



RESILIENCE & THE CIRCULAR ECONOMY

Opportunities & Risks



ABOUT THE CIRCULAR JOBS INITIATIVE

Circle Economy is an impact organisation that connects and empowers a global community to create the conditions for transformation towards the circular economy. Our mission is to accelerate the transition through practical and scalable insights and solutions that address humanity's greatest challenges.

The *Circular Jobs Initiative* is a knowledge centre that aims to ensure the transition to the circular economy is positive for work and workers. We are committed to promoting this mission by working with employers, workers, governments, multilateral organisations, education institutions and research organisations to shape this future.

With the support of the Goldschmeding Foundation, the *Circular Jobs Initiative* develops and shares knowledge and best practices on the future of jobs for the circular economy and translates this knowledge into practical and scalable solutions.

TABLE OF CONTENTS

| | |
|----|--|
| 4 | Introduction |
| 6 | Social-ecological resilience |
| 8 | Circular economy and social-ecological resilience |
| 10 | • Resource efficiency |
| 11 | • Shared resources |
| 12 | • Regenerative resources |
| 13 | • Decentralisation |
| 14 | • Skills transferability |
| 15 | • Lifelong learning |
| 16 | • Flexible labour contracts |
| 17 | • Strengthening sociological foundation |
| 18 | Case 1 : Enhancing resilience from farm to fashion in Indore, India |
| 20 | Case 2 : Reducing vulnerability through organic waste management in Quito, Ecuador |
| 22 | Case 3 : Localising manufacturing for repair in the Port of Rotterdam, Netherlands |
| 24 | Conclusion |
| 26 | Reference list |
| 30 | Acknowledgements |

INTRODUCTION

The covid-19 pandemic has resulted in mass unemployment across countries in both the global north and south, with many economies facing deep recessions. Amid the social and economic fallout caused by the pandemic, there is growing consensus that the extent of this fallout has been exacerbated by our current economic model. Even with the introduction of short-term fixes, continuing with this model will mean future shocks will continue to exceed our capacity to recover. We increasingly see calls to amplify the resilience of our systems as nations, businesses and cities seek to implement stimulus packages to ‘build back better’. Resilience, defined here as the ability of a system to recover from a shock, such as an economic crisis or a natural disaster, has been coupled with the circular economy in such calls for change. But to date, the connection between the two concepts has lacked robust definition and research. In this report, we provide a first structural analysis of the synergies between resilience thinking and the circular economy. Which circular economy trends have a positive or negative impact on the resilience of our society and planet? And how can business and government facilitate the integration of resilience into systems through the circular economy transition?

TIME FOR A SYSTEMS OVERHAUL

Characterised by its ‘take-make-waste’ tradition, our current linear economic model has led us to a new, and bleak, milestone: the amount of material consumed by our global economy each year has passed 100 billion tonnes. Of this, only 8.6% is cycled back into the global economy.¹ The rest is mostly wasted or lost. This mammoth resource use is unsustainable and straining the planet’s resources. The linear system that supports it is also inherently fragile and the disruptions caused by the pandemic—from broken supply chains and staggering unemployment—have unearthed a multitude of weaknesses.

THE CIRCULAR ECONOMY IS NOT A SILVER BULLET

By designing out waste and pollution, keeping products and materials in use, and regenerating natural systems,² a circular economy allows us to collectively reimagine and redesign our systems to realise an ecologically safe and socially just space for us all.³ This is a world where functioning social systems fall within healthy planetary boundaries.

But the circular economy is not a silver bullet for equitable employment, sustainability and prosperity in the build back better era. It is a means to achieving an ecologically safe and socially just end, the achievements of which can be strengthened by resilience thinking. Some of the trends that characterise the circular economy which we present in this report—which also includes certain trends that derive from its implementation and related labour market dynamics—can overcome some of the fragile and unsustainable aspects of the linear economy. Other trends may, however, increase its fragility.

This report points out those circular economy trends that contribute to building resilience and those that warrant caution. This will allow us to account for resilience in building a more circular economy.

MAPPING THE CIRCULAR ECONOMY ALONG RESILIENCE PRINCIPLES

To truly embed resilience in the circular economy transition, we must place these core trends of the circular economy under the microscope and ask: how can circularity make our economies and labour markets more resilient?

This report first introduces the definition and key principles of social-ecological resilience. Then, using this framework, circular economy trends have been mapped along the key principles of resilience. In identifying the relationship between these two schools of thought, risks (where one may harm the other) and opportunities (where one reinforces the other) are identified. For every circular economy trend, recommendations are formulated for businesses and companies to build resilience through circularity. Lastly, three case studies exemplify what resilient circular economy strategies look like in practice.

