ORGANISING FOR A CIRCULAR ECONOMY AND SOCIETY

THE ROLE OF THIRD SECTOR ORGANISATIONAL FORMS



WIM VAN OPSTAL

Propositions belonging to the thesis

"Organising for a Circular Economy and Society. The Role of Third Sector Organisational Forms."

Wim Van Opstal

1. Institutional quality is the foundation of circular adoption for durable goods.

2. Neglecting just transition principles in the circular economy leads to a Matthew effect.

3. A circular transition must avoid transforming waste into rubbish.

4. Mission-driven identities may generate a Life of Brian problem, undermining collaboration and the achievement of collective goals.

5. Circular business models cannot presume a uniform understanding of environmental benefits across generations.

6. Both supporting and formalising the informal circular economy may harm a just transition.

7. Repair is not just a service, it is a social practice rooted in justice, identity, and care.

8. Circularity comes with a risk premium, but trust can provide a 'discount'.

9. The circular economy literally requires game-changing governance.

10. Industry experience can be a double-edged sword for circular entrepreneurship.

11. The near absence of the French horn in jazz is a self-reinforcing missing market.

Organising for a Circular Economy and Society.

The Role of Third Sector Organisational Forms.

Wim Van Opstal

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ORGANISING FOR A CIRCULAR ECONOMY AND SOCIETY.

The Role of Third Sector Organisational Forms.

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For my children, Quinten, Elke, and Noor

Preface

The *circular economy* is an economic system that reduces, reuses, recycles and recovers materials across production, distribution, and consumption. To advance sustainable development, the circular economy requires a *circular society*, which embeds equity, participation and recognition in how resources and responsibilities are organised. A circular economy and society therefore call for rethinking not only how products are designed, used and brought to end of life, but also how the enabling activities are organised. Governments often lead where large-scale infrastructure, regulatory authority, or universal service provision is essential – for example municipal waste management or public procurement for circular construction. Firms play a central role where innovation, economies of scale, and market competitiveness drive progress – for example in developing reusable packaging systems or remanufacturing technologies.

Beyond this state-firm dichotomy lies a 'third sector' of organisational forms. Social enterprises, cooperatives, and non-profit associations step in where markets and states leave gaps, or where combining environmental and social objectives requires alternative governance models. Although the role of third sector organisations has been widely studied in the provision of social services and in the energy transition, their role and potential within the circular economy remain largely underexplored.

This research focuses on the governance of a circular economy and society through the lens of third sector organisational forms. It investigates their potential to address market failures, relational complexities, and justice considerations, as well as the factors that enable or constrain their contributions. Central questions include: how do these organisational forms mobilise their organisational comparative advantages to combine environmental effectiveness, social inclusion, and economic viability? Under what institutional conditions can their contributions be scaled and sustained? And how can their diversity be leveraged for systemic change?

My interest in these questions stems from a long-standing fascination with how organisational design influences the ability to cooperate and address societal challenges. Professional experiences working with governments, firms, and third-sector organisations has shown me not only the diversity of their dynamics and responses, but also the systemic blind spots in how their contributions to society are recognised, valued, and supported.

The empirical core of this thesis consists of seven published studies, each analysing different aspects of how civil society associations, cooperatives, and social enterprises contribute to circular practices in industrialised contexts. They are complemented by a perspectives paper that develops a broader conceptual argument on organisational

diversity in circular transitions. Together, these eight studies contribute to a more comprehensive understanding of how third-sector organisational forms can internalise social and environmental externalities more effectively than many private firms or public agencies, while also illuminating why they often operate below their potential due to structural financing gaps, coordination failures, and limited policy recognition.

A key contribution of this work is to demonstrate how organisational diversity, when supported by enabling governance and policy frameworks, can enhance the resilience, inclusivity, and effectiveness of circular transitions. My hope is that the insights from this research will not only inform academic debates, but also inspire policymakers, practitioners, and civil society leaders to recognise and connect the distinctive strengths of diverse organisational forms in building a just and sustainable circular economy and society.

Acknowledgements

This journey began over 25 years ago, when two of my undergraduate professors, Guido Van Rompuy and Paul Verheyen, first encouraged me to consider pursuing a PhD. During my graduate studies, I found further inspiration in the work and teaching of Erik Schokkaert and Frans Spinnewyn, who taught me to appreciate the deep intellectual joy and meaning of academic work. Yet, life took me in other directions, and I chose different paths – into applied research, education, and policy work. Two decades later, this long-delayed ambition returned to the foreground.

In 2020, I joined the Flemish Institute for Technological Research (VITO) and entered the field of the circular economy and circular business models. With a background in social policy and in social and cooperative entrepreneurship, it was not difficult to find interesting cross-links with this emerging domain. Not being hired as a PhD student, but as a regular R&D researcher, I was positively surprised to see my colleague, Lize Borms, combine her R&D work with a PhD trajectory. Not long after later, Peter Vercaemst – our unit manager at the time – gave me a gentle nudge to consider following a similar path. Encouraged by the explicit support of my life partner and my program manager, I cautiously began to explore the possibility. Through a collaboration with Lars Strupeit at that time, I was fortunate to be introduced to Nancy Bocken – who generously took on the role of promotor and with whom I have had the privilege to work ever since. Jan Brusselaers kindly agreed to take on the role of co-promotor.

Nancy, thank you for your support, trust, and insightful feedback throughout this journey. From our very first conversation about a PhD trajectory, you encouraged me to identify a unifying thread across my diverse research ideas, enabling me to connect past experiences and expertise with the emerging field of the circular economy. Your combination of inspiration, speed, interactivity, pragmatism, and commitment to both impact and rigour turned out to be an ideal match. I am also grateful to my co-promotor, Jan Brusselaers, whose keen and complementary perspective further supported the precision of this work.

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I thank VITO, my employer, for providing a dynamic and intellectually stimulating research environment. Although I wrote this PhD in my spare time, I gratefully acknowledge the funding that enabled the collection of empirical data across several research projects – made possible through the support of the Research Foundation Flanders (FWO), the European Union's Horizon 2020 programme, the Urban Innovative Actions programme, and VLAIO.

More importantly, I want to thank the many colleagues from VITO, the Maastricht Sustainability Institute, and the wider academic community with whom I have had the privilege to collaborate. Alexej, An, Andrea, Andreea, Ankita, Anse, Ässia, Astrid, Burcu, Christina, Dani, Deanna, Dirk, Emma, Esther, Eva, Giacomo, Ive, Jana, Jeroen, Jos, Karolien, Lars, Laura, Lize, Marco, Margot, Marko, Pili, Roger, Saskia, Stefanie, Tim, Tom, Tom, Trudo, Vivian, Wim, and Yoko. Thank you for your collaboration, your thoughtful discussions, and your role in refining my thinking. I am especially grateful for how you challenged me to grow as a researcher, tolerated my mostly straightforward approach, and helped refine the thinking that underpins this thesis.

To my parents, Paul and Lena, thank you for your unconditional support and belief in me, no matter where life took me. Although you did not have the opportunity to pursue higher education yourselves, you did everything you could to make sure I could. From you, I learned to approach whatever I do with care and dedication – and to do it well. I also learned to stay grounded, and to explain things in a no-nonsense, straightforward way.

To my life partner, Natalja, a deep and sincere thank you – not only for letting me walk this path, even when it meant sacrificing precious time together, but for encouraging me to pursue it in the first place. You understood – perhaps better than anyone – that I was genuinely enjoying the process of writing during evenings, nights, and weekends. Your support, patience, and belief in me have been invaluable throughout this journey. Our daily walks to the Abbey of Tongerlo offered both connection and inspiration.

And finally, I dedicate this work to my children – Quinten, Elke, and Noor. I hope that my unconventional academic journey may inspire you to keep going, to keep learning, and to continue looking at this wonderful world with curiosity and care – contributing in your own way to making it a better place. You have reminded me every day of what truly matters, and for whom a better future is worth striving toward. All three of you make me very proud.

Outside of research, I am a French horn player. Although I often play the lead, the horn is fundamentally a section instrument. It relies on careful listening, mutual trust, and shared responsibility, where every voice counts. This PhD, too, was an effort in many voices. To all who helped carry and shape this work, named or unnamed, thank you for being part of the ensemble.

