InvestCEC

Guidelines on Circular Economy Transition

Stadtwerke Klagenfurt AG

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List of acronyms

CCIS – Circular City Indicators Set

CCRI – Circular Cities and Regions Initiative

CE – Circular Economy

CSRD – Corporate Sustainability Reporting Directive

EASAC – European Academies' Science Advisory Council

EC – European Commission

EEA – European Environment Agency

EIB – European Investment Bank

ERA – European Research Area

EU – European Union

GIS – Geographic Information System

KPI – Key Performance Indicator

LCA – Life Cycle Assessment

MFA – Material Flow Analysis

n.d. – no date

OECD – Organisation for Economic Co-operation and Development

PPP – Public-Private Partnership

SME – Small and Medium-sized Enterprises

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1. Introduction

This document serves as a guideline for European cities and public utilities seeking to transition towards a circular economy (CE). It provides a structured approach to define circular transition project scope, vision, objectives, strategies and milestones, while also addressing potential challenges and estimating implementation costs. This guideline aims to empower cities to develop comprehensive CE transition plans tailored to their specific needs and circumstances.

The circular economy represents a paradigm shift from the traditional linear model, emphasizing resource efficiency, waste reduction and the creation of closed-loop systems. By prioritizing the reuse, repair and recycling of materials, the CE offers significant environmental, economic and social benefits. The transition to a circular economy is therefore no longer an option but a necessity for cities seeking to build sustainable, resilient and resource-efficient urban environments. In 2023, only 12% of materials used in the EU economy come from recycled sources (Eurostat, 2023). This highlights the urgent need for cities to adopt CE models.

Medium-sized cities, typically defined as urban centers with populations around 100,000, such as Klagenfurt am Wörthersee in Austria, are pivotal in driving CE transitions across Europe. These cities often act as hubs for innovation, connecting urban and rural areas while maintaining a manageable scale for implementing and adapting circular solutions. They balance the urban density needed for efficient resource management with the complexity of larger metropolitan areas, making them ideal testing grounds for CE initiatives. Importantly, they are not alone: a growing number of cities of all sizes are actively working on CE transition. Dozens of cities and regions have signed the Circular Cities Declaration, coordinated by ICLEI Europe, across Europe, representing a collective commitment to accelerate the shift from a linear to a circular economy and to share experiences, strategies, and best practices (ICLEI, n.d.-a).

While the principles of CE remain consistent, their implementation varies based on geographical, economic and governance factors. Cities often face similar challenges, including financial constraints, regulatory barriers, limited technical expertise and public hesitancy to change.

This guideline provides a practical roadmap for medium-sized cities to design and implement CE strategies effectively. It outlines key steps, including:

- Assessing local needs and defining objectives,
- Developing investment and financing strategies,
- Engaging stakeholders and managing governance,
- Overcoming implementation challenges and
- Monitoring impact.

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A core component of this guideline is the InvestCEC model, which is being tested in Klagenfurt, Austria. InvestCEC model is based on a structured four-phase approach: (1) defining local needs, (2) selecting CE solutions, (3) preparing for investment and (4) securing funding. Through this model, cities can access financial resources, enhance public-private collaboration and accelerate their transition to circularity.

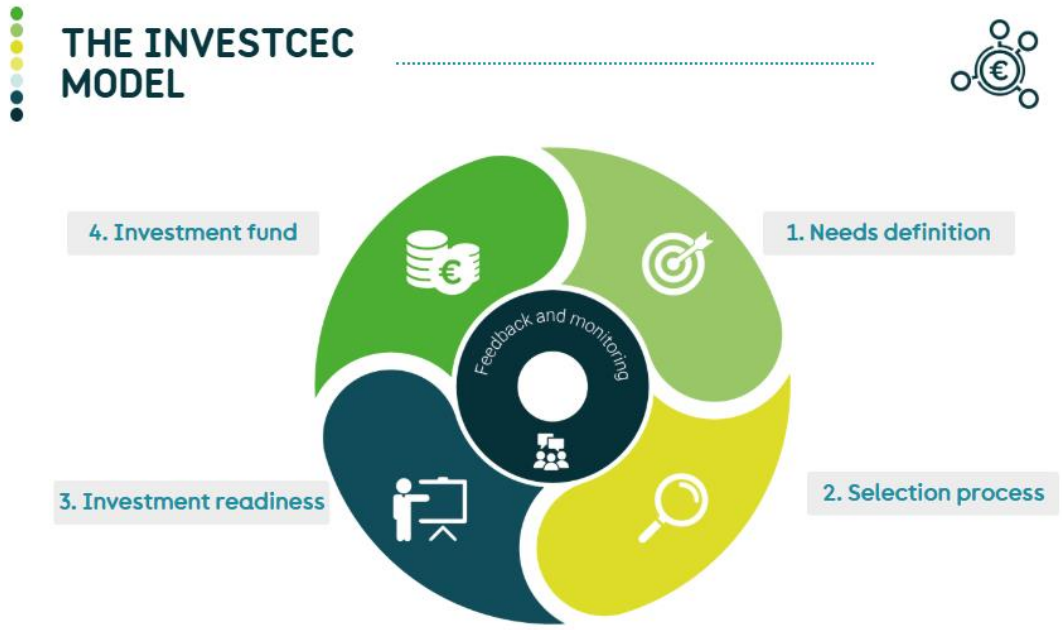

Figure 1 The InvestCEC model

By following the principles and strategies outlined in this document, medium-sized cities can transform challenges into opportunities, ensuring that their circular economy initiatives are both economically viable and environmentally sustainable. While pilot projects have played a vital role in testing and demonstrating circular solutions, the central challenge for European cities today is to move from these promising pilots to full-scale, systemic implementation. This guideline is designed not only to inspire new pilots but also to help integrate circular principles into everyday municipal policy, infrastructure and investment decisions. By leveraging lessons from pilots, fostering cross-city collaboration and utilizing EU-supported frameworks and networks, cities can ensure that circular economy becomes a core element of urban development and delivers tangible environmental and economic benefits.

2. Understanding Medium-Sized Cities' Context

There are several hundred cities in the European Union with populations in the 50,000–150,000 range, forming a significant segment of Europe's urban landscape and playing a key role in the circular economy transition (European Commission, 2024). These medium-sized cities have a

unique and essential position within the ecosystem of urban settlements. Neither extensive metropolises nor small rural towns, these cities bridge the gap between dense, resource-intensive metropolitan environments and the decentralized, often resource-constrained realities of smaller communities. This chapter explores the characteristics, challenges and opportunities that medium-sized cities encounter in their transition toward circular economy practices. By examining their specific context through multiple lenses, this chapter aims to provide an understanding of how these cities can strategically leverage their scale and governance structures to implement impactful, scalable and transformative circular economy initiatives that create lasting value for their communities and environments.

The pathways to circularity will necessarily differ among cities, reflecting their diverse economic structures, infrastructure systems and regional contexts. However, certain common principles emerge as foundational for successful transitions that deliver multiple benefits aligned with community priorities.

2.1 Unique Characteristics of Medium-Sized Cities

Medium-sized cities with populations around 100,000 inhabitants like Klagenfurt am Wörthersee in Austria, represent a distinct urban ecosystem characterized by their intermediate scale and unique position within regional networks. This intermediate scale offers a delicate yet powerful balance between complexity and manageability, enabling these cities to function effectively as hubs for regional economic and environmental activities while maintaining closer community ties and social cohesion that larger cities often struggle to preserve.

2.2 Specific Challenges

Medium-sized cities face a variety of challenges that can hinder their ability to adopt circular economy principles effectively. These challenges cover multiple dimensions (technical, financial, infrastructural, institutional and social) requiring comprehensive approaches for successful circular transitions.

Compared to larger metropolitan areas with extensive municipal departments and specialized staff, medium-sized cities often operate with significantly constrained budgets and limited access to specialized expertise in developing fields relevant to circular economy implementation, such as resource flow analysis, circular procurement, or innovative financing, due to smaller administrative teams without deep technical knowledge in complex areas of CE, and reduced capacity to engage external experts. This financial limitation directly affects their ability to invest in advanced waste management systems, resource recovery technologies or renewable energy

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infrastructure (European Investment Bank, 2023). The municipal budgets must stretch across numerous essential services, leaving limited space for innovative circular economy initiatives. While larger cities can often dedicate specialized departments and personnel to sustainability and circular economy objectives, medium-sized cities typically work with smaller administrative teams that may struggle to design and implement comprehensive CE strategies alongside their existing responsibilities. Without access to this knowledge, these cities may find it challenging to identify the most effective interventions for their specific context or to develop technically sound implementation plans. This expertise deficit extends to project evaluation and monitoring capabilities, making it difficult for these cities to assess the impacts and outcomes of their circular initiatives. Furthermore, these cities often face challenges in accessing financial mechanisms specifically designed for sustainability transitions. They may lack the capacity to develop competitive applications for national or international funding programs, or they may struggle to establish the partnerships necessary for financing models. To address these gaps, initiatives such as the EU's Circular Cities and Regions Initiative (CCRI) provide cities and regions with comprehensive technical and financial support throughout the entire lifecycle of circular economy projects, including project development assistance, matchmaking, and knowledge sharing (European Commission, n.d.-a) (ICLEI, n.d.-b). The European Investment Bank (EIB), as a key CCRI partner, has dedicated lending products and advisory services for circular economy investments, having provided €5.1 billion in circular projects between 2020 and 2024 (European Investment Bank, 2025). The combination of limited internal expertise and constrained financial resources creates a significant barrier to ambitious circular economy initiatives, forcing many medium-sized cities to pursue smaller, incremental changes rather than system-wide transformations.

Many medium-sized cities have developed over decades or centuries with infrastructure systems that were designed for linear resource flows. These cities rely heavily on aging water distribution networks, conventional waste management systems and traditional energy infrastructure that are not only inefficient and resource-intensive but also represent significant sunk investments that cannot be replaced easily. Water infrastructure in these cities often suffers from deterioration, leading to substantial leakage rates. These inefficiencies result in wasted water resources and high-energy consumption during treatment and distribution processes. Similarly, outdated wastewater treatment facilities may lack the capabilities for resource recovery, such as nutrient extraction or biogas production, which would be central to a circular approach.

Energy systems present another significant challenge, with many medium-sized cities operating district heating systems or municipal power plants that rely on fossil fuels or inefficient combustion technologies. Transitioning these systems to renewable sources such as biomass, geothermal energy or waste heat recovery requires substantial upfront investments.

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Additionally, the existing building stock in many cities is older than modern energy efficiency standards, which creates further challenges for reducing overall resource consumption.

The challenge of modernizing infrastructure is compounded by the long life cycles of facilities like water pipes and district heating networks, which represent decades-long investments. In contexts where municipalities directly manage these assets, rapid transitions to circular alternatives can be financially impractical. However, organizational structures vary widely: in countries like Denmark, private operators under municipal contracts often drive innovation within robust regulatory frameworks. Cities must therefore tailor strategies to their governance models—phasing circular principles into publicly owned systems during asset renewals, while using performance-based contracting or regulation to accelerate change in delegated or privatized contexts.

Waste management systems vary significantly across Europe. While some regions struggle with rudimentary practices, some countries exemplify advanced circular economy integration. These nations employ sophisticated separation protocols, ensuring high-purity material streams for recycling. Organic waste, which typically constitutes 30-40% of municipal solid waste, is systematically processed through composting, anaerobic digestion, or biogas production, transforming it into valuable resources. This approach minimizes resource loss and methane emissions, aligning with circular economy principles. Nordic systems demonstrate that financial constraints, technical expertise, and spatial limitations can be overcome through policy innovation, public engagement, and infrastructure investment (Nordic Council of Ministers, 2024).

If present, waste management infrastructure, such as sorting facilities, specialized recycling operations or organic waste processing plants, often requires a minimum input volume to operate efficiently. Individual medium-sized cities may struggle to generate sufficient material flows to support these facilities independently, necessitating regional collaboration that crosses municipal boundaries. Similar scale challenges apply to industrial symbiosis networks, which benefit from a diverse range of industrial activities that may not exist within a single municipality.[1]

Urban logistics and goods movement represent another mobility challenge with circular economy implications. Medium-sized cities often lack coordinated urban logistics systems that could optimize delivery routes, reduce empty vehicle movements or consolidate shipments.

