

The  
CIRCULAR ECONOMY  
& LIVEABLE CITIES



Edited by  
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more sustainable consumption and production is that of 'sharing cities', which manifests itself through a range of instruments including energy co-ops, community gardens, product rental, platforms to trade pre-owned goods, shared workspaces, shared accommodation, and shared transport such as rides, cars, and bikes, among others.<sup>143</sup> Technology is clearly an important enabler to support cities in implementing CE strategies. For instance, the sharing of goods, assets, and services within cities was facilitated by technological platforms such as Craigslist, Airbnb, and Uber, among others.<sup>144</sup> However, technological adoption is not guaranteed to achieve development objectives in the absence of institutions and regulations governing the adoption and use of such technologies, protection of property rights, and enforcement of contracts, among other things necessary for success.

### 10.6 Conclusion

The sustainability crisis our world faces today – including the impact of a changing climate and the loss of nature and biodiversity – calls for a CE approach to minimise waste, close energy and material loops, and regenerate nature and ecosystems. This, however, is much easier said than done. Today, the CE approach is gaining ground predominantly within high-income countries and with very divergent levels of progress, as explained in this chapter, while within low- and middle-income countries the discussion is still very nascent. Indeed, the bulk of published research on circular cities hails from Europe, with a primary focus on waste and wastewater, as well as recycling and recovery at the lower levels of the CE taxonomy.<sup>145</sup>

Introducing a CE approach within a society requires not just vision and boldness, but also comprehensive system change. At the same time, comprehensive system change invariably requires patient and incremental build-up to establish the foundations, strengthen the institutions, and mobilise a whole-of-society approach to change. For instance, getting to a zero-waste model will require building a functional waste management system, including a regulatory framework, viable institutions, effective collection and disposal mechanisms, and appropriate pricing, among other measures. This is typically done gradually in line with the waste hierarchy, towards the end objective of diverting as much waste away from landfills as is feasible within affordability limits. As the service quality and management system get established, it will become increasingly feasible to price waste at the level that can account for negative externalities and incentivise waste reduction, reuse, and recycling, – as well as the use of refuse-derived fuel – to a level that can eventually lead to a zero-waste, no-landfilling scenario. Technology will be able to help leapfrog in some instances, but the reality is that policies, institutions, and regulations, coupled with enforcement of rules, are the key foundations for an effective implementation of the CE, and these take time.

## 11

### Governing the Transition to Circular Economy and Liveable Cities

#### *The Butterfly Potential of the City of Vienna*

KARIN HUBER-HEIM, ALEXANDER LASZLO, AND ANNA-VERA DEINHAMMER

### 11.1 Introduction

A regenerative circular economy (CE) has been described as a concept that mimics living systems. One particular living system that may be helpful in thinking about regenerative liveable cities is the healthy human organism. Like other living systems, our organisms are made up of many subsystems – for example, the circulatory, respiratory, and digestive systems – eleven such subsystems in all. A healthy organism requires each of these systems to work effectively with the others. They are complex, interdependent, dynamic systems that are constantly responding to and adapting with change. Organisms function because materials such as blood and oxygen flow through them, without making this the purpose of life, but rather providing the basics for good living and well-being, with society acting as the backbone – holding the body up and ensuring that the brain's messages get to where they are needed.

We argue that cities are no different: in a healthy city, urban systems such as buildings, mobility, products and services, and food, as well as citizens, need to work effectively for and with each other. And things need to flow – such as materials, capital, knowledge, data, and energy – to ensure the well-being of all. A helpful reframing, consistent with a regenerative CE approach, is to think of cities as living systems that rely on a healthy circulation of resources for the well-being of their citizens. This underscores that each urban system is a set of recurring themes that are integral to the CE. These include but are not limited to the role of design, new business models and means of access, and the use of digital technologies.

To create a liveable environment for all, cities and regions must act as promoters, multipliers, and pioneers of a regenerative CE, sharing responsibility with national governments and stakeholders. They are not only in the position to promote a new economy that thrives within planetary boundaries and act as role models for businesses and citizens, but more importantly need to provide clear



information and set targets to organise the transition as promoting a CE culture. These processes are core to building trust in society and key to efforts that seek to 'leave no one behind'. In essence, achieving the goals we have outlined requires the orchestration of multi-layered governance mechanisms that are aligned to balance different dimensions that support a comprehensive and effective transition to a regenerative CE model.

Vienna is a compelling case study for a holistic approach that promotes sustainable practices, CE principles, and collaborative governance. In particular, it demonstrates the transition to a regenerative circular city through implementing CE in its 'Smart Climate City Strategy Vienna',<sup>1</sup> as well as running the transdisciplinary programme 'DoTank Circular City Vienna 2020–2030'.<sup>2</sup> Like a caterpillar that does not yet know what is coming but is attracted by development, the need for transformation is becoming increasingly clear. But just like the transition from a caterpillar to a butterfly, the transformation process will involve a remarkable metamorphosis that encompasses various stages and shows the complicated life cycle of the living system called 'city'.

Similar to a caterpillar, the current phase of the city of Vienna is characterised by rapid growth and an insatiable appetite for the supply of materials and energy. And just as a caterpillar sheds its exoskeleton with each moult and grows ever

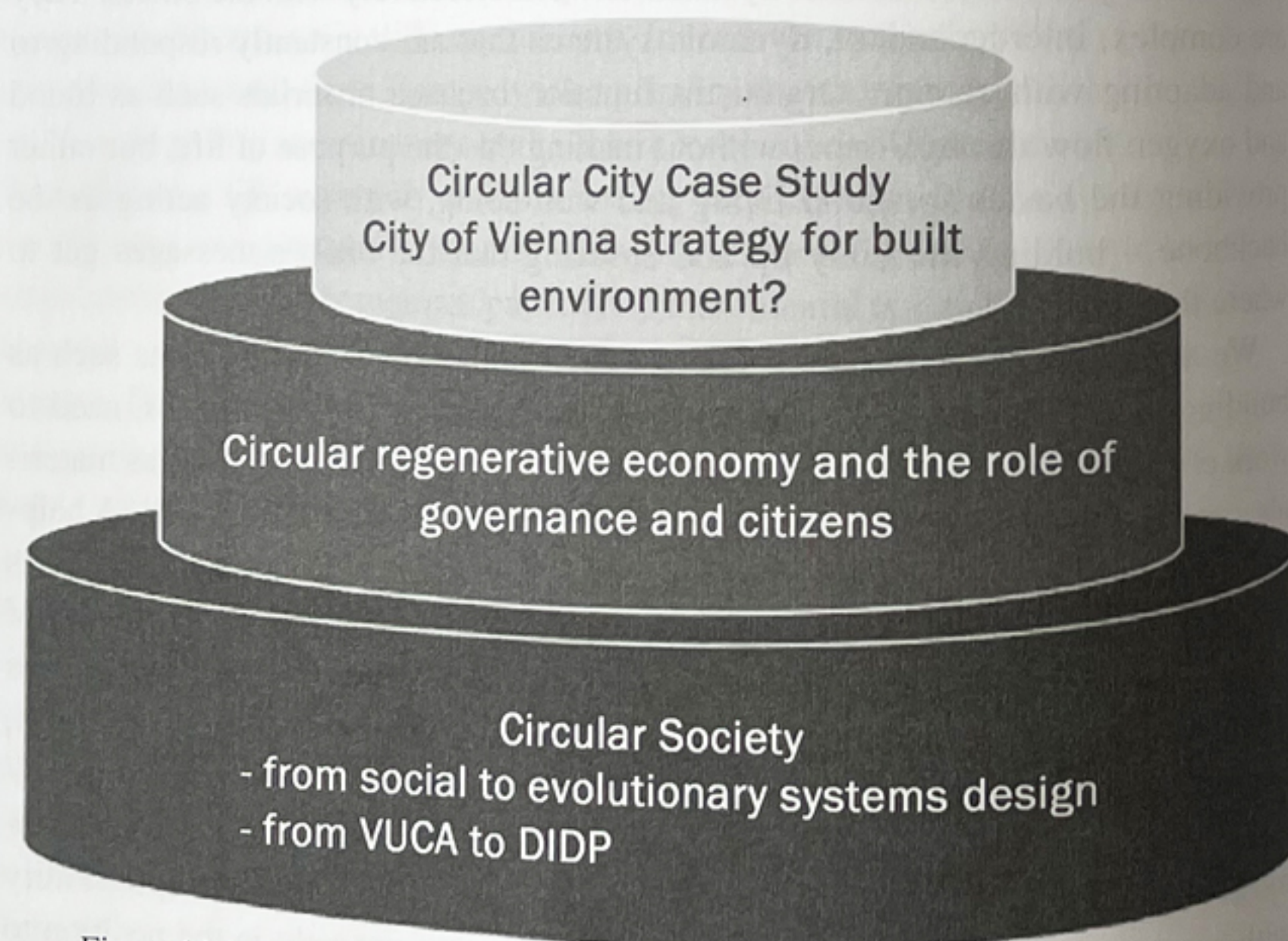


Figure 11.1 Structure of the chapter  
Note: VUCA = Volatility, Uncertainty, Complexity, and Ambiguity; DIDP = Diverse, Intricate, Dynamic, Playful

