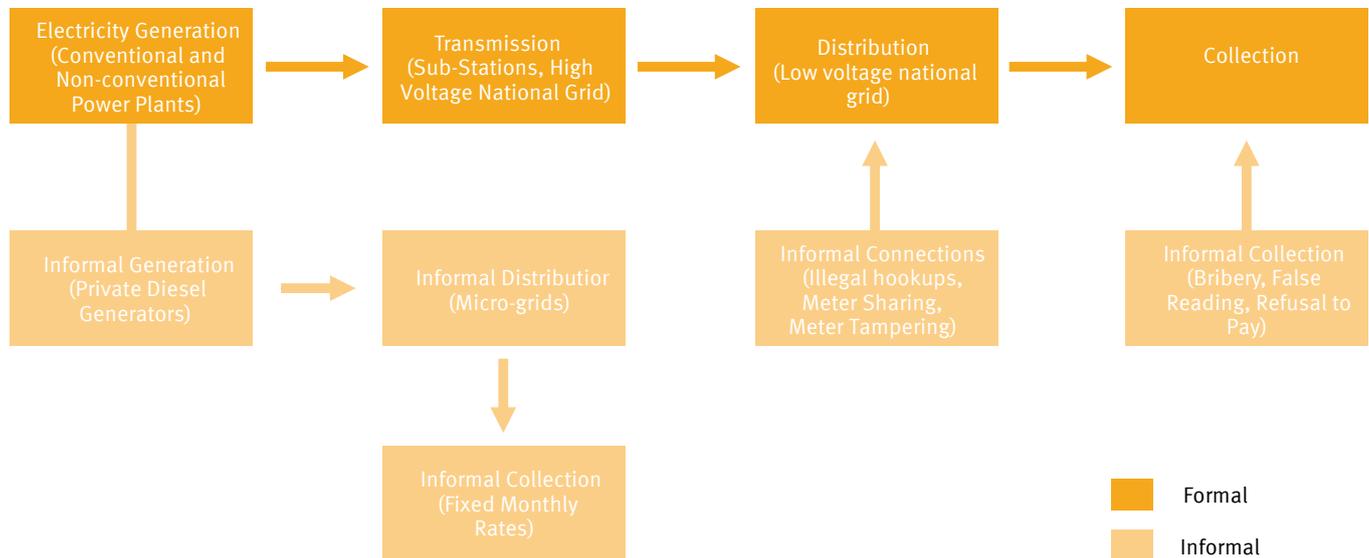


Source: Simone D. McCourtie. Powerlines cover the cityscape. World Bank Photo Library.

The Informal Electricity Sector

Informal electricity is usually referred to as informal connections (Mimmi, 2010), electricity theft, unauthorized use, illegal hook-ups or non-technical losses of the electricity network (Smith, 2004). Such informality is ubiquitous; it occurs in every electricity system. For example, in the U.S. electricity theft costs between 0.5% and 3.5% of annual gross electricity revenues and go as high up as 15% in some developing countries (Smith, 2004); it is reported that in Lebanon the figure is as high as 25% (MoEW, 2010). During distribution, illegal tapping, meter sharing and meter tampering are all ways that electricity consumers turn to in order to reduce the electricity bill (Mimmi, 2014). At the collection stage electricity users might bribe the utility representative to ensure a lower/false reading or they can even sometimes simply refuse to pay (Verdeil, 2016; Mimmi, 2014). Informality can also occur at the production level; these systems are usually found in informal settlements or slums and are sometimes referred to as the end-of-the-line (Mimmi, 2014; Mimmi, et al., 2010; Gaunt et al., 2012). The residents of these areas are forced to rely on alternative energy sources whether it's kerosene for light, or diesel generators for electricity. But informal electricity production can also occur in some electricity markets. This is where differences between varying forms of the electricity sectors start to matter. In electricity sectors where the government utility is the only provider of electricity, whole informal networks start appearing when the government fails to provide this service. These informal systems usually rely on medium-sized diesel generators, distribute electricity using their own micro grids, collect bills in this informal economy, maintain the network, and even have some kind of a customer service operation. The generators create a market plagued with territorial monopolies that act as veritable cartels but they remain the only source of electricity for a wide range of users, ranging from single apartments/houses to entire neighborhoods, business firms, service provision utilities, irrigators, hospitals, universities and factories. The informal activities that occur within the electricity sector are described in Figure 6 below.

Figure 6

Informal activities within formal electricity provision systems*The Case of Informal Electricity in Lebanon***Case Box 2. The Legal Context of Diesel Generators in Lebanon**

Private diesel generators are considered illegal according to the strict texts of the Lebanese Electricity Laws and Regulations:

- ▶ The Lebanese electricity sector is monopolized Fardoun et al., 2012
- ▶ In 1964, the establishment of the EDL public institution was mandated the responsibility of the generation, transmission and distribution of electrical energy Fardoun et al., 2012
- ▶ Power generation plants in Lebanon are divided into two categories: thermal and hydraulic. EDL owns and operates six thermal power plants. (El-Fadel et al., 2009)
- ▶ The hydraulic power plants are divided into Litani River Authority (public company), Al-Bared and Ibrahim (private companies), and Kadisha (property company of EDL) power plants. (El-Fadel et al., 2009)
- ▶ Law 462 of 2002 paved the way for an alternative financing mechanism for private sector electricity generation. (El-Fadel et al., 2009)
- ▶ Law 462 does have many shortcomings, such as not catering for the export of electricity from microgenerators at a household level. (El-Fadel et al., 2009)
- ▶ Law 462 was subsequently amended by law 775 dated 11/11/2006 that foresees independent power production for personal use. (<http://jo.pcm.gov.lb/j2006/j54/wfn/n775.htm>)
- ▶ Law 775 is currently under review; it deals mainly with technical, environmental, safety and other regulatory aspects of private power production, but no provisions allowing private power producers to sell electricity are planned.
- ▶ Ministerial decision, dated 14/12/2011, regulating the tariffs of private electricity generators which state that the generator owners are enforced to follow the guiding prices issued by the MOEW. The ministry has since issued guiding prices at the beginning of every month since January 2012.

The legal context discussed above portrays the informality in play within the private diesel generator sector. As noted in Case Box 1, the law clearly prohibits private entities from selling electricity; however, in a later ministerial decree the government attempted to regulate this market by setting the price per kWh. The situation in the Lebanese electricity provision sector best describes informality as the ever-shifting relationship between what is legal and illegal, regulated and unregulated, authorized and unauthorized.

