

# Chapter 3

## Preparedness Through Urban Resilience



*You cannot be buried in obscurity: you are exposed upon a grand theatre to the view of the world.  
If your actions are upright and benevolent, be assured they will augment your power and happiness.*  
— Cyrus the Great

### 3.1 Strengthening the Resilience: How Cities Should Prepare?

This book explores the topic of resilience at the city level. The focus is more on outbreak events at the city level, or how cities should prepare and react in facing the larger events of epidemic and pandemic. The latter two cover a larger scale of regions, countries, sub-regions, and global scales. For us, the study of cities and how cities can manage in such disease outbreak adversities is novel. It is, therefore, important to understand how cities can be strengthened, first in terms of their resilience strategies through preparedness, and then in terms of their city management through responsiveness (or reactions). As highlighted towards the end of the Chap. 2, there are issues that can be addressed from these two perspectives of resilience and management. Hence, the central question comes to mind that ‘*how cities should prepare?*’; and by such preparedness, what planning is required to strengthen the resilience in the first place? Therefore, this chapter, as the main chapter of the book, aims to highlight the perspectives of urban resilience and city management in disruptive outbreak events. In doing so, we propose practical solutions that emerge from existing literature, strategies, application, and experiences of disease outbreak and epidemic/pandemic events. The procedural approach to this important topic comes from the idea of having a comprehensive urban resilience framework, which addresses the multiplicity of city management requirements.

In order to strengthen a city’s resilience, we must look into a variety of systems and intuitions that build the city’s backbone of operations. A disease outbreak event may have a direct or indirect impact on each of them; hence, a plan for preparedness is essential. This can then eventually support the city’s responsiveness or reactions

to disruptive issues of the outbreak. In this chapter, we first delve into the concept of ‘urban resilience’ before reaching the more elaborate discussions of ‘city management’ matters; the former is believed to support the latter. In doing so, this chapter introduces a broader knowledge of urban resilience, and its conceptualisation, as well as practices in cities and associated studies to urbanism. These perspectives will then narrow down to three factors of resilience education, resilience characteristics, and resilience comprehensiveness. Afterward, we introduce a comprehensive urban resilience framework and progress with the introduction of its dimensions and characterisation, before further elaboration on action plan and responsiveness through the foremost mechanism of city management. These discussions will become more robust with a detailed evaluation of all associated aspects across multiple phases of the outbreak progression (as demonstrated in Chap. 2). This chapter would then conclude with viewpoints on the utilisation of urban resilience measures for city management issues, and how cities should be prepared and react in times of need.

### 3.2 A Broader Perspective of ‘Urban Resilience’

As demonstrated already, cities face significant challenges during disease outbreak events. In such occasions, we face certain vulnerabilities that reduce the healthiness of city operations, the society, and the overall governance of the city. The resilience of the city depends on multiple factors in a different emergency, crisis, and disaster events. On each occasion, the city must react differently but with some primary and overlapping factors that need to be understood both broadly and in detail. This is also similar to earlier statement of the Rockefeller Foundation 100 Resilient Cities organization, who argue that “...*building urban resilience requires looking at a city holistically: understanding the systems that make up the city and the interdependencies and risks they may face*” (100 Resilient Cities 2018). In their report, 100 Resilient Cities (ibid) also highlight some of the main drivers of urban resilience that address the factors of infrastructure and environment precisely at the city level. These factors include:

- *Provide and Enhances Protective Natural and Man-Made Assets*

Maintain protective natural and man-made assets that reduce the physical vulnerability of city systems. This includes natural systems like wetlands, mangroves, and sand dunes or built environment like sea walls and levees.

- *Ensure Continuity of Critical Services*

Actively manage and enhance natural and man-made resources. This includes designing physical infrastructure such as roads and bridges to withstand floods so that people can evacuate, as well as ecosystem management for floor risk management. It also includes emergency response plans and contingency plans that may coordinate airports to function so that relief can be lifted in and out during a crisis.

- *Provide Reliable Communication and Mobility*

Provide a free flow of people, information, and goods. This includes information and communication networks as well as physical movement through a multimodal transport system.

In their opening statement of their study, Admiraal and Cornaro (2018b, p. 2467), highlight the importance of resilience for multiple reasons:

The need for future cities to be resilient stems from the fact that now more than ever in history, both natural and human-made hazards are threatening cities in the forms of shocks and stresses. The ability of cities to resist or restore themselves following these events is dependent on their resilience.

This statement reflects on the importance of resilience (Hopkins 2009) in cities and city management, particularly for those that face hazards, threats, emergencies, and shocks. This requires integrated thinking (Coaffee 2013; Cheshmehzangi 2016) and a comprehensive approach (Cheshmehzangi 2020) of urban resilience in planning practice. The restoration of cities through resilience is detectable in many cases, with methods of integrating the operations, prioritising key systems, and development of a chance for the development of multi-sectoral management to inter-sectoral management. In this regard, what we see is a unique opportunity to create a healthy network between multiple domains (Ban 2012; Linkov et al. 2013; Hajer and Dassen 2014; Admiraal and Cornaro 2018a, b, 2019), through which we can reduce the adverse impacts on the social domain (in particular). Hence, the opportunity can create a new mechanism to not only maintain the primary city dynamism but also to enhance them when and where needed.

In the literature, urban resilience is also regarded as an important concept for 'sustainability' and 'sustainable development' (The World Bank 2012; Washington 2015; Knieling 2016; Tabibian and Movahed 2016; Resilience Alliance 2017; 100 Resilient Cities 2018; Admiraal and Cornaro 2018a, b; Deng and Cheshmehzangi 2018; 'Urban Resilience' webpage 2020), and particularly the environmental sustainability (van der Heijden 2014; Schewenius et al. 2014; Sanchez et al. 2018; ICLEI webpage 2020) and emerging as a component of sustainability in urban policy (Davidson et al. 2019), or associated to issues of climate change, climate change impacts, and climate change disasters (IPCC 2007; ISET et al. 2010; Roberts 2010; Moench and Tyler 2011; Cheshmehzangi and Dawodu 2018; Kershaw 2018). It is regarded as a holistic approach that recognises the systems and processes of urban metabolism (Marvin and Medd 2006; Hajer and Dassen 2014; Admiraal and Cornaro 2018a, b) and the urban being (Renner 2018); or the backbone of city capabilities and measures for the time of need. While there are many conceptualisations and policies of urban resilience (Alexander 2013; Vogel and Henstra 2015; Sanchez et al. 2018; Huck and Monstadt 2019; Nunes et al. 2019), this important topic is yet to be studied as a supplementary factor during the disruptions and adversities of outbreak events. Hence, this book partially addresses this major research gap and expands on the existing literature, which is discussed by cross-referencing to this important field of research in urban studies.

Further to what urban resilience means in the various literature, Sanchez et al. (2018, pp. 3–7) also introduce a variety of resilience conceptualisations, of which the followings are addressed in detail, which are briefly mentioned here (for more details, refer to Sanchez et al. 2018):

- ‘Disaster Resilience’ (also see: Manyena 2006, Coaffee and Boshier 2008, Leichenko 2011, Boshier 2014);
- ‘Engineering Resilience’ (also see: Klein et al. 2003, Ahern 2011, Manyena et al. 2011, Davoudi et al. 2012);
- ‘Ecological Resilience’ (also see: Adger 2000, Monstadt 2009, Davoudi et al. 2012, Anderies 2014, Vale 2014);
- ‘Socio-ecological Resilience’ (also see: Alexander 2013, Smith and Stirling 2010, Hassler and Kohler 2014, Meerow and Newell 2016);
- ‘Evolutionary Resilience’ (also see: Manyena et al. 2011, Davoudi, et al. 2012, Abdulkareem and Elkadi 2018, Nunes et al. 2019);
- ‘Built-in Resilience’ (also see: Boshier et al. 2007, Boshier 2008, Boshier and Dainty 2011, Boshier 2014); and
- ‘Climate Change Resilience’ (also see: Adger et al. 2011, Leichenko 2011, Asian Development Bank (ADB) 2014, Davoudi 2014).

In another example of demonstrating a multidisciplinary perspective of urban resilience, Chelleri and Olazabal (2012) put together a range of resilience conceptions, and put urban resilience as the core of all those necessities. They utilise some of the already mentioned examples of resilience, and few more, such as ‘Socio-Technical Systems (STSs) Resilience’, ‘Individual (Psychological) Resilience’, and ‘Market (Economies) Resilience’. They (ibid) also refer to built-in resilience as ‘Infrastructures’ or ‘Networks’ resilience. They suggest engineering resilience as ‘materials’ resilience and define socio-ecological resilience as an intersection between two separated and defined resilience categories of ‘Ecological’ or ‘Ecosystems’ resilience (Alberti and Marzluff 2004; Minucci 2012; Monteiro et al. 2012), and ‘Social’ resilience (Waters 2012). The below diagram summaries their understanding of the multidisciplinary perspectives of urban resilience in relation to other resilience sectors (also see Chelleri and Olazabal 2012; Olazabal et al. 2012). To summarise, their analysis (ibid) includes four primary resilience of social, markets (economies), infrastructures (networks) and ecological (ecosystems) in addition to their evident intersects comprised of: individual (psychological), STSs, Socio-Ecological Systems (SESs), and engineering (materials). In their analysis, Chelleri and Olazabal (2012) evaluate resilience in multiple disciplines and then position urban resilience in the center of all those defined primary and secondary resilience studies/thinking.

There are also other less-defined categories that are highlighted by Sanchez et al. (2018, p. 7). For instance, examples of stable and unstable resilience (Angeon and Bates 2015), anticipatory and reactive resilience (Vale 2014), or what Anderies et al. (2013) consider as the ‘general resilience’, which “*refers to broader system-level attributes such the ability to build and increase the capacity for learning and adaptation*” (ibid, p. 4). There are also other more recent examples of “societal resilience”

(Marana et al. 2019), which is suggested as a standardisation approach to support the resilience development process. In this chapter, our focus is more towards those generalities or “general resilience” (elaborated from Anderies et al. 2013), with some overlaps with disaster resilience, and defining what they may mean for the city management considerations in the case of disruptive disease outbreak events.

Currently, as demonstrated in the review analysis by Sanchez et al. (2018), urban resilience has gained popularity in various urban-related studies, stretching from climate change studies to urban studies and urban geography (Manyena 2006; Ernstson et al. 2010; Haase et al. 2014; Boyd, et al. 2015; Meerow and Newell 2016), and often in the apparent combination with the overarching topics related to sustainability (Cheshmehzangi and Dawodu 2018). These sustainability-oriented studies also address issues of diversity and sustainability of social-ecological systems (Folke et al. 2002), (urban) sustainability governance (Sanchez et al. 2018), recovery measures (UN Habitat 2012), and associated to urban sustainability goals (Fiksel 2003; Register 2014) as well as the institutional understanding of the United Nation’s sustainable development goals (SDGs) (Cheshmehzangi and Dawodu 2018; Acuti et al. 2020). In more recent years, urban resilience has gained a stronger position in policy associated studies to urban governance systems (Sanchez et al. 2018; Davidson et al. 2019), the complexity of city operations (Asian Development Bank (ADB) 2014; Tainter and Taylor 2014), climate resilience policies and governance (Davoudi 2014; Moffatt 2014; Lister 2016), etc.

As Davoudi (2014) puts it well, the topic of urban resilience emerging as the overarching field of ‘resilient urbanism’, which in fact is a response to a multiplicity of threats, risks/hazards, emergencies, disasters, etc. Many collections of scholarly work, cover the emerging crossovers from urbanism to urban development (Eraydin and Taşan-Kok 2013; Singh 2015; Crowe et al. 2016) or vice versa. It is also transferred from urban development to the fields of urban design (Pickett et al. 2013; Liao et al. 2016; Abdulkareem and Elkadi Abdulkareem and Elkadi 2018) and urban form (Sharifi 2019), and is integrated into the ecological, socio-economics, and planning realms (Pickett et al. 2004; Smith and Stirling 2010; Chelleri 2012). These topics are emerging fast, addressing a range of challenges, risks, and resilience (Singh 2015), such as risks associated with urban health (Singh et al. 2020), urban planning measures (Yamagata and Sharifi 2018). These are addressed from multiple perspectives of adaptation governance (Brunetta et al. 2019), security (Fekete and Fiedrich 2018), urban transformations (Westley et al. 2011; Kabisch et al. 2018), etc. Moreover, as it is highlighted by Sanchez et al. (2018, p. 10), the emergence of ‘urban resilience policy’ is also developing fast and is explored from multiple aspects:

Urban resilience policy is a complex and evolving field characterised by significant challenges associated with urban governance systems, political pressures, uncertain and emergent nature of threats, speed of change and the level of complexity of long-lived networks that form cities. Added to these issues, there are a number of resilience concepts that can potentially be used to develop such policies. These various conceptualisations come with a range of critiques, the most dominant being that they have a too strong focus on, for lack of a better term, bouncing back and seeking to maintain a known way of living; that they do not align well with other urban policy goals; and that their focus is too short-term and too small-scale.

In this regard, we can verify the significance of resilience from multiple perspectives, a range of applicability, as well as from multiple approaches, multiple planning measures, and in various spatial scales (the UN-Habitat 2012; Asian Development Bank (ADB) 2014; Moffatt 2014; Resilience Alliance 2017; Sanchez et al. 2018). In addition, urban resilience surely is a very important concept for the city management scenarios of the outbreak events. It indeed responds to the crucial issues around the reduction of vulnerabilities and the enhancement of city stability. In the following sub-sections, we briefly explore the concept of resilience from three perspectives of education, its characteristics, and its comprehensiveness. It is believed these three factors are crucial to the early preparedness of the city in the case of disease outbreak events.

### 3.2.1 *The Education of Resilience*

Our approach here must be recognised and valued as an educational approach, the one that can have a positive impact on how decision making can happen, how cities can improve their resilience, and how the society can be supported in a more extensive way. The education of resilience is as important as city operations and management. Hence, we first look into what covers the education of resilience, not only at the city level but also from the broader understanding of other scales that may be relevant to the city-scale studies of resilience. More recent scholarly research already cover the important topics of integrated health education in disaster risk reduction, including information dissemination (Pascapurnama et al. 2018), public health education (Levy et al. 2017), sector-based knowledge on public health emergencies (Ung 2020), community engagement and public health ethics (Schoch-Sapana et al. 2020), and public health decision making (Ambat et al. 2019). Most studies explore these important factors from various perspectives of different scales, as their applications are very different between multiple scales. Some examples include decision making and control measures at the ward scale (Han et al. 2020), outbreaks trends in specific settings or sectors (Taoti et al. 2019; Wu et al. 2019), neighbourhood level (Reyes-Castro et al. 2017), city-level (Levin-Rector et al. 2015), provincial level (Chirambo et al. 2019), and also at the state-level through national guidelines (Grafe et al. 2018); or from other perspectives of spatio-temporal dynamics (Paripa et al. 2019) and characteristics (Reyes-Castro et al. 2017), control measures (Al-Abri et al. 2020), etc. Moreover, it is noticeable that these examples are all driven from specific outbreak experiences, and highlight some very valuable reflections of those adversities at the time of vulnerability and need. These are studied regardless of the magnitude of the impacts.