larger, so too have the city's population and built environment grown ever larger in recent decades. Once the caterpillar reaches a certain size, it surrounds itself with a protective shell, the pupa, in which the amazing transformation takes place. This is where the authors start their case study to illustrate what the city of Vienna's strategy for the CE envisages in terms of fundamental reconstruction and subsequent reorganisation – just like how the chrysalis supports the transformation into the complex structures of the adult butterfly. The end of this metamorphic journey is the emergence of the adult butterfly, and just like it, the city's wings need to be expanded and strengthened after hatching into their new urban patterns to enable citizens to live a circular life. Just as with the butterfly, the duration of each stage depends on individual factors, including environmental and climatic conditions, but also economic and political factors.

The authors explore the parallels to the caterpillar evolving into the butterfly in the process of metamorphosis from a linear, exploratory urban system to a regenerative, circular living system, as it too goes beyond mere physical change and is a metaphor for transformation, growth, and rejuvenation for the world of tomorrow (Figure 11.1).

## 11.2 Circular Society: A Systems View of Circular Change Agency

### 11.2.1 Life in a VUCA World

Commenting on the emerging paradigm of complexity science almost 40 years ago, Nobel Laureate Ilya Prigogine observed, the danger stems from the recognition that in our universe the assurance of stable and permanent rules has vanished. We now inhabit a world marked by uncertainty and risk – one that no longer inspires unquestioning confidence.<sup>3</sup> Yet, he also articulated a perspective that has since become central to circular living and the circular lifestyle: the recognition that even small fluctuations can evolve and reshape entire systems. In this view, individual actions carry the potential for significant impact and are far from being inconsequential. While the power of individual activity for collective impact may have been recognised years ago, it is finally being acted upon in the spirit of 'inter-being' that flourishes in circular economies.

Research into complex adaptive systems theory applied to social, psychological, and economic systems has shown that human decision-making is far from a rational affair. In his 2008 Nobel Award-winning work, behavioural economist Richard Thaler explains how people tend to be susceptible to messaging that will 'nudge' them to make even difficult decisions that seem to have no obvious benefit at the moment but may be beneficial in the long term. Such realisations increase



- **Situations and contexts appear:**
  - Volatile
  - Uncertain
  - Complex
  - Ambiguous
- **Experiences and encounters appear:**
  - Rapid
  - Unpredictable
  - Paradoxical
  - Tangled
- **Flipping VUCA around to bring:**
  - Vision
  - Understanding
  - Clarity
  - Agility
- **Being and identity appears:**
  - Brittle
  - Anxious
  - Non-linear
  - Incomprehensible
- **Fostering dynamics that are:**
  - Diverse
  - Intricate
  - Dynamic
  - Playful

Figure 11.2 VUCA, RUPT, and BANI vs VUCArev and DIDP

the complexity of decision-making frames, giving rise to the notion that we live in a fundamentally VUCA world: one characterised by dynamics of Volatility, Uncertainty, Complexity, and Ambiguity. While research in the physical sciences continues to explore VUCA patterns and dynamics, the social sciences have recast the same characteristics in more humanistic terms with the acronym RUPT, expressing the lived experience of VUCA as Rapid, Unpredictable, Paradoxical, and Tangled. In either case, both VUCA and RUPT are expressions of the contemporary quandary of coping with the increasingly mercurial dynamics of change in our personal and collective worlds. Indeed, the extent to which this *Weltanschauung* or Worldview has pervaded contemporary concerns is captured by the diversity of expressions of this framing, as captured in Figure 11.2.

Circular cities are designed to help us engage with such situations, and to empower collective action to address them. The initiatives that emerge from the design of such cities herald a new era in the collective self-determination of our species. The particular pressures exerted on humanity by the need to cope with combined and compounded VUCA challenges has resulted in the emergence of entirely new social transaction systems. Clearly, no one person or team can create the needed pathways to viable futures in isolation – we are all in this together.

In essence, a circular lifestyle is concerned with ways to *human better*: how can we, individually and as a species, act in dynamic harmony with all of life and the life-support systems of Earth – especially in the densely packed contexts that urban environments afford? The challenge of addressing this question has become both profound and urgent. The practices, dispositions, and values that favour the emergence of an authentic expression of our full potential to human are varied

and multiple – and often ancient. As we engage in the process of ushering in the conditions for the emergence of a truly thrivable planet – listening into the systemic nurturance spaces and seeking to identify the systemic leverage points for the emergence of a *glocal* ecocivilisation (one that is both globally informed and locally relevant) – it will be increasingly important for our species to find ways of taking appropriate action collectively. Indeed, humanity has reached a bridge that can only be crossed in unity.

As part of this sort of ‘solarpunk quest’ for a thrivable ecocivilisation, a fundamental objective of circular economies is the creation and promotion of relational intelligence applied to systemic innovation. If *connective intelligence* is the capacity to identify and connect with individuals and resources relevant to humaning for thrivability, and *collective intelligence* is the ability to foster synergistic initiatives based on such connective intelligence, then *relational intelligence* is the ‘sense-ability’ required to harness collective intelligence for the greater good. Such evolutionary competence is at the heart of the CE impulse to foster conditions for human societies to manifest our higher potential as a truly planetary species. Authoring this narrative involves taking stock of our evolutionary situation as a species with the power to fundamentally alter the viability of life on Earth – for better or for worse. The emerging narratives of systemic sustainability, of evolutionary interdependence, and of *glocal* thrivability all depend on our ability to connect with each other in fundamentally human and sacred ways.

Acting as a collective evolutionary guidance system, emerging circular cities such as Vienna foster the ability for us to act as ‘response-able’ agents of evolutionary development – not as human beings with myopic self-centred interests, but as human becomings who are consciously evolving members of an interdependent web of life. This is the evolutionary imperative that circular economies seek to address, extending and augmenting our capacity to act together for a thrivable human presence on Earth and a flourishing future for all life – now and into the future.