SOCIAL-ECOLOGICAL RESILIENCE

Resilience refers to the ability of a system—social, natural, geographical, political, economic or cultural—to recover from a shock, such as an economic crisis, a global pandemic or a natural disaster. We can consider different scales of resilience, spanning from the individual to the collective, and different levels of implementation from which resilience can be thought of and explored:

- Individual resilience refers to the resilience of a person, their physical and psychological ability to recover from shocks such as stress and adversity, as well as their capacity to sustain themselves and those people directly dependent on them.⁴
- Organisational resilience is defined as the ability of organisations to respond to disturbances and withstand disruptions, while being capable of adapting to new risk environments.⁵
- Social resilience refers to a group or communities’ ability to cope with disturbances or external shocks resulting from political, social or environmental changes.⁶
- Ecological resilience refers to the ability of an ecosystem to withstand shocks and retain its original stable state of self-organisation, or to adapt to a new stable state.⁷

The circular economy considers all systems together under social-ecological resilience.⁸ Although each scale of resilience contains nuances in what constitutes resilience, all of them are nonetheless connected. For example, we can consider the impact of climate change on agriculture, farming or fisheries. When it is no longer possible to harvest a certain crop or its yields have significantly decreased⁹, organisational resilience is required within business to redirect or reconsider impacted supply chains. Individual resilience is required for the dismissed employees that once harvested the crop to locate new sources of income and livelihoods. Social resilience is required to rebalance industrial systems and even power dynamics between workers and within communities. Ecological resilience is needed for animal and plant species to adjust to new conditions while striving for survival. For instance, high rising temperatures may provoke earlier migration for certain fish, or shifts in birds or mammals’ breeding patterns.¹⁰

Social-ecological resilience essentially acknowledges the intertwinement of people and the biosphere: we are part of many complex and adaptive systems where change is unavoidable, non-linear and sometimes irreversible.¹¹ It also does not recognise a specific stable state that systems need to bounce back to, but rather critical system thresholds that define the amount of adaptation and change that a system can withstand before permanently shifting to a new state.¹² Resilience, therefore, provides us with a concept to aid understanding and management of (unexpected) changes within the thresholds of these systems.¹³

There are seven key principles that are pivotal for building social-ecological resilience and thereby increasing the ability of a system to recover swiftly:¹⁴



Maintain diversity through the variety, balance and disparity of elements **and redundancy** through elements performing a similar function that can be drawn on when needed. This builds resilience by providing alternative and substitute elements in response to disturbances, failures or losses.



Manage connectivity by establishing well-connected systems that can effectively overcome disturbances, either through proximity¹⁵, trust, or fortified network relationships.¹⁶ At the same time, overly connected systems may reduce the resilience of a system due to their higher potential to spread disturbances, such as highly spread value chains with hyper specialised and unique actors.



Manage slow variables that sustain desired ecosystem services **and control feedback loops** that connect these variables and reinforce or dampen change. The impact on slow variables is typically felt with a delay, due to the nature of the variables themselves or because they are impacted by a set of interacting elements. They can be both social, such as legal systems, values and behavioural norms, and ecological, such as the amount of organic matter in the soil or the trophic state of a lake.



Foster complex adaptive systems, that both acknowledge and accept complexity, multiplicity of perspectives, interactions and levels of action in order to be prepared to deal with uncertainty and unpredictability in the face of changes and shocks to the system.



Encourage learning to ensure value is attached to diverse types and sources of knowledge, skills and know-how. This could include a shift in ‘mental models’ to embrace complexity, which, in turn, contributes to the development of solutions, informed decisions and experimentation to bounce back from a shock or adapt to changes in systems.



Broaden participation by actively engaging all relevant stakeholders. Support access and reduce marginalisation¹⁷ and modify power relations that can foster unjust and unsustainable environmental and social relations.¹⁸










Promote polycentric governance as a way for public and private organisations, individuals and communities to collaborate on multiple levels and jointly affect collective benefits and costs.¹⁹ This governance structure can offer flexible solutions and support collective action in changing times where more formalised procedures can fail.

CIRCULAR ECONOMY AND SOCIAL-ECOLOGICAL RESILIENCE

Applying resilience thinking to efforts to shape the circular economy transition may help to ensure this new economic paradigm creates positive value for both society and planet.²⁰ To do this, concepts embedded in the circular economy and labour market characteristics that derive from the implementation of circular strategies warrant

special attention in their relationship to resilience. This section shows that they can either contribute substantial opportunities to build resilience while transitioning to circularity, or they may hinder resilience and therefore require increased attention.

| CE PRACTICE / RESILIENCE PILLAR |  MAINTAIN DIVERSITY AND REDUNDANCY |  MANAGE CONNECTIVITY |  MANAGE SLOW VARIABLES AND CONTROL FEEDBACK LOOPS |
|--|---|--|---|
| | | | |
| Resource efficiency | RISKS | OPPORTUNITIES | |
| Shared resources | | | OPPORTUNITIES |
| Regenerative resources | OPPORTUNITIES | | |
| Decentralisation | OPPORTUNITIES | RISKS | |
| Lack of sociological foundation | | | RISKS |
| Labour mobility and skills transferability | OPPORTUNITIES | | |
| Lifelong learning | OPPORTUNITIES | | |
| Flexibilisation of labour contracts | RISKS | | |

|  FOSTER COMPLEX ADAPTIVE SYSTEMS |  ENCOURAGE LEARNING |  BROADEN PARTICIPATION |  PROMOTE POLYCENTRIC GOVERNANCE |
|---|---|--|--|
| | | | |
| | | OPPORTUNITIES | OPPORTUNITIES |
| OPPORTUNITIES | | | |
| | | OPPORTUNITIES | OPPORTUNITIES |
| RISKS | RISKS | | |
| | | | |
| | OPPORTUNITIES | | |
| | | | |

 OPPORTUNITIES
  RISKS

Opportunities and risks for social-ecological resilience mapped according to key circular trends by Circle Economy.