[1] Industrial symbiosis networks are collaborative systems in which companies from different sectors exchange materials, energy, water, or by-products to reduce waste and improve resource efficiency. By turning one company's waste into another's input, these networks create mutual environmental and economic benefits while supporting circular economy goals.

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Without these systems, the resource efficiency of product distribution remains suboptimal, contributing to unnecessary emissions and infrastructure wear. The spatial layout of many medium-sized cities often prioritizes car-centric development patterns with separated land uses that increase transportation requirements. Transitioning toward more compact, mixed-use urban forms that could reduce mobility needs and support active transportation modes requires long-term planning and gradual redevelopment that may extend beyond typical political timeframes.

Land use practices in many medium-sized cities continue to promote greenfield development over brownfield redevelopment or adaptive reuse of existing structures. This approach not only consumes valuable land resources but also fails to capitalize on the embodied energy and materials in existing buildings. By neglecting brownfield sites and underutilized buildings, cities miss critical opportunities to revitalize neighbourhoods, preserve cultural heritage and reduce environmental impact. At the same time, the design and management of public space often follows conventional approaches that may miss opportunities for incorporating circular principles. These spaces could be designed to provide multiple functions, including rainwater management, urban food production, community composting, or material exchange points.

2.3 Unique Opportunities

Despite the list of challenges mentioned above, medium-sized cities have several unique advantages and opportunities that can facilitate their transition to circular economy practices. The issues highlighted are not universal obstacles, but rather examples of barriers that some cities across Europe face, while others have already developed innovative and effective solutions. However, mechanisms for learning from one another remain underdeveloped. InvestCEC seeks to bridge this gap by offering replicable models and real-world examples to inspire and guide other municipalities.

These opportunities not only position medium-sized cities as pioneers and leaders in implementing circular solutions tailored to their specific contexts, but also enable them to serve as demonstration sites whose experiences and lessons learned can support replication and scaling in other cities and regions across Europe. By sharing knowledge and best practices these cities help accelerate the circular transition continent-wide

The manageable size of medium-sized cities represents one of their most significant advantages for circular economy implementation. These cities operate in a context where systemic changes are still achievable without the administrative complexity found in major metropolitan areas. This enables them to implement pilot projects and experimental approaches more efficiently, as

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coordination across stakeholders is often less bureaucratic and more agile. This adaptive capacity is particularly valuable in the circular economy field, where best practices continue to evolve and context-specific solutions are often required.

Medium-sized cities can serve as ideal testing grounds for innovative circular economy solutions that can later be scaled up regionally or nationally. Their representative size makes them valuable demonstration sites, as the lessons learned can be more readily applied to other similar urban centers compared to innovations developed in either very large or very small communities. This demonstration value can help cities attract pilot project funding or research partnerships that bring additional resources and expertise. Furthermore, the administrative structures of medium-sized cities typically feature fewer layers of bureaucracy and more direct communication channels between different municipal functions.

The smaller scale fosters closer connections between municipal governments and residents, creating advantages for community engagement in circular economy initiatives. The sense of community identity and belonging tends to be stronger in medium-sized cities compared to larger metropolitan areas, providing a foundation for collective action toward shared sustainability goals. This proximity allows more personalized engagement strategies that build trust and encourage active participation in circular economy initiatives. Feedback channels between residents and local government tend to be more accessible, enabling rapid adjustments to improve program effectiveness and address community concerns.

The scale also supports the development of neighbourhood-level and sharing economy initiatives that can serve as building blocks for wider circular economy systems and increase the utilization of products and assets. Community-driven programs such as local composting schemes, repair cafés, tool libraries, shared workspaces, material exchange platforms or car-sharing programs can thrive where social networks remain strong and visible and can achieve sufficient user density to remain economically viable while significantly reducing overall resource requirements for the community. Entrepreneurs who recognize the specific needs and opportunities of their local context can pioneer these sharing models.

Education and awareness campaigns can be more effectively targeted, with messaging tailored to local contexts and delivered through trusted community channels. Schools or local businesses can serve as partners in these efforts, extending their reach and credibility. The visible nature of local initiatives means that successful circular practices can quickly become normalized within the community, accelerating behavioural changes that support system-wide transitions.

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Medium-sized cities are ideal positioned to collaborate with nearby rural areas and other urban centers on regional circular economy initiatives. Their intermediate position gives them natural connections to both larger metropolitan areas and surrounding rural communities. This position can be strategically leveraged to develop circular systems that transcend municipal boundaries. Shared facilities for recycling or resource recovery can enhance material processing capabilities while reducing costs through economies of scale. For example, specialized recycling operations for construction materials, electronics or textiles that might be financially unfeasible for a single city become viable when developed as regional facilities serving multiple communities. Similarly, organic waste processing through composting or anaerobic digestion benefits from the combined feedstock of urban food waste and agricultural residues from surrounding rural areas.

Regional energy systems represent another collaborative opportunity, with medium-sized cities potentially serving as nodes in distributed renewable energy networks. Biomass from agricultural operations or forestry in surrounding rural areas can supply district heating systems in urban centers, while urban organic waste can generate biogas for multiple uses. These circular energy systems can increase regional resilience while reducing dependence on imported fossil fuels.

Local governments can play a crucial role in developing this entrepreneurial ecosystem by providing incentives, creating supportive regulatory environments or offering incubation support for start-ups focused on circular practices. Business support services tailored to circular enterprises, such as specialized technical assistance, networking opportunities or pilot project funding, can accelerate the development of local circular economy solutions.

The proximity between business owners, municipal officials and residents in medium-sized cities facilitates the co-creation of circular business models that address specific local challenges. This collaborative environment enables entrepreneurs to develop highly contextualized solutions that may start with addressing municipal needs before expanding to regional or national markets. For example, a start-up focusing on food waste collection and processing might begin by serving municipal buildings before expanding to commercial and residential clients.

Municipalities have the flexibility to experiment with policy innovations that align with and accelerate circular economy principles. Their governance structures typically allow for more rapid policy development and implementation compared to larger cities with more complex approval processes, enabling them to serve as policy laboratories where new approaches can be tested and refined. Green procurement policies represent one device that cities can implement to drive market demand for circular products and services. By integrating circular criteria into municipal purchasing, these cities can create reliable markets for circular enterprises while demonstrating leadership by example. The procurement volumes of medium-sized cities are sufficient to

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influence supplier behaviour without the overwhelming complexity that larger cities face in transforming extensive procurement systems. Financial incentives represent another area for policy innovation, with medium-sized cities developing targeted programs such as reduced permit fees for circular construction projects, grant programs for circular business models, or revolving loan funds for resource efficiency investments. These financial tools can be designed to address specific local priorities and barriers, with eligibility criteria tailored to the unique context of each city. Innovative governance models, like urban living labs or circular economy advisory councils, can be established to facilitate ongoing dialogue and collaboration among stakeholders. These approaches can help ensure that circular economy policies remain responsive to community needs and capacities while building broader ownership of the transition process.

3. Circular economy transition plan

A circular economy transition plan provides a comprehensive roadmap for cities and regions to shift from linear to circular systems that maximize resource value and minimize waste. This chapter outlines an approach to develop and implement such a plan, focusing on needs assessment, strategy development, milestone setting and financing mechanisms. The InvestCEC model directly supports this process through its structured four-phase framework: (1) defining local needs through stakeholder workshops and market analysis, (2) selecting context-appropriate circular solutions, (3) preparing projects for investment readiness, and (4) securing blended funding mechanisms (see Figure 1). Cities can access practical tools for each phase—including needs assessment templates, solution selection criteria, and financing roadmaps on the InvestCEC-Website (InvestCEC, n.d.). By following this framework, cities can create transition plans that address their unique challenges while leveraging their specific opportunities for circular transformation and can navigate the complexities of circular transition while maximizing available resources and stakeholder engagement.

3.1 Needs and objectives definition

Before implementing circular economy initiatives, cities must develop a clear understanding of their starting point by conducting assessments of existing conditions, identifying gaps in current systems and setting objectives. This process ensures that circular economy strategies are tailored to local infrastructure, governance structures, economic conditions and stakeholder priorities rather than applying generic solutions that may not address the city's specific challenges and opportunities. A methodical needs assessment enables cities to develop targeted interventions that address their unique challenges while leveraging existing strengths and opportunities.

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The needs and objectives definition phase serves multiple functions. It creates a data-driven foundation for decision-making, helps build consensus among stakeholders by establishing shared understanding, identifies the most impactful intervention points and establishes baseline metrics against which future progress can be measured. This process also helps cities to avoid wasting resources on initiatives that may not align with local context or capabilities, focusing instead on opportunities that leverage existing strengths. Without this clarity, circular economy initiatives risk becoming disconnected from local realities, potentially leading to inefficient resource allocation, stakeholder disengagement and limited impact.

A stakeholder workshop, like the one facilitated at the beginning of the InvestCEC project, can serve as a practical and highly effective tool to support the needs and objectives definition phase. By convening key local actors, such as municipal utilities, infrastructure providers, city administrators, citizen representatives and financing experts in general (can also be municipal finance officers, public-private partnership specialists, investors etc. on other cases), such a format enables a structured dialogue that helps surface local priorities, existing constraints and shared goals across sectors. This collaborative setting fosters a common understanding among stakeholders, which is essential for aligning interests and identifying impactful entry points. For municipal departments and policymakers, regulatory alignment, public procurement levers, and measurable environmental impact are often key motivators. Businesses and solution providers prioritize economic viability, regulatory clarity and access to pilot opportunities. Citizens and community groups tend to focus on quality-of-life improvements, cost savings and transparency in decision-making. Academic and research institutions value access to real-world data, testing environments, and opportunities to contribute to evidence-based policy. Meanwhile, investors and funding bodies assess capital needs, risk mitigation, and scalability potential. When complemented by targeted market research – done for example through cooperation with universities, research departments, market research companies or other investment companies - with an overview of relevant solutions and investment activity in circular economy sectors across Europe, these workshops can further help cities to define sectoral focus areas that are both locally relevant and strategically promising. In the case of Klagenfurt, for example, categories such as Greentech, Renewable Energy, Waste Management and Smart City Logistics emerged as particularly aligned with municipal infrastructure needs and policy strategies. A workshop of this kind also enables early discussions about suitable cooperation models between cities and external solution providers, ranging from direct service integration to investment partnerships or citizen-facing product offers. Overall, such participatory processes help ensure that circular economy planning is rooted in local realities and they establish a strong foundation for the subsequent phases of solution scouting, investment-readiness and long-term transformation planning.

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3.1.1 Baseline Assessment: Understanding the City's Current State

A comprehensive baseline assessment forms the cornerstone of a successful circular economy transition. This systematic evaluation provides a detailed snapshot of a city's material flows, resource consumption patterns, waste generation volumes, infrastructure systems and circularity potential across multiple sectors. By adopting a methodical approach to assessment, cities can uncover hidden opportunities, identify critical barriers and develop targeted interventions that address their unique circumstances. The baseline assessment process consists of interconnected steps, each examining a different aspect of the city's current state. This multi-dimensional analysis ensures that circular economy initiatives tailored to local conditions and designed to maximize their impact.

Material flow and waste mapping involves identifying and quantifying key material inflows (like as raw materials, energy, water) and outflows (including waste, emissions and secondary materials) throughout the urban system. Cities can use various methods to conduct this mapping, including material flow analysis (MFA), which tracks resources as they move through the urban economy, comprehensive waste audits that characterize waste composition and recycling rates and circular economy scorecards that use predefined indicators to measure current levels of circularity. This analysis reveals resource inefficiencies, leakage points and potential opportunities for circular interventions that might otherwise remain hidden.

Infrastructure and public services assessment involves evaluating the capacity, efficiency and connectivity of existing systems that support circular practices, like waste collection networks, energy distribution systems, water infrastructure and public transport. Methods such as GIS-based mapping can identify gaps in service coverage, while stakeholder interviews with municipal service providers help assess operational bottlenecks and capacity constraints. This assessment determines whether current infrastructure can support circular initiatives or requires upgrading, retrofitting, or new investment.