### 11.2.2 From Myopia to Protopia: Strategies and Approaches to Futures Planning

Contemporary approaches to the future tend to fall in one of four categories: they are based on and informed by visions of a utopia, a dystopia, a myopia, or a protopia.<sup>4</sup> This framework offers actionable pathways for systemic innovations that can be realised now or in the nearest future (Figure 11.3). *Utopian* frames are idealistic (and at times overly optimistic) future scenarios: solutions that knowingly cannot be implemented. Even though this scenario can inspire, the inability to realise it often brings frustration rather than action. *Dystopian* frames are reactive



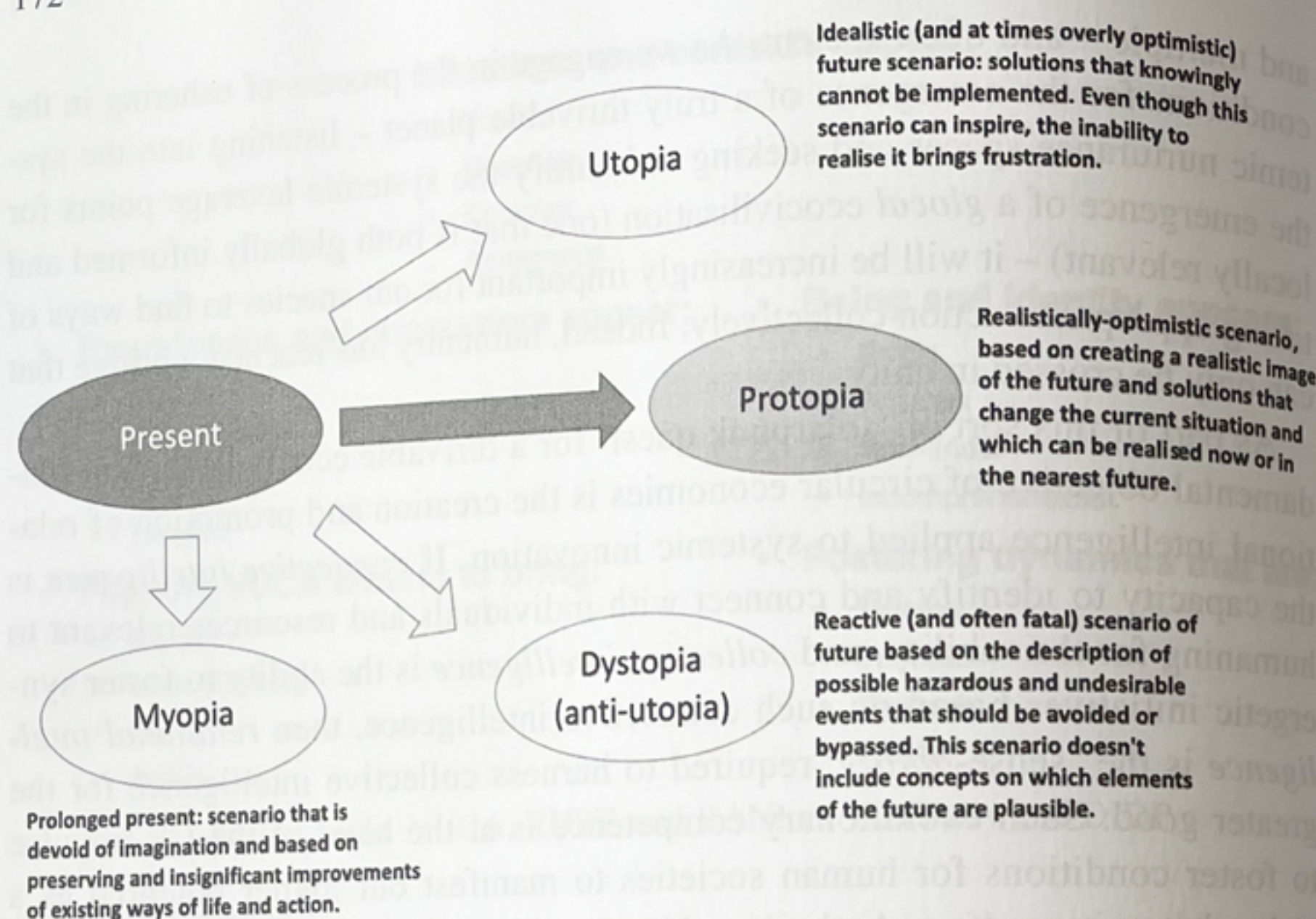


Figure 11.3 Creating a protopian path

Neither hoping for utopian idealistic societal responses to our VUCA challenges or fighting against dystopian fears, practices, or regimes can provide the necessary conditions for the generation of circular societies. The comfortable but false alternative of myopic approaches can only lead to bigger, faster, stronger caterpillars, but it will never provide the conditions necessary for the emergence of butterflies. The needed approach relies on the creation of protopian futures. Protopian vision fosters individual and collective initiatives to creating the future we want to see in the here and now. What is needed now are actionable and navigable pathways towards thrivable circular cities far and wide. For humanity to chart clear paths towards circular futures will require that we learn and lead together through the conscious evolution of our increasingly interconnected lives in an ever more

interdependent world. Protopian scenarios serve as systemic nurturance frameworks for the design and curation of circular cities that are evolutionarily viable, actionable, and attainable.

### 11.2.3 Emerging Trends in Circular City Design: Towards Living Cities and Thrivable Ecosystems

The socio-cultural, relational, attitudinal, and moral-psychological aspects of a healthy and authentic community in urban settings constitutes the research, development, and innovation focus of circular city design. Studies are emerging in this area that point to a concept of *living cities* as successful manifestations of CE designs. These studies explore how to foster an interdependent ecosystem of circular cities across the globe.<sup>5</sup>

Contemporary efforts in this regard include the creation of Integral City Meshworks, which organised the Elab 2012 with an action-based inquiry into the intelligences that constitute an integral city.<sup>6</sup> More recently, it has found expression in such landmark works as 'Systemic Innovation for Thrivable Cities'<sup>7</sup> and related research on the shift 'From Sustainability to Thrivability: Transforming Systems with Purpose'.<sup>8</sup> One general manifestation of the broader living cities initiative is captured by the emerging ecosystem called Living Cities Earth.

Such initiatives demonstrate how the transition towards a regenerative circular society necessitates moving beyond traditional social systems design to a more dynamic and adaptive approach. One such approach is known as evolutionary systems design (ESD). This recognises the interconnectivity of various social, economic, and environmental factors, emphasising collaboration, innovation, and feedback loops to facilitate sustainable and regenerative social systems. As a relatively recent contribution to the field of the social systems sciences, ESD responds to a need for a future-creating design praxis that embraces not only human interests and lifespans, but those on ecosystemic and evolutionary planes as well (Figure 11.4).<sup>9</sup> The split between macro- and micro-scale conceptual frameworks in contemplation of human developmental concerns continues to provide a difference of perspective within the systems sciences that tends to inspire either anthropocentric change efforts or evolutionary interpretive frameworks for them, but little by way of evolutionary strategies for the design of healthy and sustainable modes of being and becoming on a day-to-day basis in partnership with the life-support systems of planet Earth.

As a species, our actions and interventions on this planet have been largely driven by chance and, at best, '20/20 hindsight'. However, as Margaret Mead noted, we are at a point where for the first time in human history, we are able to explain what is happening while it is happening.<sup>10</sup> ESD builds on this relatively