The informal micro-grids are an industrious solution of a more resilient electricity system. They can reduce risk of total blackouts adding to the reliability of the whole system by complementing it, and can demonstrate high adaptability by quickly responding to operational malfunctions and growth in demand. The generators used in these systems are highly efficient, they require low capital investments, they require low technical skills and minimal maintenance costs. The result is an informal system that is highly responsive, adaptable, flexible and nimble. The informal electricity sector is a clear example of the residents’ resilience in the face of a failing of governmental service. But one cannot ignore the negative externalities that stem from hundreds of diesel generators scattered across an urban area.

Impacts

Informal electricity networks can be perceived as a sign of citizens’ resilience in the face of the lack of the government service provision; however, these systems present high economic costs to their members. Due to interrupted formal power supply and the need to find alternative sources, businesses, industries and households are forced to pay a double electricity bill. This negatively impacts household income and represents an additional cost that ideally, should be

avoided. Furthermore, informal electricity takes the shape of territorial monopolies where ease of entry into this market is almost impossible. The owner(s) of generators set the prices and the end user is often left with no choice but to subscribe to the only neighborhood or street generator available.

Additionally, the informal electricity sector is a big contributor to greenhouse gas emissions (Table 1). CO2 emissions from private generators accounts for 11.97% of total CO2 emission in Lebanon (MOE, 2015). The current use of private generators to meet electricity demands during power rationing periods is leading to significantly higher airborne pollution levels and inhalation exposure to carcinogenic compounds (Shihadeh et al., 2013). In contrast, formal electricity power plants are more centralized usually affecting a limited area. The hum of diesel generators is the background noise for residents who rely on them for electricity during these daily outages; noise is a forgotten source of pollution which can have adverse health impacts such as hearing impairment, hypertension, ischemic heart disease, annoyance, and sleep disturbance (Vermeer, 2000).

Lastly, at the social level, the electricity utility in Lebanon does not treat its consumers equally. Beirut is provided with more electricity than the rest of Lebanon, reinforcing inequalities between sectors where more importance is given to the banking and tourism sectors concentrated in Beirut (Verdeil, 2016). The informal electricity sector also reinforces the country’s inequalities; the politics created by private energy grids are not only highly uneven between social classes, but also geographically fragmented according to specific local political contexts (Verdeil, 2016). The current situation highlights the difficulties in achieving shared governance of electricity at the city level (Verdeil, 2016).

Table 1.

Fuel consumption and GHG emissions of private generation and thermal power plants for 2011 (MOE, 2011)

	FUEL USED (TONNES)	GHG EMISSIONS (TONNES CO2EQ.)	ESTIMATED PRODUCTION (GWH)	EMISSION INTENSITY (TONNES/GWH)
Private Diesel Generators	741,651	2,370,931	3,326	713
Formal Electricity (Thermal Power Plants)	2,459,225	7,722,277	10,751	718

Source: Ministry of Environment Lebanon, 2011

6.3 Solid Waste Management Solid Waste Management Systems

As urban areas continue to expand, and their populations continue to grow, managing solid waste in a healthy and effective manner will become ever more challenging, particularly for cities in low- and middle-income countries (Scheinberg and Savain, 2015; Hoornweg and Bhada-Tata, 2012; Agamuthu, 2010; Gerdes and Gunsilius, 2010; Scheinberg et al., 2010a). Increasing urbanization, rising incomes, and in turn more intensive consumerism, results in increases in the amount and toxicity of wastes produced (Hoornweg and Bahada-Tata, 2012; Scheinberg et al., 2010a). Based on a World Bank report published in 2012, , cities worldwide generate approximately 1.3 billion tons of municipal solid waste per year, a figure that is expected to increase to approximately 2.2 billion by tons per year by 2025 (Hoornweg and Bahada-Tata, 2012). The MENA region, responsible for approximately 6 percent of the world's solid waste generation, produces 63 million tons per year, with an average of 1.1 kg per capita per day (Hoornweg and Bahada-Tata, 2012). Per capita, residents of urban areas are responsible for generating as much as double the amount of waste generated by rural areas across the region, and with urban populations expected to grow along with their waste generation, it can only be expected that urban populations will place an even larger burden on municipal solid waste management (Hoornweg and Bahada-Tata, 2012; GIZ, 2012).

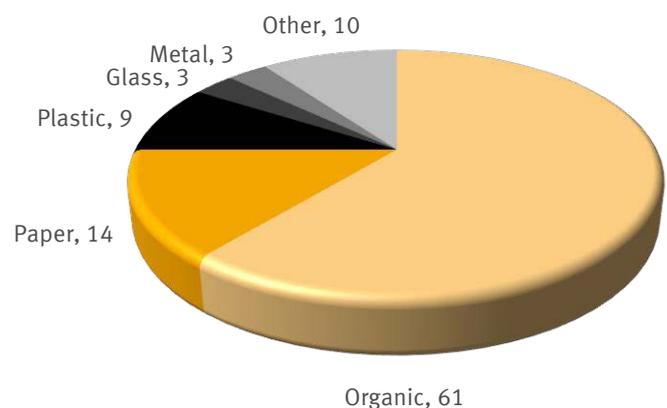
Municipal solid waste (MSW) varies in definition depending on the country considered, but is typically defined as “wastes generated by households, and wastes of a similar nature generated by commercial and industrial premises, by institutions such as schools, hospitals, care homes, and prisons, and from public spaces such as streets, markets, slaughter houses, public toilets, bus stops, parks, and gardens” (Schneiberg et al., 2010a). In some cases, municipal solid waste may also include construction and demolition wastes as well, which is mainly building rubble, concrete, and masonry. Municipal solid waste can be generally categorized into several types of wastes, which include: organic, paper, plastic, metal, glass, and ‘other’ (Hoornweg and Bhada-Tata, 2012; GIZ, 2012). The composition of waste in any urban setting is dependent on a wide range of factors, including levels of economic development, location, climate, cultural habits, and consumption patterns, and may change as urban areas expand, grow in population size, and experience economic growth (Hoornweg and Bhada-Tata, 2012; Scheinberg et al., 2010a). In the MENA region, around 60 percent of waste generated is composed of organic materials, a

fraction that is much higher compared to other regions in the world (Hoornweg and Bhada-Tata, 2012; GIZ, 2012). The composition of waste in the region is broken down by type in Figure 7.

Municipal solid waste collection rates vary by country, but on average 85 percent of waste is collected in urban areas across the region (GIZ, 2012). Based on available data for the region, it is estimated that as little as 4.4 percent of municipal waste is composted, 4.8 percent is recycled, 22.3 percent is disposed of in sanitary landfills, and over 68 percent is openly dumped (GIZ, 2012). Landfills are significant contributors to methane gas emissions (as well as several other greenhouse gasses), accounting for approximately 12 percent of total global methane emissions (Schneiberg et al., 2010a).