From the extent of available literature, Gomes Ribeiro and Gonçalves (2019) argue in regards to what seems to be the minimal available tools or methods for the improvement of city resilience, and particularly the resilience of urban systems (also, The World Bank 2012). Their analysis covers four basic pillars of (1) resisting, (2) recovering, (3) adapting, and (4) transforming, while addressing how urban resilience

should be seen from five dimensions of: 'natural/environmental', 'economic', 'social', 'physical/infrastructure', and 'institutional' (Tabibian and Movahed 2016; Gomes Riberio and Gonçalves 2019); two more dimensions than the three traditional sustainability pillars (i.e. Environmental, Social and Economic) and more complex in terms of their positions in the education and the practice of urban resilience. Also, there are some overlaps with some of those defined domains suggested by Linkov et al. (2013, p. 10109) in their proposed 'Resilience Matrix', as discussed in Chap. 2 of this book. The example of five dimensions by Tabibian and Movahed (2016) is a comprehensive illustration of not only multiple dimensions but also multiple factors of those dimensions. The breakdown of their resilient city framework includes the following factors under the specified five dimensions (ibid):

1. ***Social Dimension***

Including multiple factors, such as 'Demographics (age, race, class, gender, occupation)', 'Social networks', 'Community values-cohesion', 'Income level', 'Faith-based organisations', 'Cultural diversity', 'Education', and 'Awareness Level'.

2. ***Economic Dimension***

Including multiple factors, such as 'Employment', 'Value of property', 'Financial stability and flexibility', 'Wealth generation', 'Municipal finance and revenues', 'Job diversity of residents', and 'Housing capital'.

3. ***Natural (or Environmental) Dimension***

Including multiple factors, such as 'Erosion rates', 'Biodiversity', 'Restoration of hydrologic flows', 'Conservation of ecologically vulnerable areas', 'Proximity of different habitats', and 'Wetlands acreage and loss'.

4. ***Physical (or Infrastructure) Dimension***

Including multiple factors, such as 'Transportation networks', 'Lifelines and critical infrastructure', 'Commercial and Manufacturing establishments', 'Water demand and conservation systems', 'Flexibility of grid', and 'Energy Monitoring'.

5. ***Institutional Dimension***

Including multiple factors, such as 'Hazard analysis and creation of hazard maps', 'Emergency services', 'Zoning and building standards', 'Emergency response plan', 'Interoperable communications', 'Continuity of operations plans', and 'Collaborative planning'.

In addition to what we see from all above five dimensions of urban resilience and their breakdown (Tabibian and Movahed 2016), there are added factors of resilient measures that need to be included in the case of emergencies, of particular outbreak events. These will be discussed in later parts of this chapter. Similarly, Huck and Monstadt (2019) suggest a critical reflection on the important topic of resilience, perhaps to be seen as a 'boundary concept', which indeed needs to be assessed and understood from a cross-boundary learning approach. In this regard, with such cross-boundary, multi-dimensional and multi-domain systematic structure, we verify the importance of resilience knowledge to a wide range of stakeholder constellations, including the governmental authorities, multiple city systems, developers,

businesses, public and private sectors, and the general public. How we can reach each of these stakeholder groups is a practical challenge that may require further understanding of urban resilience practices.

The transmission of resilience knowledge to each group is possible through various means and measures, which may not be so relevant to the overall aims of this book. Nevertheless, we can argue that it is within the boundaries of resilience knowledge that we can educate those individual or clustered groups, and for each of them in a different way. Regardless of how difficult it may be in real practice, such education is essential, particularly in the event of an outbreak and its progression at the city level. It is also important to note that such challenges of education may also be context-specific as they respond to specific issues that may be related to a particular city and irrelevant to others. These include urban structures, governance structures, the existing institutions of the specific location, etc. Hence, we refrain from solving context-specific challenges by suggesting ubiquitous solutions. In this chapter, we mainly provide a framework that is adaptive and comprehensive enough for not a location, but during a particular emergency event; meaning that it responds to what urban resilience and city management may need to address during the disease outbreak event.

### 3.2.2 *The Characteristics of Resilience*

Broadly speaking, there are certain characteristics attached to the concept of resilience. Consequently, for urban resilience, as Gomes Ribeiro and Gonçalves (2019) demonstrate, there are also five relevant urban resilience characteristics, including, (1) Redundancy, (2) Robustness, (3) Adaptation (also known as ‘flexibility’, by Fabbri and Biancamano 2019), (4) Resources, and (5) Innovation. This categorisation of urban resilience characteristics share some similarities with the circular economy and resilient thinking model of Fabbri and Biancamano (2019) who demonstrate their model with seven characteristics, including three new characteristics of: (1) Reflectiveness (also known as ‘capacity to learn’, by da Silva et al. 2012), (2) Inclusiveness, and (3) Integration; and not including ‘innovation’. To summarise and combine these existing studies of multiple sources, and from the extensive reports of 100 Resilient Cities (2018) and the framework of The Rockefeller Foundation and Arup (2014), the seven characteristics of urban resilience are based on the need(s) of the city’s various (urban) systems. These are summarised as the followings:

- (1) **Reflective**—meaning to “*use past experiences to inform future decisions*”;
- (2) **Resourceful**—meaning to “*recognise alternative ways to use resources*”;
- (3) **Inclusive**—meaning to “*prioritise broad consultation to create a sense of share ownership in decision making*”;
- (4) **Integrated**—meaning to “*bring together a range of distinct systems and institutions*”;



- (5) **Robustness**—meaning to have “well-conceived, constructed, and managed systems”;
- (6) **Redundant**—meaning to “spare capacity purposefully created to accommodate disruption”;
- (7) **Flexible**—meaning to have “willingness, ability to adopt alternative strategies in response to changing circumstances”.

Furthermore, in their conceptual framework, da Silva et al. (2012, p. 3) create a network between three key elements of resilience, productivity, and circularity. This conceptual model is also very similar to the one proposed by da Silva et al. (2012) who developed a systems approach specifically to meet the challenges of urban climate change. This model (ibid, p. 3) creates a network of environmental factors, with social issues, risks, and vulnerabilities of the city. They create three central questions of: “(1) *How does the city work?* (2) *What are the direct and indirect impacts?... (of climate change for their model example), and (3) Who is the least able to respond to shocks and stresses?*”. They later link these factors to the actual purpose of urban systems, reflecting on studies of well-being conducted by Maslow (1971), Alcamo et al. (2003), Huitt (2004). Through these examples, the well-being is then demonstrated (da Silva et al. 2012, p. 6) based on five primary characteristics of:

1. Basic needs for survival (such as, biological and physiological needs)—also addressing: “Adequate livelihoods, sufficient nutritious food, access to water, sanitation and shelter, access to goods”;
2. Security (such as, safety needs)—also addressing: “Personal safety, security from natural hazards and man-made hazards (terrorism, pandemics), secure resource access, order, law and stability”;
3. Health (such as, healthy body and mind)—also addressing: “Feeling well, access to clean air and water, access to health care”;
4. Good social relations and esteem (such as, belongingness and love needs)—also addressing: “Social cohesion, mutual respect, ability to help others, family, personal relationships, achievement, status, responsibility and reputation”;
5. Freedom of choice and action (such as self-actualisation needs)—also addressing: “Opportunity to be able to achieve what an individual values doing and being, personal growth and fulfilment”.

Another more recent example of characteristics of urban resilience is the one generated as part of the UN Habitat’s ‘City Resilience Profiling Tool (CRPT)’ (2018), which is a general guideline to a range of adversities and events. In their framework conceptualisation, the team at the UN-Habitat (ibid, p. 21) utilise 10 critical factors in building urban resilience. These critical factors are recognised as holistic measures, in order to include a range of considerations. The first factor is for the urban resilience framework to be ‘measurable’, highlighting both “*tangible and intangible realities that translate into qualitative and quantitative data...[that]...can be analysed*”. The second factor is the inclusion of ‘urban systems’, the ones that are defined as complex parts of the “*integrated and complex systems of systems, comprised of sectors, people and hazards...and managed through effective governance mechanisms*”. The third

factor is the consideration of ‘inhabitants’, all people who “*live, work, visit, navigate, and/or travel to the city, as we as resident or connected institutions, organisations, businesses, etc.*”. The fourth factor is the importance of ‘continuity’, particularly including “*maintaining the protection and provision of services, flows, and structures in order to save and preserve inhabitant’s lives and livelihoods*”. The fifth factor is recognised as a response to pressures and overcome ‘shocks and stresses’. These are highlighted as examples of situations with risks to the city and those that may be “*sudden and slow-burning, natural or human-made, rare and regular, foreseen or not*”. The sixth factor is the important consideration of ‘transforming’, referring mostly to those examples of “*adopting proactive, forward-looking attitudes that turn challenges into opportunities for growth*”. These mean the methods of transformational progression(s), those that can change the situation by generating incremental and supporting transformations. The seventh factor is the recognition of ‘sustainability’ and its practices to include a wide range of community development factors, innovations, economic generation, and services support. This leads to the eighth factor that addresses the importance of ‘access’, referring to what eventually devises a range of actions, guidelines, and recommendations, those that would essentially be implementable in practice. Finally, all these eight factors feed into the two important factors of ‘planning’ and ‘action’. Through the right planning methods, we can create effective strategies and enhance the city in order to “*tackle...[a wide range of]...vulnerabilities and strengthen capacities to function effectively and efficiently*”. And through actions, we are able to provide reliable and constructive assessments for the support of those strategic planning and responsiveness to the situation. Such an approach would also provide possibilities to provide inclusiveness and take into consideration a multi-sectoral approach to combat challenges. In doing so, we are able to respond to the needs of various stakeholders through their involvement. These are then represented into six distinct characteristics of urban resilience (UN-Habitat 2018), namely (1) persistent, (2) adaptable, (3) inclusive, (4) integrated, (5) reflexive, and (6) transformative—which indicate some overlaps with other studies of urban resilience characterisation. Furthermore, this model (ibid, p. 22, 23) represents three factors of what comprises the idea of resilient (i.e. persistent, adaptable, inclusive). It also embraces three distinct processes, reflecting on how these can be achieved (i.e. integrated, reflexive, and transformative). In reality, the UN-Habitat’s model of characteristics of urban resilience, articulating urban resilience through describing “*WHAT comprises being resilient—by being persistent, adaptable, and inclusive—and the processes on HOW these can be achieved—through being integrated, reflexive and transformative*” (UN-Habitat 2018, p. 22, 23). Hence, it allows for a holistic thinking to resilience thinking:

Under **WHAT** aspects, these characteristics include (ibid, p. 23):

**Persistent**—A persistent city anticipates impacts in order to prepare itself for current and future shocks and stresses. It builds robustness by incorporating coping mechanisms to withstand disturbances and protect people and assets. It encourages redundancy in its networks by generating spare capacity and back-ups to maintain and restore basic services, ensuring reliability during and after disruption.

**Adaptable**—An adaptable city considers not only foreseeable risks, but also accepts current and future uncertainty. Going beyond redundancy, it diversifies its services, functions and processes by establishing alternatives. It is resourceful in its capacity to repurpose human, financial and physical capital. It pursues a flexibility that encourages it to absorb, adjust and evolve in the face of changing circumstances, dynamically responding by turning change into opportunity.

**Inclusive**—An inclusive city centers on people by understanding that being resilient entails protecting each person from any negative impact. Recognising that people in vulnerable situations are among the most affected by hazards, it actively strives towards social inclusion by promoting equality, equity and fulfilment of human rights. It fosters social cohesion and empowers comprehensive and meaningful participation in all governance processes in order to develop resilience.

Similarly, under **HOW** aspects, these characteristics include (ibid, p. 23):

**Integrated**—An integrated city appreciates that it is composed of and influenced by indivisible, interdependent and interacting systems. It combines and aligns many lenses to ensure input is holistic, coherent and mutually supportive towards a common cause. It enables a transdisciplinary collaboration that encourages open communication and facilitates strategic coordination. It supports the collective functioning of the city and guarantees far-reaching, positive and durable change.

**Reflexive**—A reflexive city understands that its system and surroundings are continuously changing. It is aware that past trends have shaped current urban processes yet appreciates its potential to transform through shocks and stresses over time. It is reflective, conveying the capacity to learn from knowledge, past experiences and new information. It also learns by doing and installs mechanisms to iteratively examine progress as well as systematically update and improve structures.

**Transformative**—A transformative city adopts a proactive approach to building resilience in order to generate positive change. It actively strives to alleviate and ultimately eradicate untenable circumstances. It fosters ingenuity and pursues forward-looking, innovative solutions that over time create a system that is no longer prone to risk. A transformative city is focused and goal-oriented towards a shared vision of the resilient city.

In the UN-Habitat’s model (ibid, p. 26, 27), the implementation process of urban resilience is realised as a method of data collection, information processing, assessment, and response. Such a system is designed in a way to fit with a wide range of spatial levels, including “*multiple city scales, geographies, and types*”. This then requires the specification of available data and materials for the exact conditions and the feasibility of what responses may be needed. In a way, this provides a profiling approach that needs to be integrated and holistic. It also reveals a range of aspects that are crucial to the context and the strategies needed at the (local) decision-making level (ibid, p. 26):

The definition of the assessment boundaries can be determined by the local government, based on the mandate of the local government and the relevance of the analysis in the context. The diagnosis assesses multiple geo-spatial areas and scope, as such, obtaining an understanding of decentralisation aspects is essential in our approach to clarify the administrative and financial competences of the local government. The expressions ‘city’, ‘city area’ and ‘urban area’ are employed throughout the tool to refer to the study area. Similarly, ‘local government’ refers to the government entity level that has jurisdiction over the considered study area.

The arguments here lead to the development of a holistic model, one that puts urban systems in a systematic network, and ideally in a network of networks. The implementation process then takes up the opportunity to have an iterative process that is analytical and action-driven. This requires multiple engagement activities, multiple assessment and measurements, careful monitoring, and careful development of action plans in a process. This process is described in five stages (ibid, pp. 27–36), starting from ‘initiation and training’ that offers evaluation and collaborative opportunities for implementation of urban resilience planning. In the next stage, ‘data collection and diagnosis’ are considered as key aspects of “*gathering the relevant data and ensuring its traceability is an essential step in building resilience*”. This stage is then processed through data collection of four sets of (1) City ID, (2) Local Governments and Stakeholders, (3) Shocks, Stresses, and Challenges, and (4) Urban elements (ibid). Each of these sets is then provided with a set of guidelines, addressing specific elements under each set of data collection. The third stage is ‘analysis’, which is a major part and could be conducted in an iterative process. In the final two stages, we see ‘actions for resilience’ that itself may require further analysis (again through the iterative process), and lastly ‘taking it further’ for the actual implementation and urban resilience enhancement.

In the same context of the argument, Huck and Monstadt (2019, p. 211), suggest for “*more interaction and cross-boundary learning between respective knowledge communities*”. In this regard, we can understand the values of strategies and instruments for urban resilience (Acuti et al. 2020). These require an understanding of a co-creation process, which improves the involvement of multiple city stakeholders (Marana et al. 2019). Such an approach also enables opportunities to enhance co-benefits of multiple systems, and help to restructure co-planning methods of the city management. Moreover, this allows us to assess resilience not only from its dimensions but also in terms of its application in practice. Hence, it is recommended to have a good understanding of resilience from its comprehensive nature.