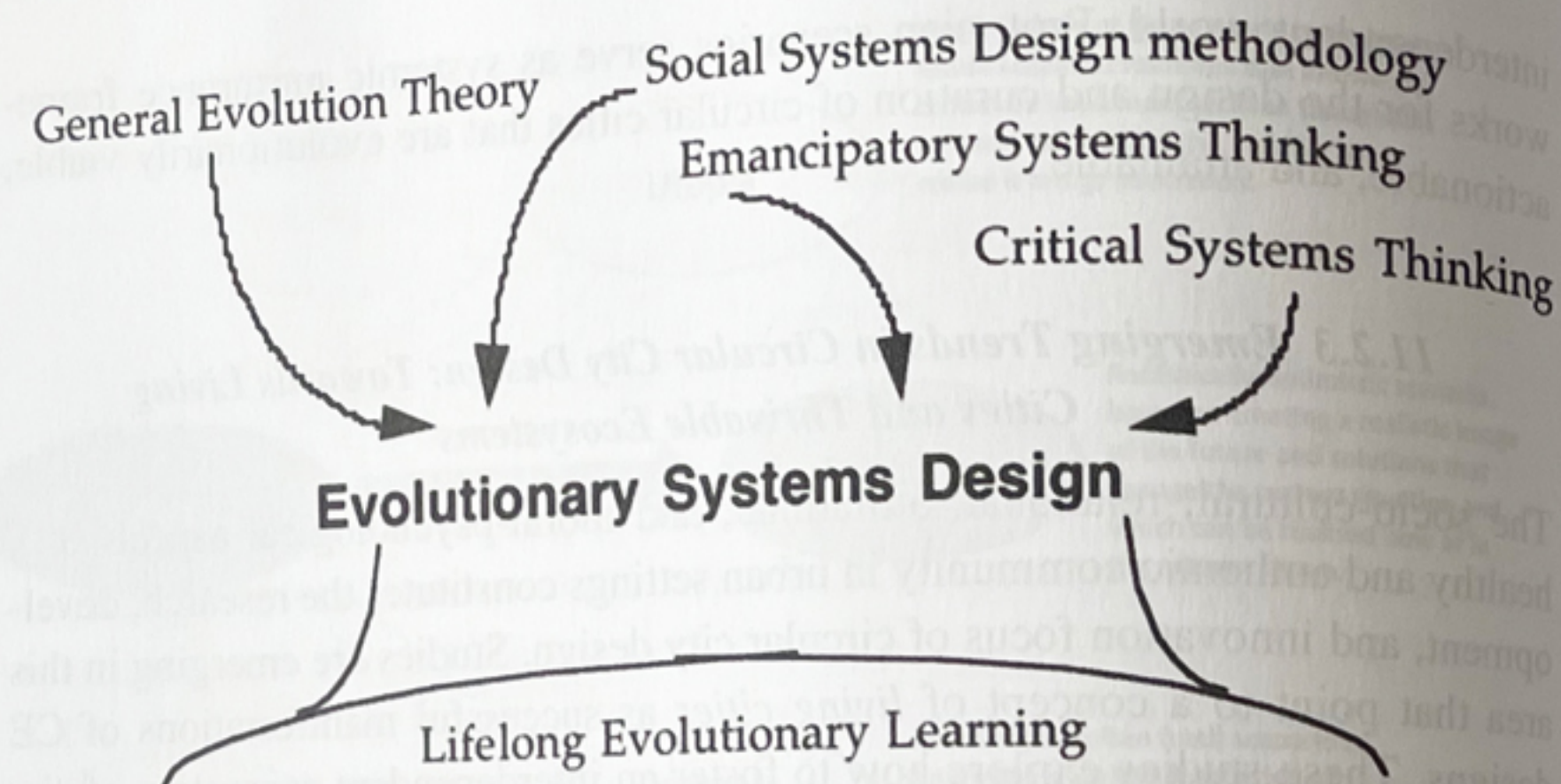


Figure 11.4 Epistemological foundations of ESD

new meta-reflective competence by serving as an instrument for the evolution of consciousness and for conscious evolution. It suggests that with the new understanding of evolutionary dynamics and effective approaches to the participatory design of circular economies and living cities, our species can stop drifting upon the currents of change and begin to adjust its sails in view of sustainable and even thrivable evolutionary futures. 'As evolution becomes history, it can become conscious. As Jonas Salk put it: conscious evolution can emerge from the evolution of consciousness – and from the consciousness of evolution'.<sup>11</sup> This is the understanding upon which ESD has been conceived.

The ESD orientation to circular design is essentially possibilistic. It assumes that human beings have the choice consciously to participate in the co-creation of the future. And yet it seeks neither to predict nor to 'socially engineer' the future. Rather, it seeks to create the conditions for the emergence of circular and evolutionary futures.

In systems such as contemporary society, evolution is always a promise and devolution always a threat. No system comes with a guarantee of ongoing evolution. The challenge is real. To ignore it is to play dice with all we have. To accept it is not to play God – it is to become an instrument of whatever divine purpose infuses the universe.<sup>12</sup>

The aphorism that captures the spirit of ESD is one of flow: *we cannot direct the wind, but we can adjust the sails*. Learning to sail the currents of evolution – not just to 'go with the flow' but to become active participants in the journey – this is at the heart of the ESD for circular design.

As an evolutionary and circular approach to change, ESD includes and transcends regeneration since it creates conditions for *evolutionary emergence*, identifying distinct phases in the culture of urban development as it has evolved over the years. These can be charted in terms of the worldviews related to nature and

the living systems which comprise cities. These positions have emphasised the following objectives at different times in urban development:

- *Extract*: Deplete–Deforest–Degrade (1760–1987)
- *Sustain*: Reduce–Reuse–Recycle (1987–2010)
- *Regenerate*: Rethink–Restore–Replenish (2010–2020)
- *Evolve*: Transform–Transmute–Transcend (2020+)

It is the last of these stages that captures the efforts and interests of circular cities such as Vienna. That is, to create conditions that invite the emergence of new ways of being and interbeing, understanding the city as a living whole, a living supra-organism in and of itself. When curated and cared for in this way, the city emerges as an ecosystem of thrivability that engenders qualities of care, life, empathy, relationships, interdependence, interbeing, vitality, and aliveness. These characteristics allow the city to evolve in ways that express ever greater coherence, synergy, and happiness both within itself and in evolutionary relation to its living bioregion.

### 11.3 Circular Living: Nurturing Cities as Living Organisms of Sustainability

Circular living describes the ability of emergent visionary frameworks to harmonise CE and regenerative principles within urban governance. The concept represents a paradigm shift in urban development, envisioning cities as dynamic, self-sustaining organisms embedded within their ecological and social contexts.<sup>13</sup>

This section explores the integration of CE and regenerative principles into urban governance frameworks, aiming to facilitate the transition towards circular living through collaborative partnerships and adaptive management. The role of transition governance in orchestrating this transformation is discussed, emphasising collaborative efforts and systemic thinking. Conceptualising cities as living entities that continuously regenerate and optimise resource flows according to regenerative circular principles offers a holistic approach to sustainable urban development.

Ever-increasing urbanisation calls for innovative approaches to urban development that can reconcile environmental sustainability, economic prosperity, and societal well-being. Circular living emerges as a transformative concept, viewing cities as dynamic, interconnected ecosystems operating akin to living organisms.

#### 11.3.1 The Metabolism of the City: A Metaphorical Framework

Circular living draws inspiration from the metabolism of a living organism. This concept encompasses the flow of materials and energy within a city, emphasising resource optimisation, waste reduction, and closed-loop systems. Additionally,



circular living involves fostering sustainable lifestyles and behaviours among city residents to support the CE.

Cities, like living organisms, have a metabolic cycle where resources flow in, are utilised, and are eventually returned to the ecosystem. The term 'metabolism' is borrowed from biology, where it refers to the set of chemical processes that occur within a living organism to maintain life. In the context of social metabolism, the concept is extended to describe the flow of materials, energy, and information within human societies and their interaction with the environment. It draws from the concept of 'urban metabolism', which refers to the study of material and energy flows in urban areas, similar to how a biological organism processes nutrients and energy. This field of research examines how cities acquire, use, and dispose of resources, and how these processes contribute to environmental impacts and sustainability. Yet there is a strong analogy to biological systems that draws on the parallel between human societies and biological organisms and their effect on societal transitions and similarities in terms of resource consumption, waste generation, and energy exchange, and the scaling relationships between various urban characteristics and their impact on resource consumption.<sup>14</sup>

Society's need for materials and energy to construct, maintain, and use its material assets – buildings, infrastructure, machines, human and animal life – is the starting point for 'metabolism'. This concept can be seen as a functional counterpart to biological metabolism and is referred to as 'social metabolism'. Social metabolism research combines biophysical resource and social structural perspectives.<sup>15</sup> The concept of social metabolism originates from the field of ecological economics and systems theory. It was first introduced by the German biochemist and systems ecologist Georgescu-Roegen in the 1970s and was later expanded upon by other scholars in the realm of sustainability studies. Like living organisms, cities require resources for growth, maintenance, and functioning, and they generate waste products that need to be managed like other complex, self-organising systems that exhibit similarities to biological organisms.

Circular living envisions a city's metabolism that mimics nature's cycles, utilising resources efficiently and regenerating ecosystems. Materials, energy, and people circulate within the city's systems structures, reducing wastefulness and fostering sustainable patterns of consumption and production. It serves the authors as a framework to enhance our understanding of urban dynamics, sustainability, and the capacity for regeneration.