Figure 7

Waste composition in the region, as percentage of total waste generated (Hoornweg and Bhada-Tata, 2012)



Local government authorities, typically at the level of municipalities or governorates, are formally responsible for managing collection and disposal of municipal solid waste (Scheinberg and Savain, 2015; GIZ, 2012; Hoornweg and Bhada-Tata, 2012; Agamanthu, 2010; Scheinberg et al., 2010a). However, this is not the case in all countries in the region, where in several countries specialized agencies are responsible for overseeing solid waste management solely or in cooperation with municipal authorities (GIZ, 2012). Algeria and Tunisia both have specific agencies dedicated for solid waste management, L'Agence Nationale des Dechets and L'Agence National de la Gestion des Dechets, respectively (GIZ, 2012). These formal actors typically contract waste collection and disposal to private sector operators, with the exception of Algeria and Palestine, where the private sector has not yet entered municipal solid waste collection and

disposal (Musleh, 2014; GIZ, 2012). Across the region, the formal municipal solid waste management sector operates under various institutional, legal, and policy frameworks. Most countries have established national solid waste management strategies and master plans, but several exceptions can still be noted in countries where strategies are still under preparation (Alhyasat et al., 2014; Rizkallah and Sabbagh, 2014; GIZ, 2012). Municipal solid waste laws are currently enacted in

Morocco, Algeria, Tunisia and Syria, but are either in draft form or under preparation in other countries in the region (GIZ, 2012). In terms of institutional responsibility for solid waste management at the national level, many countries have national committees tasked with this responsibility, formed by various ministries and national authorities. The case of solid waste management and the legal framework that applies to the sector in Lebanon is described in Case Box 3 below.

Case Box 3. Lebanon's Solid Waste Management

Although Beirut has a relatively well-established informal waste sector, the efforts of this sector are poorly recognized and acknowledged (Scheinberg and Savain, 2015; Rizkallah and Sabbagh, 2014; Green Line Association, 2015). It is estimated that informal sector recyclers process 500 tons of recyclables per day, achieving higher recycling rates than the formal sector (Green Line Association, 2015). Lebanon has a long history of challenges in SWM, an issue of increasing concern since the early 1990's, and exacerbated in recent years with the beginning of the ongoing waste crisis in 2015. Several factors have contributed to the crisis, namely corruption within the sector, absence of legal framework, and weak law enforcement, exacerbated by increases in solid waste as a result of growing urban populations (Rizkallah and Sabbagh, 2014). The policy framework within which the solid waste management sector operates in Lebanon is quite complex, with many stakeholders involved in the sector, primarily the CDR, MOE, MOIM and MOF. The CDR is the primary entity responsible for municipal solid waste management in Beirut and Mount Lebanon, while municipalities are the entities responsible for this task in remaining parts of the country. In terms of planning in the sector, the CDR prepared a Waste Management Plan at the national level in 2005, and the MOE prepared a national strategy for solid waste management in 2010, which is still awaiting approval (Rizkallah and Sabbagh, 2014).

The existing legal framework applicable to the solid waste sector is highly fragmented, and consists of several regulations (Rizkallah and Sabbagh, 2014; MOE et al., 2011):

- ▶ Decree 8753 of 1974, which assigns solid waste management as the responsibility of municipalities.
- ▶ Decree 9093 of 2002, which provides municipalities with incentives to host a waste management facility.
- ▶ Law 444 of 1988 (amended in 2002), which defines the basis of environmental protection, but does not provide specific regulations for the management of municipal solid waste.

The private sector plays a significant role in municipal solid waste management in the country, with Sukleen, a Sukomi company, as the main player in this sector. Monitoring of these private entities is lacking, contracts are awarded on a non-competitive basis, and net costs per ton for waste collection, transport, treatment, and disposal are some of the highest in the world, at around \$175 per ton (Rizkallah and Sabbagh, 2014). The solid waste management sector in Lebanon is characterized by poor coordination between stakeholders and a lack of sufficient awareness and community participation in solid waste management and planning (Rizkallah and Sabbagh, 2014). What does this mean for the country's informal waste sector? Due to a complete lack of recognition of the informal sector and its contribution in recycling efforts, informal solid waste workers are being put in a situation where they are in direct competition with private recycling companies and NGOs. Instead of working in collaboration with each other, these two sectors operate in exclusion of one another. And while recycling companies and NGOs receive praise and acknowledgement for their efforts in the country, the informal sector receives no such recognition. These entities have the power to access resources and enhance their capacities in many ways that the informal sector cannot, and without formal recognition or efforts for integration or collaboration with the informal system, this situation could have severe negative impacts on the livelihoods of those employed in it (Scheinberg and Savain, 2015; Rizkallah and Sabbagh, 2014).

Drivers of Informal Solid Waste Management

There are several drivers of informality with the solid waste management sector, including economic, social and environmental drivers. Employment in this sector is a major driver, providing a source of livelihood for many individuals across the region. The informal solid waste management sector in the region employs some of the largest informal waste sectors in the world, with an estimated 120,000 individuals employed in Cairo alone, and an estimated 50,000 individuals in Morocco (Scheinberg and Savain, 2015). The informal sector often provides more jobs than the formal sector does, and in the case of Cairo it provides as many as four times the jobs provided by the formal sector. In areas where formal municipal waste collection rates are low, a demand for informal waste collection services arises (Gunsilius et al., 2011; Gunsilius, 2011).

Informal Solid Waste Management

Informal solid waste management refers to the activities of individuals, families, and micro-enterprises, which work in either waste management services or valorization, or both (Gunsilius et al., 2011; Scheinberg, 2012; Scheinberg et al., 2010b). Activities in this sector are typically characterized by small to medium scale, labor intensive, low paid, unregulated, unregistered, and unlicensed, low-technology procedures for the recovery of valuable materials from the solid waste stream, carried out by individuals or small groups (Gunsilius et al., 2011; Agamuthu, 2010; Wilson et al., 2006). In many cases the informal and formal solid waste sectors complement

each other, but they also can be in direct competition with each other in recycling and valorization (Gunsilius et al., 2011; GIZ and CID, 2008). Figure 8 provides a very general overview of the main interactions between informal and formal solid waste management activities.