### 3.2.3 *The Comprehensiveness of Resilience*

The first toolkit developed for resilient cities (Siemens et al. 2013; The Rockefeller Foundation and Arup 2014) showcases the comprehensiveness of resilience for the first time (also see 100 Resilient Cities 2018). This was demonstrated through a multi-dimensional understanding of resilience as a concept and then was utilised as a unique practice of urban planning and city management. Through this conceptualisation, the multiplicity of urban resilience was demonstrated and then tested for a new toolkit development, addressing what it means to create resilient cities, and why:

...[The]...events are playing out against a backdrop of global population growth and urbanization, leading to a complex knot of interrelated pressures. In emerging and established cities alike, these trends are changing the spatial pattern of risk and radically altering perceptions

of whether a city is ‘safe’ or ‘well prepared’. Cities have a tremendous challenge to maintain social well-being and economic vitality in the face of these complex, uncertain and constantly changing risks (ibid, p. 3).

Through their explanations of urban resilience, they (ibid, pp. 5–7) then highlight three main factors behind “*creating resilient systems*” in the practice of resilience enhancement, including: (1) Robustness of new and existing infrastructure, (2) Decentralized resource supplies and distribution networks, and (3) Enhanced monitoring and controls. These three pillars are then identified as precursors to creating resilient cities that require a comprehensive action plan. These pillars cover three crucial areas of ‘policies’, ‘governance, and ‘finance’, which are highlighted as:

1. Urban planning and land use policies can direct development in ways that protect people and structures from harm;
2. Governance should take a whole system approach to city management; and
3. Appropriate financing mechanisms are needed to support investments in resilient infrastructure.

Further development of this conceptualisation is shaped around multiple dimensions of urban resilience measures, of which four were highlighted to be “*people, organisations, place, and knowledge*” (The Rockefeller Foundation and Arup 2014; Arup reports in 100 Resilient Cities 2018). For people, the factors of health and well-being were taken into consideration in order to emphasise the societal values and issues that are directly and indirectly relevant to the overarching factor of public health. For organisations, the key factors are in fact cross-overs between social, economic and institutional measures, with which we can develop the operational backbone of the city and the urban systems. For place, the recommendations were mostly about the quality of infrastructure, the physicality of the built environment, critical infrastructures (European Commission 2006; Boin and McConnell 2007; De Bruijne and Van Eeten 2007; Almklov et al. 2012; Brassett and Vaughan-Williams 2015; Coaffee and Clarke 2017; Monstadt and Schmidt 2019), and multiple values of the ecosystems in the city and urban environments. And for knowledge, the considerations are mostly similar to those reflectiveness matters (da Silva et al. 2012; Fabbicatti and Biancamano 2019) and the capacity to learn from the past and take appropriate actions in return. Such an approach should be “*informative, inclusive, integrated, and iterative*” for the decision making processes of the city management (Siemens et al. 2013; The Rockefeller Foundation and Arup 2014; 100 Resilient Cities 2018). Therefore, what we create through resilience is not just a product or by-product of multi-sectoral cooperation and interaction, but also a process of making those crucial decisions at the time of need. As a result, we can argue that the comprehensiveness of resilience, and urban resilience, in particular, is a reflection of the complex city operations. Such complexity of operations can be expressed and developed through decision-making processes, policy demands (Davidson et al. 2019), and planning strategies that define the overall mechanism of city management.

To summarise, there are indeed a range of resilience values (of which educational was discussed here), dimensions, and characteristics that define the comprehensiveness of resilience. They portray an array of resilient systems, resilient measures,

and resilient governance—all together can highlight the importance of resilience in urban planning and the practice of making cities more resilient. The various global examples, of which we only showed a few here, are valuable lessons for us to know exactly ‘what does resilience mean for the case of emergencies?’, and of particular, how can we develop it in the case of disease outbreak events? Undoubtedly, and as expressed in the previous chapters, in such events we deal with a different set of resilience issues; those that may require a procedural approach to be implemented and enhanced, and those that may stretch over multiple stages of the outbreak progression. However, the commonalities between what has been discussed in this section and what is proposed in the following sections are significant; and therefore, what we have in hand is a comprehensive approach to city management—something that is conceptualised in theory, nourished with the literature of cross-disciplines and multiple sectors, and is finally nurtured in the practice of resilience. In the following section and its subsequent sub-sections, and by utilising the knowledge gained from the existing urban resilience studies, we demonstrate a novel urban resilience framework mainly applicable for the case of disease outbreak events.

### **3.3 Conceptualising a “Comprehensive Urban Resilience Framework”**

In facing the disease outbreak event, the city needs to be fully prepared and it should respond in the most effective way. The city faces new adversity and it should recognise its reactions are precarious. In the case of failure, the city may face a deadly situation of high mortality rates and high infected cases, costly in every sector, and harder to reconcile. The city may become fragmented, chaotic scene, and uncontrollable with prevalent disorders and dysfunctional systems. It is then that the city may gradually collapse, and it may continue to suffer for a long time. Its failure can become widespread, and may even have larger global impacts. If the city fails, its operations will fail, and then its governance will become fragile. This is no longer a case of an outbreak. The situation may turn into a disaster, with sirens in every moment of the day, emergencies in every corner, and raids in every community. There are no unbroken shops, there is no security in place, and there is no support. The destructive damages are then beyond those preliminary disruptions. The city will fail its residents, and the hardships will become unbearable through the flames of anxiety, insecurity, fear, and distress. This is how we can negatively portray a city without an urban resilience plan. This can happen to any city and there are no exceptions (Fig. 3.1).

However, in the face of such possible calamitous probabilities, the following framework is proposed to overcome the above issues (see Subsect. 3.3.2, and Fig. 3.2), and expectantly, not to let such failures happen in the situation of the disease outbreak. The period of the outbreak would certainly be disruptive and impactful (not in a positive way), and hence we require to have a holistic review and assessment of all

aspects associated with urban resilience. The eventual outcomes would feed into the all-embracing action plan and strategies at the city management level. As discussed already, impacts from the event should be assessed throughout its progression, and all units/sectors should react in a continuous process of being reflective and adaptive. This requires a thought-through planning, a step-by-step evaluation, and preparedness of multiple factors. Each stage differs from the other stages, and each sector would also require certain needs or face certain challenges at different times of the outbreak progression. These factors have to be addressed holistically from both perspectives of individual sectors and the integration between them that is seemingly more viable on such occasions. The approach requires to be an indicator-based approach of urban resilience enhancement, enabling the opportunity to assess the progress and evaluate any shortcomings and challenges. Therefore, an indicator-based approach provides the opportunity for measurement, monitoring, and regular (but careful and reflective) adjustments to specific parts or targets of the overall plan. Also by having an “*interrelated system of indicators*”, as suggested by Fabbicatti and Biancamano (2019, p. 7), we can have a better overview of assessment and interpretation of the city complexities. Those complexities that can be regarded as measuring the city’s performance and its capacity (Huang et al. 2015), similar to standalone urban sustainable development goals (USDGs), in order to make cities and human settlements “*inclusive, safe, resilient, and sustainable*” (Klopp and Petretta 2017, p. 92). By defining these measures, we can propose a set of precise targets (or target groups), specific applications for diverse actors and systems, and a practical guideline for the time of need. In doing so, the framework would help to enhance the monitoring and control measures of the outbreak progress, and propose for an all-inclusive resilience enhancement. It is important to note that the central element of ‘enhancement’ is extremely crucial, as it responds to not only what is needed (or should be added), but also what is already in place and requires improvement or further attention. Such considerations would depend on the conditions of the context, as well as the availability of institutions, operational units, and multi-sectoral ecosystem of the place/city.

Earlier in this chapter, we explored resilience from multiple perspectives and a range of multiple aspects. Consequently, we highlighted the characteristics of both resilience and then urban resilience, and how they play their parts in both the conceptualisation of resilient systems and the practice of resilient city. Therefore, the way in which operationalisation of urban resilience (Heinzlef et al. 2019) takes place, can be developed as a territorial approach, or even through spatio-temporal, and socio-temporal methods (Hogg et al. 2016; Komugabe-Dixson et al. 2019; Jiang et al. 2020) or patterns (Ma et al. 2019; Aswi et al. 2020) of monitoring and enhancement of the city. Nevertheless, Marana et al. (2019) argue that there is a general lack of operationalisation frameworks for the development of resilience in cities—something that is also addressed in this book. This approach includes the perspective of supply and demand (Sun et al. 2019), and how cities will need to continuously adapt to healthy transitions, if not major transformations. Thus, any resilience approach ought to be as holistic as possible to be able to adapt to a ‘systemic approach’ to a particular territory or location (ibid). This requires an integrative approach to resilience thinking,

one that encompasses a range of considerations. These are expected to be arranged in a hierarchical set-up as we may change our responses or may simply alter the priorities of our operations and management. The city has its specific dynamism, and undeniably a very complex one, too. Hence, it is important to allow flexibility in such resilience planning that can support potential adjustments or amendments, when and where needed throughout the outbreak progression.

In the following two sub-sections, we first explore more about the available frameworks and what they offer and then introduce the new comprehensive framework of urban resilience in the event of an outbreak. In here, the summaries of existing studies and global examples provide invaluable observation and knowledge about this important topic—particularly that it is evident that outbreak events are exceptional cases or occasions, but they potentially can cause substantial damage to the society. Besides all these impacts, it is important to support how the city can manage during such adversities, and how the preparedness can be in place to support the overall responsiveness of the overall stakeholder constellation of the city management, public and private sectors, communities, businesses, etc. Through only a few examples that are explored here, we extract a range of commonalities and significant values that could eventually help to define what can be regarded as an explicit urban resilience framework for the outbreak events. The aim is a two-sided matter: first to reduce the negative impacts on the city, and second to reduce the vulnerabilities. By addressing these two, we are able to strengthen the city in need.

### ***3.3.1 Available Frameworks: What do They Offer?***

Current available urban resilience frameworks are mostly applicable to a variety of emergencies and disasters (The World Bank 2012; 100 Resilient Cities 2018; UN-Habitat 2018), and some are specifically designed to combat climate change impacts or natural disasters (ADB 2014). In all these global examples, outbreak and epidemic/pandemic events are either just mentioned as a category (for example in The World Bank 2012) or are not included at all. Through all examples, we see little attention is given to this global matter of biological classification, which can be recognised as frequent and disruptive adversity. Much of the work around urban resilience framework in disease outbreak events are either included as part of those overarching frameworks and tools (few examples named above) or are merely a set of guidelines and recommendations that may not be necessarily specific enough to address the resilience of multiple systems and sectors in the city. They usually appear as general guidelines or national strategies, which are somewhat different from what a city-level framework normally includes. Hence, there are certain limitations in the practicality of those frameworks, specifically for the outbreak events. In all cases, however, there is consideration of multiple aspects that show the capacity to have an integrated approach to urban resilience (Chelleri and Olazabal 2012; Olazabal et al. 2012; UN Habitat 2018; Zheng et al. 2018; Bush and Doyon 2019; Davidson et al. 2019; Sun et al. 2019; Cheshmehzangi 2020).



In their all-inclusive city resilience framework (CRF), the Rockefeller Foundation and Arup (2014) developed an invaluable set of essential urban systems that highlight the complexity of cities from various drivers and necessities to the city. Their developed CRF then includes four dimensions of “(1) *Health and Well-being*, (2) *Economy and Society*, (3) *Infrastructure and Environment*; and (4) *Leadership and Strategy*”, with each dimension comprised of “*three drivers, which reflect the actions cities can take to improve their resilience*” (ibid; also 100 Resilient Cities 2018). These drivers include:

- 1 Under ‘**Health and Well-being**’: “Everyone living and working in the city has access to what they need to survive and thrive”, including:
  - 1.1 **Meet basic needs** (which are suggested as methods to: “*particularly in times of crisis, ensure that people have access the basic resources necessary to survive—food, water and sanitation, energy, and shelter*”).
  - 1.2 **Support livelihoods and employment** (which are suggested as mechanisms to: “*assist individuals to access diverse livelihood and employment opportunities, including access to business investment and social welfare. This includes skills and training, fair labour policy, and development and innovation*”).
  - 1.3 **Ensure public health services** (which are suggested as plans to: “*provide access to effective public healthcare and emergency services to safeguard physical and mental health. This includes medical practitioners and plans, as well as clinics and ambulances*”).
2. Under ‘**Economy and Society**’: “The social & financial systems that enable urban populations to live peacefully, and act collectively”, including:
  - 2.1 **Promote cohesive and engaged communities** (which are suggested as methods to: “*create a sense of collective identity and mutual support. This includes building a sense of local identity, social networks, and safe space; promoting features of an inclusive local cultural heritage; and encouraging cultural diversity while promoting tolerance and a willingness to accept other cultures*”).
  - 2.2 **Ensure social stability, security, and justice** (which are suggested as mechanisms to: “*ensure a comprehensive and inclusive approach to law enforcement and justice that fosters a stable, secure, and just society. This includes fair and transparent policing and deterrents to crime—specifically in times of crisis, as well as enforcement of laws such as codes and regulations*”).
  - 2.3 **Foster economic prosperity** (which are suggested as plans to: “*ensure the availability of funding and a vibrant economy as a result of diverse revenue streams, the ability to attract business investment, and contingency plans. This involves good governance, integration with the regional and global economy and measures to attract investment*”).

3. Under **'Infrastructure and Environment'**: *"The man-made and natural systems that provide critical services, protect, and connect urban assets enabling the flow of goods, services, and knowledge"*, including:
  - 3.1 **Provide and enhance protective natural and man-made assets** (which are suggested as methods to: *"maintain protective natural and man-made assets that reduce the physical vulnerability of city systems. This includes natural systems like wetlands, mangroves and sand dunes or built infrastructure like sea walls or levees"*).
  - 3.2 **Ensure continuity of critical services** (which are suggested as mechanisms to: *"actively manage and enhance natural and man-made resources. This includes designing physical infrastructure such as roads and bridges to withstand floods so that people can evacuate, as well as ecosystem management for flood risk management. It also includes emergency response plans and contingency plans that may coordinate airports to function so that relief can be lifted in and out during a crisis"*).
  - 3.3 **Provide reliable communication and mobility** (which are suggested as plans to: *"provide a free flow of people, information, and goods. This includes information and communication networks as well as physical movement through a multimodal transport system"*).
  
4. Under **'Leadership and Strategy'**: *"The processes that promote effective leadership, inclusive decision-making, empowered stakeholders, and integrated planning"*, including:
  - 4.1 **Promote leadership and effective management** (which are suggested as methods to: *"encourage capable leadership and effective urban management within government and civil society, particularly during an emergency. This involves strong leadership, cross-sector communication, and evidenced-based decision-making"*).
  - 4.2 **Empower a broad range of stakeholders** (which are suggested as mechanisms to: *"ensure everybody is well informed, capable, and involved in their city. This includes access to information and education, communication between the government and public, knowledge transfer, and timely and appropriate monitoring"*).
  - 4.3 **Foster long-term and integrated planning** (Which are suggested as plans to: *"align sectoral plans and individual projects with the city's vision to be coordinated and appropriate to address the city's needs. This includes city strategies and plans"*).