### 11.3.2 Circular Economy Principles

The ability to lead a circular life in the city is based on the principles of the CE, which is regenerative by nature and aims to gradually decouple growth from the

consumption of limited resources and raw materials. It is based upon designing out waste and pollution, keeping products and materials in use, and regenerating natural or living systems.<sup>16</sup>

These principles guide the transformation towards sustainable consumption and production patterns within a circular city, focusing on closing material loops, minimising waste, and promoting resource efficiency, but also on encouraging product design for durability, repairability, and recyclability, thus promoting cradle-to-cradle cycles. Waste should become a resource by promoting activities such as recycling, upcycling, and remanufacturing. Circular by design means that products are designed to have a long life, be repairable and upgradeable, and at the end of life be disassembled and largely reused or recycled. Remaining parts that cannot be reused or recycled are designed to be biodegradable and, in general, products should be manufactured in energy- and resource-efficient processes using secondary raw materials and reusable parts of other products. The aim is to ensure that biogenic products and raw materials are integrated as seamlessly as possible into the natural life cycle. The principles of the CE are seen as a challenge to linear models and a stimulus for innovation across sectors.<sup>17</sup>

Faced with the challenges of climate change, loss of biodiversity, and increasing scarcity of raw materials, the existing linear economy 'take-make-use-waste' approach is becoming increasingly unstable, unprofitable, and inefficient under current and future conditions. A CE is seen as a promising approach and is being discussed by international and national representatives from politics, business, and society as a systemic change for such a transformation. The European Green Deal uses the CE as a key lever to achieve the EU's climate goals by 2050, and thus also aims to empower consumers.

In December 2022, Austria introduced a national CE strategy that has attracted international attention for its ambitious resource consumption targets.<sup>18</sup>

These are urgently needed, as Austria, with the fifth-largest material footprint in the EU, currently consumes 33 tonnes of resources per capita per year – 19 tonnes more than the EU average and about five times more than what is considered sustainable.<sup>19</sup>

As the first metropolitan area in Austria, the city of Vienna has introduced a transition strategy towards a CE as part of the strategy paper 'Vienna 2030 – a transition strategy towards a CE as part of the strategy paper 'Vienna 2030 – Economy & Innovation' and the framework 'Smart City Climate Strategy Vienna' and has committed itself to the goal of making Vienna a 'circular city' by 2030. According to the strategy paper, such a circular city 'focuses on resource conservation, reuse and recycling through CE for the benefit of its citizens. The aim is to create wealth, increase livability [sic] and improve the resilience of the city and its citizens. At the same time, a Circular City aims to decouple value creation from



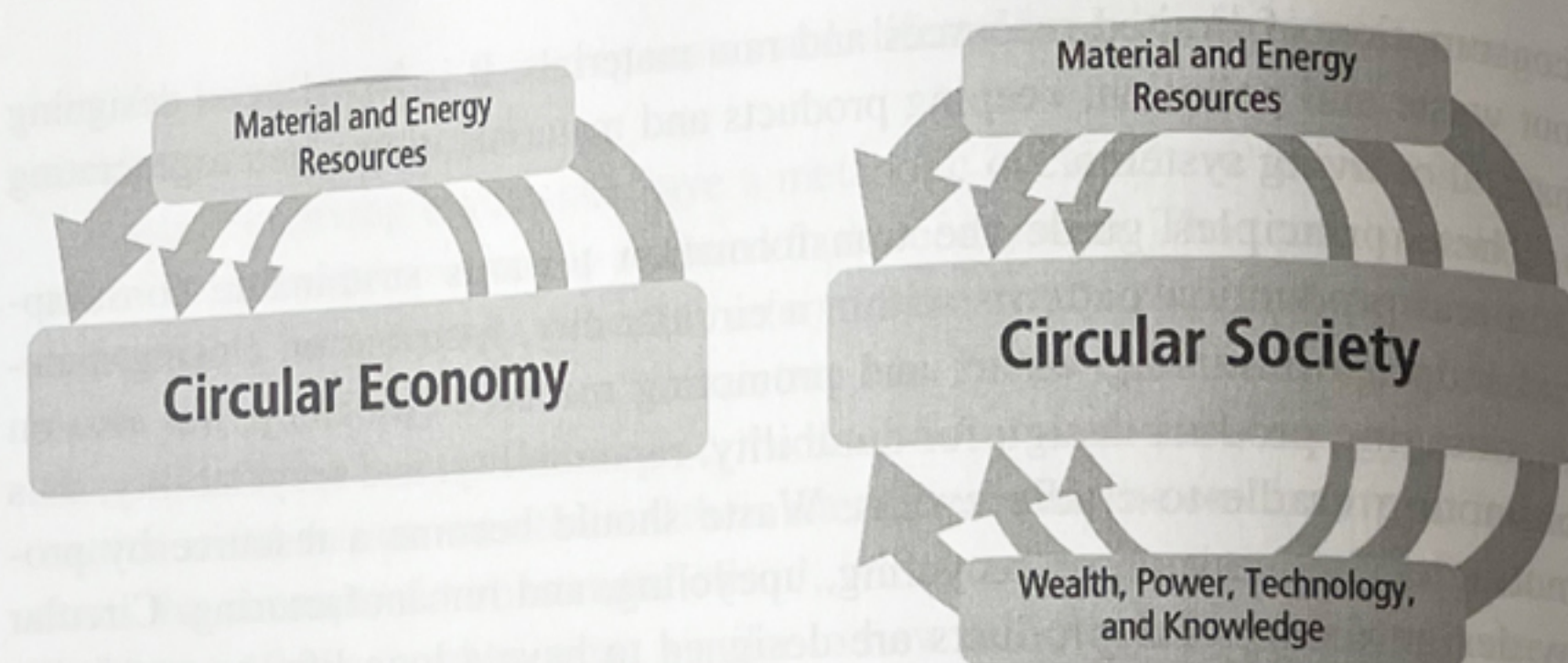


Figure 11.5 Conceptual differentiation between circular economy and circular society  
(Credit: Adapted from Martin Calisto Friant *et al.*<sup>20</sup> Reproduced with permission.)

the consumption of finite resources'. To this end, an inter-municipal 'hub', the 'DoTank Circular City Vienna 2020–2030', has been established.<sup>21</sup>

As the counterpart of an economy is society, an important factor is the transition from a disposable society to a circular society, which relies on the acceptance of more sustainable lifestyles for the transformation by citizens (Figure 11.5). This term is gaining more attention recently in academic as well as government and corporate sectors. Like many other modern cities, Vienna is a complex adaptive system with dependencies and interactions between various stakeholders, components, and subsystems that we need to analyse in order to understand their dynamics.<sup>22</sup> A CE must therefore be embedded in social structures that promote human well-being for all within the biophysical limits of our planet.

Enterprises and organisations from the manufacturing and service sectors in the city of Vienna are strongly challenged to play their role as innovation drivers and multipliers of such a new circular innovation system for a modern, regenerative economy, while citizens must be able to acquire competences for the transition to cross-sectoral value cycles. This will require knowledge and skills, from new business models such as sharing, repairing, remanufacturing, or recycling of products to the necessary data-based financing solutions or return logistics.<sup>23</sup>

In terms of the city's economic potential, this will open new business areas that can develop into an important intra-European location advantage for the city, its economy, and its citizens. However, the challenges are many and varied, ranging from systemic and strategic organisational change, innovative companies, funding, corporate governance, tax barriers, or standards to the development of the necessary skills of existing and especially future employees and customers, to the use of digital applications and skills to transform supply chains and return logistics into value webs and thriving ecosystems.

Addressing and developing transition strategies and skills at the level of policy-makers, business leaders, managers, and workers in a wide range of sectors in traditional industries is as important as the emergence of innovative circular business models in the start-up sector. Significant research and innovation efforts as well as skills development at all levels are needed to redesign economic processes towards a more circular, energy- and resource-efficient economy by reassessing existing business models, processes, risks, and logistics chains.<sup>24</sup>

To enable future decision-makers to make well-informed decisions on research, economic, and innovation policies, the education sector must promote and integrate systemic circular thinking into regular courses of study. Individual and organisational resilience is particularly needed in times of transition and contributes significantly to the successful implementation of existing knowledge and data-based information.