Informal waste workers are at the core of the informal waste sector, and go by a variety of names across the region including the “Zabbaleen” in Egypt, “Barbechas” in Tunisia, “Bouaari” or “Mikhala” in Morocco, just to name a few examples (Scheinber and Savain, 2015). The informal solid waste sector consists of two main sub-sectors: the informal service sector, and the informal valorization sector. The service sector typically consists of individuals or micro-enterprises, which earn fees for the removal of waste, a practice that occurs mostly in areas where formal municipal waste collection rates are low (Gunsilius et al., 2011; Gunsilius, 2011). The informal valorization sector consists of individuals, family, and micro-enterprises that specialize in the identification and removal of valuable materials from the waste stream. The valuables extracted are in turn sold for personal or commercial reuse, reuse with repair, recycled, or for organic valorization typically as animal feed or for compost (Gunsilius et al., 2011). There are numerous specific occupations for informal waste workers across the region, with some that are found in only one or a few countries. Table 2 presents some of the main occupations that are found in informal waste sectors in most countries across the region (Scheinberg and Savain, 2015).

Figure 8

Informal activities within formal municipal solid waste systems

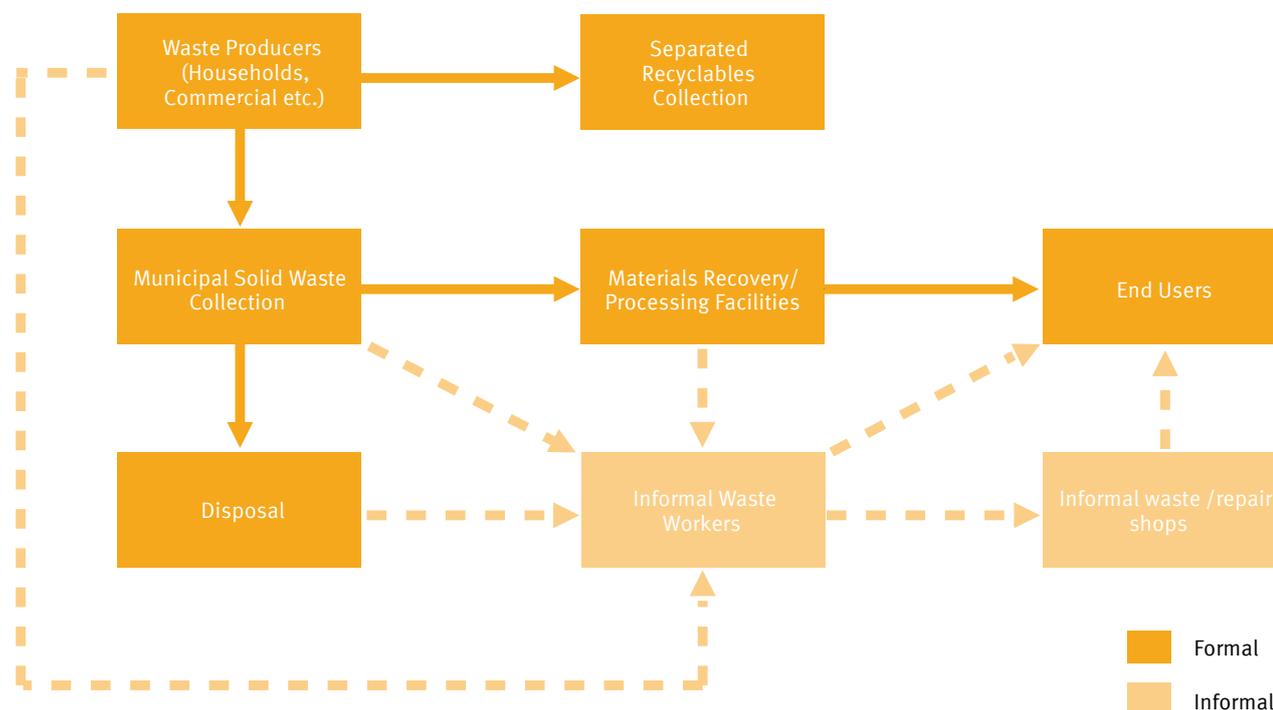


Table 2

Occupations in the informal waste sector in the region (Scheinberg and Savain, 2015).

INFORMAL OCCUPATION	DESCRIPTION	AREA OF WORK	SOURCE OF EARNINGS
Itinerant Waste Collectors (IWCs)	Collect recyclables	Households, businesses, and door-to-door services	Sell recyclables to dealers or end users
Street pickers/container pickers	Collect recyclables and bulky waste items for formal collection	Street, private, and public trash containers	Sell recyclables to dealers or end users
Truck pickers	Formal waste crews skim valuables during collection	Trucks and other waste collection equipment	Sell recyclables to dealers or end users to compensate wages
Reusable pickers	Formal workers that “steal” from municipal recycling centers	Recycling centers, private and public trash containers	Sell recyclables to dealers and second-hand traders
Dump and landfill pickers	Work and live on landfill, meet trucks and sort existing waste	Landfills	Re-sale to second-hand traders
Junk shop owners	Buy materials from IWBs by Kg or employ waste pickers	Small- and medium-size junk shops	Sell higher up the value chain
Mobile “Reusables” collectors	Collect and resell electronics, furniture, etc.	Streets, public and private containers	Re-sale to second-hand traders

Impacts

The informal waste sector as a whole, including both its service and valorization subsectors, creates numerous environmental benefits to the formal municipal solid waste management authorities. These benefits are mainly through helping cities achieve recycling targets, save valuable materials, and as a result reduce the amount of waste disposed in landfills (Scheinberg and Savain, 2015; Gunsilius et al., 2011; Gunsilius, 2011; Gerdes and Gunsilius, 2010). The recovery of recyclable materials from the waste stream by both the formal and informal sectors results in reduction of carbon footprint of waste management, mainly by reducing the volume of waste decomposition and methane gas emissions from landfills (Scheinberg and Savain, 2015; Gunsilius et al., 2011). However, in middle and low-income urban settings, the informal sector often has a large role in solid waste management, thus making a larger contribution to reducing carbon emissions. In Egypt, the informal sector recovers more than double the amount of materials from solid waste streams than the formal sector does. Carbon reduction benefits are not only a result of recovery activities and avoidance of disposal, but also through returning secondary raw materials into the production cycle, which uses less energy extracting and processing primary raw materials. The informal sector also uses significantly less fossil fuel energy in transportation of wastes collected, since they have less frequent use of motorized transport than the formal sector, and often extract wastes closer to the source minimizing the amount of transport needed (Gunsilius et al., 2011). An economic analysis

of the informal solid waste sector in Egypt revealed that in monetary form, the environmental benefits associated with material recovery by the informal sector are much higher than those from the formal sector, reducing negative externality costs by more than three times (Gunsilius et al., 2011).