The economic and industrial assessment encompasses, developing a clear understanding of local economic conditions, business engagement in circular practices and potential for industrial symbiosis. This includes sectoral analysis to identify key industries contributing to resource consumption and waste generation, as well as SME circularity readiness surveys to gauge the willingness and capability of local businesses to adopt circular economy practices. This analysis can help cities identify high-potential sectors for circular interventions and develop targeted support programs for local businesses.

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The socioeconomic analysis involves, assessing the social, economic and cultural factors that influence circular economy adoption, including public awareness, income disparities and education levels. This analysis examines consumption patterns and waste behaviours through household waste audits, consumer surveys and digital tracking technologies. It is important to understand how residents consume goods, generate waste and participate in recycling programs for developing effective circular economy strategies. It also analyses income levels and economic inclusivity to ensure that circular initiatives are financially accessible to all demographic groups. Understanding these factors helps cities design inclusive policies that address potential barriers to participation and align with community needs.

The policy and regulatory framework analysis focuses on, developing a thorough understanding of the local regulatory landscape to remove barriers and accelerate circular implementation. This involves analysing existing waste management policies, procurement regulations, building codes and energy standards to identify conflicts with circular economy goals. Regulatory analysis serves as a fundamental prerequisite for successful circular economy implementation, requiring examination of existing frameworks to identify barriers that may impede circularity. Cities must identify specific conflicts where current rules actively hinder circular transitions. This involves detailed content analysis of regulatory texts, examining explicit requirements, prohibited activities and incentive structures. It also includes aligning city policies with EU directives on sustainability, waste reduction and green public procurement. This analysis helps identify policy gaps, conflicting regulations and opportunities for regulatory innovation that can create enabling conditions for circular initiatives. The circular economy regulatory landscape at the EU level is extensive and evolving rapidly.

The circular economy business and investment potential is about, identifying sectors with strong investment potential for circular businesses and assessing the local innovation ecosystem. This includes market analysis to identify high-growth circular industries, investor mapping to engage potential funding sources and evaluation of business incubation and acceleration support to nurture circular start-ups. This assessment helps cities understand where circular business opportunities exist and what support mechanisms are needed to capitalize on these opportunities.

3.1.2 Sector Prioritization

Following the baseline assessment, cities must strategically identify and prioritize sectors that offer the greatest potential for circular economy transformation. This prioritization process ensures that limited resources are directed toward high-impact interventions that align with local

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needs, capabilities and strategic objectives. Rather than attempting to implement circular economy principles across all sectors simultaneously, targeted sector prioritization allows cities to achieve meaningful progress in specific areas.

The prioritization process should consider multiple factors, including resource intensity, environmental impact, economic significance, technical feasibility and alignment with community priorities (ICLEI & Ellen MacArthur Foundation, 2021)(European Commission, 2017). Sectors that consume large volumes of virgin materials, generate significant waste streams or produce substantial greenhouse gas emissions often represent high-potential targets for circular interventions. Similarly, sectors that play critical roles in the local economy or offer opportunities for job creation may warrant prioritization from an economic development perspective.

Energy systems for example often emerge as a priority sector for cities transitioning to circular economy practices. These systems typically represent significant opportunities for reducing resource consumption and environmental impact through the integration of renewable energy sources, energy efficiency improvements and waste heat recovery and demand management. Close cooperation between the business sector and cities can transform traditional linear energy systems into circular ones by implementing district heating networks powered by recovered waste heat from industrial processes, developing biogas facilities that convert organic waste into energy or establishing local renewable energy systems that reduce dependence on imported fossil fuels.

Waste management represents another critical sector for prioritization. Establishing closed-loop recycling or upcycling systems can divert substantial material flows from disposal while creating economic opportunities and reducing environmental impacts. Organic waste treatment through composting or anaerobic digestion, construction and demolition waste recovery and textile recycling are examples of high-potential intervention areas within the waste sector that can generate significant circularity benefits for cities.

Water management emerges as a third common priority sector, especially in regions facing water scarcity or quality challenges. Implementing water reuse systems, rainwater harvesting, stormwater management and water-efficient technologies can transform traditional linear water systems into circular ones that maximize resource efficiency while enhancing resilience to climate change impacts.

The construction and building sector represent a significant opportunity for many cities, particularly those experiencing growth or urban renewal. Circular approaches in this sector can include adaptive reuse of existing buildings, design for disassembly principles in new

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construction, use of recycled or bio-based building materials and integration of modular design approaches that facilitate future adaptability. Given the substantial material and energy impacts of the built environment, circular interventions in this sector can yield significant sustainability benefits.

3.1.3 Aligning Objectives with City Goals

Circular economy initiatives should not operate in isolation but rather be strategically integrated with broader city objectives and development plans. This alignment ensures that circular economy transitions contribute meaningfully to overarching municipal priorities while building support across different departments and stakeholder groups, notably the business and industry sector. By demonstrating how circular approaches advance existing city goals (like climate neutrality, economic development, public health improvement or enhanced quality of life) municipalities can build broader coalitions of support and access diverse funding streams.

Many cities have established ambitious greenhouse gas reduction targets or climate neutrality commitments. Circular economy initiatives that reduce material extraction, minimize waste and promote resource efficiency directly contribute to these climate objectives by reducing embodied carbon and operational emissions.

Economic development goals provide another important connection point, with circular economy approaches offering opportunities for innovation, job creation and cost savings. Cities seeking to diversify their economic base, support entrepreneurship or strengthen local supply chains can position circular economy initiatives as economic development strategies rather than purely environmental programs. By highlighting potential for new business models, green jobs and reduced municipal operating costs, cities can engage economic development agencies and business communities in supporting circular transitions.

Social equity and community wellbeing objectives can also be advanced through carefully designed circular economy initiatives. Programs that provide affordable access to goods and services through sharing platforms, create employment opportunities in repair and remanufacturing or improve neighbourhood quality through urban greening and waste reduction all contribute to social sustainability goals.

The process of aligning circular economy objectives with broader city goals should be collaborative and iterative, involving diverse municipal departments and stakeholders. This alignment process helps identify potential synergies, avoid conflicts between different policy

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objectives and create integrated implementation approaches that deliver multiple benefits across various priority areas.

3.2 Strategies and milestones

Once cities have established their needs, prioritized sectors and aligned objectives with broader city goals, they must develop concrete strategies and implementation roadmaps to guide their circular economy transitions. This planning process involves identifying specific interventions, establishing realistic timeframes and creating measurable milestones that chart a path toward circularity while acknowledging resource constraints and implementation challenges. It is also important to note, that initiating of circular economy transitions may not be started in a city/municipality, but may be growing out of pure commercial interest of local businesses and industries. In such cases it is important that processes for aligning private and public sectors interest in the circular economy transition.

3.2.1 Strategy Development

Effective circular economy strategies for medium-sized cities should focus on scalable solutions that align with available resources, local capacities and community priorities. Rather than attempting to implement comprehensive circular systems all at once, which can overwhelm municipal capacities and resources, cities should develop phased approaches that begin with manageable interventions and gradually expand towards a more ambitious transition. This incremental approach allows for learning, adaptation and capacity building while delivering early successes that build support for continued implementation.

Strategy development should prioritize interventions that are both feasible and impactful, starting with "quick wins" that deliver visible results with low complexity and resource requirements. Such initiatives demonstrate the tangible benefits of circular approaches while building institutional capacity and public support for more ambitious efforts. These early interventions might include municipal procurement policies that prioritize circular products, or repair cafés that extend product lifespans while building community engagement.

In many cases, circular transitions emerge not solely from municipal planning, but also from private sector momentum. Cities should actively recognize and integrate business-led circular initiatives into their broader strategies—even when these initiatives were not originally part of political planning. This alignment helps accelerate implementation and creates synergies between public policy goals and market-driven innovation.

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A strong example can be found in Kalundborg, Denmark, where the renowned Kalundborg Symbiosis emerged through cooperation among local industries (Kalundborg Symbiosis, n.d.-a). What began in the 1960s as a simple exchange of excess cooling water between a local power plant and a nearby wallboard manufacturer laid the foundation for what would become a globally recognized model of industrial symbiosis. By using the cooling water in its production processes, the wallboard facility significantly reduced both water consumption and energy use. Over time, this initial collaboration evolved into a highly integrated system of resource sharing, demonstrating how circular partnerships can simultaneously generate economic and environmental value. In the 1970s, the system expanded when a local oil refinery began supplying surplus gas to the power plant and other industrial users, where it was used as fuel. These early collaborations reduced emissions, minimized waste and demonstrated the mutual benefits of resource sharing. Over time, new exchanges were established, forming a broader network of interconnected public and private partners. Today, the Kalundborg Symbiosis involves more than a dozen actors exchanging energy, water, and material streams, and serves as a widely cited example of circular economy in practice (see Figure 2).

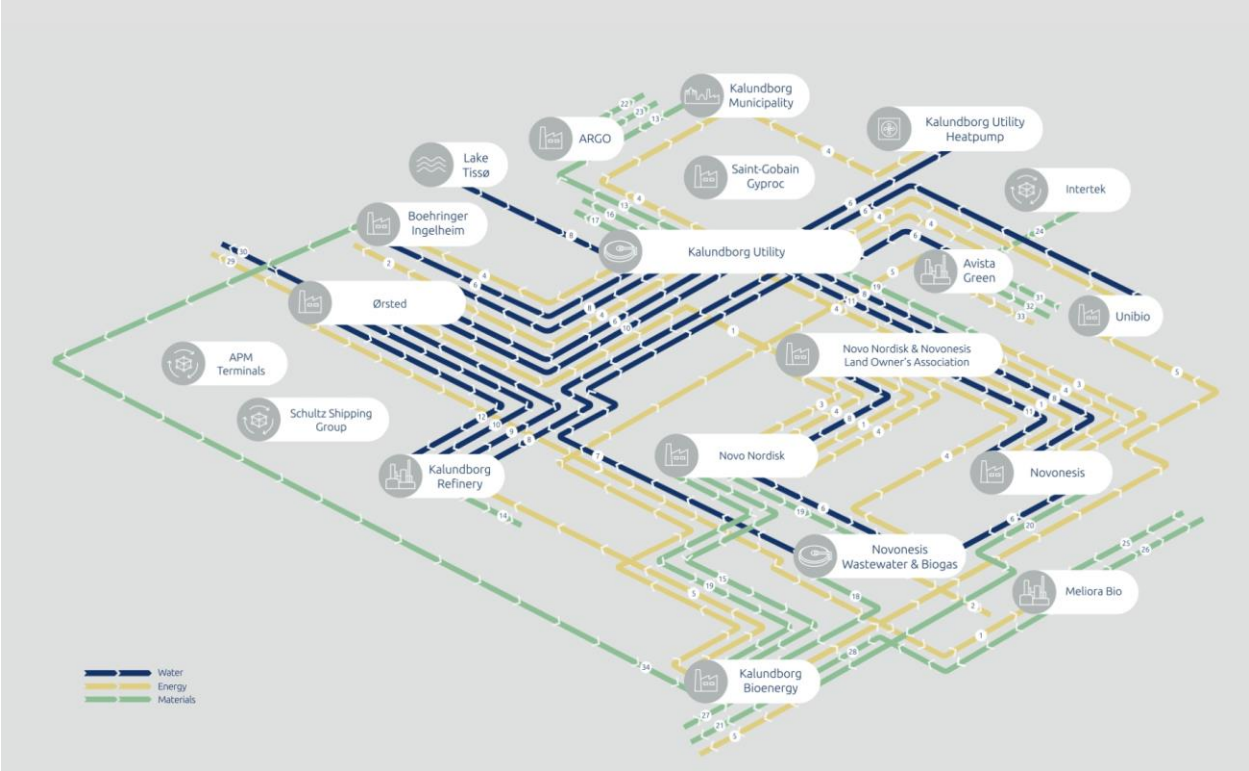

Figure 2 Kalundborg Symbioses, Resource and waste streams (Kalundborg Symbiosis, n.d.-a)

Kalundborg's success illustrates how cities can serve as facilitators of circular systems, even when initiatives originate from private actors. It emerged organically from a series of pragmatic, cost-saving decisions among neighboring companies. Initial exchanges were motivated by mutual

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economic benefits, and over time, these collaborations evolved into an integrated, circular system of industrial resource sharing. The symbiosis includes a diverse exchange of resources and waste such as surplus steam, gas, water, fly ash and organic waste, which supports both municipal services and industrial processes (see Figure 3). While each exchange is governed by commercial agreements, the municipality plays an important role in facilitating infrastructure development and long-term coordination.