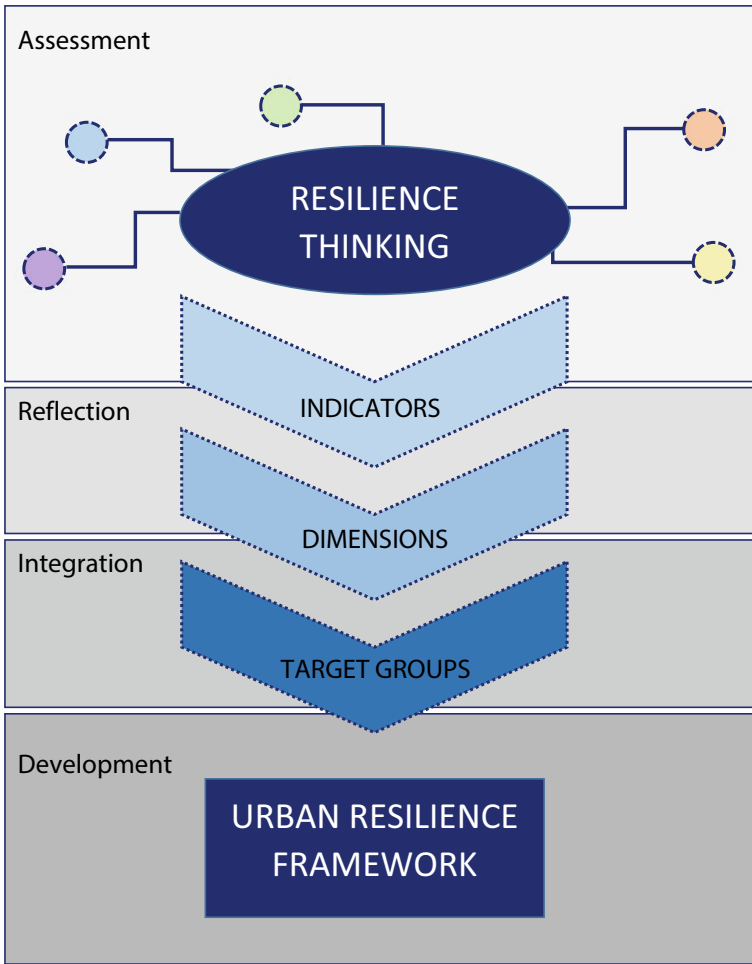
The examples of urban resilience frameworks, developed globally by major organisations, or nationally as part of national strategies, initiatives or guidelines, and in academia through conceptualisation and theory. They represent a wide range of resilience thinking and approaches that address adversities of various types. However, by decoding them carefully, we can see common messages that suggest a holistic approach that needs to be: inclusive, integrated, reflective, and systematic. Therefore,

in the first steps of developing an explicit framework, we have to take into consideration four key aspects, including: (1) the playfulness of synergies between multiple sectors and the effectiveness of integration between them, (2) the comprehensiveness of the overall structure that includes an adequate range of urban systems and measures, (3) the positions and values of stakeholders and multiple means of engagement and empowerment, and (4) the system-based mechanism for institutions that suggest a persistent network of analytical information, infrastructures, materials, and knowledge. In the following sub-section, we put together the above assessed knowledge into a major proposition, which is the development of a novel urban resilience framework against the outbreak events.

### 3.3.2 *The New Framework: What Can We Offer?*

Frameworks are known to be effective instruments, which can demonstrate a comprehensive plan in urbanism, city management, and governance. On many occasions, it is the lack of planning and framework that reduces the effectiveness of urban resilience measures (in practice). Even if those measures are in place, they may not be easily implementable without a central mechanism or structure. Hence, by having a comprehensive assessment of multiple factors, a framework seems to be a vital instrument to enhance the city’s resilience, boost its preparedness, and implement its resilient strategies. A framework development should occur in a procedural approach (Fig. 3.1), understanding what needs to be assessed at first. Those factors may be essentialities of the context, or externalities that would nurture the idea of ‘resilient thinking’. It is then through a reflective approach that indicators and dimensions are developed, before we can suggest how they can be integrated by a breakdown of target groups. This procedural approach summaries the urban resilience framework that should capture the realities and respond to them effectively and efficiently.

In the first step, we have to verify the main structure of the framework, which is generated from an indicator-based system. In this structure, we define major groups of indicators and categorise them based on their relational position to urban systems. In this regard, the urban resilience indicators are defined into two distinct (indicator) categories of ‘*management indicators*’, and ‘*provision indicators*’. These are selected through an analysis of the city’s complex systems and arrangements; through which, we can assess what can be regarded as a matter of management, and what can be identified as a provision matter. This categorisation enables us to distinguish what needs to be managed from multiple levels and by multiple actors, and what should be provided and by whom. The management indicators are central to city management structures, of which we can include a range of relevant commissions, organisations, bureaus, and municipal or district-level authorities (depending on the scale of the city). On the other hand, the provision indicators are essentialities of cities that include a range of public and private sectors, businesses, and a wider range of stakeholders in the city. The management indicators are meant to help the city by reducing the negative impacts of the outbreak event and its progression,



**Fig. 3.1** The procedural approach to urban resilience framework development, from assessment stage and including externalities to resilience thinking of the specific situation and context, to stages of reflection, integration, and development. These include the steps of identifying and categorising indicators, development of dimensions, and allocating relevant target groups for each of those defined dimensions of the urban resilience framework. *Source* The Author’s

while the provision indicators are meant to enhance the city’s capacity to reduce the vulnerabilities of multiple sectors and groups (in the city).

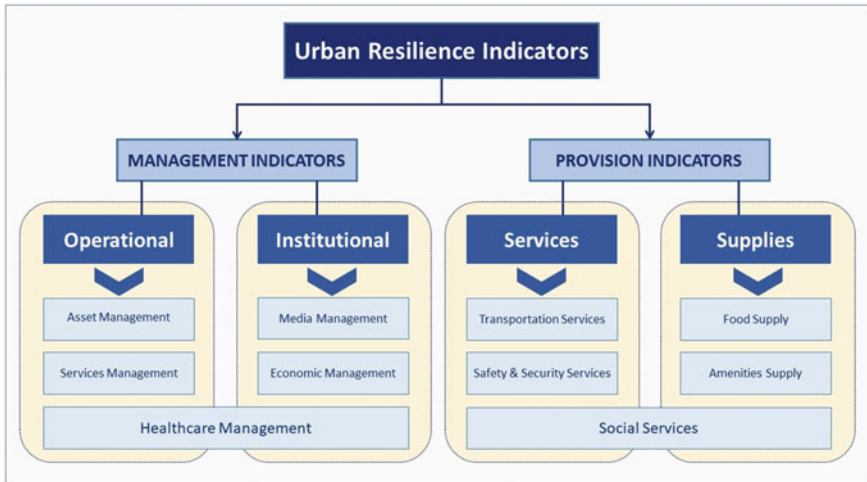
In the second step, and expanded from the initial categorisation of indicators, we define the main dimensions of each category. In this regard, we identify two critical dimensions for each of the indicator categories. For management indicators, the two dimensions are regarded as ‘operational’ and ‘institutional’ dimensions, both representing the crucial factors of the city management. For provision indicators, the two dimensions are identified as ‘services’ and ‘supplies’ dimensions, both reflecting

on the needs and necessities of the society and urban system operations. In doing so, we distinguish in a reflective manner how each of these dimensions then comes with specific needs, pressures, and vulnerabilities. For operational and institutional dimensions, we identify certain factors that feed back to the overall management matters. Subsequently, for services and supplies dimensions, the same applies that reflect on the provision factors and those essentialities of the city. The identification of urban resilience dimensions is important in terms of multiple aspects, which address:

- (1) For ‘operational dimension’—‘How cities operate?’ And ‘whom is in charge of what operation?’;
- (2) For ‘institutional dimension’—‘How cities are managed?’ And ‘which managerial group/team is in charge of those individual management mandates?’;
- (3) For ‘services dimension’—‘How services are provided?’ And ‘Through which means do we provide those services in the best possible way?’;
- (4) For ‘supplies dimension’—‘what supplies and demands are needed?’ And ‘How does the city maintain the provision of all primary supplies to all groups?’.

In this process of dimension selection, we have to match questions of ‘what’, ‘how’ and ‘whom’ to their right sectors and in most cases to multiple sectors in each dimension. Hence, integration is essential, which allows us to have a holistic plan that encompasses a wide range of operations, institutions, services, and supplies.

In the third step, we allocate specific target groups for each dimension. In this arrangement, each dimension consists of two specific target groups, and with one main target group shared between two dimensions of a singular indicator category; i.e. a total of three target groups per dimension, or a total of five target groups in each indicator pillar. In reality, the shared approach in one key target group provides a mechanism for the synergies between two dimensions of each indicator category. The breakdown is in the following. For the operational dimension, the two specific target groups are ‘asset management’ and ‘services management’, both responding to the most important groups under the operational needs of the city in the outbreak. For the institutional dimension, the two specific target groups are ‘media management’ and ‘economic management’, both responding to more socio-economic aspects of management and from the broader understanding of institution enhancement. The shared target group between the two dimensions is the overarching ‘healthcare management’, which is a crucial target group embedded in both operations and institutions of the city, and particularly in the outbreak event. In addition, in the indicator category of provision, we have a similar layout of target groups. For the services dimension, the two specific target groups are ‘transportation services’, and ‘safety and security services’, reflecting on primary services of the city operations from the perspective of the services. For the supplies dimension, the two specific target groups are ‘food supply’ and ‘amenities supply’, carefully including those primary needs of the society and multiple sectors. The shared target group between the two dimensions is the predominant target group of ‘social services’, which itself is comprised of multiple factors and sub-target groups. The social services target group includes the often neglected factors in the event of an outbreak, hence it is important to include it as a shared target group in between the two dimensions of services and supplies.



**Fig. 3.2** The breakdown of the proposed urban resilience framework for the outbreak events. *Source* The Author's, adapted from Cheshmehzangi 2020

The above breakdown of indicator categories, dimensions, and target groups is provided through a comprehensive urban resilience framework, specifically developed for the context of the city (Figs. 3.2 and 3.3). It is also applicable to smaller communities or cities of various sizes, yet it should be carefully adapted and reflected on the actual context and conditions of the outbreak event (and its progression). The breakdown of this proposed urban resilience framework is demonstrated in Figs. 3.2 and 3.3. The following two Sects. 3.4 and 3.5 will delve into all factors associated with both dimensions of management and provision.

### 3.4 Understanding the 'Management' Indicator Category

In this section, we elaborate on all target groups under the main indicator category of 'management' and its two dimensions of operational and institutional. Regardless of the type of outbreak, and even from the examples of non-human disease outbreaks, we deal with certain issues of large-scale disturbances and the implications for management practices (de Groot et al. 2018). Hence, the actual momentum is recognised as a disruptive period. The situation also encompasses a range of management issues that require urgent attention in order to sustain the performances of various systems in place. For human-related disease outbreaks, there are examples of unknown and sudden outbreaks (Schuster and Newland 2015; Ansumana et al. 2017; Lowe et al. 2019; Shears and Garavan 2020) as well those that are more common or seasonal (Firestone et al. 2012; Pires Maciel et al. 2014; Ohuabunwo et al. 2016; Godefroy et al. 2018; Rizkalla et al. 2020) but often occur in a sudden instance, too. The situation



**Fig. 3.3** Simplified version of the framework comprised of two indicator categories of management and provision, four dimensions, and a total of 10 target groups. Legend for target groups in the Management (M) Category include: **M1**: Asset Management, **M2**: Services Management, **M3**: Healthcare Management, **M4**: Media Management, and **M5**: Economic Management—Legend for target groups in the Provision (P) Category include **P1**: Transportation Services, **P2**: Safety and Security Services, **P3**: Social Services, **P4**: Food Supply, and **P5**: Amenities Supply. *Source* The Author’s Own

escalates further once the outbreak expands further to become an epidemic or even a pandemic situation. Some of these cases are novel in terms of the disease characteristics (Wang et al. 2012) and transmissions; meaning that they require a set of watchful control and management measures. The occurrence of such events, and the upsurge in their frequency and intensity, are alarming factors for the overall management of the situations as well as the management of the systems. Undoubtedly, there are certain conflict and control issues (Shears and Garavan 2020) that reflect on issues of community involvement, response programme development, strategy enhancement, integration of plan to existing health structure, and enhancement of response effectiveness. These aspects require management not only at the top, or from a top-down approach, but also at multiple sectors or systems and sometimes at the bottom levels.

Nevertheless, it is recommended that management remains mostly top-down in such incidences and for the case of strengthening the institutional networks. In doing so, management should sustain its position to help better monitor and control of the outbreak and its progression. But more important than all, is that in all management target groups, it is essential to include and maintain three main management considerations of: (1) risk management, (2) control and monitoring management, and (3) general management.

Through ‘risk management’, all associated risks of individual and collective sectors should be carefully assessed at multiple stages, through both preparedness and responsiveness (when needed). Risk management should include, in particular, the management of emergency services (which also come under the provision indicators). This should include probable plans for evacuation management, with the need for higher-level intervention in a possible escalated event. This planning would require a feasibility assessment as it may require the support of multi-level management, those that may include national and international organisations. Nonetheless, risk management can include multiple aspects, too. For instance, Smith (2006) suggests a combined approach, which is developed on the role of risk perceptions, communication, and management—an integrated plan that could support policy development, too. In another example, Hassani et al. (2019) propose a model that deals with the risk of disease emergence (and spread), which is a combined approach of risk management, signal processing, and econometrics. In all cases, there is a need for risk measurement, and forecasting scenarios of outbreak progression.

Through ‘control and monitoring management’, it is essential to have continuous or regular checks that include both control and monitoring measures. In this practice, it is essential to include a range of prevention services or even crisis prevention measures (Choi and Kim 2016) that can fully cover the management of the outbreak, which should help to avoid reaching a crisis stage. As part of prevention services, the foremost example is having structured isolation management in place, which is more practical at smaller scales of various range (Anderson 2009; Risa et al. 2009; Doménech-Sánchez et al. 2020) even though it can get prolonged and costly (Danial et al. 2016). At the city level, it is important to have a systematic investigation planning in place (Korte et al. 2016), which can increase the efficiency of monitoring and detection methods. In doing so, we can promote case management (Oluabunwo et al. 2016) from various viewpoints of on-site mobilisation, training development, management of care-providers, and rapid containment planning. Moreover, in order to promote control and monitoring management, it is also vital to utilise the integrated digital platforms (from the experience of COVID-19) and have agent-based models in order to detect multiple important outbreak patterns, such as (case) mobility, growing symptoms, transmissions, etc. Finally, in all these examples, it is crucial to sustaining control and monitoring measures across all management sectors of urban systems. Some of these prevention measures/services, should develop as isolation management plans, and if required, with urgent need of collective measures and management practice across multiple sectors or systems of the city. This means isolation management should be embedded in the overall management plan.