The social impacts of the informal waste sector are perhaps reflected most severely on those employed in the sector itself. Informal waste workers have unpleasant and dangerous working conditions, with wages that do not reflect these difficulties. Their efforts are poorly recognized by the formal sector and the communities within which they operate, and their activities are commonly looked down upon as unhygienic (Scheinberg, 2012; Gunsilius et al., 2011; Agamanthu, 2010; GIZ and CID, 2008; Gerdes and Gunsilius, 2010). Although in this region, men are more commonly involved in the informal waste sector, women and children have significant roles in the sector, and tend to get paid lower rates than men do for extracting materials (Scheinberg and Savain, 2015; Scheinberg, 2012). It provides autonomy and freedom in employment, as workers typically work on their own and receive profits based on the amount of materials they extract and not set wages, qualities that are appreciated by some individuals employed in the sector. Even though workers are frequently exposed to occupational health hazards including injuries and illness, and are seldom able to afford purchase of protective clothing and gloves, they do not have access to necessary health care or hygiene services that would greatly improve their quality of life (Gunsilius et al., 2011).

Economic benefits of the informal waste sector are reflected in the significant number of livelihoods supported by this sector, as well as through the avoided costs to formal solid waste management authorities (Scheinberg and Savain, 2015; Gunsilius et al., 2011; Scheinberg et al., 2010b; Scheinberg, 2010). The informal system primarily operates in the recovery and recycling of materials, and waste workers extracting materials with high intrinsic value for resale. As a result, although operational costs in the informal sector may be higher than those in the formal sector, high revenues from the materials extracted result in much lower operational costs per ton, and in most cases a significant net benefit (Gunsilius et

al., 2011; Scheinberg et al., 2010b). In a study on Cairo, the net benefit per ton of materials extracted by the informal sector was close to twenty times that of the formal sector (Gunsilius et al., 2011). Informal sector activities save formal authorities a significant sum, primarily as a result of reducing expenses for collection, transportation, and disposal, thus reducing overall cost to city or municipal authorities responsible for waste management. The efforts of the informal solid waste sector in Cairo resulted in a savings of € 3.4 million for the municipality (Gunsilius et al., 2011); considering that municipal solid waste management is a major budget item for official authorities, these savings are of no small value.

Case Box 4. Integration of Informal SWM Sector in Morocco

Informal waste picking has a long history in Morocco, but much has changed over the past decade in the informal waste sector. Similar to other countries in the region, a significant portion of the waste sector is informal, especially in valorization and disposal. However, what distinguishes Morocco from other countries in the region is that its national solid waste management plan, Programme National des Dechets Menagers, encourages informal waste worker inclusion, in order to ensure that workers in the informal sector are not left behind as the solid waste sector evolves and upgrades. Morocco has led efforts in establishing one of the first successful informal waste worker cooperatives in the region, the “Attawafouk” agreement (World Bank, 2016; ESCWA, 2015; Scheinberg and Savain, 2015). This inclusive initiative began in 2007 and was implemented in 2011, and was developed with assistance from CARE, an international NGO, and Pizzorno, a private landfill operator (ESCWA, 2015).

Through this cooperative, informal waste workers previously working in a landfill in Akreuch were able to organize, and were given the opportunity to work at the Oum Azza waste sorting facility just outside of Rabat. This initiative has enabled the transfer of the livelihoods of 150 families from the informal waste sector to a more stable source of income in the formal waste sector (Scheinberg and Savain, 2015; World Bank, 2016).

A sector that was previously characterized by its poor and unhealthy working conditions is slowly evolving and taking new form. In the past, men, women, the elderly, and children competed for recyclable materials of value, scavenging through wastes in a dumpsite that was an unregulated old quarry, without any form of protection from the wastes they searched through or the elements, all to make as little as 120

Dirhams a day (\$12 USD), an insufficient source of livelihood. The Akreuch dumpsite was not only a source of environmental and public health hazards to the informal workers who sought to make a living from it, but also to the community at large, as it leached pollutants into the Bouregreg, a river that runs through Rabat. Today, much has changed, and the integrity of the Bouregreg, as well as the working conditions of those employed in the informal waste sector are examples of the change. The Oum Azza waste management site, the largest modern sorting and landfilling facility in Morocco, has played a major role in these improvements. Receiving approximately 850,000 tons of waste per year, it extracts roughly 2,200 tons of solid waste for sale into the valorization market, and composts 100,000 tons of organic waste, significantly reducing the volume of solid waste that needs to be landfilled (World Bank, 2016; ESCWA, 2015). The site employs individuals who work in the informal waste sector, and provides them with a monthly salary of 2,260 Dirhams (\$265 USD), a more stable source of income, as well as a safer, healthier, and more organized work environment. Through the Attawafouk Cooperative, workers are ensured fair pay, and offered additional benefits including shared profit based on sales of recyclables, as well as other benefits, including health insurance, establishment of personal bank accounts, and even low mortgages (World Bank, 2016). It is not limited to these new and improved benefits, as the Oum Azza landfill is also designed to generate electricity from biogas resultant from the decomposition process, and plans to sell excess electricity generated back to the national grid (World Bank, 2016). The success of this site has been encouraging, and by truly viewing waste as a resource, and cooperating with the individuals who perhaps have been in the valorization and recycling industry longer than most, has resulted in something that can serve as a great example for other cities in Morocco, and the region as well (World Bank, 2016; Scheinberg and Savain, 2015).

6.4 Transportation

Transportation Systems

Formal transportation systems in urban areas are typically government-provided bus and rail-based transport systems, organized in vertically integrated systems involving neatly layered hierarchies for the production of service (Cervero, 2000; Kumar et al. 2016). Transportation systems operate within a formal regulatory framework providing scheduled, planned or frequency controlled services along fixed routes. The vehicles in these systems are usually periodically maintained and typically abide by minimum safety standards (Ferro et al., 2013). But in many cities these systems are unable to meet the demands of urban commuters (Cervero et al., 2007).

Drivers of Informal Transportation

Within the MENA region, informal transportation dominates transportation modes. Lebanon is heavily reliant on private transportation, data shows that the number of private cars in Lebanon is estimated to rise from 700,000 to 1,100,000, an increase of 57%, between 2000 and 2030 (CDR, 2005). Furthermore, the increase in housing and living costs in the cities is pushing the Lebanese to reside in the suburbs while still working in the cities. Moreover, the rise of the automobile could be largely attributed to factors such as not re-activating the public tramline, the erosion of pedestrian amenities and the development of suburban sprawl aided by deliberate policies adopted during the post-civil war development era of expanding the city proper through a network of highways that encourages suburbanization (Fawaz, 2011). Moreover, the failure of the formal transportation sector to cover demand in most urban areas can be brought down to several factors, including population growth, rural migration, and the decision to invest in roads, putting cars at the center of developing transportation modes, and in the case of Lebanon the destruction of train rails, trams and roads due to the civil war. The growing informality in the region can be brought down to all these reasons but on the other hand informality can offer learning opportunities in terms of operational efficiency and resilience.