Figure 3 Overview of exchanges resources & waste (Kalundborg Symbiosis, n.d.-c)

This circular model, developed in a small Danish municipality, offers valuable lessons for cities, utilities and industrial actors worldwide. It demonstrates how local partnerships focused on resource efficiency can deliver both environmental and economic benefits. Moreover, the Kalundborg Symbiosis contributes to national sustainability goals, supporting Denmark's target of a 70% reduction in CO_2 emissions by 2030 (Kalundborg Symbiosis, n.d.-b).

Beyond the initial interventions, cities should develop sector-specific strategies for their priority areas. These strategies should define clear pathways for transitioning from current linear systems toward circular alternatives, identifying the specific policy changes, infrastructure investments, business model innovations and behaviour shifts required. For instance, a circular construction strategy might include modified building codes, material passport systems, urban mining initiatives and training programs for contractors. Effective strategies must address multiple dimensions of system change, including technological innovation, policy frameworks, financial mechanisms, business models and social practices.

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Cross-sectoral integration represents another critical element of strategy development, identifying synergies between different circular economy initiatives and creating systems that connect multiple resource flows. For example, organic waste management strategies can be integrated with energy production through biogas facilities, creating closed loops that address both waste and energy challenges simultaneously.

Throughout the strategy development process, cities should maintain a focus on scalability, ensuring that initial pilot projects can be expanded and replicated. This approach allows cities to demonstrate proof of concept through small-scale interventions before committing to larger investments, reducing financial risk while creating opportunities for learning and adaptation. Modular implementation approaches are particularly valuable for medium-sized cities with limited resources, allowing for incremental expansion as funding becomes available and institutional capacity develops.

3.2.2 Short-, Mid- and Long-Term Milestones

Establishing clear milestones across different timeframes is essential for guiding implementation, maintaining momentum and measuring progress toward circular economy objectives. These milestones should be specific, measurable, achievable, relevant and time-bound (SMART), providing concrete targets against which cities can assess their advancement. By differentiating between short-, mid- and long-term horizons, cities can balance immediate action with strategic vision, creating roadmaps that acknowledge implementation realities while maintaining ambitious transformation goals.

Short-term milestones, typically covering 1-3 years, focus on building foundations, demonstrating proof of concept and creating enabling conditions for broader circular transitions. During this initial phase, cities should implement pilot projects in priority sectors to test approaches, build institutional capacity and generate data on outcomes. A city might establish a pilot materials recovery facility for construction waste, implement circular procurement guidelines for municipal departments or launch a community-scale composting program for organic waste diversion. These pilot initiatives should be documented and evaluated, and well aligned to respond to the needs of the local business and industry sector.

Community engagement represents another critical focus for short-term milestones, with cities establishing programs to raise awareness, build knowledge and encourage participation in circular practices. Workshops, public campaigns, educational programs and participatory planning processes help build understanding of circular economy principles while gathering input

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on community priorities and concerns. These engagement efforts lay essential groundwork for broader behaviour change and collaborative implementation in later phases.

Policy and regulatory groundwork should also be established during this short-term phase, with cities reviewing existing regulations for barriers to circular practices and developing initial policy interventions that create enabling conditions. These might include modifications to waste regulations, updates to procurement policies or adjustments to zoning codes that facilitate circular activities. While comprehensive regulatory transformation typically requires longer timeframes, these initial policy changes can remove immediate barriers while signalling municipal commitment to circular principles.

Mid-term milestones, covering approximately 3-7 years, focus on scaling successful pilot projects, deepening policy integration and expanding circular infrastructure and programs. During this phase, cities should translate lessons from initial pilots into broader implementation, expanding successful initiatives from neighbourhood to city-wide scale. The mid-term phase should see deeper integration of circular economy principles into municipal policies and urban planning frameworks. Comprehensive waste management strategies, circular land use policies, sustainable construction codes and green infrastructure requirements can be developed and implemented during this period, creating stronger regulatory foundations for circular practices. This policy integration helps to normalize circular approaches across different sectors while providing greater certainty for businesses and residents investing in circular solutions.

Capacity building and knowledge transfer accelerate during the mid-term phase, with cities developing more robust training programs, technical assistance services and knowledge sharing platforms. These capacity-building efforts ensure that municipal staff, local businesses and community organizations develop the skills and expertise needed to implement increasingly sophisticated circular approaches. Partnerships with educational institutions, industry associations and technical experts often play important roles in these capacity development efforts.

Long-term milestones, typically extending beyond 7 years, envision transformative system changes that fundamentally reshape resource flows and economic models within the city. These ambitious targets might include achieving significant reductions in virgin material consumption, establishing comprehensive material recovery systems across multiple waste streams or developing fully integrated circular districts that demonstrate systemic application of circular principles across energy, water, materials and food systems.

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During this long-term phase, cities should aim to position themselves as regional leaders in circular economy practices, establishing demonstration sites or innovation hubs that highlight successful approaches and share knowledge with other municipalities. This leadership role not only advances local circular implementation but also contributes to broader transitions across regions and countries, maximizing the impact of local innovations.

Infrastructure transformation represents another focus for long-term milestones, with cities developing fully circular systems for water, energy, materials and mobility. These integrated infrastructure networks maximize resource efficiency and minimize waste through approaches such as cascading water use, district-scale energy systems with waste heat recovery, automated materials sorting and recovery facilities and multimodal mobility networks that reduce resource requirements for transportation.

Throughout this milestone development process, cities should maintain flexibility and adaptability, recognizing that technological innovations, policy changes, or shifting community priorities may necessitate adjustments to implementation pathways. Regular review and revision of milestones based on implementation experience, emerging opportunities and evolving contexts ensures that circular economy transitions remain relevant and responsive to local needs.

3.3 Investment and Financing Strategies

The implementation of circular economy initiatives requires significant investment in infrastructure, technology, capacity building and program development. Developing comprehensive financing strategies that blend diverse funding sources, leverage private investment and create sustainable revenue models is essential for successful circular transitions. These financing approaches must be tailored to local economic conditions, institutional capacities and project types, recognizing that different circular initiatives may require different financing mechanisms.

Public investment and funding sources represent essential components of most circular economy financing strategies, particularly for initiatives that deliver public goods or address market failures. Municipal budgets can provide baseline funding for program development, staff positions and initial pilot projects, demonstrating local commitment while using additional external resources. However, most medium-sized cities face significant constraints on their general funds, requiring strategic allocation of limited municipal resources toward high-priority initiatives with potential for catalytic impact.

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National and EU grants offer valuable supplementary funding sources, particularly for innovation, demonstration projects or initiatives that align with broader policy priorities. Programs like Horizon provide substantial resources for circular economy implementation across various sectors. Medium-sized cities can enhance their competitiveness for these funding programs by developing well-designed projects that demonstrate innovation, replicability and alignment with EU policy objectives. Collaborative applications that involve multiple municipalities or diverse stakeholder consortia often have advantages in competitive funding processes.

Beyond these public funding sources, private sector investment and market-based financing mechanisms play increasingly important roles in circular economy implementation. Venture capital and impact investment can support circular start-ups and scale-ups developing innovative technologies or business models with commercial potential. Cities can facilitate these private investments by creating supportive ecosystems for circular businesses, providing access to testing facilities, demonstrating municipal demand for circular solutions or connecting entrepreneurs with potential investors through networking events and pitch competitions.

Public-private partnerships (PPPs) offer particularly valuable mechanisms for financing circular infrastructure and services that require substantial capital investment. These collaborative arrangements enable cities to leverage private expertise and capital while maintaining public oversight of essential services. For example, PPP models can finance waste sorting facilities, material recovery operations or district heating networks, with private partners assuming construction and operational responsibilities while municipalities guarantee certain usage levels or regulatory conditions. While PPPs require careful structuring to ensure public benefit and appropriate risk allocation, they can significantly accelerate infrastructure development beyond what municipal capital budgets alone could support. Securing a financial commitment from local or regional public stakeholders can significantly enhance the credibility of an investment vehicle. It signals political support, reduces perceived risk, and increases the likelihood of attracting private capital. In public-private investment structures, such co-financing strengthens trust in long-term collaboration and sends a clear message to institutional investors that the region is invested—both strategically and financially—in the success of the circular transition.

Corporate partner-/sponsorships and business contributions provide additional private financing opportunities, particularly for visible community initiatives that align with corporate sustainability objectives. Repair cafés, material exchange platforms or community gardens can attract support from local businesses seeking to demonstrate environmental commitment while building community relationships. Cities can strategically cultivate these partnerships by highlighting visibility opportunities, community benefits and alignment with business sustainability goals.

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Community-based financing models represent another category of funding approaches, engaging residents directly in supporting circular initiatives while building ownership and participation. Crowdfunding platforms can mobilize community resources for specific projects such as tool libraries, seed libraries or community composting facilities, particularly when these initiatives have high visibility and tangible community benefits. These participatory funding approaches not only generate financial resources but also build community engagement and ownership of circular initiatives.

Cooperative ownership models offer another community-based approach, with residents collectively investing in and governing shared circular assets or services. For example, renewable energy cooperatives allow community members to jointly finance solar installations or district heating systems, receiving both environmental and financial returns on their investments. Similarly, cooperatively owned repair facilities or maker spaces can provide circular services while building community capacity and engagement. In the case of the InvestCEC pilot in Klagenfurt, Venionaire Capital is responsible for structuring the financing concept and preparing a dedicated circular economy fund, which shall be continued post-project. A professional fund manager ensures robust investment processes, portfolio oversight, and alignment with both public and private capital sources.

4. Stakeholder Engagement

Stakeholder engagement is critical for a successful transition to a circular economy. By fostering collaboration and aligning interests, cities can build a foundation for implementing CE initiatives effectively. This chapter provides an approach to identify key actors, analyse their relationships and develop engagement strategies that foster collaboration across diverse groups.

4.1 Key Stakeholders

The successful transition to a circular economy hinges on the active participation and collaboration of diverse stakeholders. Each group brings unique perspectives, resources and capabilities to the table, that form an interconnected network that drives systemic change. The interplay between these stakeholders determines the pace and success of circular economy transitions.

Policymakers and municipal decision-makers play a particularly critical role. Through local regulations, planning frameworks, zoning laws, and public procurement rules, they shape the

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institutional environment in which circular initiatives can emerge and thrive. Their leadership is essential in aligning circular economy goals with broader urban development strategies and ensuring long-term political support. When actively engaged, they can act as enablers of innovation by removing regulatory barriers, supporting pilot projects, or mandating circular criteria in public investments.
While local municipalities can create policies tailored to their unique contexts regional and EU governments establish overarching legal frameworks and funding programs that enable and accelerate CE transitions. At the regional level, coordination across municipalities can support shared infrastructure and harmonized standards, while national and EU institutions define broader targets, regulatory requirements and financial mechanisms.

Individuals and households serve as the foundation, directly influencing consumption patterns, waste generation and resource recovery through daily behaviours. Their adoption of sustainable habits, such as participating in recycling programs, composting organic waste or choosing repair over replacement, determines the effectiveness of CE strategies. For instance, high engagement in municipal composting schemes can divert significant organic waste from landfills, while preferences for second-hand goods or rental services stimulate circular markets. However, to achieve behavioural change, it requires addressing barriers such as convenience, cost and awareness. Tailored education campaigns, accessible infrastructure and financial incentives are essential to empower residents as active contributors to circular systems.

Small and medium-sized enterprises (SMEs), innovative start-ups and established corporations form the economic backbone of many medium-sized cities, driving job creation and resource flows. SMEs and start-ups often pioneer circular business models that decouple economic growth from resource extraction. Larger employers can scale circular practices by redesigning supply chains, adopting renewable energy, or implementing take-back programs for end-of-life products. Collaborative platforms that connect businesses to share materials, equipment, or expertise further amplify their impact. For example, a local textile manufacturer might collaborate with a recycling start-up to transform fabric scraps into new products.