Lastly, through ‘general management’, it is essential to sustain the generalities of management demand, such as those supply and demand factors that can feed into policy adaption and policy implementation. Such an approach to policies should include the development of general public guidelines, general public education, enhanced control, as well as the development of restrictions and further inspection (if needed). The general management should act as a major mechanism in between multiple objectives and multiple criteria of urban systems, to ensure their management is monitored, supported, and updated (or adjusted) in the times of need. Here, the primary functions of general management are beyond the usual finance, marketing, and operations. In the outbreak, the general management ought to maintain a range of activities that can promote the involvement of a larger group of stakeholders who can feed into the critical factors of planning, strategy development, conflict management, and decision making.

In the following five Subjects. 3.4.1–3.4.5, we explore all five individual management target groups, across two dimensions of ‘operational’ and ‘institutional’. As expressed previously, while these target groups are recognised as individual systems or factors of the overall (city) management, they should also be seen collectively, and if not, at least in integrative thinking. This is certainly realised as a crucial factor for the enhancement of urban resilience from the perspective of multiple management.

### ***3.4.1 Operational Dimension—MI: Asset Management***

Asset management is all-encompassing management that includes a range of products, values, investments, and the overall profile of one’s resources. While it is a terminology mostly used in the finance sector, it is highly important for the operational dimension of urban resilience, particularly that it provides a wide-range understanding of urban resources. More broadly, asset management can include asset vulnerability framework (Moser 1998), asset allocation and performance (Sharpe 1992), and measures that address issues of maintenance, replacement, and reliability (Jardine and Tsang 1973). The latter is the crossover between two crucial aspects of maintenance management and physical asset management, from the understanding of productivity and maintenance. In urban resilience, it is important to have an overview of what is available? In what capacity are they available? And how they can be maintained as resources for better resilience? Hence, asset management can play a major part in how we identify necessary resources, and then manage where and how we should allocate them in the practice of preparedness and the later responsiveness.

In her presentation on issues of asset management in cities, Mian (2018) profoundly connected the dots between urban resilience development, city-scale governance, and asset management (from the general resilience perspective). She addressed how asset management cannot be dealt with in the isolation of individual sectors, but should be seen holistically across multiple sectors of urban resilience. Hence, there is a need for us to identify how we assess our assets and how we then

manage them in the case of city preparedness through urban resilience enhancement. The asset management decisions should be made across multiple sectors and in line with the critical infrastructures' resilience plan. Similarly, other examples link asset management to measures of risk management and risk reduction that enable the possibility for urban resilience enhancement. For instance, AECOM (2020) explores a range of representative services, comprised of critical infrastructure protection, physical security and hardening, climate change adaptation, cybersecurity, disaster risk reduction, hazard mitigation planning, and disaster recovery. In all cases, they (ibid) highlight the position of asset and asset management in the practice of urban resilience, by addressing: "*investment in resilience today means protection and cost avoidance in the future. We help clients and communities around the world build resilience through an extensive understanding of assets, risks, and vulnerabilities*". This is similar to earlier reports by Mitchell and Harris (2012), who described resilience as a risk management approach. They included asset management as part of risk management across multiple policy areas, suggesting how they can support the plan for resilience enhancement. This is a reflection on asset resilience and how it helps to reduce the vulnerabilities through prompt management (MMI Engineering webpage 2020); i.e. asset as a service to help to manage the risk. In their narrative, assets are valuable for resilience and the resilience of assets are valuable for good operations (ibid). Other examples are those that relate to specific sectors, such as building community resilience (Municipal Affairs of Alberta 2015), transportation asset management scenarios (US Department of Transportation 2013), or understanding infrastructure resilience from the perspective of asset management (New South Wales Government webpage 2020). In the latter, the argument is that "*infrastructure resilience is focused on the resilience planned for, designed and built into assets, networks and systems*", namely those assets that deliver "*positive service or amenity to their communities e.g. transport infrastructure, water and wastewater, stormwater drainage, waste facilities, dams, community buildings, etc.*" (ibid). Therefore, we can argue asset management plays a major part in general city operations, particularly in the time of outbreak events.

To summarise what needs to be taken into consideration for asset management, we argue in terms of the overall operationalisation perspective (Marana et al. 2019), which includes a variety of systems, resources, and capacities at the city level. Hence, we should include factors that include human resource management, particularly for those weaker healthcare systems or those who lack enough human power to handle the outbreak event. The boosting support from human resources will be a major asset for the overall operational factors, and as such, it is evident that early assessment of assets would help to overcome the later problems. One of the other aspects significantly crucial in the event of an outbreak is having a structured plan to implement a well-informed asset resilience index (Argyroudis et al. 2020), which should be in place to address any damages or deficiencies to the overall asset management. This system-based approach is very much relevant to those specific critical infrastructures, and those that can help to support the operations of the city. In addition, having an adaptive plan in asset management would help to overcome one of the main resilience shortages, which is to ensure having the capacity to adapt or to even transform the

urban systems (Cariolet et al. 2019). This comprehends a greater understanding of a 'reflective approach' that suggests the systematic property of resilience (ibid), which is particularly relevant to the city operational factors. Moreover, it is important to put together a combined approach of resilience-based infrastructure planning and asset management, as proposed by Rasoulkhani et al. (2019). Again, this approach responds to those supply and demand mechanisms and the overall operational needs of the city. Lastly, and more importantly, we can argue that much of the asset management comes down to resource management (Berg and Nycander 1997). Hence, it is crucial to have a holistic plan of resource-asset management that is multi-sectoral, multi-objective, and multi-spatial.

### **3.4.2 Operational Dimension—M2: Services Management**

As critical as it sounds, services management is commonly recognised as the backbone of city operations. Services themselves are identified as one of the two dimensions of provision indicators. But for the specific target group of 'services management', we have to understand how services should be managed, and how they play their part from the operational perspective. The city normally operates through a range of daily operational services, some can be in full operations and some are partial, seasonal, and temporary. Their management plays a major part in how they run, as well as how they may impact the societal need. Hence, the management aspect should consider the basic services (Etinay et al. 2018), and if not all. In the case of emergency, the management may exclude secondary services, usually the ones that run in parallel to the basic services as they either support the secondary activities or merely maintain the sustainability of the basic operational activities. Therefore, the basic services are defined as the most accessible ones (McPhearson et al. 2014) and are usually the ones essential for the daily needs of society. In most cases, infrastructure and services come together (The World Bank 2012; Ogie et al. 2017; Chaturverdi et al. 2019), suggesting how they jointly address the primary needs of city operation.

In urban resilience, services management refers to the enhancement of societal resilience (Marana et al. 2019). This needs to develop through a co-creation process, holistically planned to involve a larger body of stakeholders (ibid). In return, the co-benefits of each service management criteria should ideally reflect on the development of an integrated management system. At first, we may require to take on a board a multi-service differentiation plan (Wang et al. 2020) before the middle stage of service management co-creation through integration, and the later stage of network development for multi-services management. Hence, this needs to develop into a holistic services management system (SMS), which is defined as an inclusive management system bringing together a range of organisation management aspects, such as planning, policies, strategies, objectives, documentation, and processes. Developed first in manufacturing and then vastly utilised in the information technology systems, services management (for cities), can be an integration between operational aspects of production and activities with information-based processes. Hence,

there is an evident advantage of utilising this particular system of multi-management and integrate it with a digital platform for operational monitory purposes.

In the case of an outbreak, services management can be a flexible platform for control and monitory of operations in a multi-aspect approach. There are also some minor overlaps with the earlier asset management target plan, which refer to services as resources for operation. In smart city examples, we can see such a mechanism as integrated management of public services (Smart Water Magazine 2019), which is aimed to optimise the operations:

...the efficiency in terms of managing new and existing infrastructures has to reach levels previously unseen. This requires the integration of all infrastructure, both public and private, with regard to operation and maintenance. The purpose is to have a sensible impact and improve the quality of life of citizens.

However, we must conduct a feasibility assessment to certify the effectiveness of such an integrated management system model, or aim to enhance the capacity of multi-management approach when needed. This should be seen beyond the typical provision of quality services, as it ought to undertake the role of management beyond just one sector or one need. Similar to those water services management examples (highlighted in Katko et al. 2013), a system approach of multi-services management would help to strengthen the governance of public services. This approach indicates a move away from risk management to resilience management of services, one that can boost the “*deployment of crucial services*” (Linkov et al. 2014) in the time of emergency. There are some similarities of such approach with those in ecosystem services and social-ecological systems (Lundberg and Moberg 2003; Briggs et al. 2012, 2015), which indicate the benefits of multi-management approaches in the resilience paradigm, particularly in the sub-field of resilience planning. To summarise, in the case of an outbreak, services management should enhance the operational robustness, particularly in public services. The approach, as expressed through other resilience examples, should be integrated into a multi-sectoral and multi-management mechanism. Through a co-creation approach, the mechanism should develop a dynamic network-based system for resources, basic services, critical infrastructures, productions, and primary city operations.

### **3.4.3 Operational/Institutional Dimensions—M3: Healthcare Management**

A major management aspect of outbreak events is healthcare management, which is jointly shared between operational and institutional dimensions of management. In reality, the healthcare system is a major player in outbreak events, particularly that it requires to provide a variety of aspects, including health care services, resources, physical support (infrastructure), facilities, emergency services, isolation support, health care logistic response (Cutter et al. 2010), etc. In many cases, healthcare units become obvious hotspots of disease outbreak, and their workforces and units

are usually subject to high(er) risk of disease transmission (Ghebrehewet et al. 2016; Hiller et al. 2019; Orsi et al. 2019; Taori et al. 2019). The healthcare system generally receives one of the early sudden shockwaves of the outbreak. In return, they face a higher probability of becoming a vulnerable system at the early stage(s) of disease outbreak progression. If not managed well, the impacts on health systems can cause other issues that may have a wider societal impact (Johnston et al. 2007; Elston et al. 2016). This may even cause further psychological and emotional issues that may increase the society's level of anxiety; also often leading to extreme examples of health conditions (Atkinson et al. 2009). But despite the difficulties it may face, the healthcare system plays a vital part in the delivery of health services to the general public. In the case of an outbreak event, it is crucial to monitor the quantity and quality of healthcare units and centers; hence, careful management is essential. Kruk et al. (2015) also suggest how fragile the healthcare system can become during disease epidemic situations, highlighting the ways we should enhance the resilience of the health systems to ensure their preparedness and continuity in operation and services. In reality, the management of the healthcare system is invaluable as part of the primary city preparedness measures.

In urban resilience enhancement, we ought to comprehend healthcare management as both an operational matter and an institutional factor. Healthcare is an operational target group based on its position in dealing with relevant training, treatment, control, and even containment procedures. It is also an institutional target group (i.e. identified as a healthcare system), which is defined as a formal structure comprised of multiple aspects. These aspects include certain associated organisations, workforce units, people and actions, principally intended to maintain, restore, or promote health. It should not be mistaken with health infrastructures and/or facilities (e.g. hospitals, clinics, etc.) as healthcare is broadly described as a system more than just the facilities it should normally offer. Also, there is a common misinterpretation between the two primary terminologies of 'healthcare system', and 'public health', which in reality, are linked together in resilience thinking. However, public health is closely linked with factors of governance, regulation, and support. It is also defined as a branch of medicine, which includes disease prevention (Hall et al. 2011) or crisis prevention (Quah and Lee 2004) as one of its mainstreams. The other main difference between the two terminologies is the focus areas that define them more clearly. While public health focuses more on disease prevention, it mostly focuses on safety measures and health improving mechanisms. It is also commonly used as a platform to detect health issues and provide necessary responses at the time of need. On the other hand, the healthcare system or health system is the actual capacity of operations. At the same time, it is a major institution within the array of public services and urban systems. Hence, during the outbreak, its management requires a two-sided approach, both as part of the city operations and also as the institution that supports the delivery of health care services. In their studies, Lurie and Fermont (2009) suggest building bridges between health care and public health, including also the associated medical care systems (Woolf 2013) that are vital to cases such as the outbreak event. In their recommendations, Lurie and Fermont (2009) highlight the importance of synergies between health care and public health, including

the possibility to integrate the two in practice. As such, they argue in favour of the “*effectiveness of shared efforts between health professionals and other stakeholders, including community-based organisations (COBs) and health plans*” (ibid).

Resilience, as an integrative construct (Zautra et al. 2010), should ultimately sustain the health and well-being of the society in the case of an outbreak. This should help to further develop the capacity of public health and its effectiveness in practice, including specific programmes and interventions that are specifically designed for the promotion of health and societal well-being (ibid). If healthcare management is not sustained promptly, it can eventually fail the healthcare system and its services. This will lead to a shortage of workforces, shortage of medical support, shortage of treatment support, and many health disadvantages that can intensify the adversities of the outbreak event. The immediate impacts can be increased in the number of infected cases and mortality rates. As a result, healthcare management would need to sustain all healthcare operations. In return, the healthcare system should persistently operate as a fundamental institution in support of public health and medical demand (particularly in the case of emergency). It should also continue with optimal quality of medical care, providing support to those in need for various health conditions, and not only for the specific disease of the outbreak. The involvement and integration of both private and public sectors would help to increase the health system capacity to ensure all healthcare services are maintained, offered, and managed in the most optimal way. In doing so, we require to aim at safeguarding the society from any risks associated with the outbreak event and provide healthy management of the resilient healthcare services.

#### ***3.4.4 Institutional Dimension—M4: Media Management***

In our age of media control (Rosa and Rosa 2011), we have to understand the two-sided control of media in the case of the outbreak—i.e. how media can control? And how it can be controlled? Such control comes from the idea of media management that signifies the important role of media as an institution, which ought to be influencing and informative. Strongly tangled with public policy and education, media is a playful part of an outbreak, from the dissemination of correct and false news, to strengthen the public trust, reassurances, support, education, etc. The way how media plays its part during the outbreak is very crucial for the maintenance of a societal mindset, educating the general public, and informing them of the guidelines, policies, requirements, and updates of the situation. The consequences of lack of trust in governance may cause adverse impacts on a wide range of areas of policy effectiveness, economic policy, the economy, the economic crisis, compliance(s), accountability, regulations, education, and social capital. Hence, it is important to maintain healthy public diplomacy (extracted from multiple sessions by Algan 2013, Burns 2013, Coyle 2013—all from Organisation for Economic Co-operation and Development (OECD) workshop on “joint learning for an OECD Trust strategy” 2013), which is trustworthy in every step and is informative to a larger group of the community.

While the sensitivity of the information should be taken into full consideration, it is important to maintain the right level of transparency and community engagement through the right sources of media. The rightfulness of this particular management is vital to avoid any further uncertainties, confusion, fear, and anxiety.