Informal Transport Systems

Informal public transport services, as the term suggests, refer to public transport services that are provided differently as compared to the typical government transport in cities (Kumar et al., 2016). These systems often provide highly competitive services that compete with formal transit services. They frequently move faster than buses, provide high accessibility, and respond to demand more rapidly

as the services can change almost instantaneously to respond to change in market needs (El Geneidy et al., 2013). In addition, these informal services are sometimes cheaper than formal services as they can offer the same service at a lower cost. Thus, informal motorized transport typically thrives where public transport services and formal taxi services are limited or non-existent. Informal systems grow in areas where service coverage is devoid of formal transit (Cervero et al., 2007). These services often start as illegal services and acquire legality as they become more established in the city (Ferro, et al., 2013), most of their service parameters remain unregulated but they operate within an organizational structure or an internal framework that rationalizes their service parameters (Takyi, 1990; Cervero, 2000, Cervero, 2007).

Informal transport services are nowhere near vertically or methodically organized: service production quite often lies at the hands of a single individual—the owner-operator. The informal transport sector is often held together in a loose, horizontal fashion, dependent upon carefully cultivated linkages and nurtured relationships among stakeholders, including fellow operators, parts suppliers, mechanics, local police, creditors, and street hustlers, among others (Cervero et al., 2007). Informal operators are not “illegal” in all respects—even among non-registered operators, some have commercial driving permits, carry insurance, and/or register their vehicles, and most respect territorial limits (Cervero et al., 2007).

Most drivers in the informal sector are low-skilled young men who migrated to cities from rural areas for employment (Cervero et al., 2007). They usually operate a spectrum of modal options that lie between an exclusive-ride taxi (i.e., car-like service) at one extreme, and a conventional fixed route, fixed-schedule buses, at the other. The vehicles usually lack minimum safety standards and are not necessarily periodically maintained. Informal operators themselves are often politically weak and poorly represented in the formal city democracy (Cervero, 2000). Route associations however can bring relative power to its members, these exist to bring order and avoid inefficiencies and redundancies within a spatially defined service area. In some cases, route associations function as veritable cartels, which in some cases are backed by political entities, fixing prices and service practices, and by using any means to fend off possible competition in the market over trade route, while at the same time ensuring that supply is reasonably balanced with demand where duplication in the routing and scheduling of services is kept to

a minimum (Cervero et al., 2007; Schalekamp et al., 2013). In any case, informal services operate in a laissez-faire environment, prompting operators who survive on low profit margins to actively, and sometimes dangerously, compete for customers (Schalekamp, H., & Behrens, R. 2013). This is expressed in overloaded vehicles, unsafe driving habits, and stopping almost anywhere to board passengers. In this same regard, operators often offer frequent services at peak times and in peak directions, while leaving off-peak riders waiting until vehicles fill (Cervero et al., 2007). There are many issues with informal transportation but several initiatives helped integrate this system to include a larger population base, successfully complementing the formal public transportation network. A few examples worth mentioning are the community bus stops in Brazil where community members printed blank stops labels and residents who knew which bus stopped where would write it on the bus stop itself. Another initiative in Cairo where a group called

“Transport for Cairo” produced the first map of the city’s complex public transit systems—both formal and informal in an initiative that hopes to integrate the two systems.

The regional and Lebanese informal transport sectors share a lot of similarities with the informal systems described above. The most common modes of informal transportation in the region are minibuses and shared taxis. In Egypt, shared taxis alone represent 34 percent of passengers’ modal transport (Ministry of Transport Center of Excellence, 2010). In Sana’a, Yemen, the majority of trips are made by public transport modes, with an approximate share of 60 percent of trips made by informal minibuses and taxis (El Geneidy et al., 2013). In Algiers, Algeria, the share of minibuses and shared taxis has been estimated to represent 56 percent of motorized transport in 2004, while in Damascus, Syria, the share of minibuses has been estimated to be 46 percent of motorized transport in 1998 (El Geneidy et al., 2013).

Case Box 5. Lebanon’s Informal Transportation: The Case of Van #4

Informality is demand-driven, highly responsive to the needs of the consumer. Informal transportation offers efficient mobility, where services are door-to-door, providing mobility to marginalized socio-economic classes. Minibuses operate in Lebanon in the form of route association, and are able to connect marginalized neighborhoods to the city, thus enhancing social integration in a highly polarized and segregated context (Samaha, 2016). The operational efficiency of the informal sector makes it more attractive than formal modes of transport, the drop-offs are fast, as drivers can stop basically anywhere, making stops almost door-to-door (Samaha, 2016). Payment is done in such a way as not to stall the trip; if the passenger is sitting among the back rows, s/he passes the money from seat to seat until it reaches the driver, and s/he will receive the change back the same way, in due time before reaching her/his destination (Samaha, 2016). The informal system demonstrates clear signs of flexibility; the drivers are free to change routes if they see fit, avoiding traffic or road blockings

(Samaha, 2016). Additionally informality is flexible enough to adapt to demand: the vans depart regularly every 2-3 minutes, but is flexible enough that at peak hours the waiting time decreases as the vans fill up quickly (Samaha, 2016). Through this organizational process, the operators are able to limit quarrels between drivers, and maintain a constant and frequent flow of vans, thus increasing the line’s reliability and punctuality (Samaha, 2016). The number of drivers working simultaneously varies across the day, to accommodate the demand, and prevents oversupply (which leads to the dissatisfaction of drivers), or undersupply (which leads to the dissatisfaction of passengers). The drivers’ schedules are not set by a fixed rule but this flexible organization was probably adapted through several iterations before the optimal calibration was achieved (Samaha, 2016). Women prefer these vans to shared taxis since they consider them to be safer; the vans are rarely empty and follow fixed routes unlike shared taxis where the possibility of being harassed or kidnapped is higher. Tourists also prefer these buses because using the shared taxi usually implies that they need to negotiate prices with the drivers.