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List of Abbreviations

AC	Alternating Current
ARCH	Adaptive Reuse of Cultural Heritage
BMS	Battery Management System
CAPEX	Capital Expenditures
CBM	Circular Business Model
CE	Circular Economy
CEAP	Circular Economy Action Plan
CGE	Computable General Equilibrium
CHP	Combined Heath Power
CS	Circular Society
CSA	Civil Society Association
DC	Direct Current
DSM	Demand Side Management
DSO	Distribution System Operator
EESC	European Economic and Social Committee
EIB	European Investment Bank
EMS	Energy Management System
ESG	Environmental, Social and Governance
EV	Electrical Vehicle
FTE	Full-Time Equivalent
HVAC	Heating, Ventilation, and Air Conditioning
ICA	International Cooperative Alliance
ICF	International Classification of Functioning, Disability, and Health
ILO	International Labour Organisation
IRENA	International Renewable Energy Agency
KPI	Key Performance Indicator
NEET	Not in Education, Employment or Training
OECD	Organisation for Economic Co-operation and Development
OLS	Ordinary Least Squares
OPEX	Operational expenditures
PSS	Product-Service System
PV	Photovoltaics
REScoop	Renewable energy source cooperatives
RQ	Research Question
RREUSE	Reuse and Recycling European Union Social Enterprises Network
S-LCA	Social Life Cycle Assessment
SDG	Sustainable Development Goal
SEAP	Social Economy Action Plan
SME	Small and Medium-sized Enterprise
TCO	Total Cost of Ownership

TSO	Transmission System Operator
UIA	Urban Innovative Actions
UNEP	United Nations Environment Program
VDAB	Vlaamse Dienst voor Arbeidsbemiddeling en Beroepsopleiding
VAT	Value-Added Tax
VIF	Variance Inflation Factor
WISE	Work Integration Social Enterprise

Summary

This thesis examines the role of third sector organisational forms – social enterprises, cooperatives, and non-profit associations – in enabling a just transition to a circular economy. These organisations are particularly relevant to research on both the circular economy and a circular society because they pursue purpose over profit and create value through participatory governance structures. They thus offer distinctive approaches to organising production and consumption that complement market- and state-led strategies. The thesis responds to the gap in scholarship and policy understanding of how these organisations can address market failures, govern relational complexities, and integrate justice considerations into circular strategies. While the circular economy is often framed through the actions of governments and firms, this research demonstrates that the third sector occupies a distinctive and under-recognised position in bridging economic, environmental, and social objectives.

The study builds on multiple empirical studies and comparative analyses, exploring how organisational form choice influences the ability to enable and embed circular goals and outcomes. It shows that third sector organisations often have a comparative organisational advantage in internalising externalities, mitigating informational asymmetries, and resolving missing markets. However, their potential is restricted by structural financing constraints, limited policy recognition, and coordination challenges. At the same time, their governance structures – designed to safeguard mission integrity – can foster trust and inclusion, but may also limit their ability to respond quickly to rapidly changing markets.

This research identifies patterns across contexts. In some cases, supportive policy environments have allowed third sector organisations to integrate circular practices into everyday operations; in others, similar organisations have struggled to move beyond pilot initiatives. The thesis analyses these variations through a lens of organisational design, law and economics, and institutional economics, highlighting how comparative advantages can be leveraged when there is alignment between mission, governance, and enabling frameworks.

The key insights of this thesis are organised around three themes. *First*, organisational choice matters: the form, governance, and ownership structure of an organisation affect how it creates and distributes value in a circular economy. *Second*, enabling factors – such as financing, collaborative networks, skills development, and policy recognition – are critical to sustaining and scaling impact. *Third*, diversity in organisational forms offers system-level benefits: when governments, firms, and third sector organisations play to their strengths and collaborate deliberately, their combined impact exceeds what each could achieve alone.

The thesis contributes to academic debates by advancing an organisational perspective on a circular economy and society that integrates governance, economics, and justice considerations. It also offers actionable recommendations for policymakers and practitioners, emphasising the need to make organisational design and choice a deliberate feature of transition strategies rather than a by-product.

Overall, this thesis argues that a fair, resilient, and effective circular transition depends not only on technological innovation and market incentives, but also on recognising, enabling, and connecting the distinctive capacities of diverse organisational forms. Although scaling can be constrained by funding and operational challenges, the participatory way value is created within these organisations positions them to advance a circular economy and, more broadly, a circular society.

Samenvatting

Dit proefschrift onderzoekt de rol van organisatievormen in de derde sector – sociale ondernemingen, coöperaties en verenigingen – bij het mogelijk maken van een rechtvaardige transitie naar een circulaire economie. Deze organisaties zijn relevant voor onderzoek naar zowel de circulaire economie als een circulaire samenleving, omdat zij doel boven winst stellen en waarde creëren via participatieve bestuursvormen. Daarmee bieden zij een alternatief dat markt- en overheidsgestuurde strategieën aanvult. Het werk speelt in op de lacune in zowel de academische literatuur als het beleid omtrent de vraag hoe deze organisaties marktfalingen kunnen aanpakken, omgaan met relationele complexiteit en rechtvaardigheidsoverwegingen kunnen integreren in circulaire strategieën. Hoewel de circulaire economie vaak wordt benaderd vanuit de acties van overheden en bedrijven, toont dit onderzoek aan dat de derde sector een eigen, onderbelichte positie inneemt in het verbinden van economische, ecologische en sociale doelstellingen.

Het onderzoek bouwt voort op meerdere empirische studies en gaat na hoe de organisatievorm invloed heeft op het vermogen om circulaire doelstellingen en resultaten te realiseren en te verankeren. Het toont aan dat organisaties in de derde sector vaak een comparatief organisatorisch voordeel hebben bij het internaliseren van externe effecten, het verkleinen van asymmetrische informatie, en het oplossen van ontbrekende markten. Hun potentieel wordt echter beperkt door structurele financieringsproblemen, beperkte beleidsmatige erkenning en coördinatie-uitdagingen. Tegelijk kunnen hun bestuursstructuren – ontworpen om de missie te bewaken – vertrouwen en inclusie bevorderen, maar ook de wendbaarheid beperken in snel veranderende markten.

Dit onderzoek identificeert patronen over verschillende contexten heen. In sommige gevallen heeft een ondersteunend beleidsklimaat derde sectororganisaties in staat gesteld circulaire praktijken in de dagelijkse werking te integreren; in andere gevallen slaagden vergelijkbare organisaties er niet in verder te geraken dan proefprojecten. Vanuit organisatieontwerp, rechtseconomie en institutionele economie toont het proefschrift hoe comparatieve voordelen kunnen worden benut wanneer missie, bestuur en ondersteunende kaders op elkaar aansluiten.

De belangrijkste inzichten van dit proefschrift zijn gegroepeerd rond drie thema's. Ten eerste: de keuze van de organisatievorm doet ertoe – de structuur, het bestuur en de eigendomsverhoudingen bepalen hoe waarde wordt gecreëerd en verdeeld in een circulaire economie. Ten tweede: randvoorwaarden zoals financiering, samenwerkingsnetwerken, de ontwikkeling van vaardigheden en beleidsmatige erkenning zijn cruciaal voor het bestendigen en opschalen van impact. Ten derde: diversiteit in organisatievormen biedt voordelen op systeemniveau: wanneer

overheden, bedrijven en derde sectororganisaties hun sterktes benutten en bewust samenwerken, is hun gezamenlijke impact groter dan wat elk afzonderlijk kan bereiken.

Dit proefschrift levert een wetenschappelijke bijdrage door de circulaire economie en samenleving te benaderen een organisatieperspectief dat beschouwingen omtrent goed bestuur, economie en rechtvaardigheid integreert. Het bevat ook concrete aanbevelingen voor beleidsmakers en praktijkactoren, met de nadruk op de noodzaak om de keuze en het ontwerp van organisaties als een bewuste component van transitiestrategieën te beschouwen, en niet als een toevallig neveneffect.

Samengevat stelt dit werk dat een rechtvaardige, veerkrachtige en doeltreffende circulaire transitie niet alleen afhankelijk is van technologische innovatie en marktprikkels, maar ook van het erkennen, ondersteunen en verbinden van de unieke capaciteiten van diverse organisatievormen. Hoewel opschaling kan worden belemmerd door financiële en operationele uitdagingen, maakt de participatieve manier waarop deze organisaties waarde creëren hen bijzonder geschikt om niet enkel bij te dragen aan een circulaire economie, maar ook aan een circulaire samenleving.