Trust in governance is essential from various perspectives, and should be maintained through a robust media management plan. As highlighted by the OECD (2019), there are six areas that governments can increase the public trust, including (1) reliability, (2) responsiveness, (3) openness, (4) better regulation, (5) integrity and fairness, and (6) inclusive policy-making. In each area, there are certain aspects that should be identified and practiced. These are key aspects that can be utilised later on specifically for the practice of media management, and help to increase its effectiveness:

- **Reliability**—*governments have an obligation to minimise uncertainty in the economic, social, and political environment;*
- **Responsiveness**—*trust in government can depend on citizen's experiences when receiving public services—a crucial factor of trust in government;*
- **Openness**—*open government policies that concentrate on citizen engagement and access to information can increase public trust;*
- **Better Regulation**—*proper regulation is important for justice, fairness, and the rule of law as well as in delivering public services;*
- **Integrity and Fairness**—*integrity is crucial determinant of trust and is essential if governments want to be recognised as clean, fair, and open.*
- **Inclusive Policy Making**—*understanding how policies are designed can strengthen institutions and promote trust between government and citizens (ibid).*

Furthermore, what we can extract from this trust-building strategy are multiple factors of inclusiveness, openness, and engaging attributes that can help to strengthen the media and its management. The official sources should remain valid and trustworthy so that the general public can have consistent access to the right information and updates, and have a clear understanding of the outbreak progression, its impacts and the guidelines to control and monitoring measures. As an institution, media management should be effective to address these factors from the inception of the outbreak event. Failures to do so would shift the general public mindset to different directions. It could also create added confusion and anxiety, and could intensify the mistrust with the government. Hence, it is vital to avoid the inappropriateness of empowering the unofficial media, as they may have a higher chance of creating and disseminating false news and information. Thus, the role of media management should be effective enough to avoid unnecessary distributions caused by the public or even professional assumptions. Media management should rather focus on the provision and management of rightful sources of information that people can trust and follow meticulously. Adhering to such means of media management would help the society to play a part through health engagement, too.

To summarise, media management should propose for certain media arrangements during an outbreak, those that can provide access to right resources of information, knowledge of urgent matters, incident response arrangements, information on

possible restrictions, and relevant considerations for outbreak progression (Biosecurity Incident National Communication Network 2019). This dialogue of public communication would normally be widespread in the mass media (Watson 1993), which in reality is consisted of multiple media means, including: digital media (of various examples), social media, unofficial media (e.g. forums, blogs), and official media (e.g. news and official dissemination). Mass media also operates at different scales of community-level, local level (district or city level), provincial/regional, national, and international. The media may also be framed and generated by different groups, such as local or federal officials, academics, medical experts, public health authorities, etc. (Kott and Limaye 2016). In an outbreak event, all these sources play a part in the dissemination of information. While social media is appraised as a valuable tool from certain viewpoints, such as for supporting public health practices (Charles-Smith et al. 2015), it is important to manage its validity and effectiveness through the practice of media management. Hence, there needs to be an integration between a particular professional sector and the social media, to ensure valid knowledge is transformed into the wider community. A similar example of social media use during Ebola outbreak was assessed by Hossain et al. (2016, p. 2136), suggesting to have a formalized channel of communication as a necessity and to have public health responses as the priority:

The West African 2014 Ebola outbreak has highlighted the need for a better information network. Hybrid information networks, an integration of both hierarchical and formalized command control-driven and community-based, or ad hoc emerging networks, could assist in improving public health responses. By filling the missing gaps with social media use, the public health response could be more proactive rather than reactive in responding to such an outbreak of global concern.

Furthermore, as Tumpey et al. (2018) put it well, the evolving outbreak also comes with evolving communication. Hence, careful attention should be given to those widespread news/information broadcasting networks such as the digital media environment and those means of constant news dissemination (ibid; also see: Reynolds and Seeger 2014; World Health Organisation (WHO) 2018). Therefore, it is important to involve the official public health authorities (Collinson et al. 2015) in the whole process: *“because the ways in which receipt of news is evolving, the ways in which public authorities communicate with the media and public needs to adapt in similar ways”* (Tumpey et al. 2018, online source). Such involvement should help to enhance the dissemination of important public health measurements (Collinson et al. 2015), and avoid any disparities between multiple official sources. The media management should be effective enough to identify and avoid any unforeseen conflicts between multiple sectors or professional bodies, particularly through the public health system and their respective authorities. Any differences could impact risk perception, attitude, and subsequent behaviours (Kott and Limaye 2016), which can be risky itself and can create unwanted tensions. Any misinterpretation could cause pressure on the authorities, hence it is important the communication is legible and inclusive to all. In this regard, the public perception of risk (Sandman 1989) and risk information (Kott and Limaye 2016) should be accurate, and communications should be



conducted through the right channels. This should be processed through the development of a healthy communication planning (Covello 2002; Reynolds and Quinn Crouse 2008; Mitchell et al. 2016; WHO 2008; CDC 2018). In line with such planning and arrangements, Singleton et al. (2000, p. 267) highlight a range of media management suggestions, including ten key recommendations that reflect on their experience of an outbreak:

Four of these...[recommendations]...are around managing the media, including using a proactive press release, providing detailed briefings, using a single spokesperson and coordination of the response by a press officer experienced in media management. Another four describe how to deliver an appropriate on-site response, often requested during community intervention programmes. The two final recommendations relate to ensuring good communication and supporting staff during what is an intensely stressful period.

The above should reflect on the details of communication planning. Therefore, we can argue that the reliability of information sources is extremely important for multiple stakeholders, multiple uses, and multiple levels. As it only takes one single ill-informed information to cause a chaotic situation with some added disruptions. In this regard, media management as a major institution, should be a constant supporting means during the outbreak progression. Finally, ignoring is not the right tool of communication, and media management should be taken seriously from inception. Media management should be done for the enhancement of reassurance, provision of guidelines and support, and information sharing with the right knowledge and updates to multiple stakeholders. While the information dissemination is important, its management is even more so.

### ***3.4.5 Institutional Dimension—M5: Economic Management***

The correlation between epidemics and economics is widely studied (Bloom and Mahal 1997; Bloom et al. 2004; Bloom and Canning 2006; Beutels et al. 2009; CDC 2016; Fan et al. 2017). Much of this correlation is studied in the field of 'Economic epidemiology', an intersection of epidemiology and economics. Yet, the overall economic assessment needs to be studied from the management perspective. Branched out of management sciences, economic management reflects on the functionality of economic operations, such as the management of resources, finances, income, expenditures, businesses, various enterprises, etc. Besides severe impacts on the society, mortality rates, and the health system, there are long term economic impacts from outbreak events; those that put production on halt, and impair the city's operations at most. Regarded as 'economic burden of disease', the World Health Organisation (WHO) (2009) identifies a range of measures that are oriented around productions (market and non-market), controls, and coping strategies through incorporation between multiple systems. Their report (ibid) focuses on disease and injuries at the micro level, while it can be understood and reflect on a higher level of a disease outbreak (Huber et al. 2018), and how it may have economic consequences

for the overall city management. This is related to both short-term and long-term impacts on cities and communities.

The economic costs of outbreak events are generally significant (Thomson et al. 2003), and the economic burden often comes in combination with ‘social burden’ or ‘social costs’ (Huber et al. 2018; Qiu et al. 2018). Hence, the impacts can also be identified as socio-economic impacts (United Nations Economic Commission for Africa 2014). Similar to animal outbreak events, the “*general economic and financial instability*” in a particular location is the result of weaker institutional structure (The World Organisation for Animal Health 2007, p. 112); hence, they become a bigger burden in the outbreak management during different terms. Similarly, in their report on ‘The Economic Impact of the 2014 Ebola Epidemic’, The World Bank Group (2014) assessed the economic impacts of the outbreak at short and medium terms, estimating the various channels of impacts on the society. In their report, they suggest two distinct channels of impacts, direct and indirect (ibid, p. 7):

The impact of the Ebola epidemic on economic well-being operates through two distinct channels. First are the direct and indirect effects of the sickness and mortality themselves, which consume health care resources and subtract people either temporarily or permanently from the labor force. Second are the behavioral effects resulting from the fear of contagion, which in turn leads to a fear of association with others and reduces labor force participation, closes places of employment, disrupts transportation, motivates some governments to close land borders and restrict entry of citizens from afflicted countries, and motivates private decision-makers to disrupt trade, travel, and commerce by cancelling scheduled commercial flights and reduction in shipping and cargo service.

In this regard, economic management needs to be considered at multiple levels, and it is beyond the boundaries of the city. It often takes into consideration certain national strategies, regional planning, and in more severe cases the attention of the global level. In the latter level, global trade may become disrupted (Amadeo 2020) and affected regions need to implement the emergency economic plan. While we do have an international mechanism of Global Health Security Agenda (GHSA) to improve health emergency preparedness globally (GHSA 2017), its operations do not necessarily support the economic losses of specific locales. It is unfortunate that in some cases of an outbreak, the international cooperation (usually) responds with a delay; and the outbreak only becomes a matter of emergency once the economic impacts are felt at a larger scale (through development at epidemic and pandemic events). Throughout such a process, the city still needs to cope with its economic losses, financial burdens, social losses, and production reduction; and these require widespread economic management. In addition to these factors, the city needs to deal with external economic considerations (Awalime et al. 2017) and manage the economy at micro and macro levels (Luo 2013), if not anything further. Some suggestions on economic management are associated to the implementation of a robust risk management framework (Santos et al. 2013; Cheshmehzangi 2020), which can essentially inspect “*the tradeoffs between minimising sectoral inoperability and minimising economic loss*” (Prager et al. 2017, p. 7).

To summarise, economic management should carefully consider issues of: reduction in trade and transportation, reduced tourism, reduced mobility, decreased agricultural production, decreased production activities, fewer investors, business temporary closures, market decline, high fiscal impact, higher unemployment, and redundancies (some extracted from lessons by Mercy Corps 2019). The city management ought to assess various costing and demands of multiple sectors (Luyten and Beutels 2009), particularly those that are directly affected by the outbreak. A relevant cost analysis would help to decide on certain adjustments or priorities that can help the city’s economic stability. From the institutional perspective, economic management should be conscious of slowing down the economy, assess the risks, and evaluate the long term economic impacts. There is an urgent need for emergency economic plans (i.e. through a multi-sectoral framework) to have an immediate action plan, short term contingency plan, and long term recovery plan. A multi-sectoral approach is essential (Smith et al. 2019) to evaluate co-benefits between various urban systems and have effective risk management beyond medical responses (World Economic Forum 2019, p. 13). Finally, economic management response strategies should be inclusive and should create an ecosystem of multiple businesses, sectors, and organisations.

### 3.5 Understanding the ‘Provision’ Indicator Category

In this section, we elaborate on all target groups under the main indicator category of ‘provision’ and its two dimensions of services and supplies. Apart from the multi-management requirements of urban resilience enhancement, the city needs to sustain the provision of certain services and supplies. In doing so, we respond to a situation of supply and demand, while dealing with potential shortages across various sectors. Thus, it is inevitable that the outbreak event results in the decline of services and a shortage of supplies. For services, there is a significant decline in regular operations of multiple units/sectors and their provisions, as we see mostly in weakening health care services and primary social services. We anticipate potential fragmentation in regular operations that impacts not only the growth but also the stability of the society. While emergency services are on full alert, the operation of other services may be significantly affected. Some services may have to reallocate their resources (including human resources), change their operations (i.e. towards reduction, interim halt, and provisional closure), and may be required to shift their capacity of service delivery in the time of need. Correspondingly, the most perceptible and common impacts on the provision of supplies are on medical supplies of various kinds (both related and unrelated to disease), anti-infective products, food supplies, and associated amenities that may cause major disruptions in the society. In the case of conflict zones/areas (and also those experiencing wars, sanctions, etc.), the impacts are generally more significant. For instance, the case of Venezuela (Lodeiro-Colatosti et al. 2018, p. 1343) highlights:

scarcity of basic resources largely affecting the public health infrastructure, resulting in long-term shortages of essential medicines and medical supplies, including vaccines for universal immunisation programs and the immunisation of specific risk groups against specific diseases.

Hence, the already affected areas due to other structural factors such as conflicts, war, sanctions, economic crisis, or societal/political unrest, may face more severe impacts of the outbreak on the provision of their services and supplies. Therefore, it is harder to maintain the security of those communities as the impacts are expected to cause more adversities; and vulnerabilities are expected to be much higher. This factor also puts pressure on the effectiveness of the most pragmatic solutions or strategies. Thus, we can argue that the general impacts on those communities (as well as other cases of vulnerable cities or communities) become more perceptible in the control of the outbreak. Such vulnerability also triggers the event to have a more malicious progression, at a larger scale and a faster pace. In addition, the eventual impacts show a rapid sign of development on the supply chain, business enterprises, market, and their respective productions. Hence, we have to utilise both quantitative (Morgan 2019) and qualitative assessments of our services and supplies. The delivery of services and supplies, even in the most disruptive conditions, is meant to create a healthy continuity of daily activities. The patterns of such provisions will certainly be different from customary circumstances. More importantly, all provision target groups should include three fundamental considerations of: (1) risk assessment, (2) adaptive maintenance, and (3) prioritisation plan.

Through ‘risk assessment’, we have to identify all risks and provide an immediate action plan. In general, the risk assessment needs to be quantitative and evidence-based (Athar et al. 2005; Guillier et al. 2013). Hence, a qualitative risk assessment (QRA), as proposed by Guillier et al (2013), can enhance the understanding of the outbreak and its risks on services and supplies. Ultimately, this approach sheds light on possible deficiencies in provision target groups. In their disaster resilience assessment, UN’s International Strategy for Disaster Reduction, UN/ISDR (2014, 2017) put cities as primary audience and suggest several risk assessment criteria in six distinct categories of:

- Research—including evidence-based compilation and communication of threats, and needed responses;
- Organisation—including policy, planning, coordination, and financing;
- Infrastructure—including critical and social infrastructure and systems, and appropriate development;
- Response capability—including information provision, and enhancing capacity;
- Environment- including maintaining, and enhancing ecosystem services; and
- Recovery—including triage, support services, and scenario planning.

We can argue that such a criteria-based approach can enhance the possibility of a thorough assessment. Also, through its prediction modelling approach, QRA could develop possible scenarios across the provision target groups. Existing research suggests risk assessment for the applicability of evidence-based practice in public health (Forland et al. 2012), which can improve the multi-sectoral assessment and

their status, and can provide a reporting procedure to ensure better availability of necessary data (Cassady 2006). In doing so, we may be able to have a better assessment in place in order to reduce potential burdens, as these are expected to be widespread and disruptive to all primary services and supplies. If needed, certain adjustments should be proposed to reduce vulnerabilities.

Through 'adaptive maintenance', it is essential to increase the resilience of services and supply provisions. By responding directly to the changing environment and conditions, this factor includes both the modification plan and implementation plan for changes. In their study, Wilson et al. (2013) describe adaptive maintenance as 'resilience', which should not be confused with the transformative capacity of specific systems. In this regard, we may be able to provide a chance to "*deliberately transform systems and society*" (ibid, p. 1) or deploy an array of supporting measures when it is required. The practicalities of doing so are mostly associated to monitoring of changing situations, responding to each stage of progression, the flexibility of provisions in multiple scenarios, and modification of resources in between various sectors/units in our urban systems. Hence, in order to enhance the city's resilience, adaptive maintenance should create a systematic model of multiple sectors in a hierarchical network and ensure adaptability is prudently measured across each of them. This approach would enable us to maintain the flexible operation of necessary urban systems in the time of need.