Impacts

Informal motorized transport serves an important part of the transportation needs in most countries throughout the region, regardless of the country's level of development, and with varying social, economic, and environmental impacts. Social impacts can be first manifested in the lack of social security and worker protection for those involved in the sector, and not much is known about the setting of wages for those employed in the sector. Second from the passenger's point of view, female passengers prefer vans compared to other form of informal transport (shared taxis). Informal transportation, in this sense, contributes to social integration providing mobility for women and lower income population as the informal transportation is usually cheaper. These systems however run as localized monopolies, with no easy entry into the system, and offer little insurance to the

informal workers involved. They are also not accessible or used by everyone, individuals of middle- or upper-income choose not to engage in public transportation and prefer to use private vehicles. This is most commonly due to maintenance and safety standards absent in the informal transportation. In terms of environmental impacts, the informal sector is not subjected to regular maintenance and vehicles can in turn become highly polluting. Safety is an additional concern for users of informal transport services especially in the case of the shared taxicab "service". These types of shared taxis offer passengers a more affordable alternative to private taxi; however, they generally only run when the service is profitable for proprietors. These shared taxis, in many cases across the region have been associated with harassment of female travelers, posing challenges of equality for women's access to safe transport.

Figure 9

Informal van stop in Beirut.



Source: Taha El Baba, Jad. 2016. Beirut

6.5 Informal Use of Public Space

The use of urban spaces and more specifically, informalities in the use of urban spaces cannot be defined as a system in the same manner as urban water and wastewater, energy, transportation, and solid waste management systems, as it differs in its nature. Unlike the other systems described in this report, urban space, and more specifically public urban spaces cannot be assessed as resource/service provision systems. This section attempts to describe some of the forms of informal activities that can occur in urban public spaces, as well as explore the relationships between informal activities in the water and wastewater, energy, transportation, and solid waste management systems and the urban spaces within which they operate. It is important to note the distinction between the use of public space for informal activities, and the informal appropriation of spaces for public use, as informality in these two contexts differs in its nature.

Urban Public Space

In cities across the world, public spaces, including parks, plazas, streets, sidewalks, and markets are the centers of civic life, providing opportunities for various forms of expression. Forms of expression include, but are not limited to, gathering of groups, socializing, leisure, recreation, and even political protest. Public spaces, specifically open and green spaces, provide relief from dense urban environments (Hou, 2010). Although public space by its very definition is “open to all, well known by all, and acknowledged by all” (Henaff and Strong, 2001), what is officially defined as public space and the designated activities that can be carried out in such spaces can often be exclusionary, excluding communities and individuals that may seek to use the space for purposes they deem appropriate (Hou, 2010). The functions of such spaces, the meanings attributed to them, and the specific uses for which they are designated vary significantly based on the culture and tradition of the communities within which they are located, and the communities which make use of them (Hou, 2010; Low et al., 2009).

Drivers of Informal Use of Public Space

Heavy regulation, privatization, and development of urban public spaces is threatening access to and availability of such spaces, and in many cities this has resulted in attempts by individuals and communities to gain greater freedom and access to urban spaces through a variety of means (Darwish, 2015; Fawaz, 2015; Gharipour, 2016; Hou, 2010). As a result urban residents often become involved in initiatives and partake in informal activities in efforts to create new uses and forms of urban public space.

Informal Use of Public Space

Informality in the use of public urban spaces is difficult to define due to its complexity and the wide scope of activities that can be included. The informal actions that can occur in the use of urban public spaces varies widely across regional and local boundaries, and is often reflective of the specific social settings, issues, and needs of the individuals and communities making use of the space (Hou, 2010; Franck and Stevens, 2006). Informal or unintended uses of urban public space “have the ability to loosen up the dominant meanings of specific sites that give rise to new perceptions, attitudes and behaviors” (Franck and Stevens, 2007).

The types of informal activities or uses can include a wide array of activities that defy or deviate from the existing rules and regulations pertaining to the use of that specific urban space (Hou, 2010; Watson, 2006). Uses can be playful in their nature, where individuals seek out areas to express themselves through sports, recreation or artistic expression, and can involve both children and adults alike (Mady, 2015; Chen, 2010; Hou, 2010). They can be centered around local commercial markets, as in the case of informal pop-up market places that bypass regulations and enforcements, while promoting local small businesses and supporting the livelihoods of community members (Mady, 2015; Hou, 2010; Franck and Stevens, 2007; Fernando, 2007). Within a more local context in Lebanon, common informal activities in public space include Seeran, what can be simply described as an outing or day-trip into an outdoor space typically in groups, and community festivals often linked to cultural or religious holidays (Bekdache and Saksouk, 2015a). Streets and sidewalks are also an interesting interface for all forms of informal activities. Although designed mainly for pedestrian and vehicular use, streets and sidewalks often are host to a wide range of other activities including: street vending and extension of cafes and restaurants onto the street, begging, parking, and play by both youth and the elderly. Each of these activities may be constant or intermittent, varying in their occurrence depending on the time of year or day, and shifting depending on pedestrian or vehicular traffic (Gharbieh and Fawaz, 2015).

Informal uses of public spaces can also create new green spaces, through community gardening initiatives and pop-up green spaces initiatives (Boulad, 2014; Hou, 2010; Mares and Pena, 2010; Merker, 2010). A pop-up green space initiative was started in Beirut, with the goal of raising awareness on the right to have public green space in Lebanon,

and draw attention to the minimal amount of green space in the city, which in Beirut is well below the World Health Organization's standards for healthy, livable cities (Boulad, 2014). Because these spaces are self-made, they reflect and serve the unmet needs of public life in the specific urban settings (Mady, 2015; Mady, 2012; Hou, 2010; Rivlin, 2007). Spaces where these types of activities occur typically serve as gathering places for diverse, immigrant, and marginalized communities (Chen, 2010; Hou, 2010; Rojas, 2010; Franck and Stevens, 2007; Rivlin, 2007).

One of the most noted and often visible informal uses of space in cities in the region, and more specifically in Beirut, is use for informal football fields. Informal football fields remain one of the few ways in which public, especially youth groups, continue to make use of open urban spaces, even as Beirut's urban landscape is constantly evolving. These informal fields were more prevalent in the

past, but with increased development in the city, roughly 85 percent of informal football fields have been lost over the past decade, converted to parking lots, buildings, and construction sites (Bekdache and Saksouk, 2015b). Located throughout different neighborhoods across the city, these fields have been maintained over the years by numerous stakeholders, including community members, youth, football players, and in some cases political or religious social development organizations. There are several informal football fields in Beirut, including the Karantina or Al-Khodr Field, Mar Elias Palestinian Camp Field, Ard Jalloul Field, and Ras El Nabej Field, some of which have been in use for over 40 years. They serve a wide variety of functions and users, mainly used for football games by young boys and girls, but also in some cases used for other activities such as family "picnicking" (Bekdache and Saksouk, 2015b). Figure 10 shows a map of the location of various football fields across the Beirut area, including those that are informal.