Municipal departments responsible for energy, waste management, water, urban planning or public services play a pivotal role in shaping CE transitions through policy development, infrastructure investment and service delivery. The waste management department, for instance, can transition from linear disposal models to circular systems by introducing separate collection streams for high-value materials or supporting community-composting initiatives.

Academic institutions and research organizations provide the intellectual basis for CE transitions through data-driven insights, technological innovations and workforce training. Universities

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often host living labs where circular solutions can be tested in real-world settings. Think tanks contribute policy analysis, benchmarking studies and best-practice guidelines. Partnerships between municipalities and academic institutions can also promote the training of talents by equipping students with practical skills.

Non-governmental organizations (NGOs) act as bridges between policymakers and citizens, advocating for equitable CE policies while raising public awareness. NGOs pilot often community-led initiatives, like repair cafés or tool-lending libraries that normalize circular behaviours. Social enterprises address inclusivity by ensuring low-income populations can access affordable circular services, such as energy-efficient appliance rentals.

Investors (from venture capitalists to public grant agencies) provide the financial tools and risk capital needed to scale CE projects. Public funding sources, such as EU grants or national green transition funds, enable cities to pilot innovative infrastructure. Private investors often support circular start-ups developing disruptive technologies. Finance models, which combine public and private capital, can mitigate risks for large-scale projects. Beyond providing capital, investors can serve as strategic partners in project design, risk assessment, and scalability evaluation. Engaging them early allows for co-creation of financially viable implementation models and improves long-term bankability.

4.2 Stakeholder matrix and Relationships

Categorizing stakeholders based on their influence, interest and roles allows cities to prioritize engagement efforts, allocate resources efficiently and tailor communication strategies. Without this clarity, cities risk overlooking critical allies, misjudging opposition or wasting energy on peripheral actors. A stakeholder matrix ensures that engagement efforts align with project objectives while addressing power dynamics and expectations. It transforms fragmented groups into a cohesive coalition for circular transitions. By categorizing stakeholders based on influence and roles and proactively addressing synergies, conflicts and dependencies, cities like Klagenfurt can foster collaborative ecosystems that accelerate CE implementation. This not only minimizes risks but also unlocks innovative partnerships, ensuring that cities maximize their unique potential as circular economy pioneers.

One strategic tool for categorizing stakeholders is a power-interest matrix, which based on the capacity to affect change (power) and the level of concern or involvement (interest) in circular economy initiatives. This matrix enables cities to prioritize engagement efforts and allocate resources effectively, ensuring that stakeholder management aligns with project goals.

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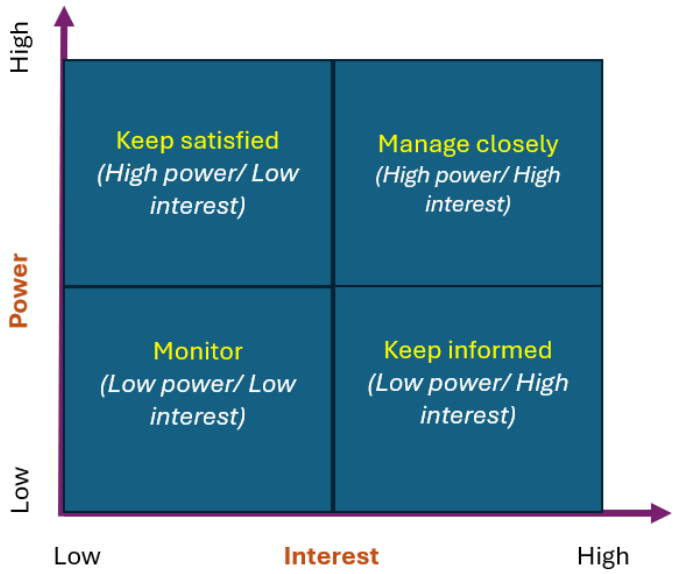

Figure 4 Power-Interest-Matrix (RIGCERT, 2024)

High power, high Interest stakeholders form the core. These actors, such as municipal departments overseeing waste management or major employers driving local economic activity, have both the power to drive initiatives and interest in their success. Their dual positioning makes them the cornerstone. They can either accelerate progress through active collaboration or disrupt efforts through resistance. For example, a city's environmental or waste department with decision-making power over waste policies and a strong commitment to sustainability would fall into this category. Engaging these stakeholders requires consistent, transparent communication and involving them directly in decision-making processes. Regular updates and opportunities to shape outcomes are critical to maintaining their support.

High power, low Interest stakeholders hold significant power but may lack immediate motivation to prioritize CE goals. Regional policymakers allocating budgets or institutional investors funding infrastructure projects represent this group. While their influence is substantial, their engagement may hinge on how well CE initiatives align with their broader objectives, such as economic growth or regulatory compliance. To secure their involvement, cities should tailor communications to emphasize benefits, like framing waste-to-energy projects as cost-saving measures or job creators. Targeted briefings, high-level endorsements from respected figures or linking CE projects to existing priorities can effectively capture their attention without overwhelming them with operational details.

Low power, high Interest stakeholders, such as community organizations or small businesses, often demonstrate strong enthusiasm for CE principles but possess limited authority to drive systemic change. A neighbourhood association advocating for zero-waste practices might fall into

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this section. While their direct impact on policy or funding may be minimal, their connections and niche expertise can bolster community participation and innovation. Cities should empower these groups through participatory roles, such as advisory committees or pilot project partnerships, ensuring their voices inform planning processes. Providing platforms for visibility can amplify their impact and sustain their engagement.

Low power, low Interest stakeholders, such as occasional vendors or transient residents, have minimal capacity or motivation to shape CE outcomes. While their involvement is not critical to immediate success, maintaining basic awareness through newsletters, public forums or annual reports ensures transparency and prevents unintended opposition.

Mapping the relationships among stakeholders is important for enhancing collaboration and addressing potential challenges. Stakeholders rarely operate in isolation. Their goals often overlap, conflict, or depend on another. Understanding these dynamics allows cities to foster partnerships while mitigating risks.

Synergies occur when stakeholders share common goals or complementary resources that can be leveraged for mutual benefit. For example, a university conducting research on waste-to-energy technologies might collaborate with a municipal energy department seeking innovative solutions for renewable energy integration. Identifying synergies involves network-mapping tools that visualize connections between stakeholders based on shared interests or objectives. Workshops focused on joint problem solving can also uncover opportunities for collaboration.

Conflicts arise when stakeholders have competing interests or priorities. For instance, residents opposing new waste facilities due to noise or odor concerns may conflict with municipal departments aiming to expand recycling infrastructure. Conflict resolution requires interest-based negotiation that addresses underlying concerns rather than surface-level positions. Neutral facilitation by third-party mediators can help bridge gaps between opposing parties.

Dependencies refer to resource flows or operational reliance between stakeholders that create mutual obligations. For example, municipal departments may depend on SMEs for material recovery services. Farmers supplying biomass feedstock rely on stable demand from district heating providers. Mapping dependencies involves creating matrices that clarify who rely on whom for resources, approvals (permits), or operational support (technical services).

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4.3 Stakeholder Engagement Strategies

Effective stakeholder engagement is very important for the successful implementation of the circular economy and requires tailored strategies that resonate with different groups while aligning the interests of different sectors of society.

Public awareness initiatives must go beyond superficial information dissemination to create meaningful behavioural shifts. Successful campaigns use a strategic mix of digital and physical channels selected based on stakeholder demographics and consumption patterns. Digital platforms like social media networks and dedicated websites serve as dynamic hubs for sharing progress data, hosting virtual workshops and facilitating community discussions around circular practices. These channels enable real-time interaction, fostering participatory engagement rather than passive consumption of information.

Communication with residents should emphasize the direct improvements in quality of life through the circular economy, presenting waste reduction not as a sacrifice but as an opportunity for cleaner neighbourhoods and household budget savings. Messages might highlight benefits from reduced packaging waste, always anchoring abstract environmental goals in concrete local impacts.

Business outreach focuses on competitive advantages of circular economy and demonstrates how material recovery systems buffer against resource price volatility or how product-as-service models unlock new revenue streams. When communicating about compliance, regulations should be presented as catalysts for innovation rather than barriers. Economic development arguments could prove particularly persuasive by highlighting the potential of the circular economy to create jobs and align with sustainable investment criteria.

Policymaker communications strategically connect circular initiatives to broader governance priorities. Cost-benefit analyses quantify the fiscal impact of circular economy measures and compare traditional infrastructure costs with the long-term savings and revenue potential of circular systems. Regulatory frameworks should be seen as enablers rather than endpoints, with a focus on creating conditions for innovation in the private sector.

Contemporary models of urban development increasingly prioritize governance, active citizenship and the essential inclusion of stakeholders throughout the transformation process. A particularly relevant framework is the modified Triple Helix model, which categorizes urban stakeholders into four key groups (Esteban-Narro, Lo-Iacono-Ferreira, & Torregrosa-López, 2025):

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- Knowledge stakeholders
- Social stakeholders
- Economic stakeholders
- Political stakeholders

This model has been operationalized by ensuring representation from each stakeholder group across the six dimensions of the city and the cross-cutting domains of planning and technology. This approach ensures a comprehensive and balanced engagement strategy that reflects the full spectrum of urban dynamics.

Further enriching this perspective, Ligorio et al. examine the sustainable city through the lens of institutional work theory (Ligorio et al., 2022). Here, sustainable or smart cities emerge through the interplay of political, cultural and technical institutional efforts. Local governments play a regulatory and monitoring role; citizens act as agents of change; and professionals and experts contribute through the integration of specialized knowledge. This triadic interaction fosters meaningful and adaptive urban transformation.

While differing in structure, this institutional work approach aligns with and complements the modified Triple Helix model. Both emphasize the need for diverse, coordinated stakeholder collaboration across multiple dimensions to realize sustainable urban futures.

5. Mitigating risks in medium-sized Cities

Some medium-sized cities face specific barriers in circular economy transitions from funding gaps and regulatory misalignment to technical capacity constraints and public scepticism that demand targeted, context-sensitive solutions. In contrast, cities like Kalundborg succeeded in initiating circular collaboration through strong partnerships among local industries. It is worth noting that several of the participating companies—such as the Statoil refinery, Novo Nordisk, and Novozymes—were relatively large players (Kalundborg Symbiosis, n.d.-a). Their commercial interests and financial capacity played a key role in securing the investments needed for infrastructure development, making the transition more feasible from the outset.

Financial risk mitigation begins with diversifying funding sources to avoid over-reliance on municipal budgets, which are often overburdened by competing priorities. A blended finance approach combining public grants, private investments and community contributions creates a robust financial foundation. For example, public grant programs like Horizon Europe can provide foundational support for innovative projects. Venture capital injects market-driven innovation, enabling scalable solutions like material recovery technologies or circular supply chain platforms.

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Crowdfunding engages residents directly, fostering community ownership while validating demand for initiatives such as local recycling hubs or renewable energy co-ops.

A phased implementation through pilot projects mitigates technical and operational risks by testing concepts in controlled environments. Small-scale initiatives, like neighbourhood composting systems or modular solar micro grids, serve as living laboratories, generating critical data on cost efficiency, public acceptance and technical feasibility. Pilots allow cities to identify and address bottlenecks early, such as optimizing collection routes for organic waste or calibrating energy storage for decentralized grids. The success of these trials builds stakeholder confidence and provides evidence to secure greater investment and political support for city-wide expansion. For medium-sized cities, this incremental approach is particularly important as it is consistent with limited administrative capacity and allows for iterative learning without overstretching resources.

Political consensus building ensures that CE initiatives go beyond short-term election cycles and bureaucratic inertia. Early engagement with policymakers through cross-departmental working groups aligns CE goals with existing priorities, such as job creation, public health, or infrastructure modernization. Framing CE as a solution to pressing local challenges, like reducing landfill costs or enhancing energy security, transforms it from an abstract concept into a pragmatic strategy. A transparent dialog with political decision-makers clarifies the legal obstacles and promotes joint problem-solving. This coordination not only secures the support of both parties, but also anchors the principles of the CE in long-term urban planning frameworks and ensures continuity across different administrations.