List of papers included in this thesis

Paper I — Van Opstal, W., Bocken, N. & Brusselaers, J. (2026), Why organisational diversity matters in a circular economy and society. Resources, Conservation & Recycling, 229, 108833. https://doi.org/10.1016/j.resconrec.2026.1088333

Paper II — Van Opstal, W. & Borms, L. (2024), Work Integration Ambitions of Startups in the Circular Economy. Annals of Public and Cooperative Economics 95 (2), 477-504. https://doi.org/10.1111/apce.12431

Paper III — Van Opstal, W., Borms, L., Brusselaers, J., Bocken, N., Pals, E. & Dams, Y. (2024), Towards Sustainable Growth Paths for Work Integration Social Enterprises in the Circular Economy. Journal of Cleaner Production 470. 143296. https://doi.org/10.1016/j.jclepro.2024.143296

Paper IV — Van Opstal, W., Bocken, N. & Brusselaers, J. (2025), Unlocking the social circular economy: value propositions and organisational design of social circular hubs. Business Strategy and the Environment. https://doi.org/10.1002/bse.70138

Paper V — Van Opstal, W., Bocken, N. & Brusselaers, J. (2025), Cooperating for circularity? Perspectives of citizen energy cooperative members on circular solar business models. Journal of Cleaner Production 487. 144653 https://doi.org/10.1016/j.jclepro.2025.144653

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1. Introduction

1.1 Conceptual background

1.1.1 The circular economy and a circular society: institutional and governance dimensions

The *circular economy* (CE) is commonly defined as an economic system that minimises waste and resource use by reducing, reusing, recycling, and recovering materials across production, distribution, and consumption (Kirchherr et al., 2017). It seeks to decouple economic activity from the consumption of finite resources and to design systems that maintain material value for as long as possible (Geissdoerfer et al., 2017a). A CE entails the deliberate design of industrial and societal systems that narrow, slow, close, and regenerate material and energy flows (Konietzko et al., 2020).

Yet when conceived mainly in technical or economic terms, the concept of a CE only partly captures the broader societal transformation required for sustainability. The complementary notion of a *circular society* extends the focus beyond resource efficiency to include social relations, governance processes, and justice dimensions. It emphasises that circular transitions must ensure equity, participation, and recognition in how resources and responsibilities are organised (Calisto Friant et al., 2023; Jaeger-Erben et al., 2021). A circular society thus embeds the circular economy within a wider social and institutional context, acknowledging that social innovation, citizen engagement, and shared value creation are essential conditions for systemic change.

An institutional perspective provides a useful lens to analyse how circular economy and circular society concepts emerge and evolve (Bocken & Coffay, n.d.; Bocken & Shirahada, 2025). Scott (1995) conceptualises institutions as comprising three interrelated pillars: regulative, normative, and cultural-cognitive. The regulative pillar refers to formal rules, laws, and enforcement mechanisms. The normative pillar encompasses social values, norms, and expectations about appropriate conduct. The cultural-cognitive pillar represents the shared understandings and taken-for-granted beliefs that shape perception and action. Together, these pillars influence how organisations and actors interpret and implement a circular economy and society.

At the European level, the regulative pillar has evolved through successive policy frameworks that formalised circular ambitions. The *EU Circular Economy Action Plan* (EC, 2015) and its update under the *European Green Deal* (EC, 2021a) embed circularity across product design, sustainable consumption, waste prevention, and industrial policy. Normatively, circularity has become linked to European values of sustainability, competitiveness, and social inclusion (EEA, 2024a). The cultural-cognitive dimension is

reflected in the growing perception that linear models are no longer viable, and that circularity has become a societal norm (EEA, 2024a; Ranta et al., 2018). In recent years, however, policy discourse has reframed circularity as a driver for industrial resilience and strategic autonomy. Initiatives such as the *Clean Industrial Deal* (EC, 2025b) and the *Competitiveness Compass* (EC, 2025a) position resource efficiency and material security in circular value chains as prerequisites for competitiveness and decarbonisation. This evolution signals a shift in emphasis from environmental governance towards industrial and geopolitical priorities (EC, 2023).

While these developments share a common policy foundation, implementation across Europe remains uneven. The Circular Economy Monitoring Framework (Eurostat, 2025) reveals clear geographical differences: northern and western Member States, including Belgium and the Netherlands perform strongest in implementing circular strategies (Claudio-Quiroga & Poza, 2024; D'Adamo, Favari, et al., 2024). Although this framework does not cover the full spectrum of circular practices it nonetheless confirms that the region examined in this thesis, Flanders (Belgium), can be considered as a frontrunner region. The regulative pillar is expressed in the launch of Circular Flanders in 2017, a partnership coordinated by OVAM (the Public Waste Agency of Flanders) that aligns government, industry, and research partners under a shared vision to achieve a circular economy by 2050 (Government of Flanders, 2020a). Circularity has since become embedded in the Flemish sustainability agenda and is framed in terms of innovation, competitiveness, material independence, and (social) employment opportunities (ETC CE, 2025b; Versluys et al., 2021). Yet tensions remain between ambition and outcome. For example, household waste per inhabitant decreased from 522 kg in 2013 to 416 kg in 2022, and the recycling rate (excluding construction and demolition waste) reached 65.6% in 2022 (CE Center, 2025). Conversely, material productivity has remained constant over recent years, and total raw material input increased from 500 to 562 million tons between 2012 and 2021 (CE Center, 2025).

The interaction between regulative frameworks, normative expectations, and cultural-cognitive understandings does not unfold automatically. It depends on how policy objectives, market incentives, and organisational practices are aligned across European, national, and regional contexts. The circular transition therefore constitutes a *governance* challenge. Governance refers to collective attempts to steer society and the economy towards common objectives through institutionalised interaction among public, private, and civil society actors (Torfing et al., 2012). *Hierarchical governance* relies on authoritative rule-making and formal enforcement by public authorities, as illustrated by binding waste directives and eco-design regulations. *Market governance* coordinates behaviour through price mechanisms and economic incentives, such as extended producer responsibility schemes, deposit-refund systems, and tradable permits. *Corporate governance* concerns internal systems of accountability and control within firms, for example when companies integrate circular targets into board-level strategy and reporting structures. Within the broader field of interactive governance,

collaborative governance refers more specifically to formal, consensus-oriented and deliberative processes in which public authorities directly engage non-state stakeholders in collective decision-making (Ansell & Gash, 2008). These governance logics coexist and interact in circular transitions, shaping the distribution of authority, the design of incentives, and the organisation of participation.

Despite the embedding of circular economy objectives across regulative, normative, and cultural-cognitive pillars at European level, a substantial part of circular economy scholarship still reflects a predominantly techno-managerial and market-corrective framing. Strong attention goes to eco-design, resource efficiency, innovation incentives, and regulatory alignment, and firms and public authorities are considered as the primary actors (Geissdoerfer et al., 2017a; Kirchherr et al., 2017). This orientation leaves both an empirical and a theoretical gap that matters for both effectiveness and legitimacy. Empirically, it underexplores the diversity of organisational forms and governance arrangements that mediate circular transitions in practice. Theoretically, it tends to treat governance as either hierarchical regulation or market coordination, while giving limited attention to how alternative governance logics structure participation, allocate control rights, and shape legitimacy in a circular economy and society. By focusing primarily on technologies, business models, and policy instruments, dominant approaches risk overlooking how institutional and governance configurations condition both the effectiveness and the societal acceptance of circular transitions.

1.1.2 Why organisational diversity matters in a circular economy and society

Based on:

Van Opstal, W., Bocken, N. & Brusselaers, J. (2026), Why organisational diversity matters in a circular economy and society. Resources, Conservation & Recycling, 229, 108833. https://doi.org/10.1016/j.resconrec.2026.1088333 [Paper I]

While regulative, normative, and cultural-cognitive pillars jointly define the institutional environment for a circular economy and society, much of the academic and policy discourse remains centred on governments and firms. This focus reflects hierarchical and market governance frameworks in which public authorities regulate and firms respond to price signals. Such a framing overlooks the wider set of organisational forms that shape how circular transitions are implemented in practice. A circular society depends on the interaction between multiple institutional logics and organisational forms operating beyond a firm-state binary.

This calls for closer attention to organisations in the *third sector* – civil society organisations located between market and state, including non-governmental and voluntary organisations (Evers & Laville, 2004). These organisational forms typically[1] involve cooperatives, non-profit associations, and social enterprises. Each form embodies distinct ownership structures, control rights, incentive systems, and decision-making procedures. In governance terms, they introduce alternative ways of structuring authority, participation, and accountability that complement hierarchical regulation and market coordination. This resonates with Mintzberg's (2015) argument that a healthy society requires a strong "plural sector" alongside public and private sectors. While the third sector is typically defined in institutional and legal terms, Mintzberg emphasises the distinct organising principles of community affiliation, collective ownership, and shared purpose that characterise this sphere. He argues that problems arise when market logics are imposed on organisations rooted in such plural principles (Mintzberg, 2015; Mintzberg & Neamtan, 2015). Recognising these differentiated logics reinforces the importance of organisational diversity in shaping a circular economy and society.