RESOURCE EFFICIENCY

Maintain diversity and redundancy

Manage connectivity

A resilient system relies on alternative and substitute elements to replace disturbed or lost resources in the event of a shock. While a resource efficient system—one that uses less materials to obtain the same outputs—usually contributes to leaner and less resource intensive operations, it may, under certain circumstances, reduce its resilience.

Underpinning circular economy thinking is the waste hierarchy, which places the ‘Reduce’ strategy high-up in its established order of preference. In following Reduce strategies, resource use is minimised through reduced consumption and, consequently, waste is reduced. Indeed, a resource efficient system designs out intermediate leakages and waste, so as to produce the same outputs with less input materials and energy. This results in lean systems with less redundancies.

This leanness, however, may result in a system that is more vulnerable to shocks. This is because redundancies in supply chains act as buffers when regular activities are interrupted. Overstocking certain resources, for example, enables warehouses to continue their supply activities even when their supplies are temporarily cut off.

At the same time, a more resource efficient supply chain is less reliant on heavily globalised supply chains, thereby reducing the risk of an overly connected system.

A system with a sole focus on redundancy could result in wasteful supply chains, while a sole focus on resource efficiency could result in fragile supply chains. Importantly, any circular economy strategy striving for an effective system should strike the balance between the two.^{21,22}

Recommendations

Businesses

Design circular value chains that strike a balance between efficiency and redundancy. Take into consideration that redundancy may be more important for newly emerging and fast-changing businesses and efficiency may become a safer bet for established ones.²³

Shift the business mindset from scarcity to abundance by searching for alternative resources and means with higher availability, or by standardising components.

Develop impact indicators to move beyond measuring only overall efficiency, especially in organisational structures such as eco-industrial parks

Governments

Take the role of facilitators to create networks and share knowledge between regions, countries and industries, to support building new or changing circular value chains.

Support the establishment of the required infrastructure for circular value chains through innovation and R&D funding or other forms of incentives.

Develop and establish policy frameworks and standards that ensure impact indicators and measurements strike an effective balance between efficiency and resilience.

SHARED RESOURCES

Promote polycentric governance

Broaden participation

Hybrid and polycentric governance structures can build long-term resilience by sharing the local management of common-pool resources between multiple public and private organisations, individuals and communities. This results in a collaboration on diverse scales, with all stakeholders actively engaged in jointly affecting collective benefits and costs.²⁴

The circular economy, when implemented on the micro, meso and macro scale, manages both privately owned resources, such as assets, and public, common-pool resources, such as the environment and waste flows. Businesses implementing circular practices own and manage private resources. Waste flows and unused resources can be considered as commons and are governed either by regional waste management systems such as household plastics and cardboard municipal collections, or by collaborations between private entities such as by-products from agrifood used as input for biorefinery. Other types of shared resources, such as knowledge, constitute the virtual commons and are governed globally through networks and in sharing economy settings.²⁵

Resource flows on different scales offer a promising platform to contribute to polycentric forms of governance. Similarly, polycentric governance of resources can create system-level benefits.²⁶ Reviewing the way in which we manage common-pool and privately-owned resources will also entail a critical assessment into current accumulation and distribution of capital, as well as risk-sharing across diverse geographies, communities, businesses and individuals.²⁷ Shared resources in a circular economy can therefore broaden access and participation while supporting a transition towards a more just and equitable society.

Recommendations

Businesses

Take a more public-facing role through voluntary disclosure of data, information and best practices to help build a culture of stewardship and co-responsibility.

Share and learn from best practices of social and solidarity economy enterprises taking on societal responsibility in managing shared resources over the profit-maximising logic with other businesses.



Governments

Develop a multi-level circular economy policy framework that combines the setting and enforcement of broad societal goals and a degree of autonomy for local actors to translate these goals to their local realities.

Take the role of facilitators to create networks and share knowledge to support building a culture of stewardship and co-responsibility.

Ensure rules and regulations on the use of common-pool resources are aligned to local conditions, context and needs.²⁸

REGENERATIVE RESOURCES

-  **Maintain diversity and redundancy**
-  **Foster complex adaptive systems**

Access to alternative strategies and resources enhances the resilience of a system by providing diversity. Using less virgin materials and shifting towards regenerative or recycled resources in a circular economy can contribute to this diversity.

The circular economy prioritises resources that are renewable and regenerative, or at least cyclable, in contrast to the current system which heavily utilises non-renewable options such as fossil fuels. This shift reinforces material and energy security by providing alternative and diversified feedstock in a future characterised by the threat of scarcity of non-renewable resources and volatile material pricing.^{29,30}

The interrelation between elements and actors in the circular economy through multiple feedback loops can increase a system's resilience by providing ways in which a material can circulate for longer in consecutive cycles of repair, reuse, refurbish, remanufacture, and recycle. Feedback cycles are therefore diversified across stages and processes in the value chain, building better resilience in the midst of a disturbance with one of the material supplies.³¹

Examples of these cascading uses may be found in solid wood, which can be used multiple times as a construction material before it becomes a biofuel, or cotton fibre, which can be used and reused in garments before it is recycled into new textiles, used as industrial rags, or fiberised to use in furniture fillings or insulation.