Lastly, through 'prioritisation plan', it is essential to identify what are the priorities in services and supplies? Where are potential deficiencies and how to address them? And when do we strengthen certain provisions? To answer these, and following from the utilisation of adaptive maintenance, a prioritisation plan would help to assess the needs of the urban systems. In a responsive approach, their needs should be carefully considered without negative impacts on other systems. The prioritisation plan can include a variety of factors, such as temporary arrangements, different spatial use, services support, economic support, supply increase, etc. In doing so, we can provide a holistic plan that encompasses multiple urban systems, and help to boost public investment programmes (if applicable), infrastructural support, financing (Cities Development Initiative for Asia (CDIA) 2010), as well as facilitating necessary strategy programmes to certain priorities, such as health care services, emergency medical services, etc. In the outbreak, the prioritisation plan ought to be reflective of the realities, and help to reduce vulnerabilities of those priority areas. This essentially helps decision-makers and enhances the aptitude of response strategy programmes.

In the following five Subsects. 3.5.1–3.5.5, we explore all five individual provision target groups, across two dimensions of 'services' and 'supplies'. Similar to management target groups, we urge to consider the provision target groups both individually and collectively in integrative thinking. This is considered to be effective for the reduction of vulnerabilities and enhancement of provisions at the city level.

### 3.5.1 Services Dimension—P1: Transportation Services

In cities, transportation services include a large body of transportation networks, and a wide range of public transportation systems (e.g. buses, underground/metro, monorail, trams, taxis, boats, etc.), intra-city and inter-city transportation systems (e.g. airports, highways, motorways, ports, etc.), shared transportation systems (e.g. shared cars, shared bikes, shared taxis, etc.), private transportation (not limited to private cars), emergency systems (like ambulance, fire services, police, etc.), and logistic system. Such services are also linked to transportation infrastructure (or physical infrastructure), such as roads, air transport, warehousing, water bodies, railways, etc. Hence, it is clear that transportation services operate for multiple purposes, for multiple groups of stakeholders/people, at multiple periods, and for multiple occasions. In the early phases of the recent COVID-19 outbreak in Chinese cities, Xu Yanhua, an official from the Ministry of Transport (MoT) had to intervene with an official announcement in support of the outbreak control progress. His statement was given as a reassurance to the general public, highlighting, in particular, the operational plans of transportation services: “*all-out efforts are being made to keep the transportation network and the green channels operational while curbing the spread of the virus through traffic control*” (The State Council 2020). There is a two-fold from this statement, one that suggests the approved operations, and one that proposes extended control through traffic control measures.

In addition, transportation services cover a large body of logistical support, those that are beyond internal productions and consumptions of the city and its residents. From emergency medical operations to food supply delivery, transportation services are comprised of many necessary factors that should be addressed during outbreak events. Many of our daily city operations are based on transportation services, and without them, the city may not be able to maintain the needs of its society, organizations, and businesses. On one hand, they are essential to the city, and on the other hand, they play a major role in speeding the spread of disease (Lowe et al. 2014). The latter is evident in many cases as the transport process is recognised as a source of transmission, particularly “*if adequate hygiene measures are not implemented*” (ibid, p. 872). It is also proven that transportation is the first cause of disease spread and scaled up situations (i.e. of disease transmission); leading to eventual change of the event status, i.e. from outbreak to the epidemic, and from epidemic to potential pandemic. Hence, the ins and outs of city areas, city districts, and communities can easily boost the outbreak transmission across the city and beyond its boundaries.

In most outbreak cases, there are limited measures that can be effectively implemented in time. Controlling and limiting transportation system services are difficult tasks for any city that should be driven by top-down decisions. The transportation system is extremely dynamic that we cannot predict how fast and in what direction the spread can take place. Similarly, as suggested by Rodrigue et al. (2020, Chap. 11), “*transportation systems due to their speed and ubiquity act as a vector in the diffusion of pandemics*”, but they also need to continue with freight distributions. This means there is a likelihood of a great risk “*resides in the geographical*

*and functional structure of supply chains because the continuity of freight distribution could be compromised*" (ibid). Some of these factors are associated with the increasingly global economy and its pros and cons, particularly that many aspects of our contemporary life are now dependant on global supply chain networks. As Rodrigue et al. (ibid) suggest, "*even the slightest disruption in the availability of parts, finished goods, workers, electricity, water, and petroleum could bring many aspects of contemporary life to a halt*".

Moreover, the spread of disease through transportation is somewhat inevitable, as relevant control measures are often only applied at the later stages of outbreak progression. Therefore, our preparedness should rely on how the city can maintain the optimal operation of transportation services. An example of this is the utilisation of redundant transportation services to help with other provisions, such as the delivery of food and medical supply (into the city). While air transport becomes more restrict or reduce in operations, it is suggested to use those services for the provision of primary supplies. In more extreme cases, they can operate in a one-way system to ensure the city is not left without its primary supplies. Transportation, as a system is essential for multi-level operations, and as a service requires to support the demand of the society. Nevertheless, there are some challenges in regards to transportation services, such as, control measures for populated public transportation networks, density control plan, healthy ventilation systems of often enclosed spaces for public transports and their stations, provision of emergency transportation services, provision of safe transportation of infected and deceased people, closure of specific transportation networks, and reduction in general mobility across the city. Moreover, transportation services of all kinds may reduce in operation, meaning that adaptive measures should be taken into consideration to ensure certain transportation services are prioritised, some are maintained, and some are carefully controlled.

### **3.5.2 Services Dimension—P2: Safety and Security Services**

A crucial part of the services dimension is related to both the provision and operation of safety and security services. It is important to note that provision alone is not effective, similar to what we can identify as the non-operational institutional dimension of the city (Cheshmehzangi and Dawodu 2018). The provision and operation of such services respond to the role of co-benefits resiliency actions (Siemens et al. 2013), which are obligatory for decision-making procedures. The safety and security services are widespread, encompassing a range of imperative systems beyond just policy and security forces. Many safety services come under this particular target group, specifically focused on crucial factors of food safety, occupational safety, medical services, distribution system safety, logistics safety, emergency services, etc. Many security services include primary and secondary units/forces, such as security forces, police, fire services (fire detection, fire engine, etc.), bomb detection units, special forces dealing with various threats and emergencies, border offices

(including immigration control), community security, communal guards, and military forces/army. Altogether, these factors shape the overarching factors of societal safety and human security, which are exceptionally important during outbreak events. By linking human security and public health, and by quoting John Donne's inspiring adage "no man is an island", Curley and Thomas (2004, p. 30) argue that "*the human security concept offers one possible model that can equitably meet the analytic needs of the international community without devaluing or distorting its myriad elements*". In this regard, it is important to maintain the safety and security of society, as it determines the overall safety and resilience of the city.

Most studies associated with safety services of the outbreak are linked with food safety and how they should be maintained in healthy conditions (Jung et al. 2014), particularly in agricultural businesses and food processing firms (Jin and Kim 2008). This also requires to address any possible threats to food and nutrition security (Chen et al. 2020). However, it is evident safety services are more than just food safety. Many safety measures should be in place through structured services (i.e. as per the above descriptions), and they should be up and running to maintain control and monitor of the city and its communities. Such services should directly respond to various societal needs, and deal with emergencies in the best possible way. Moreover, due to potential conflicts in communities as a result of increased anxiety and uncertainties, the safety and security of cities should be continuously sustained throughout the outbreak. Communities become more vulnerable under the shadow of fear and anxiety, and those in less affluent communities may suffer the most. In such occasions, many opportunists may consider taking advantage of the city's vulnerabilities; hence, careful attention is needed from those respective services to ensure reflecting on the society's gradual and sudden changes, and those that may potentially cause larger-scale disturbances. Also, another role of safety and security services is to monitor the compliance of the general public to regulations and rules that are in place. These should be conducted through regular and careful monitoring procedures throughout specific phases of the outbreak progression.

More importantly, it is vital to reduce the chances of chaos and monitor any unexpected situations. The end result of such chaotic situations would enhance the vulnerabilities, some that can potentially develop as societal disparities, unrest, looting, and potential societal downfall. Hence, many safety and security issues are dependent on society's compliance and their persistent support. Without such compliance, the outbreak can increase the chance of disorder, which ultimately increases the intensity of disruptions and vulnerabilities. Such a situation may turn some of the critical urban systems into dysfunctional units/services. Hence, precautionary measures are highly crucial. Moreover, the safety and security services, should reinforce the guidelines to ensure they are appropriately implemented through the right channels. In doing so, the effectiveness of those enforcements is essential. Such measures are assessed by Condon and Sinha (2010, p. 50), as voluntary and mandatory public health measures:

...there was not a significant difference in compliance with mandatory and voluntary public health measures where the effect of the mandatory measures was diminished by insufficiently severe penalties, the lack of market forces to create compliance incentives and sufficient



political influence to diminish enforcement. Voluntary compliance was diminished by lack of trust in the government.

Hence, healthy community engagement is important to gain and cultivate community support; one that helps to nurture the micro-level safety of the communities in the city, if not the city-wide scale. In outbreak events, the priority is usually given to emergency services, and it remains so to ensure providing necessary support to specific emergency medical services. However, we still require to preserve the healthy operations of other services; particularly those that uphold the safety and security of our communities. Thus, a holistic understanding of multiple safety and security services would help to reduce their vulnerabilities and make necessary arrangements or adjustments in the time of need. Finally, it is important to strengthen the resilience of prioritised units and services through a hierarchical structure, which considers both the adaptive maintenance strategy and effective prioritisation plan. This approach should be practiced across multiple urban systems or sectors, to ensure all vulnerabilities are carefully assessed and addressed.

### ***3.5.3 Services/Supplies Dimension—P3: Social Services***

A major provision aspect in outbreak events is social services, which is jointly shared between services and supplies dimensions of provision indicator category. In reality, social services are often neglected in early stages of outbreak events, but become significant players of the later recovery and post-recovery phases (more details provided in Chap. 4). Social services are widespread and include many important aspects of our cities and communities. For the case of an outbreak, a selective number of social services are very crucial and require supporting plans/strategies. Hence, the need to prioritise primary social services is essential for more effective outbreak control. In fact, social services deal with a wide range of services primarily accountable for providing, managing and evaluating social care and support services. They also include a range of public health services, health care, and safety services. In the latter category, only a few social services overlap with what has been already covered in safety and security services, such as police and fire services. Other relevant social services (and some applicable to outbreak events) are the provision of benefits and facilities that include education, food subsidies, health care, job training, subsidised housing, adoption, community management, policy research, and lobbying. For the case of an outbreak event, the priority social services are to ensure the right education is provided through appropriate means. This is a twofold matter, including the provision of relevant community training opportunities and supporting the city management in the development of education for medical services, emergency units, and health care systems (such as precautions.) This should effectively influence the density of awareness through the development of social-physical networks (Yi et al. 2019), as well as through the right education.

For food subsidies, relevant social services may not be able to cope with their regular subsidies as the adversities become widespread and embrace a much larger group of people. As a substitute, those relevant bodies can provide support to the city management units, to ensure the following three provisions are maintained: (1) price monitoring of primary products, inclusive of food, sanitation, and anti-infection products, medical products (inclusive of protection products, such as masks and gloves), medicine, etc.; (2) ensuring vulnerable groups have accessibility to such provisions; and (3) securing external support for emergency needs and supplies. The other essential factors under social services that should be fully maintained are community management, through which relevant social services can empower the community leaders or community management units (if any); or otherwise, can provide the necessary support to disadvantaged groups and vulnerable communities.

Above all, social services must play significant roles in the provision of health care, from both perspectives of services and supplies. This should reflect on issues of social protection and public health, a combination of effective measures that can be inclusive and supportive at the larger scale of the city. This provision could help to provide necessary precautions, specifically to those groups usually recognised with a higher risk of infection, such as health care workers (Cohen 2018), elderly, and those groups that may have no access or limited access to health care systems. In specific cases, social services should address issues of social determinants of health, which in general are the *“complex, integrated and overlapping social structures and economic systems that are responsible for most health inequities”* (Hepburn 2017). Thus, social services as an activity designed to promote social wellbeing can provide health equity (Richardson et al. 2017) and the crucial health care provision, which are needed across all communities. Finally, it is important to note that not all social services can cope with the adversities of an outbreak. Some may need to temporarily stop their operations, and some may have to deal with a set of longer-term outbreak impacts. Therefore, it is recommended to seek external support (i.e. at the national and/or the international levels) in early stages. In doing so, we should make certain that the city’s primary social services, particularly those that can help to overcome the societal vulnerabilities, are resourcefully maintained, strategically strengthened, and properly managed. As a major provision target group, social services are expected to provide multi-objective support to the society and the city’s resilience.

### ***3.5.4 Supplies Dimension—P4: Food Supply***

Apart from food safety, which is already covered under the previous target group, one of the main target groups under the supplies dimension is food supply. Undoubtedly, food is a primary consumable product, which can become a scarce product at certain stages of an outbreak event. The considerably large demand for food in cities is a major challenge for regular provisions of the city. This is particularly evident in the case of lockdown situations of communities and cities. In general, the main

disruptions associated with food supply are associated with its 'production', 'distribution', and 'provision'. To date, there is little scholarly research regarding food supply during outbreak events, and the majority of existing literature only focus on food safety and not from the perspective of how it is supplied or distributed in affected areas.

For food production, we see a major decline in or around cities, particularly in peri-urban areas and regional food production hubs. Due to temporary closure or non-operational status of many agricultural businesses, as highlighted by Jin and Kim (2008), we see tangible reductions in food stocks, variety of food, and freshness of essential food or commonly known as 'fresh produce' (such as fruits, vegetables, (some types of) meat, etc.). Another factor associated with this conspicuous shortage is the common reaction of the society to uncertainties of the outbreak progression. This is caused by growing anxiety and the fear that the outbreak may last longer than initially anticipated. In most cases, people rush to shops and supermarkets and store as much food as they think it may be required. With limited impacts on fresh produce, we see a larger impact on other food products. This somewhat expected behaviour causes immediate food shortages. Hence, this inevitable reaction changes the equilibrium of supply and demand. On certain occasions, even if food production is only slightly reduced, we see a complete imbalance in what has been purchased and stored and what is remained on supermarket shelves. In this regard, the city may face sudden food shortages that cannot be recovered by partial operations of transportation systems. As we still lack wide-spread urban farming in our city environments, greater pressure would remain on food distribution; i.e. how do food supplies get to the city? How can they be distributed in time? And how regular can they be provided and distributed? Hence, ensuring smooth logistical operations are vital for the distribution of food supply, particularly of the regional agricultural and food supply chains (Chen et al. 2020).

In the recent COVID-19 pandemic outbreak in China (which was just epidemic for almost the first two months), the national-level Ministry of Agricultural and Rural Affairs (of the Chinese central government) released an emergency notice to all relevant and responsible departments to sustain order in markets, provision of supplies, and their delivery (ibid). In this specific event, the test for e-commerce, particularly for food and fresh produce delivery, was a success; highlighting in particular how food distribution can happen with minimised personal contact:

...as lockdown measures have led to a huge spike in demand for home delivery of fresh groceries, e-commerce companies have announced an in-app feature for contactless delivery, allowing the courier to leave an order in a convenient spot for the customer to pick up, without having to interact. Making use of these delivery platforms could address many logistical challenges for obtaining food, while minimising the potential risk of infection from visiting crowded markets to buy groceries (ibid, 2020, online source).