### 11.3.3 Regenerative Principles

In general, regenerative social-ecological systems – regions, cities, communities as well as economies, or businesses – can be defined as those that sustain positive, reinforcing cycles of well-being.

Something regenerative has the capacity to exist or to emerge again and again. Regenerative principles aim to restore and replenish natural resources and ecosystems. These principles go beyond mere sustainability and focus on actively enhancing the environment's health and resilience through circular practices, thus going beyond the concept of sustainability, as its practices aim to keep the system in operation with no degradation, while restoration practices use management strategies to restore the system to improved productivity and health.<sup>25</sup>

Incorporating regenerative principles elevates the concept of CE beyond mere resource efficiency. Regeneration encompasses the revitalisation and rejuvenation of systems, whether ecological or otherwise, with the aim of reinstating health, of resilience, and desirable outcomes. A crucial aspect of regeneration lies in augmenting a system's inherent capacity to effectively restore and renew itself, a recurring and pivotal attribute. To distil, regeneration is fundamentally concerned with leaving both the natural world and society in a state that is more robust, healthier, and more resilient than its initial state. It emerges as the vanguard of sustainability, embracing a trajectory that extends beyond mere preservation. Its practices rejuvenate natural systems, promoting symbiotic relationships between urban areas and their surrounding ecosystems.

Coincidentally, just as sustainability has evolved into an imperative for businesses over the past 15 years, regeneration has emerged as a burgeoning imperative – offering even more substantial advantages than its predecessor, given the science-based



facts of having taken our planet to the brink of mass extinction. We now have plenty of evidence that degenerative linear systems, while yielding short-term benefits, erode and undermine nature and society in the long run. Sustaining the existing status quo is not appropriate given the current and projected status of environment and society. Hence, multiple influential organisations, such as the World Business Council for Sustainable Development, the Capital Institute, the Doughnut Economics Action Lab, and Forum for the Future are looking at what regenerative businesses and economies might look like, and entire sectors are beginning to explore how they can enable the shift to a regenerative dynamic economy and society.

Regeneration entails a multitude of pivotal facets, spanning from the revival of natural systems to the rejuvenation of relationships with vital stakeholders in society. This approach entails reimagining a more harmonious balance between material and non-material pursuits while cultivating leadership capable of systemic thinking and prioritising mutually beneficial outcomes for all stakeholders. Regenerative principles therefore embody an evolutionary form of sustainability that seeks more than to uphold and sustain, but also to reinstate, rejuvenate, heal, and nurture. The formula to be considered in every aspect of systems design is to align the criteria of restoration, renewal, and resilience towards a regenerative trajectory.

#### 11.4 Transition Governance

Effective governance is critical for driving the transition towards circular living and a circular city. Research on transition governance frameworks for detecting the societal potential for system's change and for orienting the societal system towards transitions is a multidisciplinary field, and findings vary based on specific contexts, research methodologies, and objectives.

In general, transition governance explores the mechanisms, strategies, and approaches necessary to facilitate and guide societal transitions towards more sustainable and resilient systems. It involves setting a clear vision, fostering stakeholder engagement, and implementing policies and frameworks that support circular initiatives.<sup>26</sup>

Transitioning towards a regenerative CE and regenerative lifestyles for citizens demands robust governance frameworks that promote collaboration, innovation, and adaptive management. It needs multi-stakeholder engagement and the fostering of partnerships between governments, businesses, communities, and academia. Collaborative decision-making processes facilitate the co-creation of policies and strategies that align with regenerative circular principles to foster and enable circular living in the city. To be successful, the transition requires the involvement of all actors in society and their capability to network and create appropriate patterns of cooperation and exchange.<sup>27</sup>

The facilitation of linkages and dialogue by implementing effective multi-level governance to align priorities and incentives across sectors, levels of government, and stakeholders plays a vital role in the process. Pioneering municipalities and city authorities need to promote systems thinking among decision-makers to achieve policy coherence by integrating segmented policies to adopt a functional approach that transcends administrative boundaries and promotes rural-urban linkages and partnerships. Systemic intermediaries – 'transition brokers', according to Jacqueline Cramer's work – can play a vital role in regional governance by enhancing processes of change, building alliances, helping create the necessary preconditions, and developing impactful initiatives from a neutral standpoint. Based on Cramer's research, there is a clear division of labour between transition brokers vis-à-vis other key actors in a multi-stakeholder setting, within which the local government is included.<sup>28</sup>

In pursuing the overarching goal of transforming urban life, it is of paramount importance to establish the necessary governance parameters that encompass a variety of key dimensions. A particularly crucial aspect in this regard concerns the careful examination and delineation of the legal frameworks that need to be readjusted to effectively support the transition to an overall regenerative CE framework. At the same time, the meaningful mobilisation of financial resources, allocated in such a way that the funds are efficiently directed towards the intended development path, is an imperative requirement. Moreover, the adaptation of the available workforce and technologies to meet the emerging challenges becomes a fundamental prerequisite for the realisation of this transformation process.

Related to this, it is essential to stimulate economic progress through strategic initiatives that include the dynamic reshaping of innovative spaces, state-sponsored procurement projects, and the promotion of synergies in cooperation within industrial sectors. Given the intricate interplay between public and private interests, the promotion of collaborative interfaces has a central role to play as a hub for fostering collaboration between non-profit public institutions and businesses.

To understand the above dynamics, it is crucial to establish an information framework that is firmly anchored in empirically robust data systems. This construct is of paramount importance, as it serves as the linchpin for enabling stringent metrics that allow for informed assessment of the wide-ranging impact and consequent effectiveness of policy interventions.<sup>29</sup>

#### 11.5 Towards a Circular City: Methods, Processes, and Tools

A circular city brings the postulated paradigm shift from the well-known take-make-waste model of linear economies that characterises much of our materialised world by upshifting our consciousness and habits of being based on circular mindsets,



heart-sets, and skill sets. The physical structure of the city determines not only the climate adaptivity of a city, but moreover the way denizens behave, move, and live within the built environment. Therefore, following the design dictum that 'form follows function', attention to how the built environment of the city serves and promotes the liveability and thriving of its denizens is of paramount importance.

The emerging paradigm of circular cities promotes an upshift in thinking, doing, and being by dramatically extending the lifespan of its existing built environment in value and usage. This is the balancing act between designing and constructing for eternity, but in parallel developing concepts for the eventuality of eternity not happening due to urban optimisation, profound societal changes in lifestyle, or remarkable technological evolution. Self-evidently, material loops are closed, and all players connected to the circular city are thriving for doing the same in their individual parts of the circular living space provided: they preserve the value and utility of circulating products, components, materials, nutrients as long as possible 'as they are'. A circular city seeks to improve resource access for everyone – lowering its emissions, protecting, and enhancing biodiversity – and strives to reduce social inequalities, as demanded by the Sustainable Development Goals.<sup>30</sup>

#### 11.5.1 Harvesting Circular Construction Material: Urban Mining versus Urban Material Stock

As previously described, our built environment generates a huge material footprint. Cities only cover 2 per cent of the world's land surface, but activities within their boundaries consume over 75 per cent of the planet's material resources.<sup>31</sup> Against this background, integral engineering science, among others, is developing processes and technical-operational options for producing secondary materials. Producing means in this case harvesting already applied construction elements, building products, or construction materials from our built environment.

Urban mining implies the extraction of secondary materials with similar effort to traditional mining. In the long run, urban mining will always be part of our value chain, replacing naturally exploitable sites (e.g. copper mines). In a circular city, the built environment will be transformed into an urban material stock, requiring that building materials, products, and/or elements can be removed for reuse with minimal (energy) input.

Given the lack of focus on reusability or recyclability in construction in the past, most of the contemporary built environment consists of inseparable combinations of materials and structures and thus, is neither designed nor constructed for deconstruction or reuse.

The anthropogenic stockpile is currently more suitable for urban mining with the consequence that materials and construction elements can only be used for

downcycling or – even worse – landfill. Under the current regulatory framework, urban mining is more likely being applied. The vision of an urban building stock will unfold when the legal foundations are laid in the sense of switching from a prohibitive to an enabling legislative environment. This change of approach requires courage, ambition, and pace on policy level, and a certain degree of maturity in society concerning self-responsibility.