Capacity building addresses knowledge gaps by investing in training programs for municipal staff and local businesses. Municipal staff often lack training in circular design, life cycle analysis or circular procurement, while SMEs struggle to adopt new business models. Targeted training programs, developed in collaboration with universities or industry experts, provide these actors with technical skills, from material flow analysis to circular product design. Certification programs and workshops create a shared knowledge base that promotes innovation and reduces dependence on external consultants. For companies, mentoring initiatives that bring SMEs together with circular economy experts demystify the transition and enable them to redesign products for dismantling or introduce resource recovery systems.

Community engagement can transform communities from passive recipients to active partners, mitigating social resistance and enhancing the relevance of projects. Participatory budgeting processes, where residents provide a share of municipal funds for CE initiatives, democratize decision-making and build trust. Co-design workshops for projects such as urban reuse centers

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or shared mobility networks can ensure that solutions reflect local needs, which increases adoption rates. Transparent communication about project timelines, benefits and trade-offs, such as temporary disruptions to infrastructure upgrades, prevents misunderstandings.

Targeted communication reduces misunderstandings by tailoring the messages to the different population groups. Emphasizing cost savings, such as lower energy bills through energy-efficient buildings or lower waste disposal fees, makes CE tangible for citizens. Social media campaigns highlighting cost savings from energy-efficient appliances, for example, resonate well with cost-conscious families, while webinars for businesses can emphasize the profitability of circular models. Businesses respond to narratives that link circularity to market differentiation and regulatory compliance, while policy makers need data-driven arguments that link circularity to broader goals such as climate neutrality or economic resilience. Regular updates of pilot results through accessible formats such as community dashboards or impact reports will ensure transparency and strengthen accountability.

From an investment perspective, an important aspect of risk mitigation is the strategic evaluation of solution providers. Municipalities should aim to work with companies that have already proven themselves in the market. Ideally, these are companies in the late seed or early growth phase with a validated product, initial revenues and strong teams. This significantly reduces implementation risk and ensures that circular economy solutions are both technically feasible and operationally supported over time. In this context, cities can establish internal investment criteria to evaluate potential partners based on key factors such as technological maturity, scalability, financial health and alignment with local infrastructure needs. In this way, municipalities improve their ability to attract private co-financing and accelerate implementation while maintaining high standards of quality and impact. Carefully structured collaboration models, ranging from procurement of services to strategic partnerships or minority investments, can further balance innovation and institutional risk tolerance.

6. Implementation tools and resources

The transition from circular economy strategy to concrete action requires robust, scalable frameworks that equip cities with the technical, collaborative and analytical capacity to operationalize their ambitions. This chapter presents capacity building tools and resources that enable municipalities to overcome barriers to implementation while aligning with EU-wide circular economy standards.

While tools and technical resources play a critical role in supporting circular economy implementation, experience shows that tools alone rarely initiate the transition. In many cities,

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the biggest challenge is not the lack of planning frameworks, but the difficulty of getting the process started in the first place.

Starting a circular economy process requires identifying key decision makers, understanding their priorities, motivations and concerns and then building momentum through early dialogues, trust-building and targeted framing. Once political and administrative support is secured, tools and analysis can play their full role in guiding strategy, assessing options and building stakeholder alignment. Therefore, capacity-building efforts, stakeholder mapping and informal political engagement should be seen as prerequisites, not just supplements, to tool-based planning.

In the InvestCEC project, this approach was reflected in the early phases by bringing municipal utilities, infrastructure providers and city officials together in workshops to surface interests and define shared starting points.

6.1 Decision-Support Tools

Decision support tools are essential for cities to develop transition plans towards the circular economy in a strategic, informed way, aligned with their local capacities and priorities. These tools allow them to accurately assess the current state of the urban system, identify critical points for intervention, set measurable targets and design realistic roadmaps towards circularity. Among the most relevant methodologies are circular economy scorecards, which allow measuring the degree of circularity through structured indicators such as those proposed by the Ellen MacArthur Foundation with its Circulytics tool (Ellen MacArthur Foundation, 2021) and used within the Circular City Indicators Set (CCIS) developed by ICLEI and Circle Economy (CityLoops Consortium, 2020). A particularly relevant tool for municipalities is the CCRI Self-Assessment Tool developed under the Circular Cities and Regions Initiative (CCRI) of the European Commission (Circular Cities and Regions Initiative, 2025). This tool enables cities and regions to evaluate their circular economy maturity across key areas such as governance, data availability, sectoral focus and stakeholder engagement. It supports cities in identifying strengths and gaps, setting strategic priorities and tracking progress over time. These tools, which do not require advanced knowledge, facilitate the initial diagnosis and monitoring of progress in multiple dimensions (materials, energy, water, mobility, etc.).

Likewise, life cycle analyses (LCA), applicable with tools such as SimaPro (PRé Sustainability, n.d.), Sphera LCA (Sphera, n.d.), or the free software OpenLCA (GreenDelta GmbH, n.d.) help to assess the environmental impacts associated with products, services or infrastructures throughout their life circle, making it possible to compare alternatives and guide decisions towards the options with the smallest ecological footprint. However, these tools require technical expertise for their correct application and interpretation. On the other hand, Material

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Flow Analysis (MFA) offers a comprehensive view of the movement of resources within the urban system. Tools such as STAN (Cencic; Rechberger, 2008) enable the visualization of resource inputs and outputs in key sectors (energy, water, waste) and highlight inefficiencies, losses and opportunities for valorization, although their use also usually requires specialised technical profiles.

In addition, platforms such as CityLoops (CityLoops Consortium, n.d.), coordinated by ICLEI offer sectoral planning models based on real data and replicable methodologies for sectors such as construction and organic waste, while tools such as CE Strategy Scanner allow prioritising circular strategies according to the characteristics of the local context. Integrating these tools into planning enables cities to translate ambitions into action plans that are feasible, adaptable and oriented towards measurable results in the short, medium and long term, while improving financial and political decision-making, strengthening accountability through key indicators and helping to anticipate and mitigate risks associated with the transition.

6.2 Toolkits for Stakeholder Engagement

Surveys, workshops and participatory processes are important tools for effective stakeholder engagement. These engagement tools are used to inform and educate stakeholders, gather critical feedback, build trust, promote collaboration and ensure that decisions and policies are legitimate, effective and responsive to the needs of all affected parties. Effective stakeholder engagement requires balancing resource constraints with the need for meaningful participation.

Surveys are valuable for collecting quantitative and qualitative data from a broad range of stakeholders, allowing organizations to understand their knowledge, attitudes, needs and experiences. This information is critical for identifying priorities, improving service delivery and informing planning and policy-making processes. Surveys also help monitor and evaluate the impact of initiatives and foster transparency and accountability by sharing the results with the participants. Surveys need to balance limited budgets with the need to capture representative community perspectives. A phased approach starts with a mapping exercise to define clear objectives, such as assessing baseline awareness of circular economy principles. The questionnaires should contain a mixture of quantitative indicators and qualitative questions, avoiding leading language while ensuring accessibility for different levels of education. Sampling strategies must take account for demographic heterogeneity without overextending logistical capacities. Random sampling techniques ensure proportional representation across neighbourhoods, age groups and socioeconomic strata, while targeted sampling addresses key interest groups such as local business associations or environmental groups. Digital distribution through municipal portals and social media channels complements targeted personal

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dissemination. After the survey, the results can be compared with municipal records and observational studies.

Workshops provide interactive environments where stakeholders can discuss issues, share ideas and collaboratively develop solutions. They help build trust, foster transparency and reduce resistance to change by ensuring that stakeholders feel heard and involved in the decision-making process. Workshops also facilitate consensus-building and enable participants to co-create strategies that reflect the real needs and priorities of the community or organization. Workshops thrive when structured as interconnected learning ecosystems rather than standalone events. Preparation for the workshop includes mapping the power dynamics among the participants to design activities that enable equal participation and weaken the dominance of institutional actors.

Participatory processes, such as public consultations or joint planning sessions, bring together people with different backgrounds, interests and expertise. These processes improve mutual understanding, reduce potential conflicts and promote effective cooperation between stakeholders. By involving stakeholders directly, participatory approaches empower individuals and groups, increase ownership of outcomes and lead to more sustainable, widely supported decisions and policies.

6.3 Training and Capacity Building

Effective implementation of circular economy initiatives begins with equipping the municipal staff with a detailed understanding of circularity principles. Municipal employees across departments require tailored education that connects circular economy concepts to their specific roles and responsibilities. Local governments must recognize that transitioning from linear systems to circular models demands cross-departmental coordination and a shared understanding of circular principles.

The training programs for municipal staff should start with foundational knowledge about circular economy frameworks, including resource efficiency, waste reduction and regenerative design. This baseline knowledge creates a common language across departments, from waste management to economic development, from procurement to community engagement. Municipalities can leverage existing resources such as online courses, workshops facilitated by circular economy experts or peer-to-peer learning networks.

Beyond theoretical knowledge, the municipal staff benefit from experiential learning through site visits to successful circular economy initiatives. Such “first-hand” contact to functioning circular systems helps translate abstract concepts into tangible applications relevant to local contexts. To

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foster organizational change, municipalities can develop internal “circular economy champions” across departments. These individuals receive advanced training and take responsibility for driving circular initiatives within their respective area. Engaging senior leadership as champions would further legitimizes these efforts and encourages broader municipal participation.

Municipalities can also facilitate business engagement through structured capacity-building programs tailored to local economic contexts. Business training programs combine theoretical frameworks with practical applications. The curriculum should cover circular business models, resource optimization, product lifecycle design and opportunities for collaboration in the value chain. The most successful programs go beyond classroom instruction to include mentoring, peer learning networks and direct connections to municipal purchasing opportunities. Training efforts should also address sector-specific challenges and opportunities. For instance, construction businesses may focus on material passports, while food-related enterprises might concentrate on organic waste valorisation or packaging innovations.

Furthermore, circular entrepreneurs face different challenges when working with the public sector. Training programs should address public procurement processes, regulatory frameworks and collaboration opportunities with municipalities. These entrepreneurs benefit from learning about the priorities, constraints and decision-making structures within government entities. The training should show pathways for public-private collaboration beyond traditional supplier relationships.

Effective training and capacity building programs also include robust evaluation components. Municipalities should establish key performance indicators to assess knowledge acquisition, behaviour change and ultimately, environmental and economic impacts resulting from enhanced capacity. Regular assessment allows for continuous improvement of training approaches. Beyond immediate learning outcomes, municipalities should track how enhanced capacity translates into implementation of circular initiatives.

6.4 Data Collection and Management

Data collection and management is a fundamental basis of circular economy transitions, enabling municipalities to map material flows, optimize resource use, and validate policy effectiveness. Without accurate and structured data, it is impossible to identify resource flows, detect inefficiencies, set sectoral priorities or measure the impact of interventions.

The process starts with specific audits, such as urban waste analyses, which quantify and characterise the types of waste generated per sector or neighbourhood. Sector-specific audits extend beyond waste to map industrial by-product exchanges, construction material stocks, and

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textile lifecycle trajectories. Energy consumption assessments leverage smart metering infrastructure to disaggregate usage patterns across municipal buildings, public lighting, and water treatment facilities, revealing inefficiencies and renewable integration potential.

Circular Economy KPI Dashboards in tools like Power BI (Microsoft Corporation, n.d.) synthesize metrics on material recovery rates, carbon avoidance, and circular procurement into interactive visualizations, enabling scenario modelling and progress tracking. Geographic Information Systems (GIS) (Esri, n.d.) map material banks, recycling networks, and reuse hubs, optimizing logistics through spatial analysis of collection routes and facility locations. Real-time sensor networks embedded in smart bins, water systems, and energy grids feed digital twins that simulate circular interventions, predicting outcomes of waste-to-resource schemes or district-level symbiosis projects. Other digital tools such as Qlik Sense (Qlik, n.d.) enable the creation of interactive dashboards that integrate real-time data for both operational and strategic decision-making. In addition, systems such as the Waste Data Tool allow municipalities to standardise data collection on building materials and organic waste, facilitating comparisons between cities.