Several arguments support this claim. First, the transition towards a CE faces market failures – externalities, information asymmetries, split incentives, and transaction costs – that neither firms nor states can always address efficiently (Grafström & Aasma, 2021; Siderius & Zink, 2023)[2]. Second, calls for a "circular society" (Jaeger-Erben et al., 2021) and a "just circular economy" (Kirchherr, 2021) emphasise the need to integrate equity, participation, and recognition. Third, circularity does not only alter production processes and value chains; it reconfigures social institutions and governance mechanisms that structure economic interaction. It relies on novel but long-term relationships: between producers and users, across generations, and between formal and informal sectors. These require capacities to relate, resonate, and responsibilise (Jaeger-Erben et al., 2025), which are unevenly distributed across organisational forms.

Organisational forms are institutional arrangements through which economic activities are structured, governed, and legitimated (Ben-Ner, 2018). They comprise rules and norms governing ownership, accountability, control rights, incentive structures, and

[1] Other third-sector forms include foundations and mutualities. In European typologies they are core components of the third sector (alongside non-profit associations, cooperatives, and social enterprises), but in the context of a circular economy they appear mainly as indirect enablers rather than operational actors. Foundations tend to fund, convene and diffuse knowledge (e.g., the Ellen MacArthur Foundation) – rather than deliver circular services themselves. Mutualities are health-insurance bodies whose statutory remit lies outside circular economy activities.

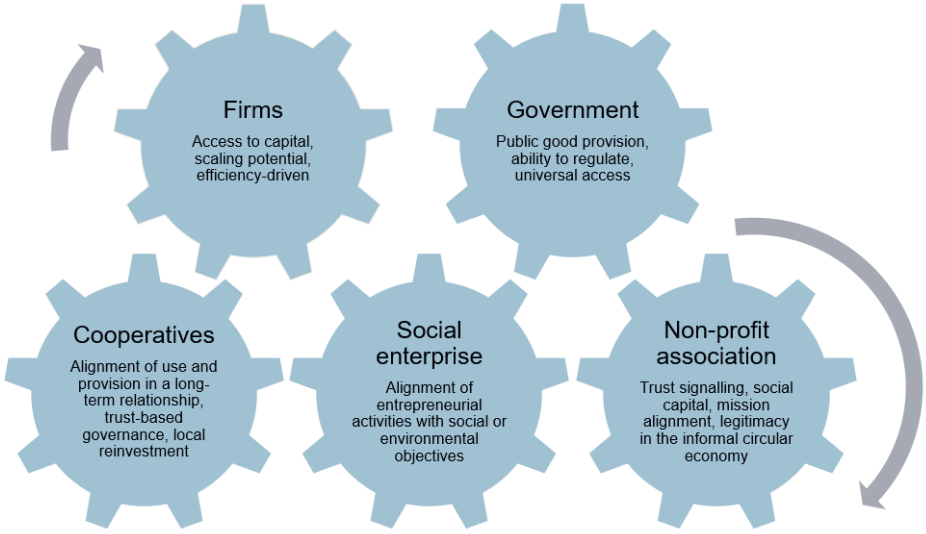
[2] Innovation and transition scholarship has broadened the failure rationale beyond market failures to include structural system failures and transformational failures. Systems failure approaches emphasise weak networks, institutional misalignment, capability gaps, and lock-in dynamics within innovation systems (Bergek et al., 2008; Bleda & del Río, 2013). Transformational failure frameworks further highlight problems of directionality, demand articulation, policy coordination, and reflexivity in sustainability transitions (Schot & Steinmueller, 2018; Weber & Rohracher, 2012). While these perspectives offer important insights for circular transitions, the present thesis focuses primarily on how organisational forms mediate coordination, incentive, and justice challenges within such broader systemic contexts.

decision-making. These structural features influence how organisations respond to market failures, coordinate under uncertainty, and balance economic and social objectives. Literature on hybrid organisations has focused on purpose hybridity, examining how organisations combine social and commercial missions (Alter, 2007). These frameworks describe organisational forms along a spectrum between social value creation and financial return. However, purpose alone does not capture *how* governance structures and ownership arrangements condition behaviour.

Despite this, circular economy governance research often treats organisational arrangements as secondary to policy design and market incentives. Firms and public authorities are typically positioned as the central actors, while variation in ownership structures, control rights, and accountability mechanisms receives limited systematic analysis. This orientation implicitly assumes that once regulation and market incentives align, organisations will respond in broadly similar ways. Such an assumption overlooks that organisational form structures incentives, risk allocation, and participation differently across contexts (Ben-Ner, 2018; Mintzberg, 2015; Scott, 1995). Without a comparative perspective on organisational forms, barriers to circular implementation may be interpreted as temporary coordination problems, even when they arise from the underlying allocation of ownership, control rights, and incentives.

This thesis therefore treats organisational diversity as a core analytical concern in understanding circular transitions. It examines how different organisational forms mediate market failures, relational coordination challenges, and justice considerations that frequently arise in implementing circular strategies (Grafström & Aasma, 2021; Siderius & Zink, 2023). It conceptualises organisational forms not merely as carriers of circular strategies, but as institutional instruments with distinct comparative advantages in enabling and embedding a circular economy and society. We propose a complementary perspective that considers the distinct comparative advantages or organisational forms in enabling and embedding a circular economy and society, as summarised in Figure 1.

Investor-owned firms benefit from clearly defined property rights, access to capital markets, and incentives aligned with profit and efficiency. These features support innovation and scaling and can drive CE adoption when aligned with regulation and consumer demand, for example through remanufacturing, product-as-a-service models, or take-back schemes in manufacturing and retail sectors. However, these same features often discourage investment in durability, repairability, or reuse – especially when returns accrue to others (Grafström & Aasma, 2021; Siderius & Zink, 2023). Profit imperatives can lead to cost externalisation, and firms may struggle with trust-building, community alignment, or collective action when returns are diffuse or uncertain.



Source: author's own elaboration

Figure 1 – Comparative organisational advantages in addressing challenges towards a circular economy and society

Governments possess the authority and resources to enforce regulation, redistribute benefits, and provide public goods. They can correct market failures through standards, coordination, and subsidies, and enable innovation by temporally sheltering promising circular initiatives from market pressures or investing in high-risk, high-potential solutions. Examples include regulatory frameworks such as the the EU Circular Economy Action Plan (EEA, 2024a), municipal support for repair cafés and the provision of semi-public goods such as waste management. However, governments often suffer from bureaucratic rigidity and limited responsiveness to decentralised CE initiatives. State-led interventions may also lack participatory mechanisms to build trust and engage communities.

Cooperatives represent an alternative organisational form that embeds participatory and member-based governance within enterprise structures. The International Co-operative Alliance defines a cooperative as "*an autonomous association of persons united voluntarily to meet their common economic, social and cultural needs and aspirations through a jointly owned and democratically controlled enterprise*" (ICA, 1995). Cooperative governance aligns users and producers through shared ownership and democratic control. Such arrangements can internalise trust, reduce transaction costs, and enable self-enforced agreements through repeated interaction (Hansmann, 1999; Spear, 2000). Shared ownership and voluntary engagement enhance social acceptance, reduce asymmetric information, and embed circularity in locally rooted infrastructures – as seen in many renewable energy source cooperatives. However, democratic governance increases decision-making costs and may lead to free-riding or

demutualisation, especially with growing or heterogeneous membership. Access to capital is also constrained by limits on profit distribution, and cooperatives often lack cognitive and normative legitimacy in regulatory and financial systems (Novkovic, 2022).

Non-profit associations are typically defined as organised, private, self-governing and non-profit-distributing entities with a meaningful degree of voluntary participation (Salamon & Anheier, 1997). Across the world, they are mostly recognised as voluntary associations formed to pursue public-benefit or mutual-benefit aims under the freedom of association, with a legal non-distribution constraint that prohibits the allocation of surplus to founders, members or directors. Non-profit associations benefit from a non-distribution constraint, ensuring that all income and assets serve the organisational mission (Helmig et al., 2004). This reduces profit-maximisation incentives, mitigates agency problems, and signals trustworthiness – attracting mission-oriented agents and enabling long-term engagement. These traits enable them to address externalities, engage volunteers, and support collective action. Beyond filling institutional gaps, non-profits reconfigure governance by mobilising trust, reciprocity, and identity, especially when market signals fail to reflect social value. In informal repair and reuse economies, non-profit associations can legitimise marginalised actors, diffuse learning, and amplify political voice through translocal networks. However, they face constraints. They often rely on volunteer labour, project-based funding, and mission legitimacy, which can limit scalability, continuity, and responsiveness to changing societal demands. Internal governance structures may also reproduce exclusionary norms or paternalistic dynamics, undermining their inclusive potential.