Recommendations

Businesses

Prioritise the utilisation of renewable energy sources in operations.

Understand regenerative material alternatives, their potential for cyclability and the related implementation requirements to make an informed decision on resource use.





Pursue income streams based on a combination of strategies in the waste hierarchy, so as to increase your business' potential for reorientation and alternative feedstock when necessary.

Governments

Support and encourage the transition towards renewable, regenerative and cyclable resources as an integral part of circular economy policy, through strategy and policy development as well as monitoring, financing and governance systems.

Next to those in the wind and solar energy sectors, make careers in the biobased industries visible and an attractive career path to current workers and future graduates, so as to avoid labour shortages hindering growth of these sectors.

DECENTRALISATION

-  **Maintain diversity and redundancy**
-  **Promote polycentric governance**
-  **Broaden participation**
-  **Manage connectivity**

Decentralisation contributes to building resilience by bringing governance systems closer to their communities and actively engaging all relevant stakeholders to support access and broaden participation. As the successful implementation of the circular economy depends on efficient management of material flows, the governance of these will have to be decentralised in certain instances, such as food, energy and waste, as well as repair and maintenance services.

In a decentralised system, decision-making does not rely on a single centralised authority. Instead it is shared among a network which can facilitate swift decision-making. The circular economy is increasingly characterised by decentralised activities and infrastructure that drive local activities. In the agricultural sector, we see decentralised facilities for combined heat and energy, supporting regional farms in meeting energy demands whilst closing nutrient loops.³² The manufacturing sector is also more decentralised in the circular economy, with 3D printing and additive manufacturing increasing the viability of redistributed, smaller-scale and localised manufacturing.³³

As energy systems and value chains, for example, become decentralised they reduce their reliance on outside resources and increase their resilience in the face of shocks of disturbances experienced in specific regions and their knock-on effects. Smaller scale, localised activities may also enhance adaptation abilities and speed up decision-making, as authority is ideally distributed across all management levels and is in closer proximity to the core of the activities.³⁴ Decentralisation will mean a more diverse range of activities are carried out locally, thereby creating demand for a diversity range of skills on a regional level too. Indeed, a (re) distribution of skills is needed to move away from the hyperspecialisation of regions, that currently characterises certain linear value chains, to a more circular economy.

Nevertheless, moving towards decentralised activities also warrants caution. For example, a shock in a specific activity that has a pivotal role in the physical or financial flows of the region, will have an impact on other activities or operations from sectors present locally as well. Hence, moving towards more varied and localised value chains and sectors does not necessarily reduce the vulnerability of them to shocks if they are intrinsically connected to other sectors in the region.³⁵

Recommendations

Businesses

Engage in polycentric governance structures for managing privately-owned resources in CE.

Take part in and further develop shorter value chains/cycles, with closer proximity to your operations, where possible.

Build and maintain trusted relationships with partners and networks that could provide support in the event of a shock.

Governments

Promote the development of decentralised circular economy solutions in energy, water, waste, manufacturing and food systems.

Engage citizens, social partners and the industry in developing circular transition pathways, so as to develop locally embedded and decentralised governance systems.

Manage the degree of specialisation in the region, plan for more diverse local industries and corresponding skills and training pathways.

SKILLS TRANSFERABILITY

Maintain diversity and redundancy

Regions with higher potential for labour mobility, meaning the capacity for workers to be employed in different sectors as a result of skills transferability, will see their labour markets recover faster after a shock. The circular economy requires a set of transferable skills across the labour market as sectors and business models evolve across stages of the transition, directly contributing to local resilience.

The transition to the circular economy requires a set of transferable skills that consistently arise as sectors adapt their business models and see increased needs for business models such as servitisation. These transferable skills include maintaining customer service, creating solutions, developing critical thinking, solving problems and assessing risks.³⁶ Therefore, developing a workforce with ample transferable skills contributes to resilience by creating surplus in (part of the) labour and skills supply, meaning that people can complete multiple different tasks and switch industries.³⁷ This can happen on the one hand through formal education, which currently sees too little emphasis on transferable skills in curricula and assessments,³⁸ as well as through cross-organisational and -sectoral learning.

Recommendations

Businesses

Pursue a skills-based labour market over a focus on qualifications by reconsidering the way in which vacancies are formulated and mapping out specific and transferable skills required for different activities.

Governments

Pursue a skills-based labour market over a focus on qualifications by developing instruments such as skills passports and/or by supporting educational institutions in offering modular learning packages.

Education

Promote the development of transferable skills, which should take equal importance in both curricula and assessments.

Develop modular learning packages based on skills to support incremental and redirecting specialisation.

LIFELONG LEARNING

Maintain diversity and redundancy

Encourage learning

Individuals and organisations that are accustomed to continuous and adaptive learning will be more resilient in terms of developing solutions, moving between employment opportunities, making informed decisions and experimenting in order to bounce back from a shock or adapt to changes in a system. As the circular economy is a system in constant change, the circular transition should be underpinned by a culture of lifelong learning, as such directly contributing to resilience.