Data quality and validation play a critical role in ensuring that the insights drawn from these systems are reliable. Automated data cleaning routines, anomaly detection algorithms, and human verification procedures are often necessary to manage large, heterogeneous datasets. Moreover, data governance frameworks must define responsibilities, access rights, and quality standards to ensure consistency, security, and ethical data use across municipal departments and external partners. The adoption of open platforms and interoperable formats promotes initiatives such as Open Data for Circularity, which ensures that data can be shared with external stakeholders such as researchers, start-ups or regional platforms, improving transparency and cooperation. At the same time, municipalities must balance openness with compliance to data protection regulations (GDPR), especially when personal or business-sensitive information is involved.

Emerging practices also emphasize participatory data ecosystems, where citizens, local businesses, and civil society organizations contribute to data generation and validation. Mobile apps and crowdsourcing platforms enable residents to report illegal dumping, suggest reuse opportunities, or provide feedback on collection systems, enhancing the inclusiveness and responsiveness of circular planning processes.

Finally, capacity-building and digital literacy are essential to ensure that municipal staff and stakeholders can interpret and act on data-driven insights. This includes targeted training, knowledge-sharing platforms, and collaboration with academic institutions and innovation hubs

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to foster a data-informed culture that supports continuous improvement and long-term circular economy goals.

6.5 Resource Sharing and Partnerships

Effective collaboration with regional and international networks is crucial for cities aiming to transition to a circular economy. These partnerships provide access to shared knowledge sources, funding mechanisms and multi-stakeholder ecosystems that enhance local efforts while aligning with broader sustainability agendas. By strategically engaging with existing networks, cities can overcome resource constraints, accelerate innovation and position themselves within circular value chains.

Cities should prioritize membership in established circular economy networks that offer structured platforms for knowledge exchange and collaborative governance. Participation in EU-funded consortia, such as those under Horizon Europe programs, allows municipalities to contribute to transnational innovation ecosystems while accessing new methodologies. Aligning local strategies with network priorities, particularly those addressing shared challenges like material recovery or renewable energy integration, ensures relevance and maximizes reciprocity.

Regional and international networks serve as channels for blended financing opportunities, particularly when cities demonstrate alignment with EU circular economy action plans. By forming consortia with network partners, municipalities can gain access to funds, green bonds and impact-oriented investment instruments that require transnational cooperation. Joint applications to initiatives like the Circular Cities and Regions Initiative (CCRI) (European Commission, n.d.-a) not only diversify funding sources but also de-risk projects through shared implementation responsibilities.

Effective collaboration requires embedding network partnerships into municipal governance structures. Cities should designate cross-departmental liaison teams to maintain engagement with key networks, ensuring circular economy strategies remain synchronized with evolving EU regulations and funding cycles. Regular policy alignment exercises endorsed frameworks like the EU Taxonomy Regulation help identify regulatory gaps while positioning cities to influence continental standard-setting processes.

6.6 Call for Entrepreneurs as a Starting Tool

A practical and tested approach to initiate the implementation of circular economy solutions in cities is the use of a *Call for Entrepreneurs*. Within the framework of the InvestCEC project, this

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instrument showed to be an entry point for translating identified needs into project opportunities. It served not only as a method for solution scouting, but also as a strategic format to mobilize external innovation potential and connect it directly with municipal infrastructure needs and policy ambitions. As an easily replicable element, the Call for Entrepreneurs can be considered a key tool for other cities aiming to initiate circular transitions. It operationalizes strategic intentions, strengthens stakeholder engagement, and positions municipalities as active enablers of innovation.

The Call for Entrepreneurs was implemented as an open invitation addressed to start-ups, SMEs and solution providers working in various circular economy domains. Its purpose was to attract innovative, market-ready concepts that could respond to specific sectoral challenges previously defined during the needs assessment and stakeholder dialogue processes. In the case of Klagenfurt, these sectors included areas such as renewable energy, green technologies, circular construction, resource recovery, water systems and smart city logistics. The call made these needs transparent and accessible, thereby inviting the market to co-develop applicable solutions with the city.

This instrument offered several advantages for cities seeking to move beyond planning and initiate action. First, it provided an entry point to engage with the innovation ecosystem, without requiring complex procurement procedures or large-scale funding commitments upfront. Second, it allowed municipalities to explore the spectrum of available solutions and technologies, some of which might not have been known internally. Third, it created a structured, yet flexible basis for collaboration — whether through pilot projects, investment partnerships, service integration or joint development formats.

As highlighted in the InvestCEC public procurement strategy paper (InvestCEC, n.d.), innovative solutions from young SMEs often face substantial challenges in accessing public tenders—especially in the context of circular economy. Standard procurement procedures tend to favour large, established companies due to complex compliance criteria, risk-averse tender wording and limited flexibility for unproven technologies. This creates a significant barrier to market entry for SMEs offering innovative solutions. To overcome these obstacles, cities should consider adopting more innovation-friendly procurement models. This includes using procedures like competitive dialogues, innovation partnerships or design contests that explicitly encourage creative approaches and allow for early-stage collaboration. Public authorities can also structure calls with outcome-based specifications rather than rigid technical requirements, enabling SMEs to propose diverse solutions tailored to local needs. Moreover, pre-tender market dialogues and simplified documentation requirements can reduce entry barriers and enhance transparency.

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In the broader context of the InvestCEC model, the Call for Entrepreneurs marked the transition from strategy to action. It connected the early phases of local needs assessment and objective setting with the later phases of investment preparation and financing. By generating a portfolio of solution proposals, the city/municipality gained not only access to new ideas, but also a clearer understanding of the practical requirements, maturity levels and investment needs associated with each concept.

7. Funding and cost management

To navigate the financial landscape of the circular economy, blended finance mechanisms, public-private partnerships and EU funding streams need to be strategically aligned to overcome resource constraints while maximizing impact.

7.1 Cost consideration

Effective cost management is a critical component of circular economy transitions. Medium-sized cities often face financial constraints, such as limited municipal budgets and competing priorities, which require tailored approaches to budget planning and resource allocation. Practical budget planning tailored to local contexts not only reduces risks but also maximizes long-term economic and environmental benefits, positioning these cities as leaders in sustainable urban development.

Budget planning for medium-sized cities must account for both short-term expenses and long-term benefits. A practical approach involves the use of lifecycle cost analysis (LCCA), a tool that evaluates the total cost of a project over its lifetime, including upfront investment, operational expenses, maintenance costs and eventual savings. By focusing on long-term benefits such as reduced waste disposal fees, lower energy consumption and improved resource efficiency, LCCA helps cities justify initial investments in CE infrastructure. For example, transitioning to renewable district heating systems may involve high upfront costs but generate significant savings through reduced fossil fuel dependency and lower greenhouse gas emissions over time.

Another important step in cost planning is the development of budget scenarios tailored to pilot projects and large-scale implementation. Pilot projects serve as a proving ground for CE initiatives, allowing cities to test feasibility while minimizing financial risk. Budget scenarios for pilots should include detailed cost breakdowns for infrastructure, staffing, outreach efforts and contingency funds to address unexpected challenges. As pilot projects demonstrate success, scalability becomes a key consideration for full-scale implementation. Cities must account for

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incremental costs associated with expanding infrastructure or services while ensuring that economies of scale reduce per-unit costs over time. For instance, a modular composting facility can start small and grow incrementally as demand increases, reducing upfront financial strain while maintaining flexibility.

Starting with small-scale modular solutions is particularly advantageous for cities with limited resources. Modular systems, such as decentralized waste sorting stations or localized water reuse facilities, require lower initial investment compared to large, centralized infrastructure projects. Their scalability allows cities to expand capacity gradually based on demand and available funding. Additionally, modular solutions can be adapted to specific local contexts, ensuring that investments align with community needs and priorities.

Exploring cost-sharing models further increases the financial resilience, as the expenses are distributed among several stakeholders. Public-private partnerships (PPPs) are an effective mechanism for financing CE initiatives that require substantial capital investment. In PPP arrangements, private sector partners provide funding and technical expertise while municipalities retain oversight to ensure alignment with public goals. Similarly, inter-municipal collaborations enable neighbouring cities to pool resources for shared infrastructure projects such as regional recycling facilities or renewable energy grids. These collaborations reduce individual financial burdens while fostering regional cooperation and scalability.

In addition to technical feasibility, cities should also assess the investment-readiness of circular solutions when considering long-term cost implications. Circular projects that generate measurable cost savings or create new revenue streams, such as pay-per-use systems, resource-as-a-service models or decentralized energy production, can increase their attractiveness to co-investors and reduce the pressure on municipal budgets. Transparent business models, clearly defined KPIs and robust data on operational performance from pilot phases helps de-risk investment decisions and supports the transition from public funding dependency to hybrid or private funding models. By integrating financial viability assessments into early-stage cost planning, cities strengthen their capacity to scale effective solutions while attracting external capital aligned with long-term urban development goals.

7.2 Funding sources

A diversified funding strategy is essential to ensure the financial resilience and scalability of circular economy initiatives. Medium-sized cities should actively blend different funding sources to address varying project types, timelines and capital requirements, mitigating the risk of over-

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dependence on any single source. Public funding mechanisms such as EU-level programs (e.g., Horizon Europe, LIFE, Interreg and the Cohesion Fund) can provide foundational support for innovative and pilot-scale activities. These grants are particularly suited to early-stage initiatives that involve research, demonstration, or stakeholder engagement and are often aligned with broader EU policy objectives such as climate neutrality, digitalization and resilience. At the national and regional level, additional grant schemes, especially those supporting climate action, smart cities or infrastructure modernization, can complement EU funding and help tailor support to local policy frameworks.

However, public funds alone are often insufficient to fully finance the implementation and long-term scaling of CE projects. Therefore, cities are increasingly exploring private co-investment options, including venture capital, impact investment and green infrastructure funds. These sources can support market-ready solutions that generate returns, such as decentralized energy production, digital resource tracking platforms or circular logistics systems. Establishing partnerships with private investors also enables cities to benefit from additional expertise in business development, commercialization and technology deployment. In this context, project developers should present CE projects with clear financial models, robust KPIs and verifiable impact potential to attract funding beyond grants.

Community-based financing models, such as crowdfunding or cooperative ownership, can further complement this mix by directly engaging residents and local businesses. These models are particularly valuable in strengthening public support, promoting co-ownership and anchoring circular initiatives in local ecosystems. Examples include citizen-funded solar projects, community-run reuse centers, or participatory financing for food waste prevention initiatives.

To operationalize this funding mix, cities should proactively build local or regional project pipelines and align them with suitable funding channels. Developing modular, investment-ready business cases, including clear revenue strategies, cost-benefit scenarios and risk profiles, is critical for mobilizing external capital. A dedicated CE financing roadmap or matchmaking strategy can help identify appropriate instruments at each project stage from seed grants and technical assistance to growth-stage equity and infrastructure bonds. This structured approach, informed by early financial planning and stakeholder coordination, empowers cities to access a broader funding landscape and drive sustained circular transformation.

7.3 Investment networks

The establishment of strong investment networks is an important enabler for the long-term success of circular economy projects. These networks act as link between public institutions,

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private capital, technical solution providers and civil society. Rather than looking at each financing opportunity in isolation, investment networks create ongoing platforms for collaboration, deal-flow exchange and knowledge transfer. For circular economy initiatives, such networks can help bridge the gap between policy ambition and investment capacity by aligning technical project development with capital availability and investor expectations. Local authorities can take a proactive role in bringing key stakeholders together, such as regional development banks, venture capital firms, business angels, ESG funds or philanthropic foundations, to identify shared interests in urban sustainability and innovation. When structured effectively, these relationships evolve into trust-based ecosystems that generate repeated cooperation over time.

For example, investment networks can be used to organize pitching events, where cities present validated CE projects or partnerships with local SMEs and start-ups. These formats not only attract financial partners but also increase visibility and credibility of municipal initiatives. As part of the InvestCEC project, such matchmaking formats help to position cities like Klagenfurt as serious players in the European circular economy and present investable solutions for real urban challenges. Beyond direct financing, investment networks also provide access to strategic advisory, technical validation and scaling expertise. Involving investors at an early stage enables them to help design bankable models, which increases the chances of successful implementation and reduces costly redesigns later on in the process.

In the long term, the institutionalization of these networks through special CE financing platforms, public-private round tables or regional investment committees can ensure continuity beyond individual project cycles. By integrating investment logic into the planning and structuring of circular economy initiatives, cities are not only improving access to capital, but also building momentum for systemic, self-sustaining change.