Social enterprises can be defined as organisations that pursue a social mission through entrepreneurial means, combining market-oriented activities with explicit social or environmental goals (European Commission, 2020c). Social enterprises illustrate hybrid organisations combining entrepreneurial activity with social objectives. Positioned between markets and public support, they seek to generate positive externalities (Santos, 2012), such as employment for people distant from the labour market – as in Work Integration Social Enterprises (WISEs) – or the provision of affordable repair and reuse services. WISEs frequently engage in repair, reuse, and recycling, combining ecological and social goals. Yet social enterprises also face pressure from market-based funding and performance metrics that neglect social outcomes or long-term value creation (Van Opstal, 2025).

Each organisational form offers comparative advantages for addressing specific CE challenges. Externalities, transaction costs, and public goods dilemmas call for institutions that align incentives, build trust, and enable long-term cooperation. Property rights, governance mechanisms, and contracts influence organisational behaviour. Relational contracts – based on trust and mutual adjustment – thrive in cooperative and associative settings where repeated interaction, shared norms, and

mission alignment reduce enforcement costs (Baker et al., 2002). Game-theoretic insights show that collective action problems can be mitigated through communication, identity, and reputation – conditions more common in non-profit associations and cooperatives than in anonymous market transactions (Bowles & Gintis, 1998, 2011).

These same organisational dynamics also have implications for a just circular transition (Kirchherr, 2021). They shape who participates in circular activities, who gains or loses from circular value creation, and whose voices are recognised in governance processes. Non-profit associations make visible the knowledge and contributions of informal workers often overlooked in mainstream CE strategies. Cooperatives empower communities to retain agency over resources and decisions. Social enterprises offer pathways for labour market inclusion alongside CE goals. Together, these organisations not only support circular material flows, but also reconfigure power relations, institutions, and values.

A successful circular transition relies not on one single organisational form, but on their *interplay*. Each brings distinct capabilities, yet it is their combination that enables systemic change. Governments create enabling conditions for a circular economy and society through regulation, investment, and coordination, but their impact deepens when partnering with trusted intermediaries such as non-profit associations that mobilise citizens. Investor-owned firms are essential for innovation and scaling, yet their efforts can be grounded and legitimised through collaboration with cooperatives that embed circularity locally. Social enterprises often operate at the interface of market and mission, linking vulnerable groups to circular activities like repair or reuse, but their effectiveness improves when supported by public procurement or by networks facilitated by non-profits. This interplay enables diverse organisational logics to co-evolve: state agencies provide stability, firms offer dynamism, cooperatives foster trust and shared ownership, and associations and social enterprises build inclusion and resilience. Therefore, we invite policymakers, scholars, and practitioners to consider how organisational diversity, their comparative advantages, and their interplay can broaden CE strategies and policies, making them not only more effective, but also more equitable and inclusive.

1.1.3 Approaches to study organisational forms

This thesis examines organisational forms through a plural set of theoretical traditions, each offering distinct lenses on why arrangements emerge, how they function, and the conditions under which they create economic, ecological, and social value. Together, these perspectives explain how organisational diversity contributes to a circular economy and society, show how forms operate and evolve in response to economic, institutional, and social challenges, and clarify that no single form can meet all requirements of a circular transition. The analysis uses this complementarity to identify

comparative advantages across contexts and to guide the selection and design of organisational arrangements for circular outcomes.

Institutional and comparative economics conceptualise organisational forms as institutional arrangements that emerge to reduce the costs of economic coordination. Transaction cost economics (Coase, 1937) emphasises that activities are organised in the form that minimises the sum of production and transaction costs, given asset specificity, uncertainty, and frequency of exchange. This framework may explain why certain CE activities, such as repair services, are sometimes integrated within organisations or conversely coordinated through markets. Comparative institutional analysis extends this reasoning, demonstrating how institutional complementarities across regulatory systems, financial structures, labour relations, and cultural norms define organisational behaviour in specific contexts (Hall & Soskice, 2001). Ben-Ner and Van Hoomissen (1991) contribute with a varieties-of-organisations perspective, classifying organisations by ownership, control, and benefit allocation. This approach links structural features directly to their comparative advantages in addressing market failures. Applied to the CE, Nygaard (2022) concludes that circular supply-chains tend to favour stronger ownership and control across the supply chain in order to economise on transaction costs.

Law and economics perspectives on organisations examine the allocation of ownership and the choice of legal form, because ownership and organisational law determine incentives. Hansmann (2000) defines ownership costs as the monitoring, risk-bearing, and collective decision-making costs borne by the owners. The most efficient form assigns ownership to the patron group that can bear these costs at least cost (e.g., investors, users, donors/beneficiaries, or the state). Hansmann and Kraakman (2000) show that organisational law supplies standard-form entities with legal personality, asset partitioning and entity shielding, fiduciary duties, and default governance rules that allocate residual control rights. Property-rights models formalise this allocation under incomplete contracts (Grossman & Hart, 1986; Hart & Moore, 1990). Besley and Ghatak (2001, 2005, 2007) add a mission-alignment criterion: ownership should rest with the party whose objectives most closely match the mission, thereby strengthening non-contractible investment and stewardship. Herbst and Prüfer (2016) model selection among firms, non-profits, and cooperatives when intrinsic motivation, profit distribution constraints, and member control affect effort and selection. Relational contracting theory (Baker et al., 2002) complements formal organisational law by explaining how repeated interaction and informal norms sustain performance where legal enforcement is limited. This perspective resonates with empirical work by Yawar and Kuula (2021), which shows that different ownership structures and underlying missions shape societal legitimacy of CE initiatives.

Behavioural, polycentric, and normative perspectives complement these economic-legal theories. Behavioural economics and psychology provide the micro-foundations,

questioning the assumption of self-interested actors and highlighting the role of pro-social motivations. Bowles and Gintis (2011) show how reciprocity, fairness, and collective identity can underpin cooperative behaviour, particularly in settings where repeated interaction and shared purpose reduce the need for costly enforcement. Ostrom's (1990, 2010) work on polycentric governance specifies the conditions under which self-organised institutions can sustainably manage common-pool resources. This encompasses the existence of clearly defined rules, monitoring, graduated sanctions, and participatory decision-making. Normative frameworks, such as Fraser's (2009) theory of justice, extend the analysis with evaluative criteria, by integrating distributive, procedural, and recognitional dimensions[3]. This perspective emphasises that organisational forms are not only economic coordinators but also vehicles for inclusion, empowerment, and recognition of diverse stakeholders in a circular economy and society. Patala et al. (2022) illustrate this in three CE systems in Finland, the United States and Spain, where polycentric governance emerges through mutual adjustment, collective agency and resource sharing between businesses, public authorities and societal actors to manage privately owned residual resources in closed-loop systems.

Resource-based and capability perspectives explain differences in organisational effectiveness by focusing on the resources and competences that underpin competitive advantage. The resource-based view (Barney, 1991) stresses the strategic value of unique, difficult-to-imitate assets, including tacit knowledge, brand reputation, and relational capital, which may differ systematically across organisational forms. For example, non-profit associations often mobilise volunteer expertise and social legitimacy, while firms may leverage capital and proprietary technology. The dynamic capabilities framework (Teece, 2007) adds a temporal dimension, examining how organisations sense, seize, and reconfigure resources to adapt to changing technological and policy environments. These approaches are particularly relevant for understanding how organisations build the absorptive capacity to adopt and scale circular innovations. Castillo-Ospina et al. (2025) apply this perspective in circular ecosystems, where focal firms develop dynamic capabilities that enable them to adopt circular innovations and co-create value with external stakeholders under conditions of market uncertainty.