As the transition to the circular economy continuously develops, so do the related skills requirements. For this reason, a culture of lifelong learning should be promoted as part of the circular economy. Whereas current learning paths are organised in a linear way (we are often schooled for a profession), in a circular economy, the labour force can adopt new skills and pursue different careers where necessary in a flexible way.³⁹ This creates flexibility and diversity in the skills that are available in the labour market to implement the tasks necessary in that moment and as such contributes to resilience.

On top of the need for transferable skills, different emerging professions require a set of specialised skills.⁴⁰ As such, lifelong learning opportunities also contribute to flexibility in skills supply in so far as they are organised in a way that can easily respond to changing needs in the labour market.

The capacity for continued and adaptive learning relates to the value and consideration given to diverse types and sources of knowledge and skills, as well as a recognition that knowledge is always incomplete and therefore in constant development.⁴¹

Recommendations

Businesses

Promote a culture of lifelong learning and adaptive career paths as part of company culture as viable and valuable alternatives to the traditional linear career path.

Governments

Promote a culture of lifelong learning and adaptive career paths by including lifelong learning institutions and social partners in circular economy development and raising awareness amongst future graduates and the current workforce of different career pathways and options.

Education

Develop customisable learning paths. Innovative forms of learning, such as online courses, demonstrator sites, and MOOCs can, when fully embraced, develop new skills real-time in line with innovations occurring in the market.^{42,43}

FLEXIBLE LABOUR CONTRACTS



Maintain diversity and redundancy



Manage slow variables and control feedback loops

While the resilience of businesses may be increased through flexibility of labour supply in value chains, individual workers may not experience the same positive outcomes when this flexibility is pursued in labour contracts. Flexible labour contracts are common practice in the circular economy, putting worker resilience at risk.

The platform and gig economy are taking shape in the circular economy through business models which feature peer-to-peer marketplaces and exchange platforms, as well as those that provide business-to-consumer services in repair and maintenance and the sale of secondhand goods. Flexible labour contracts are common practice within the platform economy, and becoming more and more common in traditional sectors transitioning into circularity such as construction and manufacturing. This means that the number of irregular, 'flexible', workers is increasing in the circular economy.

While these contracting practices increase the capacity of firms for radical innovation and short response rates to disruption, hence increasing their resilience,⁴⁴ they are also linked to higher levels of vulnerability for individual workers and could therefore decrease the resilience of both individual workers and society as a whole.⁴⁵ A healthy balance between individual and business resilience needs to be struck to ensure a just transition.

Recommendations

Businesses

Work with government and labour unions to shape labour contracts with the help of collective labour agreements in the emerging platform and gig economy, as well as more traditional sectors that increasingly rely on contracted workers.

Governments

Invest in research into the impact of newly emerging labour contracts in sectors that are central to the circular economy, such as the platform economy, construction and manufacturing.

Work with employers and labour unions to ensure labour contracts in the emerging platform and gig economy do not increase worker vulnerability.

LACK OF SOCIOLOGICAL FOUNDATION



Manage slow variables and control feedback loops

Complex and adaptive systems require managing all environmental and social variables, as well as their feedbacks and interactions, to ensure resilience is built both in the short- and the long-term. The circular economy is as yet mainly embedded in environmental thinking, and is lacking a strong sociological basis to manage slow social variables.

The origins of the circular economy thinking lie in industrial ecology and are, therefore, well embedded in sustainability literature.⁴⁶ The circular economy tends to focus on economic and environmental impacts such as resource depletion, resource efficiency, innovation rates and air pollution. These are both slow- and fast-moving variables that are used to guide the development of the circular economy. When it comes to social impact, however, the circular economy only focuses on fast-moving variables, such as income, job creation or access to resources. Important slow social variables to the circular economy which as yet have not received sufficient attention include legal systems, behaviours, value systems and traditions.⁴⁷

Knowledge around the circular economy largely focuses on industrial symbiosis, supply chains, material loops and business models.⁴⁸ Indeed, the circular economy has mainly been put forward as an instrument to achieve green growth until recently, when the discussion around the circular economy as a means to green recovery has taken centre stage.^{49,50} The link between circular economy and social equity is considered weak.⁵¹ This is, amongst other things, reflected in the way we monitor the impact of the circular economy, where social consequences remain largely under addressed.⁵²

The circular economy also has as yet not addressed the issues surrounding the growth paradigm and only marginally discusses the role of the consumer.⁵³ As such, in its current form, the circular economy does not address the root causes of environmental degradation and growing inequality, a consequence of the lack of sociological foundation of the concept.

Recommendations

Businesses

Include slow social variables in circular economy monitoring systems such as human capital, worker habits, job quality, company culture, traditions and employee mindset.

Develop circular economy governance systems that can respond to slow variables as well as the currently used fast variable indicators such as greenhouse gas emissions, job creation or revenues.

Governments

Invest in research into the social impact of the circular economy, with a focus on slow variables such as culture, values and institutional change. This research agenda should be strongly embedded in the social sciences and political economy and not shun potential controversy or risks.

Consider these slow social variables, such as legal and value systems in circular economy action plans, strategies and roadmaps.