7.4 Financial Risk Management

Effective financial risk management is critical to ensure the long-term stability, adaptability and credibility of circular economy initiatives, especially in medium-sized cities with limited financial buffers. While diversified funding streams reduce exposure to the volatility of a single source, risk management must go beyond the question of “where funding comes from” to also address “how financial uncertainty is handled throughout the project lifecycle.” One key strategy involves the early allocation of contingency budgets or reserve funds to absorb unexpected costs or delays in implementation, such as permitting issues, supply chain disruptions, or stakeholder pushback. Embedding flexibility into financial planning, including scalable budgets and modular project structures, enables cities to adjust scope and timing without derailing core outcomes.

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Moreover, municipalities should evaluate the financial resilience of their partners, especially when cooperating with SMEs or start-ups as solution providers. Applying basic due diligence, such as reviewing liquidity, funding runway and contractual obligations, helps to ensure service continuity and reduces dependency on high-risk counterparties. When public funds are leveraged to attract private co-investment, a shared understanding of risks and returns must be built from the outset. Cities can use structured financial instruments, such as milestone-based disbursement plans or performance-linked incentives, to align partner accountability with project goals while protecting public interest.

In addition, developing robust business cases with transparent cost assumptions, sensitivity analyses and realistic break-even scenarios helps build trust with funders and institutional partners. These documents not only inform internal decision-making but also support funding applications and investor pitches. Establishing internal risk governance practices like periodic financial reviews, escalation protocols and cross-departmental risk mapping, further enhances oversight.

Unforeseen costs, whether from construction delays, technology failures or regulatory changes, can derail even well planned CE projects. Allocating reserve funds provides a critical buffer against such risks. These reserves should be calculated based on risk assessments that evaluate project complexity, supply chain dependencies and historical data from similar initiatives. A city developing a municipal composting facility might reserve additional funds to address potential odor mitigation technologies or community litigation costs. In cases where reserves are insufficient, insurance products offer an alternative risk-transfer mechanism.

By embedding such mechanisms into their project design, cities increase their credibility as reliable implementation partners and improve their ability to attract and retain external capital over time.

8. Monitoring and measuring impact

Robust monitoring and evaluation frameworks form the backbone of a successful transition to the circular economy. They enable cities to quantify progress, optimize resource allocation and be accountable to stakeholders.

8.1 Metrics and indicators

The correct measurement of progress is essential to ensure the effectiveness, transparency and continuous improvement of circular economy strategies. Establishing indicators allows cities to

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assess progress against concrete targets, detect deviations and adjust policies, communicate results to citizens, funders and stakeholders and align their local actions with European regulatory frameworks such as the EU Taxonomy Regulation (European Parliament & Council of the European Union, 2020) and the Corporate Sustainability Reporting Directive (CSRD) (European Commission, n.d.-b). In this context, medium-sized cities should prioritize relevant, specific, measurable and feasible indicators according to their technical capacities and available resources.

Based on the frameworks established by the European Environment Agency (EEA) (Kristensen, 2003), the Organisation for Economic Co-operation and Development (OECD) (OECD, 2025), the European Commission (EC), the EASAC – European Academies' Science Advisory Council (EASAC, 2016) and the European Circular Economy Stakeholder Platform (SUMMA, n.d.) it is proposed to structure the key performance indicators (KPIs) into five strategic categories:

1. Resource and waste flow indicators: These indicators provide insight into the efficiency of the urban system in terms of material use. They include metrics such as waste diversion rate (percentage of waste avoided from landfill and incineration), recycling and reuse rate including specific fractions (organics, plastics, textiles, construction), separate collection rate by fraction, volume of secondary materials used in relation to total consumption (circular material rate) and the intensity of consumption of virgin materials per inhabitant, known as DMC (Domestic Material Consumption).

2. Climate and environmental indicators: These assess the environmental impact of circular measures. They include the reduction of CO_2 emissions linked to circular strategies, the reduction of the ecological or carbon footprint of products and processes (measured by life cycle analysis), the efficient use of water (volume reused or sectoral savings) and the reduction of air and soil pollutants associated with inadequate waste management.

3. Economic indicators: These measure the economic effects of the circular transition. These include economic savings from increased resource efficiency, the creation of green jobs in sectors such as repair, reuse, recycling and eco-design, the number of circular enterprises active or having received public support and the volume of investment mobilised in circular projects.

4. Social and participation indicators: These assess the degree of citizen involvement and social impacts. They include the rate of participation in circular programs such as recycling, composting or exchange platforms, the rate of public perception of the circular economy measured through surveys, the affordability of circular products or services and

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social inclusion expressed through employment generated in circular sectors for vulnerable groups.

5. Regulatory and governance indicators: These measure the degree of institutionalization of the circular economy. They include the number of municipal policies and ordinances aligned with CE principles, the proportion of public spending subject to circular procurement criteria (Green Public Procurement), the level of integration of CE in strategic plans (urban planning, waste, climate change) and the frequency and quality of data monitoring through dashboards or interoperable platforms.

8.2 Continuous Improvement and Adaptation

A successful transition to circular economy demands more than initial planning and implementation, it requires a commitment to ongoing refinement and adaptability. Cities must establish systems that foster continuous improvement, enabling them to respond dynamically to emerging challenges, stakeholder feedback and evolving opportunities. By prioritizing stakeholder feedback, rigorously evaluating progress and designing for adaptability, cities cultivate the agility needed to navigate uncertainty and maximize impact.

Cities should implement multi-channel platforms to gather insights from residents, businesses, municipal departments and external partners systematically. Digital tools, like dashboards or mobile apps, allow real-time input on CE projects, while periodic workshops and focus groups provide deeper qualitative insights. Residents might highlight inefficiencies in waste separation protocols, or businesses could identify regulatory barriers to material reuse. Structured surveys, aligned with key performance indicators, can quantify satisfaction and track behavioural changes over time. By institutionalizing these loops, cities transform stakeholder experiences into actionable data, fostering transparency and co-ownership of CE goals.

Annual reviews serve as checkpoints to evaluate CE initiatives against predefined objectives and KPIs, such as waste diversion rates, carbon savings, or job creation. These reviews should analyse both quantitative metrics and qualitative feedback, identifying successes, bottlenecks and unintended consequences. A city might discover that its composting program achieves high participation in dense urban areas but struggles in suburban neighbourhoods, prompting targeted outreach adjustments. Reviews also provide opportunities to recalibrate KPIs in response to new EU directives, technological advancements, or shifts in community priorities. Resources can then be reallocated; scaling high-impact initiatives while pausing or redesigning underperforming projects.

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CE initiatives must be architected for flexibility, anticipating disruptions such as funding fluctuations, policy changes or supply chain volatility. Modular project designs, such as scalable recycling hubs or phased renewable energy rollouts, allow cities to expand efforts without overcommitting resources. Adaptive management frameworks, such as agile sprints or iterative prototyping, further enable cities to test solutions rapidly, learn from failures and refine approaches in real time.

8.3 Reporting and Transparency

Transparent reporting and stakeholder communication are critical for maintaining accountability, building public trust and ensuring the long-term success of circular economy initiatives.

Detailed internal reports serve as the backbone of informed decision-making, enabling municipal departments to track progress, identify bottlenecks and allocate resources effectively. These reports should synthesize quantitative and qualitative data, including key performance indicators like waste diversion rates, carbon emission reductions and cost savings from resource efficiency. Financial performance metrics, such as return on investment from CE infrastructure, should be transparently documented to justify expenditures and secure future funding. A balanced narrative is important: highlighting successes, but also addressing challenges, such as delays in permit approvals or community resistance. Lessons learned provide actionable insights, guiding iterative refinements to project designs or stakeholder engagement strategies.

Translating complex data into accessible formats ensures that all stakeholders, residents, businesses, investors and policymakers, can engage meaningfully with CE progress. Interactive digital dashboards, updated in real-time with IoT sensor data, allow users to explore metrics like neighbourhood-level recycling rates or energy savings from efficiency upgrades. Infographics and short video summaries turn annual reports into visually appealing content that is ideal for social media campaigns or public presentations in community centers.

Academic partnerships can provide third-party validation of environmental impacts through lifecycle assessments, while NGOs contribute grassroots insights on social equity and inclusivity. Joint publications might focus on thematic areas like circular construction or regional material loops, positioning cities as contributors to pan-European CE strategies. Co-creation workshops with these partners can refine reporting methodologies, ensuring they capture both quantitative metrics and qualitative community impacts.

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9. Conclusion

The transition to a circular economy represents an opportunity for cities and regions aiming to reconcile economic growth with planetary boundaries. While urban centers are struggling with resource scarcity, the urgency of climate change and a changing regulatory landscape, medium-sized cities are becoming key players in this transformation. Their intermediate size, which balances the complexity of cities with the flexibility of management, makes them ideal laboratories for CE initiatives that can be replicated, scaled and adapted in different contexts.

Concrete showcases such as the Kalundborg Symbiosis demonstrate the long-term potential of full-scale circular economy systems at the local level. While such examples reflect unique local conditions that may be difficult to replicate in detail, they still offer valuable insights and serve as inspiration for municipalities seeking their own transformation pathways. The United Circles project is further examining the lessons emerging from these mature examples to distinguish between generalizable principles and context-specific drivers (United Circles Consortium, 2024).

The InvestCEC project has focused on the opportunities and challenges facing medium-sized cities — exemplified by the pilot activities in Klagenfurt am Wörthersee — and developed a structured process to support the early stages of circular economy transition. These cities often find themselves constrained by limited resources and fragmented governance landscapes, but their scale also allows them to act with agility and build close-knit partnerships across sectors. From decentralized renewable energy systems to more circular urban material flows, they offer fertile ground for experimentation and learning.

At the core of the project is a model designed to support cities in defining local needs, identifying suitable circular solutions, improving investment readiness, and preparing financing structures. This approach reflects the diverse starting points and capacities of municipalities across Europe. While the full circular transition remains a long-term endeavour, InvestCEC has contributed to testing and refining practical methods that can help other cities take meaningful first steps.

In Klagenfurt, this approach included the preparation a dedicated venture capital fund of up to €20 million and initiating pitch competitions to identify promising circular economy start-ups. These efforts illustrate how entrepreneurial collaboration can complement public sector planning and contribute to building a pipeline of implementable solutions. By fostering early-stage investment structures and connecting public actors with innovators, the project demonstrates how circular solutions can be shaped to become both technologically feasible and financially scalable. The planned continuation of the InvestCEC Fund under the leadership of

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Venionaire Capital and in cooperation with Stadtwerke Klagenfurt AG reflects a shared ambition to continue developing regional investment structures and to accelerate innovation and circular economy transformation in the region. This setup is intended to ensure continuity, strategic alignment, and professional capital deployment across key sectors such as green infrastructure, renewable energy, and smart logistics.

A promising tool tested in this context was the *Call for Entrepreneurs*, which acted as a bridge between identified local needs and available market-driven solutions. The call enabled the city/municipality to invite external innovators into the process. This approach provided an accessible, transparent mechanism to initiate collaboration, surface new ideas, and explore implementation pathways — and may serve as a helpful starting point for other municipalities.

While the opportunities are substantial, CE transitions face persistent challenges, including funding gaps, regulatory misalignment and public scepticism. Blended financing mechanisms, combining EU grants, municipal bonds and impact investments, diversify risk and attract private capital. Equally critical is the role of participatory governance. Securing a financial commitment from local or regional public stakeholders can significantly enhance the credibility of an investment vehicle**.** It signals political support, reduces perceived risk, and increases the likelihood of attracting private capital. Medium-sized cities must institutionalize stakeholder engagement. By involving residents, cities build social license and ensure that CE initiatives address community priorities, from air quality improvement to job creation.

The climate crisis and resource constraints demand urgent, decisive action. Medium-sized cities, with their unique blend of agility and influence, are in a strong position to lead this transition towards CE. The InvestCEC framework offers a toolkit for translating circular principles into tangible outcomes. Cities worldwide are proving that economic growth and environmental stewardship need not compete but can reinforce one another through innovative design. The road toward circularity is iterative, requiring patience, adaptability and courage to challenge linear norms. Yet the rewards (resilient economies, thriving communities and regenerated ecosystems) are profound.

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