The following subsections propose a common thread about 'by what' – introducing the Quadruple Helix approach as a method for innovation and transformation – 'whereby' – using the incubator neighbourhood transformer as an example. We close the chapter by tackling the 'how' – with a brief introduction to the Circular City Funding Guide,<sup>32</sup> one action under the *Urban Agenda Partnership for Circular Economy* that has been developed by the European Investment Advisory Hub.

#### 11.5.2 The DNA of the Transformation to a Circular City Is a Quadruple Helix

The fundamental preconditions for climate protection are decided at city level because cities are responsible for around 75 per cent of global greenhouse gas emissions.<sup>33</sup> Thus, it is becoming ever more widely understood that climate protection can only succeed in the context of a just transition to a CE.

In Austria, citizens commonly refer to the local municipality as the 'commune'. It is an outdated term, but there is an understandable reason for its persistent existence. Another definition of a commune is the binding cohabitation of unrelated individuals – in other words, a freely chosen living community where the interplay between individuals is nurtured and encouraged in the absence of family ties. At the same time, all participants are constantly renegotiating their creative space within this community of purpose.

The Quadruple Helix approach is a concept that was introduced to a wider audience by a recognised article of Fraunhofer IAO, Centre for Responsible Research and Innovation in 2019. According to the research team, the collaboration of academia, industry, government, and society is necessary to ensure that innovative solutions are relevant, feasible, and sustainable.<sup>34</sup>

The existence of the quadruple or fourfold helix in human DNA was first observed at the University of Cambridge in 2013 and will lead to breakthroughs in the fight against major diseases. We are following the exploration of the human genome intellectually in an attempt to get closer. Our DNA structure has been commonly thought of as a double helix, two strands wrapped around each other, for the last 60 years. Similarly, we assume our society is divided into two strands. Those who make rules – 'those up there' – and those who more or less follow or question them – 'at the bottom'.



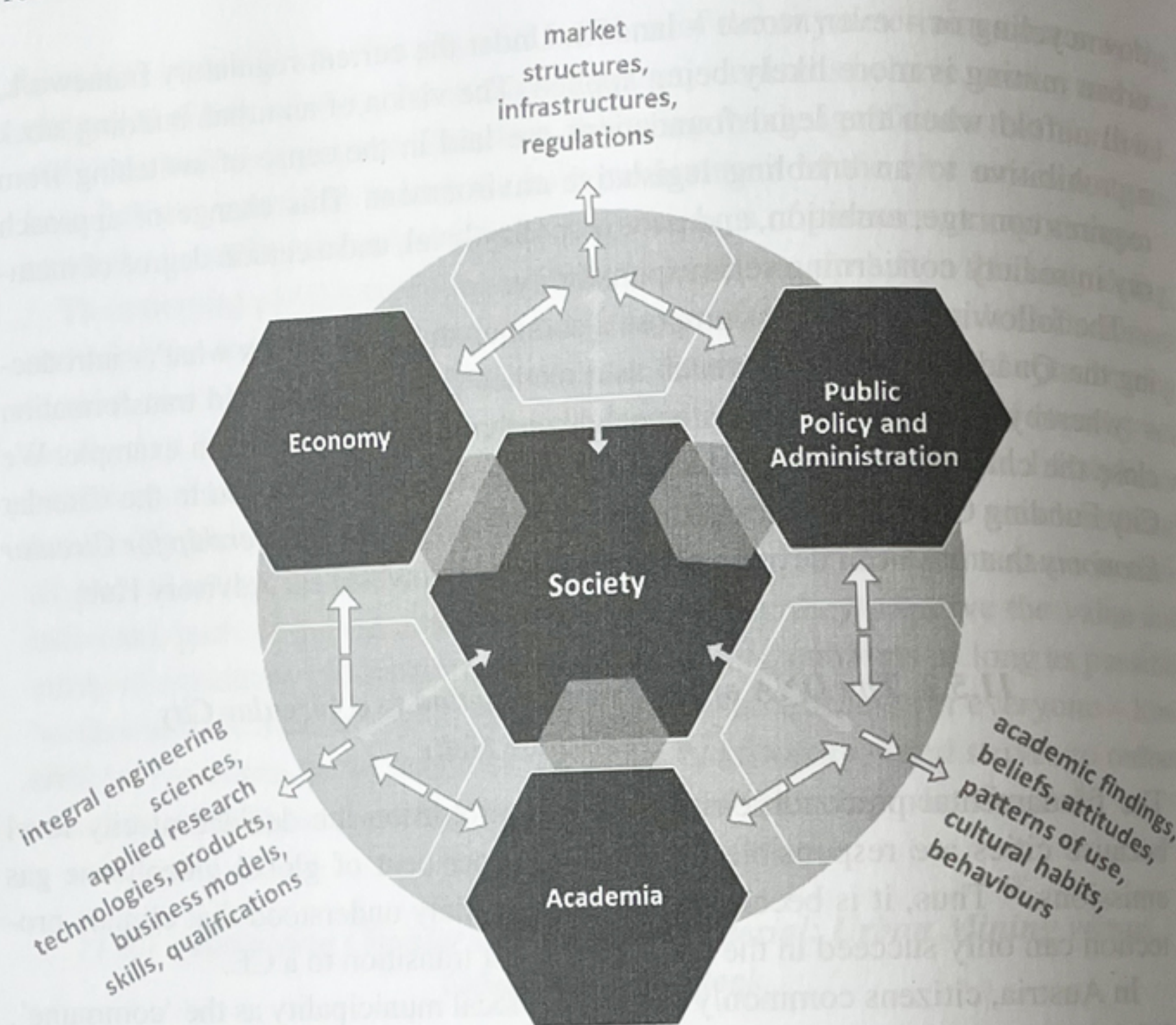


Figure 11.6 Quadruple Helix approach to socio-technical innovation in the circular economy

If we recognise the commune as an organism, which also underlies the DNA mechanism of action, the significance of the Quadruple Helix approach emerges. We can think of climate change, biodiversity loss, and over-consumption of primary resources as serious diseases to which we must adapt and which we must stop by actively protecting the climate and reducing resource use. We can do this through the concerted elaboration of our perspectives in an accompanied manner and the bringing together of these perspectives in recurrent autocatalytic and cross-catalytic loops. The process is visualised in Figure 11.6.

The four strands collaborating tolerantly in this process are business, research, politics, and administration, and certainly civil society. Of course, it is not possible to always discuss all aspects in a grassroots approach with all stakeholders. But that's not necessary if we identify possible contributors from the other strands of the Quadruple Helix as we develop content or concepts for transformation and prioritise the focus groups as part of a knowledge web.<sup>35</sup>

Aspects of research and development should, on the one hand, be integrated into cultural-social habits and, on the other hand, into economic and regulatory

capabilities for implementation. Even if we make the transformation somehow happen by solely updating the regulatory frameworks or constantly adding particles for pseudo-novelties just for demonstrating action, a transformed built environment as well as economy cannot function under outdated frameworks.

Using innovation and development as a showcase, we open up the space of possibilities in accordance with the communal DNA. Holistic and in-depth negotiation of relevant topics between affected actors from business, science, politics, and administration – transparent for society at all times – ensures the efficiency required for an understandable, systemic, and thus rapid paradigm shift.

However, transitioning to a CE requires significant changes in the way we produce and consume. This can create disruption and uncertainty, particularly for those who are accustomed to the current linear model of production and consumption. Additionally, in the case of very liveable cities such as Vienna, there is currently no need for transformation. The quote 'never change a winning team' starts circling in many brains – especially in the brains of people who are not part of the sustainability and regenerative bubble and of course many policymakers or politicians.