Develop circular economy governance and monitoring systems that can respond to slow variables, as well as the currently used fast variable indicators such as greenhouse gas emissions, job creation or incentives.

CASE 1

ENHANCING RESILIENCE FROM FARM TO FASHION IN INDORE, INDIA

RESILIENCE STRATEGIES

- **Manage diversity and redundancy**
- **Foster complex adaptive systems**
- **Encourage learning**

CIRCULAR ECONOMY TRENDS

- **Regenerative resources**
- **Resource efficiency**
- **Lifelong learning**

Pratibha Syntex is a vertically-integrated manufacturer of knitted textile products based in central India. With a strong focus on organic cotton, the company employs 6,000 workers, connects around 35,000 farmers through the cooperative Vasudha Organic, and supplies apparel brands across 20 countries, producing over 55 million garments a year.

As a cotton grower and manufacturer, the impacts of conventional agriculture on land and water cannot be overlooked. Through intensive land use and resource depletion, India is currently losing 5334 million tonnes of soil each year due to soil erosion.⁵⁴ Water is also critically scarce in India, with 65% of the country's water reservoirs drying up.⁵⁵

Therefore, efficient and effective resource use that prioritises regenerative and renewable resources becomes of utmost importance for their operations. The company has implemented the following strategies, amongst others, which have contributed to increase their resilience in their transition to a circular and sustainable business:

- The implementation of a new cold batch dyeing system for garments at the production facility, which reduces the water needs at the dyeing stage by 50% and the share of water effluents that need to be treated after this process. From the water that is still used, 97% of it is recycled to be used again in several production

cycles. Meanwhile, a water harvesting system maintains and improves the quality of the groundwater at the production facility.

- The installation of renewable energy sources that partly power the production facility. This includes a 5MW pilot with solar panels and biomass briquettes for boilers. Through switching to LED lighting and installing power monitoring units across the facility they have reduced any potential leakages and improved efficiency of energy use. Calculations done by Pratibha Syntex point towards energy savings equivalent to the annual consumption of 3500 households for their operations in the period between 2016 and 2019. The shift from diesel fuel to biomass briquettes for boilers has also resulted in a significant decrease in the scope of greenhouse gas emissions.
- A shift towards regenerative agriculture that was kicked off in 2018, by partnering with farmers, civil society and brands. The latter have invested together with Pratibha Syntex and committed to a buy back of the production. This has remarkably changed the landscape of agriculture, changing a culture of mono-cropping to multi and intercropping, which balances nutrient extraction from the soil and improves its health.

This complex and adaptive approach towards sustainable and circular operations has evidenced increased resilience for the organisation through:

- Business diversification as the company is also now working closely with the food value chain, through non-cotton produce such as wheat, corn, turmeric and soya, resulting from regenerative agriculture practices.
- Reduced dependence on scarce resources and decoupling from finite resource use through a robust self-land system that allows them to safeguard their supplies through internal resources. These resources include recycled water and renewable energy supplies at the production facility, as well as land with improved soil health.

- Improved performance of workers has been observed through flexibility, innovation and continuous learning embedded within the company culture.






Further, at an individual level it has contributed to enhanced resilience through:

- Diversified and increased income sources for the estimated 1000 farmers currently connected through the regenerative agriculture initiative. On one hand, by growing ~25 different crops, the impact of a crisis or failure of a crop is lessened. This diversity also increases the amount of transactions that the farmers have across the year, as they sell different crops each season.
- Better food security for individuals and communities in rural areas where the crops are grown, due to increased soil health and improved animal welfare.
- Continuous learning and R&D opportunities have enhanced the possibilities of acquiring new skills for manufacturing workers, while fostering a flexible and growth mindset.

CASE 2

REDUCING VULNERABILITY THROUGH ORGANIC WASTE MANAGEMENT IN QUITO, ECUADOR

RESILIENCE STRATEGIES

-  **Manage diversity and redundancy**
-  **Manage slow variables and control feedback loops**
-  **Broaden citizen participation**
-  **Promote polycentric governance**
-  **Encourage learning**

CIRCULAR ECONOMY TRENDS

- **Resource efficiency**
- **Regenerative resources**
- **Decentralisation**

As the capital of Ecuador, Quito counts almost 3 million inhabitants. The city is nested in the high altitude Andes mountains. With this comes accessibility and infrastructure challenges, exposure to natural hazards, as well as a wealth of natural resources and biodiversity hotspots directly surrounding the city. Quito is part of the Global Resilient Cities Network, and has, with the support of the network, developed an urban Resilience Strategy, which specifically includes circular economy development.

The resilience strategy is built on five pillars (subsystems) that are interdependent: social systems and the citizen participation system; ecosystems and natural resources; technical systems (e.g. mobility system, building production system); economy (e.g. food systems, production systems) and risk management. The crux of building resilience is addressing them in a systemic and holistic way. As such, the circular economy is explicitly addressed in the economy pillar, yet pertains to all other pillars as well.