Evolutionary and co-evolutionary perspectives view organisational diversity as the product of adaptation, selection, and retention processes over time. Organisational ecology (Hannan & Freeman, 1977) analyses the emergence, survival, and decline of organisational forms in response to environmental conditions, including regulatory

[3] Environmental justice scholarship has proposed broader multidimensional frameworks that incorporate capability and responsibility alongside distribution, recognition, and participation (Davoudi & Brooks, 2014). Capability refers to the substantive freedom of actors to participate in and benefit from socio-technical transitions, while responsibility concerns the allocation of moral and institutional duties in preventing or addressing injustice. Empirical applications in social housing renovation demonstrate how these dimensions interact in practice (Broers et al., 2022). The justice literature further encompasses restorative, intergenerational, spatial, epistemic, energy, climate, and environmental justice, highlighting temporal, spatial, knowledge-based, and sector-specific dimensions of fairness (ETC CE, 2025a).

shifts and technological change. Evolutionary economics (Nelson & Winter, 1985) highlights path dependence and the role of routines in shaping organisational adaptation. Co-evolutionary frameworks extend this lens to examine reciprocal adaptation between organisational forms, technologies, regulatory regimes, and social norms. This perspective highlights that organisational form diversity is not static but evolves through ongoing interaction with its institutional and ecological environment. Chizaryfard et al. (2021) exemplify this view by conceptualising the CE as an evolutionary industrial transformation, marked by structural tensions and interlinked development blocks rather than a simple linear shift, and by analysing the mechanisms that drive and constrain such change over time.

Taken together, these theoretical traditions imply that organisational form is not an implementation detail. Organisational form structures ownership, control rights, incentives, and accountability, and these features influence how actors coordinate under uncertainty and how commitments persist over time. This framing also supports that governance arrangements shape who participates, who benefits, and whose contribution counts in a circular economy and society.

1.2 Aim and research questions

The thesis builds on the premise that a CE involves not only a technical transition but also an institutional and societal one. The resulting theoretical challenge concerns explanation, not only description. It concerns how different organisational forms structure incentives and participation, and how these structures shape economic, environmental and social outcomes in a circular economy and society. Existing studies on CE governance often focus on firms and governments, whereas this work examines third sector organisational forms such as social enterprises, cooperatives, and non-profit associations. Empirical research and theoretical insight into their role in a CE remain limited. Three gaps are particularly evident:

- Limited evidence on their comparative organisational advantages and disadvantages in CE contexts.
- Limited understanding of how these organisational forms operate beyond public service or consumer markets, particularly in business-to-business settings.
- Sparse analysis of how they collaborate with other actors to deliver environmental and social outcomes, including work integration, community resilience, and just transition goals.

This dissertation addresses these gaps by examining how diverse organisational forms enable and embed a circular economy and society, and how their specific organisational comparative advantages can be mobilised for environmental effectiveness, social

inclusion, and economic viability. The overarching objective is to provide empirical evidence and theoretical insight into the organisational, institutional, and governance conditions under which different actors contribute to circularity.

Across seven empirical studies, the research pursues three aims:

1. Investigate how organisational forms address market failures, relational complexities, and justice considerations in a circular economy and society.
2. Identify enabling and constraining factors that define their potential contributions to a just circular transition.
3. Inform policy and practice on how organisational diversity can support systemic change.

Each of the seven empirical studies contributes to these three aims, addressing specific research gaps concerning the role of third sector organisational forms in a CE. A first set of three papers focuses on the role of *social enterprises* – in particular Work Integrational Social Enterprises (WISEs).

- *Work Integration Ambitions of Startups in the Circular Economy* (Paper II) addresses a lack of quantitative research on how circular startups engage with the work integration of vulnerable groups. While startups are recognised as innovation drivers in the CE and WISEs as strategic partners for inclusive employment, the connection between these two organisational forms remains underexplored. This study investigates which startups have ambitions to employ or collaborate with vulnerable groups, how these ambitions relate to their implementation of circular strategies, and how these ambitions relate to perceived barriers and enablers to circularity.
- *Towards Sustainable Growth Paths for Work Integration Social Enterprises in the Circular Economy* (Paper III) responds to limited empirical evidence on how WISEs can transition towards circular models while maintaining economic, social, and environmental value creation. WISEs aim to integrate vulnerable groups into the labour market, yet their current activities are often embedded in linear value chains. This study examines the impact of CE-supporting and enabling measures on WISE employment, identifies challenges and opportunities in shifting towards circularity, and formulates boundary conditions for sustainable growth paths.
- *Unlocking the Social Circular Economy: Value Propositions and Organisational Design of Social Circular Hubs* (Paper IV) tackles the absence of research on the governance and business models of social circular hubs, a new organisational form designed to connect WISEs with companies pursuing CE strategies. While WISEs are well-documented in public service and consumer markets, their potential in B2B circular ecosystems is less understood. This study analyses the assets and disqualifiers of WISEs from the perspective of company partners,

identifies relevant value propositions for social circular hubs, and draws lessons from established circular hubs to define organisational design and governance conditions for their sustainability.

A second set of three papers addresses research gaps on *cooperatives* as an organisational form in a circular economy and society.

- *Cooperating for Circularity? Perspectives of Citizen Energy Cooperative Members on Circular Solar Business Models* (Paper V) addresses the absence of empirical studies on how members of citizen energy cooperatives perceive and engage with circular solar business models. While cooperatives are seen as potential enablers of a circular society, it is unclear whether their members' preferences differ from non-members in adopting circular strategies. This study compares adoption patterns, perceived value propositions, and barriers for solar product–service systems (PSS) and photovoltaic panel reuse between members and non-members of citizen energy cooperatives.
- *Smart, Circular and Renewable: The Role of Cooperative Governance in Accelerating a Sustainable Energy Transition* (Paper VI) responds to a research gap on how cooperative governance can support circularity in complex socio-technical systems such as smart grids. While cooperatives have been studied for their role in renewable energy provision, little is known about their ability to embed CE strategies in energy infrastructure projects. This study identifies barriers and enablers for fostering circular outcomes in a smart grid, examines how cooperative stakeholder governance can integrate circularity goals, and derives lessons from a demonstrator project to inform broader uptake.
- *Enabling and Embedding Circularity Goals in Housing Cooperatives* (Paper VII) addresses the limited understanding of how housing cooperatives can enable circular strategies in the built environment. Housing cooperatives are distinct from commercial and state-led providers in their governance and ownership models, but their organisational advantages or disadvantages in implementing CE strategies are poorly documented. This study investigates how cooperative governance influences the adoption of circular strategies in different housing types, how stakeholders can be aligned, and how cooperatives compare institutionally to other providers.

Finally, a last empirical study focuses on the role of *non-profit organisations* – in particular civil society associations. Civil society associations (CSAs) are voluntary, membership-based non-profit associations that organise collective action for mutual or public benefit through associative governance and a non-distribution constraint. The non-distribution constraint means that profits or financial surpluses cannot be distributed to members, founders, or board members. Any surplus must be reinvested in the statutory mission of the organisation. The focus in this work lies on the associational form of CSAs rather than on the broader set of civil society organisations

(CSOs), since CSO is an umbrella category that also covers foundations, charities, NGOs without members, social movements, and other entities with different governance and membership logics. The interest in membership, local embeddedness, and intermediary roles in the informal circular economy directs the analysis to CSAs as non-profit associations. They primarily include associations under non-profit legal forms, such as registered non-profit associations, socio-cultural organisations, environmental associations, repair café networks, community exchange groups, solidarity initiatives, and local volunteer-based organisations. These organisations operate in domains such as sustainability, social inclusion, culture, education, and neighbourhood development.

- *The Roles of Civil Society Associations in Organising the Informal Circular Economy* (Paper VIII) responds to a lack of empirical research on the role of civil society associations (CSA) in organising the informal CE in industrialised contexts. While CSAs are recognised for their ability to mobilise trust, voluntary engagement, and collective action, their specific contributions to informal repair, reuse, and sharing are not well understood. This study analyses the relationship between CSA membership and participation in informal CE activities, identifies barriers and enablers from multiple perspectives, and examines how CSAs act as intermediaries to support a just informal CE.

Together, these questions form a systematic investigation into how organisational forms, individually and in collaboration, contribute to the environmental and social goals of a circular economy and society.

1.3 Methods

This dissertation employs a mixed-method research design to investigate how achieving a circular economy and society intersects with the comparative advantages of several organisational forms. Across seven empirical studies, the research combines survey analysis, economic modelling, expert interviews, and longitudinal case work to capture systemic patterns and dynamics. The methodological choices are guided by the need to address complex socio-technical challenges, engage diverse stakeholder groups, and ensure both analytical rigour and practical relevance.

The research mobilises a range of data collection and analysis techniques tailored to the specific research questions and contexts of each study. Table 1 provides an overview.