The other suggestions by Chen et al. (2020) about issues related to the provision of food supply are concentrated on "close monitoring of food prices and market supervision", "enabling policies for spring planting and increase support for production entities", "smooth flow of trade and make full use of international markets as a vital

tool to secure food supply and demand”, “protection of vulnerable groups and provision of employment services to (migrant) workers”, and “further regulatory measures on wild food markets to curb the source of the disease”. Under provision matters, agricultural enterprises are often hit by the complexity of outbreak issues; hence, there is an urgent need for financial support to reduce potential risks of delays and production closures. Chen et al. (2020) even suggest for possible temporary subsidies that could reduce burdens on those specific primary productions, such as food production. At the epidemic level, the increase in the import of food supply can help to increase supply stocks. However, this should be done with extra care to avoid any unexpected spread of disease between different countries or regions. In particular, occasions when food supply may be the carrier of the disease, more measures need to be implemented to ensure scanning and full monitoring of food import and export throughout the outbreak.

Furthermore, it is evident that the shortage of food supply may turn into major socio-economic disruptions. The possible ripple effects on food prices and markets, as highlighted by Martin (2020), is a major concern to issues of supply and demand in food production and its provision. With restricted logistical operations, food supply and associated businesses face significant losses; hence, extra support from multi-levels of the government is essential. Similarly, Jung et al. (2014) argue the impacts of the food production chain from various aspects, as large as agricultural practices to widespread processing of certain food supplies. From their perspectives, there is scope for the development of science-based best practices to ensure food safety is maintained (ibid) before we can sustain the food and nutrition security of society. To summarise here, and in order to address issues of food supply, we have to consider the multiplicity of measures, practices, and provisions. Food supply remains a priority that requires careful attention, including both production processes and consumption demands.

### ***3.5.5 Supplies Dimension—P5: Amenities Supply***

In addition to the primary target group of food supply, other supplies require attention and support during outbreak events. In this target group, we classify these other supplies into an overarching category of amenities supply, which in reality are in forms of supplies, facilities, and services; hence, altogether defined as amenities. These amenities are categorised under four groups of ‘basic amenities’, ‘secondary amenities’, ‘mobile amenities’, and ‘virtual amenities’. Through these amenities (including also public amenities), we have to sustain the provision of certain facilities, services, and supplies that are crucial to the well-being (Dyakova et al. 2017) of our communities and cities. From the provision perspective, we have to prioritise the societal needs and conditional essentialities of the outbreak. In particular, basic amenities tend to be more effective in maintaining socio-economic values of society. Secondary amenities can be regarded as a non-priority group, while the other

two groups of mobile and virtual amenities can be provided with a certain level of flexibility and through what Alterman (1988) refers to as 'adaptive planning'.

Basic amenities are commonly recognised to be essential for the provision of societal well-being and quality of life (QoL). While the latter may be significantly affected during the outbreak, it is essential to sustain the former (i.e. societal well-being) through certain socio-economic benefits, facilities, and provisions. Some crucial examples of basic amenities are roads (particularly with access to highways and motorways), running water, energy (electricity and natural gas), telephone services (or connection networks/telecommunications), internet, as well as main public amenities, such as hospitals, clinics, medical facilities, pharmacies, sanitation units, waste collection services, and waste management units, general and specialised shops and markets, goods collection points, maintenance units, long-term care facilities (such as nursing homes and assisted living), and provision of clean environments. In this category, such amenities provide necessary values of societal well-being, those that are essential for smooth or partial operations of urban systems, multiple sectors, and communities. The city and its residents are dependent on such basic amenities, and such provisions are fundamental, with significant impacts both at the micro or individual level (such as individuals, households, and specific groups/sectors), and collective level of the city and its communities. There are also specific active facilities during an outbreak (from Interior Health website, online source 2020) that only operate in addition to those basic amenities, and are more specific to the disease treatment (including the provision of antibodies if applicable) or facilities that are temporarily needed during the event of an outbreak (or in certain emergencies).

In addition, the secondary amenities are the provision of non-priority facilities, mostly comprehended as general public facilities, such as public places or communal areas, health centers/clubs, sports centers, restaurants and food courts, street food areas, community clubs, public toilets (or facilities of such kind), public baths, temples and religious centers, (urban) parks, leisure areas, libraries, cinemas, common public buildings (such as museums, galleries, malls, outlets, etc.), hair-dressers and barbers, banks, post offices, recycling centers/units, connections to major transportation hubs (such as airports and ferry terminals), local bus and railways stations, training units, educational areas (inclusive of nurseries, schools, colleges, institutes, research centers, and universities), and other public areas for recreation. Certain businesses may also offer some amenities in this category, such as marketing, finance, etc. In this category, we deal with certain non-priority amenities, hence their provision during the outbreak is not advisory, or should be limited in main phases of the outbreak progression. In most cases, it is important to limit such amenities and their operations, particularly the ones that encourage populated use or gathering, multiple functionalities of the environment, closed environment activities, and non-essential public uses. Apart from these two categories, we also have mobile and virtual amenities that include certain facilities and provisions. For mobile amenities, they mainly include mobile facilities such as fuel services, oil change units, recycling facilities, food trucks, auto washing and detail service, retails sales of specific products, mobile repair trucks/units, mobile retail of any kind, and mobile health care services. For virtual amenities, we can refer to any of the above

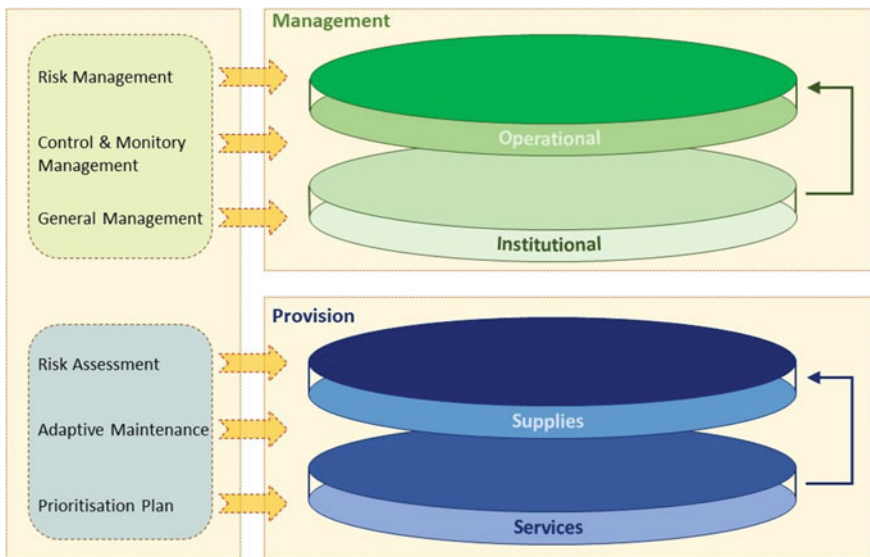
facilities that can be provided online or virtually, including in particular: retail (both buying and selling), selective educational means, training, and entertainment.

To summarise, we refer to amenities as both priorities and non-priorities in the case of outbreak. As defined in their respective categories, certain amenities are more crucial for the societal well-being. It is also essential to effectively respond to context-specific matters, including—but not limited to—climatic conditions, availability of amenities, cultural and social factors of the society, behavioural attributes, institutional arrangements, and socio-economic structure of the city. To maintain the operations of basic amenities, as the least provision, we ought to ensure having an effective prioritisation plan in place or else the impacts would be widespread and may cause additional adversities to the society. As a matter of fact, these may potentially increase the vulnerabilities and reduce the values of essential socio-economic benefits to the societal well-being. Finally, to avoid any further adversities, the city should prepare comprehensively through strengthening resilience and an effective action plan.

### **3.6 Preparing an Action Plan and Supporting City Management Decision Making**

Through the conceptualisation of the urban resilience framework and its details, we verify tailor-made measures and practices for city preparedness during outbreak events. This conceptualisation is a novel approach in scholarly research, which benefits the process of preparing an action plan. Through the complexity of disease outbreaks that suggest their occurrence frequency, multiple types of infection, the intensity of the event, and various transmission mode, we can verify the need to understand such events from case by case and locale to locale; but more importantly, from the overall approach of ‘preparedness’. Disease outbreaks are usually infectious and vary in their nature of transmissions, such as animal-to-person, person-to-person, from the environment, or other sources. They can create critical conditions, put cities and communities under disruptive threats, and impose high risk on our socio-economic values and humanity. From their findings in comparing disease outbreak issues against natural disasters, Alwidy et al. (2020) highlight the widespread lack of knowledge in outbreak events. Hence, we can argue that the combined effects of uncertainties (as highlighted before) and unawareness of how we should deal with the situation, make the society more vulnerable. It is worrying that in most cases, most people have very little knowledge of the situation of disease outbreak, pay very little attention to precautionary circumstances, and delay their responses in the face of mounting issues and adversities. We can argue that in all cases the society is not expected to be or cannot be fully prepared, but the city can. Thus, the city ought to prepare itself through comprehensive planning—or in other words, with a robust action plan.

Our so far analysis indicates the obvious need for preparedness in multiple ways (e.g. with multiple sectors, dimensions, characteristics, actors, systems, and target groups) and by strengthening resilience in the practice of disease control and containment (summarised in Fig. 3.4). In order to do so, we need to develop an action plan, which is comprehensive (Cheshmehzangi 2020), quick (Ung 2020), and effective. In reality, having effective responsiveness without an action plan is absurd, and having an action plan without preparedness and knowledge of the situation is even more so. Thus, the primary role of an urban resilience framework is to ensure it has the capacity to prepare the city either before the actual outbreak or with immediate effect at the beginning of the outbreak. This preparedness helps the city to develop an immediate action plan, which is reflective enough to the conditions of the outbreak. More specifically, we should aim to break prevailing boundaries between singular operations of the city, as they no longer can sustain their customaries or they may eventually fail to operate on their own. In this approach of integrated thinking, we could be in a much stronger position to support decision-making procedures at the city management level. Whatever procedure this may be, it should be all-inclusive and integrative in order to enrich the approach to embeddedness thinking (Thomson-Dyck et al. 2016) and comprehensive consideration of multiple sectors, multiple systems, and multiple stakeholders; and without having anyone or anything left behind.



**Fig. 3.4** The summary of four key dimensions of urban resilience and their relationships in their two indicator groups of management (above), and provision (below). The summary also includes specific essential factors for each indicator group, namely three factors of ‘risk management’, ‘control & monitory management, and ‘general management’ for management indicator group; and three factors of ‘risk assessment’, ‘adaptive maintenance’, and ‘prioritisation plan’ for provision indicator group. *Source* The Author’s Own

Our discussions in Sects. 3.4 and 3.5 of this chapter are narrated from a comprehensive perspective, ensuring that all city-oriented aspects of management and provision are included and addressed. By proposing this comprehensive framework, we suggest a people-centric approach, addressing: how it is implemented as an instrument (or tool) to guide the city's preparedness plan, and how it can instantaneously strengthen the city's resilience during disruptive disease outbreaks. Unquestionably, we identify the important position of people. We also highlight the major need for comprehensive control measures and communication, including a healthy process of community engagement, which is "*increasingly recognised as a key component of outbreak response, allowing responders to engage the affected population and to alter behaviours which may propagate an outbreak*" (Houlihan and Whitworth 2019, p. 142). In this regard, cities and city authorities should be adaptive, reflective, and more importantly, they should be prepared and resilient. They should prepare to: (1) make effective adjustments, (2) enhance the institutional arrangements, (3) provide the necessary support, (4) reduce uncertainties and vulnerabilities of the society, and even (5) make new policies—even if all these have to be temporary. Just because relevant policies are absent from the national agenda or local plans, it does not mean new policies or adjustments cannot be made during emergency/crisis situations, such as in outbreak. If we neglect to make necessary adjustments, it indicates the lack of reflectiveness, and hence, we may neglect the actual meaning of having an action plan. Thus, our preparedness should lead to effective responsiveness at the time of need.

### ***3.6.1 From Preparedness to Responsiveness: A Reflective Summary***

The effectiveness of urban resilience depends on the healthiness of urban systems. They need to be supported by strong institutional arrangements, and systematic preparations through adaptive planning and reflective progression. The outbreak investigation itself should be conducted promptly, reflecting specifically on how it is reported, how the quality of procedures are maintained, and how transparency is practiced (Kurup et al. 2019). In the process of preparedness, the city and its authorities need to adhere to precautionary guidelines and provide necessary updates throughout the outbreak. In a real situation, no official or authority would like to admit the risks of outbreak situations, all because of the impacts it may have on the city and the society. Nevertheless, to maintain the idea of bringing people back in practice (Thomson-Dyck et al. 2016), we have to ensure any preparedness planning is a response to immediate socio-economic contexts. Therefore, in parallel to outbreak science (Houlihan and Whitworth 2019), we have to understand the complexity of city management and how it reflects on the societal well-being and the enhancement of urban systems. This requires resilience thinking, through which we can successfully progress from preparedness to responsiveness.



On the other hand, many technological advances and instruments can be utilised to strengthen the city's resilience. There are new technologies for outbreak investigation (Srikantiah et al. 2005; Chester et al. 2011), data-based notifications (Kahn and Kinsolving 2010), new vaccine technologies (Rauch et al. 2018), enhanced information and communication technologies (ICTs) (Tom-Aba et al. 2015), informatics for detection (Zeng et al. 2005), various spatio-temporal methods for detection (Jiang and Cooper 2010), algorithms for detection (Buckeridge et al. 2005; Li et al. 2012), automated surveillance (Cassa et al. 2006; Buckeridge 2007), and many more methods and instrumental mechanisms that involve the use of data management, information systems, and digital platforms. As highlighted by Houlihan and Whitworth (2019, p. 142), in comparison to previous events, "*outbreak response has made significant and impressive progress involving a wider range of disciplines, embracing modern technology, and recognising the importance of research during and in between outbreaks*". Hence, we can argue in a positive perspective that disruption provides a chance for innovation; a chance for the trial of those innovative interventions, digital-based platforms, community enhancement, and multi-sectoral management. Moreover, such disruptive situations provide an opportunity to create synergies in management and operations, identify the city's weaknesses and deficiencies, and find means of resilience. It is almost like conducting a large scale SWOT analysis of the city's resilience, only that there is no analysis of such kind but strategic (and usually immediate) actions through preparedness, planning, and responsiveness.

Finally, while in most cases we cannot simply stop a disease outbreak from happening, we have to ensure we are resilient enough against any possible adversity. In the first steps, we can increase the effectiveness of our detection procedures, enhance precautionary measures, data collection, observation measures, and prepare a reflective and feasible action plan. This preparedness can happen through resilience enhancement, and it should be comprehensive enough to include multiple aspects of our cities and communities. In doing so, we could boost the effectiveness of our responsiveness in disruptive disease outbreak events. There may be some losses and there may be some necessary adjustments or rearrangements. But above all, it is better to have a bit of loss at first than to deal with longer-term adversity.

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