All activities contributing to the circular economy are designed to increase the urban resilience of Quito. One of the most prominent resilience strategies with regards to the circular economy is

to broaden citizen participation, which has proven especially important in contexts where most of the population lives in informality. As a result of participatory planning efforts of the Municipality, neighbourhood leaders are prepared to lead and able to plan in a participatory fashion for the development of their barrios (neighbourhoods) under a resilience lens. This helps create social cohesion, self-governing structures, while also helps to close the gap between the Municipality of Quito and communities. This also amplifies the capacity of the city to manage different situations. For example, when the Coronavirus crisis struck the city of Quito, the Municipality was able to learn and better understand where and how to better help the most needed.

The Municipality has also identified slow variables to keep track of structural changes in the city, which evolve over long time scales. With regards to the food system, for example, it monitors the food literacy of people to positively impact eating habits and overall health of the population.

Here are a handful of examples on how the circular transformation of the production and waste management system is organised to increase urban resilience:

- The city has set up “EcoCentre” pilots, which are localised participatory organic waste treatment locations based in the local neighbourhood. They produce fertiliser and teach the population how to do this, building social capital in the community.
- A pilot project in an industrial area in the city aims to reduce its environmental footprint and degradation, while improving co-habitability with dwellers in its surroundings. Communities were brought together with their neighbouring industries to analyse their waste flows and identify opportunities to recover value, which can be taken on by university students and entrepreneurs.
- Urban farming is based on participatory and decentralised processes where local, fresh and organic produce is made available for urban

farmers’ families and organic waste is fed back into the production system. As part of this program the city supports 1600 farmers, where 80% of them are women head of family or helps provide economic independence from their husbands.

The examples above highlight how the circular economy and resilience are mutually reinforcing strategies in the context of a city too.

Pursuing a more circular economy in Quito has so far resulted in:

- Job creation, as a result of neighbourhood level waste management activities and which increases human and social capital.
- Stronger local production systems, as a result of locally embedded research and development around regenerative and secondary resources and which increases innovation power.
- Reduced degradation of the environment, as a result for the reduced amount of waste that is sent to landfill and which brings about health benefits and reduces the pressure on an already overwhelmed waste collection system.

As such, circular economy strategies address some of the chronic stressors that increase the vulnerability of the population. This outcome is important since risk is configured by natural or manmade hazards that cause catastrophes, while the vulnerability impedes people to be better prepared and recover faster.

Overall, pursuing a more circular economy in Quito can go hand in hand with increasing the city’s resilience. The circular economy helps production systems work better and reduces vulnerabilities, ergo, builds resilience.



CASE 3

LOCALISING MANUFACTURING FOR REPAIR IN THE PORT OF ROTTERDAM, NETHERLANDS

RESILIENCE STRATEGIES

- **Manage diversity and redundancy**
- **Manage connectivity**

CIRCULAR ECONOMY TRENDS

- **Alternative/Regenerated resources**
- **Resource efficiency**
- **Shared resources**
- **Decentralisation**

The maritime industry is key in most of today's economic and industry dynamics, with 11 billion tons of cargo shipped internationally in 2018 and a global fleet of 95,402 ships.⁵⁶ The Port of Rotterdam is the largest port in Europe and the 10th largest port in the world. It is home to large industrial and maritime clusters. Each year 29,491 sea-going vessels and 100,000 inland vessels⁵⁷ make their way through the port, regularly needing repairs, maintenance and replacement of parts with spare ones. These are usually sourced from manufacturers upstream the value chain, leading to longer lead times for delivery of spare parts, and many times increased material use and inventory stocking at the supplier due to misalignments between supply and demand.

While trying to address on-demand maintenance and repairs while reducing material use, the Port of Rotterdam, together with partners InnovationQuarter and RDM Makerspace, started RAMLAB⁵⁸ in 2016. The initiative aims to provide manufacturing services for on demand certified metal parts to end-users, across some of the 25 partner organisations of the initiative. This is done through additive manufacturing, made possible with 3D printing techniques, a process where objects are created using 3D modelling and layering materials upon each other to achieve the desired forms.⁵⁹ Additive manufacturing allows for working with a variety of materials such as metals, plastics, clay, glass and concrete.

Due to its focus on shipping, the RAMLAB provides Wire Arc Additive Manufacturing services, a technique which creates metal tailor-made objects through 3D scanning of the damaged part, a robotic welding system and additive toolpath generation software. This technology allows for the production of spare parts for repairs at site, whenever they are needed.