A good portion of circular measures, such as renovation, waste reduction, and recycling, may require upfront investments that logically lead to short-term costs for individuals and businesses. This could be seen as a burden, particularly for those with limited financial resources when they don't see themselves embedded in a solidarity-framework and do not think of themselves as part of a commune. Therefore, we must put the Quadruple Helix approach into practice if we want the public to follow the path of transitioning to a CE and successfully participate in this upshift. In this context, courageous political decisions will become feasible. Awareness-raising efforts will end in a deeper understanding of the necessity to act, so elected officials will not be punished at the ballot box.<sup>36</sup> By adopting these strategies, residents of the city can be nudged to avoid 'not-in-my-backyard' thinking and become motivated to join the New European Bauhaus initiative of the European Commission.

### 11.5.3 Cross-Sectoral Collaboration

Whereas the initially described Quadruple Helix approach defines which parts of society should work together on which occasions and why, cross-sectoral collaboration can be seen as the tool which perfectly matches initiatives with each other. The circular city thrives on cross-sectoral collaboration, where diverse industries and sectors come together to develop integrated solutions. This collaboration promotes the efficient use of resources, reduces duplication, and fosters innovation.

It is particularly significant in the case of the built environment to look beyond the processes for effective collaboration towards physical outcomes achievable



through site developments within the context of impact. Communes with a high quality of life are characterised by the interplay of urban planning considerations and their implementation in property planning. Ideally, the effects are multiplied by a selection of locally sensible, cross-silo measures in both private and public areas.

If, for example, a municipality redesigns a street space by planting trees, the optimal effect will only occur if adjacent buildings do not counteract this microclimatic improvement. Possibly coordinating the timelines of related projects (i.e. the growth phase of newly planted trees could be aligned with the renewal cycle of the adjoining facades), vertical greening solution would cover with its lifespan the period needed for the tree to develop its complete microclimatic effect. From a circular point of view, in this case the secondary structure of the shell would have to be designed for this change from the very beginning in order to ensure that as few materials as possible must be replaced. These should then have reached the end of their life anyway or be reused nearby.

Likewise, merely legitimising actions by saying 'because it is not forbidden' does not promote the common good. Similarly, it should not lead to suspicion if someone wants to make money. Yes, it is exhausting to negotiate the balance between the expectations of the individual and the needs of the collective, but the fact that neither the 'public hand' nor the 'invisible hand of the market' will be able to play the role of *deus ex machina* must be acknowledged. Everyone must take their share of responsibility for the ecological, economic, and social effects of their activities.

Currently, there is a limited understanding and implementation of this kind of urban development approach within the Viennese municipality. Still, the common five-step model of the policy and roadmap development process is standardly applied: (1) agenda setting, (2) formulation, (3) adoption, (4) implementation, and (5) evaluation.<sup>37</sup>

Every stage of the process has some nodes of participation; however, the administration is not yet ready to cede some of its process, outcome, and negotiation power to the remaining strands of the Quadruple Helix. Up to a point, this patronising approach is comprehensible, as it has given the city an unprecedented track record of raising and sustaining the quality of life to the highest level. A good portion of citizens have also adjusted to this: taking responsibility and do-it-yourself attitudes prevail over complaining about the city administration acting according to 'confidential rules' in the status quo.

To convince citizens to foster circularity and accept cross-sectoral collaboration – which also entails decision dependencies to a certain degree – it is crucial to embrace all perspectives and engage in a continuous dialogue with them. Several parallel strategies can be adopted to motivate citizens towards embracing CE solutions in urban planning, architecture, and everyday life. Therefore, for a while,

change agents inside and outside the municipality tried to introduce the 'Paradox of the Red Queen' as a new, additional interpretative paradigm for a modern, transformative municipality. Shortly put, this paradigm says that a successful system has to adapt itself in an increasing number of narrow cycles to ensure its functionality: in this country you have to run as fast as you can if you want to stay in the same spot.<sup>38</sup>

#### 11.5.4 Incubator Neighbourhood Transformer

One practical example of an application of cross-sectoral collaboration is the incubator neighbourhood transformer, jointly developed in 2022 by Green4Cities and ParaMind Brainstorming Software. Although the idea was discussed very positively by municipalities all over Austria, those especially involved in grassroots activities were the most supportive. Unfortunately, as it was not yet time for *medias res*; all the decision-makers at the executive level decided against the idea, one after the other, like a row of dominoes. The concept continues to circulate in Vienna, particularly in architectural circles, and is therefore briefly described as follows.

Incubator neighbourhood transformers are hubs that foster experimentation, innovation, and knowledge-sharing within the circular city. These transformative spaces serve as laboratories for implementing circular solutions and prototyping regenerative practices.

Innovation techniques and methods are methodological developments that include the definition of the process towards the transdisciplinary choice of applicable key performance indicators. This leads to a suitable implementation of potentially high-impact climate mitigation measures in the fields of action nature-based solutions, energy, and mobility. Simultaneously, it also involves development of solution pathways enabling sustainable decision-making when trade-offs arise. A master plan for those cross-siloed climate measures for whole city quarters and their corresponding cost estimation will be developed. In line with the requirements of the European Green Deal, the transition to a CE necessarily also provides the general scope for this project.

Governance innovation includes the design of co-creative neighbourhood organisations as locally set Special Purpose Vehicles (SPVs) to connect private stakeholder groups in collaboration with partners representing the public sector. In this manner, the interdependencies between innovative financing, social inclusiveness, and the impact measures of the master plan are guaranteed. Additionally, this approach ensures operating in accordance with the common good economy.

Financial innovation focuses on blended finance (e.g. revolving funds, private public partnerships, crowd funding, or green bonds), with special focus on Europe's innovative and unique financial instrument – the so-called Environmental



Impact Bonds operated by the suggested SPVs. Philanthropists, as well as impact investors and representatives of the public hand, are brought together under this umbrella. This holds the potential of unleashing the combined power between private money as well as the efficient and responsive use of public money.

### 11.6 Summary and Conclusions

The exploration of circularity presented in this chapter provides a holistic perspective for envisioning and creating a future that is sustainable, regenerative, and in harmony with the planet's ecosystems. As we navigate the complexities of a VUCA world, the authors establish the urgency of collective action and innovation in response to the challenges we face. The introduction of the concept of interbeing emphasises the interconnectedness of all life forms and ecosystems and serves as a foundation for circular action for change. Protopian thinking, as highlighted in Section 11.2, provides actionable pathways towards circular cities and societies, and promotes conscious participation in shaping a desirable future. Evolutionary systems design emphasises the role of collaboration, innovation, and adaptability in managing change.

Based on these principles, the concept of circular living is applied to urban governance frameworks. Integrating CE and regenerative principles into urban governance is shown to be a powerful approach to achieving sustainability and resilience. The metaphor of a city's metabolism illustrates the potential of circular living to optimise resource use and reduce waste, guided by CE principles. Regeneration, as an extension of these principles, aims to actively improve the health and resilience of urban systems, fostering a symbiotic relationship between cities and their surrounding ecosystems. The emphasis on transitional governance, systemic intermediaries, and collaboration highlights the importance of a holistic approach in driving the transition to circular living.

Turning to the practical application of circularity in urban contexts, the authors point to Vienna as a prime example. The concept of a circular city challenges the conventional linear economy and promotes circular mindsets, heart-sets, and skill sets. Strategies such as urban mining and the transformation of the built environment into a material stock highlight the need to close material loops and minimise waste. The Quadruple Helix approach – involving academia, industry, government, and society – is emerging as a collaborative means to foster innovation and drive circular transformation. The neighbourhood transformer incubator illustrates how experimentation, governance innovation, and cross-sector collaboration can contribute to realising the circular city vision. Further research is emerging on a variety of these focus areas that holds great promise for regenerative circular city design to become much more mainstream in the near future.

Together, these considerations weave a narrative of conscious evolution towards circular societies and liveable cities. The principles of circularity and regeneration, coupled with innovative governance models and collaborative efforts, offer a blueprint for addressing the challenges of the present and creating a thriving future. The transition to a circular way of life is not just a change in practice; it is a profound upshift in mindset and approach. It recognises the interdependence of human well-being and the health of our planet, emphasising harmony and symbiosis rather than extraction and depletion. Navigating our world's uncertainties, these perspectives present a vision of cities and societies evolving in resonance with nature, fostering connectedness, vitality, and resilience.