Case Box 6. Informal Appropriation of Public Space: The Case of "Dalieh of Beirut"

Drastically distinct from Beirut's many privatized "public" spaces, Dalieh, 140,000 square meters of waterfront land in the Raouche area of Beirut stands out. This area, one of the few remaining publically accessible pieces of land along the coast of the city, has significant historical value, mainly attributed to its use by diverse members of the public over years, who have appropriated this privately owned area for public or common use. Ownership of the Dalieh has changed over the years, and includes a large number of families. However, its long history of use informally as a communal public space, dating back to at least the early 1940s, has solidified its publicness over the years. Historically described as a "mantaqit tanazzuh", which means a picnicking or outing spot for groups and families, its use as such has prevailed over the years. Although this space is not officially designated as a park or public property, it has been used as such for generations, and over time has become one of the most well known spaces for public use in the city. The area is informally used for numerous activities, including picnicking, swimming, sunbathing, strolling, diving, and many other seashore activities. There are also several fishing docks located in the area, and a few boats that

provide boat rides geared toward tourists. Although traditionally most commonly used by the Dalieh's fisherman communities, this spot is now used by a diverse range of individuals. User groups include tourists, urban dwellers, migrant workers, and Syrian and Iraqi refugee communities. It is also home to the Kurdish community's annual "Nowroz" festival. Through carrying out these informal activities, communities have shaped this space into a space for public use. And although this form of informal public space is quite dynamic and grassroots in its nature, it is vulnerable, constantly threatened by private interests in the land upon which these spaces reside. In the mid-1990s, a private real estate firm purchased most of the shares in properties in the Dalieh, and have since been laying the claims through a series of efforts to exclude the public from using this space. The threat to public use of this space has given rise to NGOs seeking to protect the right of the community to access and use public space, most notably in this case the Civil Campaign to Protect Dalieh of Raouche, which has been quite active since its initiation, and have helped shape the struggle to protect this site for public use.

Sources: Saksouk, 2015; The Civil Campaign to Protect Dalieh

Urban public spaces are also used as components of the informal activities described previously throughout this report in the informal water and wastewater, electricity, transportation, and solid waste management sectors. Some interesting questions to answer are specifically how are residual urban spaces used by these informal sectors? And what are the relationships between informal activities in the water and wastewater, electricity, transportation, and solid waste management systems and the urban spaces within which they operate? Some examples of such informal use can be seen across the sectors studied. In the informal solid waste system, informal waste workers often use urban streets and sidewalks to lay out waste

while they sort and extract materials for valorization, and in some cases store collected wastes before sale in abandoned properties (Green Line Association, 2015). In the energy sector, generators for informal electricity generation are located in convenient places within neighborhoods, often areas such as vacant lots or abandoned factories (Verdeil, 2016). In informal transportation systems, vans and mini-buses frequently use sidewalks and street corners as impromptu stops when no specific spots are formally designated. Understanding how these systems use and rely on urban spaces may be important in assessing how they contribute to urban sustainability and resilience in the communities within which they operate.

Figure 10

Map of informal football fields in Beirut (Bekdache and Saksouk, 2015b)



7. SUMMARY

As cities across the region continue to grow, so will the complexity of the urban systems upon which their functions rely. Cities are often viewed as “systems of systems”, and it is vital that these systems are fully understood if efforts to enhance their overall sustainability and resilience are to be undertaken (Da Silva, 2013). Systems of water and wastewater, solid waste management, transportation, and energy, as outlined in this report, are dependent to a large extent on the informal sector. The informal sector in many cases is highly interconnected to the formal sector within these urban systems, and in some cases these connections create a complex web of interactions, as is the case in solid waste management, making a distinction between the formal and the informal nearly impossible. In the case of some systems, such as the energy system, the informal sector operates separate from the formal sector, with little interconnection between the two. As demand for their services grows, and the factors contributing to their growth remain unchanged, the extent and complexity of these informal systems may grow as well. And although complexity of urban systems may contribute to their overall resilience by increasing redundancy, robustness, and diversity, this does not always translate into more sustainable systems over the long-term. In some cases high levels of connectivity and complexity within a system may result in increases in resource use, which in turn diminishes its resilience (Hassler and Kohler, 2014; Ahern, 2011).

Informality across the various systems discussed in this background document results from a complex array of contributing factors. It appears, based on a review of the literature on these systems across the region, that the most common contributors across the systems are either a lack in the provision of services by the formal sector responsible for providing them, particularly in sectors of water and energy, or they provide employment and financial opportunities for urban populations who are dependent on them as their main source of income, as in the case of informal waste collection and valorization. The informal sectors across these systems also exhibit some resilient qualities, such as flexibility, creativity, entrepreneurship, resourcefulness, adaptability, and ability to respond quickly to challenges and changing demands. However, there are also numerous environmental, social, and economic costs that result from informal activities in the sectors that cannot be

ignored. For these reasons, it is important to gain a better understanding of how these informal systems operate in relation to the formal systems. Addressing urban challenges will be dependent not only on the resilience and sustainability of the formal systems that operate within urban settings, but will also depend largely on the resilience of informal systems as well, particularly in countries where these systems play a significant role in the function of the overall urban system. In order to do so, research efforts are needed to gain a more extensive understanding of informal systems within urban settings, how they operate, their environmental, social and environmental impacts, the links to the formal system, as well as their contributions to overall urban resilience.

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ABOUT THE PROGRAM

Climate Change and Environment

The Climate Change and Environment Program aims to initiate, develop and harness research, from both applied and social sciences fields, to define the most appropriate policy recommendations on issues related to climate change and environment in Lebanon and the Arab world. The program further aspires to activate the link between research and policy-making with the objective of improving policy development and the production of scientific discourse in response to policy needs. The program also intends to influence national and regional debates in international negotiations on climate change and sustainable development.

ABOUT THE AUB POLICY INSTITUTE

The AUB Policy Institute (Issam Fares Institute for Public Policy and International Affairs) is an independent, research-based, policy-oriented institute. Inaugurated in 2006, the Institute aims to harness, develop, and initiate policy-relevant research in the Arab region.

We are committed to expanding and deepening policy-relevant knowledge production in and about the Arab region; and to creating a space for the interdisciplinary exchange of ideas among researchers, civil society and policy-makers.

Main goals

- ▶ *Enhancing and broadening public policy-related debate and knowledge production in the Arab world and beyond*
- ▶ *Better understanding the Arab world within shifting international and global contexts*
- ▶ *Providing a space to enrich the quality of interaction among scholars, officials and civil society actors in and about the Arab world*
- ▶ *Disseminating knowledge that is accessible to policy-makers, media, research communities and the general public*

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