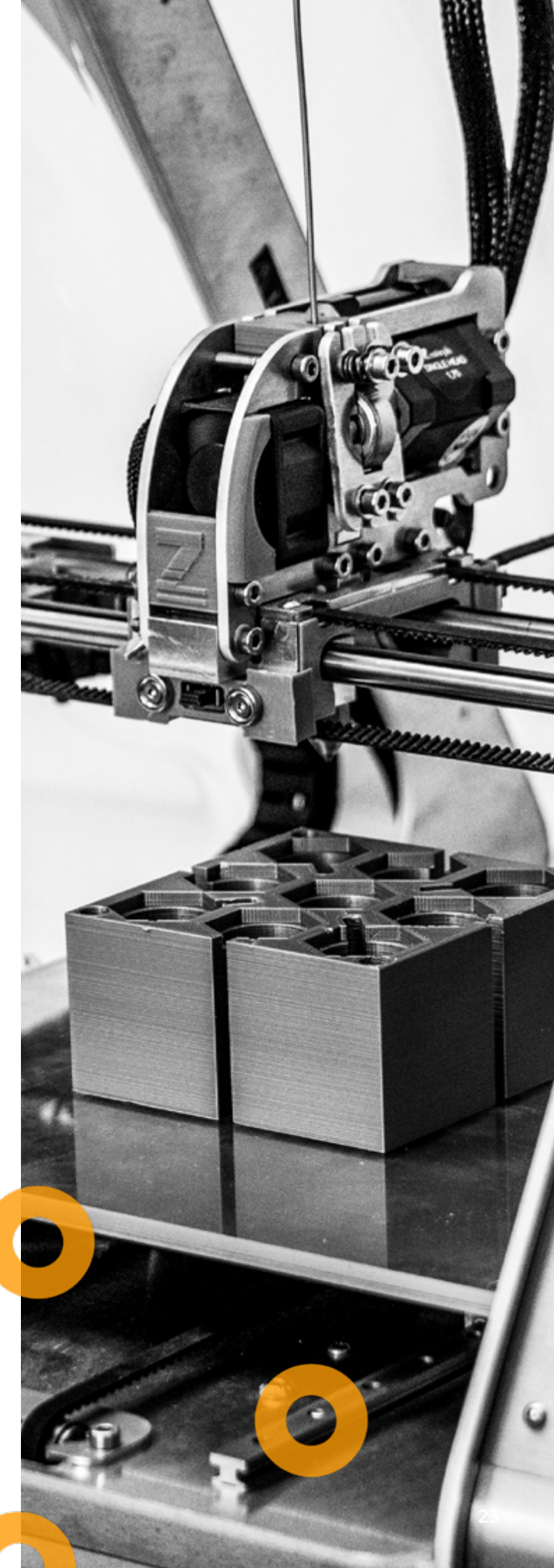
The RAMLAB therefore supports the circular economy in the following ways:

- Repair and maintenance of the ships and their components, even if these were not initially designed for repair.
- Producing on demand spare parts reduces costs in material used per part as well as in reduction of stock levels for spare parts.
- Establishing a manufacturing-as-a-service business model makes efficient use of facilities, as it allows for on demand access to joint facilities.

This type of manufacturing at RAMLAB could also potentially provide an alternative to raw material sourcing, by enabling the possibility to use secondary feedstock as input for the processes. Nevertheless the availability of durable materials with high reuse value for additive manufacturing is still an issue.⁶⁰

In turn, these circular strategies are supporting resilience building for the port businesses and community as they enable:

- Localised manufacturing for spare elements for repairs, hence, building resilience against potential shocks or disruptions in other parts of this manufacturing supply chain upstream.
- Shared use of facilities, where research and investment efforts are split, thereby reducing financial risks for the individual organisations, while at the same time encouraging collaboration and inter-organisational learning.
- The future use of secondary raw materials available locally instead of only depending on the sourcing of virgin non-renewable resources.



CONCLUSION

There are a multitude of synergies between resilience thinking and the circle economy, but in certain cases, a delicate balance must be struck. Not all circular economy trends will deliver on the principles of social-ecological resilience.

Several circular economy trends increase resilience. In cycling resources, the circular economy increases resilience by increasing the diversity of feedstocks; in sharing resources, it increases resilience through localised management and participation of stakeholders; and decentralised activities and infrastructure increase resilience by bringing governance bodies closer to communities, enhancing broader participation and moving away from the hyperspecialization that characterises the linear economy.

There are also labour market characteristics that are necessary for the circular economy to flourish, which also concurrently increase social-ecological resilience. In requiring ample skills transferability, the circular economy could increase the labour market's recovery in times of crises of shocks. In supporting lifelong learning, individuals and companies can quickly develop solutions, experiment and be less at risk of job-loss.

However, there are potential trade-offs between circularity and resilience. In propagating resource efficiency, the circular economy could design out the excessive extraction of primary materials, however, this should be considered in balance with resilience. And whereas flexible labour contracts could also increase how businesses can respond to change in agile and flexible ways as part of a circular economy, labour contracts should be shaped to be as supportive as possible for workers to not increase individual vulnerability.

Lastly, the circular economy's economic and environmental focus has led to a lack of sociological foundation. In implementing circular solutions, social consequences - especially those that manifest slowly - are often not aptly addressed. But as we accelerate the transition, there is a need to strengthen this foundation of the circular economy. An example here could be integrating considerations around company culture or employee habits in circular economy monitoring systems.

As we continue to navigate uncertain times, reshaping our systems to be resilient to ongoing and future shocks is imperative. This paper spotlights the need to carefully evaluate how circular economy trends and resilience thinking will impact one another in practice and measure individual circular economy trends to the resilience of the social-ecological system. It also illustrates which circular economy strategies contribute to greater resilience and which on the other hand warrant caution, the potential of marrying the circular economy transition with resilience principles in working toward a more just and equitable society, thereby highlighting the need to integrate the two across circular economy blueprints such as the EU's Circular Economy Action Plan. Essentially, applying resilience thinking to shape the transition towards circularity may be the optimal approach to ensure this new economic paradigm creates positive value for both society and planet.⁵⁶

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