Table 1 – Data collection and analysis techniques applied in the empirical studies of this thesis

Paper	Quantitative data and methods	Qualitative data and methods
Paper II – Work integration ambitions of startups in the circular economy	Original online survey (n=165) of circular startups in Flanders. Descriptive statistics and regression analysis	Semi-structured expert interviews (n=9). Thematic analysis combining deductive and inductive coding.
Paper III – Towards sustainable growth paths for work integration social enterprises in the circular economy	Post-estimation calculations on two CGE scenarios calibrated to the Belgian economy for 2018, using linked WISE accreditation lists, administrative financials and employment data, and survey data.	Semi-structured expert interviews (n=20). Deductive and inductive thematic analysis.
Paper IV – Unlocking the social circular economy: value propositions and organisational design of social circular hubs	Original online survey of circular enterprises in Flanders (n=115). Descriptive and multivariate analyses (probit, Poisson, and OLS regressions)	Semi-structured interviews (n=16) Thematic coding Premortem analysis
Paper V – Cooperating for circularity? Perspectives of citizen energy cooperative members on circular business models	Original online survey (n=3996) among households in Flanders; Descriptive statistics and multivariate analyses (OLS and Probit regressions)	Preparatory qualitative work through a small-scale pilot survey; informed by prior expert interviews.
Paper VI – Smart, circular, and renewable: the role of cooperative governance in accelerating a sustainable energy transition	/	Qualitative case study; document analysis and semi-structured interviews (n=33); thematic analysis; premortem analysis.
Paper VII – Enabling and embedding circularity goals in housing cooperatives	/	Semi-structured interviews (n=23) with cooperative representatives, policymakers, and housing experts; qualitative content analysis; premortem analysis
Paper VIII – The roles of civil society organisations in organising the informal circular economy	Original survey of households in Flanders (n=820). Descriptive statistics and multivariate analyses (OLS and Bivariate Probit regressions)	Semi-structured interviews (n=24) with CSA representatives at local, regional, and EU levels; thematic coding and comparative analysis

Quantitative methods are applied in several large-scale surveys targeting key actors in the circular transition: circular startups, frontrunner enterprises, and private households. These surveys employed rigorous instrument design and piloting protocols and were developed and distributed in close collaboration with ecosystem partners. Quantitative analysis was needed to capture structural patterns in behaviours and business practices, and generate generalisable insights (Hair et al., 2006; Sovacool et al., 2018). Statistical analyses included Ordinary Least Squares (OLS), (regular, ordinal, and bivariate) probit and Poisson regressions, and non-parametric methods to assess relationships and control for potential biases. Collinearity was assessed using Variance Inflation Factor (VIF) analysis, and robust standard errors were employed to correct for heteroskedasticity where identified (Baum, 2006).

Qualitative methods complement and enrich these findings. This was needed because qualitative approaches allow for in-depth exploration of meanings, practices, tacit knowledge, and institutional dynamics that cannot be adequately captured through quantitative analysis alone (Bell et al., 2022; Sovacool et al., 2018). Over 120 semi-structured expert interviews were conducted across the empirical studies, engaging a broad range of stakeholders – entrepreneurs, managers of social enterprises, policymakers, civil society actors, service providers, cooperative board members, and energy consultants. Interview sampling was guided by principles of stakeholder relevance and saturation, and analysis followed a combination of deductive and inductive coding strategies using software such as Atlas.ti. In multiple studies, each semi-structured interview concluded with a *premortem* question, asking respondents to explain why, by a specific future date, the project or initiative they were involved in might ultimately fail. This technique, originating from behavioural economics (Gallop et al., 2016; Thaler & Sunstein, 2008), helps to mitigate cognitive biases among interview respondents such as confirmation bias, hindsight bias, and groupthink. Finally, respondents reviewed draft results to ensure accuracy and validation.

The dissertation consistently applies methodological triangulation by integrating survey data, economic modelling, and expert interviews within and across papers (Bell et al., 2022; Sovacool et al., 2018). For example, CGE model scenario and survey results were contextualised through interviews with stakeholders. This approach enhances the robustness and credibility of findings and provided multi-dimensional insights into underlying complexities. Furthermore, the dissertation is rooted in embedded and participatory research practices, ensuring that results are not only theoretically grounded but also reflect lived experience and institutional realities. Several studies were co-designed with public or civil society partners, and one paper is based on a four-year action research engagement. Participatory observation, project documentation, and stakeholder dialogue are core features of this longitudinal case, reflecting a commitment to producing situated knowledge relevant to real-world transitions.

The analytical orientation of this research builds on a range of theoretical perspectives from economics, business studies, policy studies, and organisational sociology. These frameworks inform the design of interview protocols, coding schemes, and interpretative strategies. Throughout, the research applies theoretical triangulation to avoid conceptual blind spots and ensure a balanced interpretation of the findings.

1.4 Thesis outline

This thesis integrates one perspectives paper and seven empirical studies. The perspectives paper is embedded within the introduction as part of the conceptual background, while the seven empirical studies are presented as individual chapters (Chapters 2–8).

Chapters 2-4 examine social enterprises, with a particular emphasis on Work Integration Social Enterprises (WISEs). Chapters 5-7 investigate cooperatives, and Chapter 8 addresses non-profit organisations, specifically civil society associations. While the studies address distinct contexts – from startups and WISEs to cooperative energy and housing initiatives, and from B2B social circular hubs to the informal CE – they share a common focus on how organisational forms such as social enterprises, cooperatives, and non-profit associations contribute to enabling and embedding a circular economy and society. Each chapter is self-contained, presenting its own background, methods, results, discussion, and conclusions.

Chapter 9 synthesises the findings from these studies, integrating insights across organisational forms, sectors, and circular strategies to provide an overarching discussion. The chapter situates these findings within debates among scholars, businesses, and policymakers on CE governance. It also reflects on the methodological scope of the thesis, acknowledging its conceptual and empirical contributions and limitations. The chapter closes with concluding remarks, including avenues for future research.

2. Work Integration Ambitions of Startups in the Circular Economy

Based on:

Van Opstal, W. & Borms, L. (2024), Work Integration Ambitions of Startups in the Circular Economy. Annals of Public and Cooperative Economics 95 (2), 477-504. https://doi.org/10.1111/apce.12431 [Paper II]

Abstract

An increasing number of studies illustrate and estimate the potential of the circular economy to create new jobs, most particularly for vulnerable groups at the labour market. This creates collaborating opportunities for Work Integration Social Enterprises (WISEs) and circular economy ventures. Since a shift to a circular economy requires new visions and strategies, startups are considered as powerful engines for the innovation processes needed to support a circular transition. Nevertheless, academic literature at the crossroads of the circular economy, work integration of target groups, and startups remains quasi non-existent. In this paper we present results from survey-data of startups with varying implementation levels of circular strategies, and assess their willingness to cooperate with WISEs, or to engage in other forms of target group employment. We find a strong positive relationship between the implementation of circular strategies and work integration ambitions among startups. Circular startups who need skills on production, transportation, and logistics seek collaboration with WISEs for both inner (repair and redesign) and outer circle (recycling) strategies. Our findings suggest that the circular social economy faces specific barriers that need tailor-made enabling policies. We recommend WISEs to explicitly assess reskilling and upskilling opportunities while embracing the circular economy as a future-proof economic activity.

Keywords: circular economy; circular strategies; startup; social economy; work integration social enterprises (WISEs); survey

2.1 Introduction

The circular economy (CE) can be described as an economic system based on business models that reduce, reuse, recycle, and recover materials in production, distribution, and consumption processes (Kirchherr et al., 2017). Apart from its environmental impacts, CE strategies contribute to economic aspects of sustainability by mitigating risks stemming from value chain disruptions and increasing prices of energy and raw materials (Rodriguez-Anton et al., 2019; Schroeder et al., 2019; Wuyts et al., 2020).

The CE also has the potential to contribute to social sustainability by creating qualitative jobs. The shift towards a CE is expected to generate a shift from material-intensive to more labour-intensive activities and requires investing in new skills. The transition to a low-carbon, circular, and resource-efficient economy is estimated to generate 18 million new jobs worldwide and 1.2 million new jobs in the EU by 2030 (ILO, 2022b). Many of these jobs are believed to create training and working opportunities for vulnerable groups. Experienced in organising local employment for target groups, the social economy in general, and Work Integration Social Enterprises (WISEs) in particular, are believed to be a strategic partner to accelerate the transition towards a circular and inclusive economy (OECD & European Commission, 2022). This has been recognized in both the Circular Economy Action Plan (CEAP) and the Social Economy Action Plan (SEAP) of the European Commission (European Commission, 2020a, 2021).

Since a shift to a CE requires new visions and strategies, startups are considered as powerful engines for the innovation processes needed to support a circular transition (Lewandowski, 2016; Spender et al., 2017). While collaboration is an important scaling strategy for both social enterprises and CE ventures, academic literature at the crossroads of CE, work integration, and startups remains scarce to non-existent. There exists an increasing number of studies estimating the job creation potential of the CE (Brusselaers et al., 2022; Delanoeije & Bachus, 2020; Dubois & Christis, 2014; European Commission, DG Environment, 2018; Geerken et al., 2019; Lahcen et al., 2022). Also, job opportunities for vulnerable target groups have been identified (OECD & European Commission, 2022; RREUSE, 2021; Willeghems & Bachus, 2018b), as well as business opportunities the CE may generate for WISEs (Banerjee & Anand, 2021; França et al., 2022; Schadenberg & Folmer, 2022). While most of these studies involve conceptual work, or qualitative research methods, some recent studies use survey data to investigate opportunities for WISEs in a CE (Halberstadt et al., 2021; Kurleto, 2019; RREUSE, 2022b). However, quantitative studies on circular startups remain scarce (Bauwens, Mees, et al., 2020; Henry et al., 2020), and do not discuss opportunities for work integration. Given their mutual reenforcing potential, we consider a lack of knowledge on the relationship between circular startups and work integration as a relevant research gap.

In this paper, we make use of a novel dataset from a recent survey on 165 startups in Flanders (Belgium). The survey respondents are entrepreneurs at different stages of the startup lifecycle, representing startups with varying degrees of implementation levels of a set of ten circular strategies. The survey includes personal and company level characteristics, and perspectives of startup entrepreneurs on barriers and enablers. We also included questions on their ambitions to work with target groups, either by hiring them themselves or by collaborating with WISEs. This study is the first to our knowledge that investigates ambition levels, profiles, barriers, and enablers of startups in the CE engaging in work integration of vulnerable groups. Our survey enables us to investigate the following research questions:

- RQ1: Which startups want to engage in work integration for vulnerable target groups?
- RQ2: What is the relationship between work integration ambitions of startups and the implementation of circular strategies?
- RQ3: What is the relationship between startup work integration ambitions, and barriers and enablers to implement circular strategies?

The rest of this paper is structured as follows. In Section 2.2 we provide a brief reconstruction of the relevant policy landscape in Flanders. In Section 2.3 we provide a short literature overview on the connection between startups, CE strategies, and work integration. In Section 2.4 we elaborate on the survey we conducted, validated by conducting semi-structured interviews with experts. In Section 2.5 we present and discuss our most important results and point at limitations of this research. Finally, in Section 2.6 we conclude and identify novel research gaps and avenues for further research.

2.2 Work Integration and Circular Economy Policies in Flanders

In Europe, WISEs make up a large part of the social entrepreneurship landscape (Crucke & Bockaert, 2022; Crucke & Knockaert, 2016). However, the institutional context WISEs operate in may differ substantially between countries (Spear & Bidet, 2005). Therefore, we provide a short overview of the policy landscape on work integration and CE in Flanders.

2.2.1 Work Integration in Flanders

In Belgium, active labour market policies are mainly a regional competence. Historically, the landscape of WISEs in Flanders has been dominated by sheltered workshops and social workshops. Sheltered workshops have been established since the 1960s, aiming at the employment of people with work disabilities. They have a strong business-to-

business profile, and perform a wide array of economic activities including packaging, assembly, green area and park maintenance, wood manufacturing, bookbinding, and printing (Van Opstal et al., 2007). Social workshops were mostly established in the 1980s and 1990s as an answer to rising unemployment figures. They focus on jobseekers with difficulties in the regular labour market due to physical, social, or psychological problems. Social workshops were on average smaller than sheltered workshops: in 2013 average employment in social workshops was 50.5 full-time equivalents (FTE), compared to 286.2 FTE in sheltered workshops (Van Waeyenberg & De Cuyper, 2016). While social workshops and sheltered workshops perform mostly similar economic activities, a specific and important activity domain of social workshops are reuse shops, which we refer to as social enterprise reuse shops (Kringwinkels) (Delanoeije & Bachus, 2020).

After several years of reforms, the regulatory policy landscape for work integration is evolving towards a dual framework for accredited WISEs ('collectief maatwerk', implemented on January 1st, 2019), and individual work integration support ('individueel maatwerk', to be implemented on July 1st, 2023). With this reform, sheltered and social workshops became 'accredited WISEs' (maatwerkbedrijven). Individual work integration support is a framework that will provide subsidies for individual companies willing to hire people with a distance to the labour market. It will gradually replace existing frameworks including local service economy initiatives (lokale diensteneconomie), work integration units (maatwerkafdelingen), the Flemish Support Bonus (Vlaamse Ondersteuningspremie), and the Social Insertion Economy measure (SINE) (Vandekerkhove et al., 2021).

Table 2 provides an overview of some key figures on work integration in Flanders. In 2019 accredited WISEs employed 26,965 people, of which 23,447 have a significant distance to the labour market. Other employment includes workplace supervision, social support, technical staff, management, and administrative staff. Citizens with a work disability or psychosocial problems can become eligible for these work integration measures after screening and guidance by the Public Employment Service of Flanders (VDAB) or its partners. This screening is based on an ICF-based methodology (International Classification of Functioning, Disability, and Health). For unemployed whose distance to the labour market is considered too big for paid employment, there are work and care programs, that are often integrated in accredited WISEs (De Norre & Cabus, 2020; Samoy, 2004).

Table 2 – Work Integration in Flanders, key figures for 2019

	Number of companies	Target group employment	Subsidies (million EUR)
Accredited WISEs	140	23,447	392.9
Individual work integration support			
Local Service Economy Initiatives	180	2,635	25.7
Work Integration Units*	14	na	na
Flemish Support Bonus**	na	12,594	21.8
Work and Care Program	53	2 659	4.5

* In 2019, 14 employers gained a recognition to hire target group employees in a work integration unit. In sum, this represented a capacity of 89.5 FTE. Figures on actual employment in this program are not made available, however.
** Figures for Q1 2020. No figures are available on the number of companies receiving this support.
Source: (Dept. WSE, 2021b, 2021c)

Over time, WISEs became increasingly institutionalized within the labour market policies of the Flemish Government (De Cuyper et al., 2015; Pel & Bauler, 2017; Van Opstal et al., 2009). In 2020, for example, they received 386 million euro of subsidies to compensate for the diminished productivity of their workers, to provide support and guidance, and to support WISEs at the organisational level (Dept. WSE, 2021b). The way WISEs hire, evaluate, and support target groups is regulated. For budgetary reasons, each accredited WISE is granted a quota defining the maximum number of target employees that can be hired. To gain an accreditation, WISEs also need to take the legal form of a non-profit association or a cooperative accredited as a social enterprise. All WISEs in Flanders opted to become a non-profit association, ensuring both a non-distribution constraint and an asset lock to signal and safeguard its social objectives (Coates & Van Opstal, 2009). While in theory conditions to become accredited as a WISE have been set out by the Flemish Government, in practice there is no room for new entrants to become accredited.

Yet, while being criticized for institutional isomorphism, WISEs in Flanders operate independently as businesses, competing with firms both within and outside the social economy (Van Opstal et al., 2009). In sum, they deliver services to over 10,000 Belgian companies and serve business-to-business customers in over 28 countries. Over 70% of their customers is active in the same province, showing the strong local economic anchoring of WISEs (Termote & Demeyere, 2021).

While social enterprise reuse shops are established for over two decades now, only back in 2006, only 5 of the 55 sheltered workshops in Flanders were active in recycling (Van Opstal et al., 2007). Today, however, virtually all WISEs are looking into opportunities that may stem from a transition towards a CE. Moreover, developing activities in the field of CE or climate mitigation recently became a prerequisite for WISEs to apply for extended quota to hire target groups (Dept. WSE, 2022).

2.2.2 Circular Economy policies in Flanders

In its fourth Sustainable Development Strategy the Flemish Government recognizes the CE as one of its seven transition priorities (Government of Flanders, 2021). Policy measures and the governance of Circular Flanders (see Appendix 2.1) are the competence of both the minister of economy, innovation, work, social economy, and agriculture on the one hand, and the minister of justice, environment, energy, and tourism on the other hand. The coalition agreement of the current Flemish Government (2019-2024) and its subsequent domain specific policy notes refer to the CE as follows (Government of Flanders, 2020a):

- *"We strive for a maximum circular economy in order to better meet our needs for raw materials and water in our society and to maximize our well-being with a smaller ecological footprint. We emphasize the partnership between companies, knowledge institutions, civil society and governments*" (Policy Note Economy, Science, and Innovation)
- *"We have the ambition to make Flanders a frontrunner in the circular society"* (Policy Note Environment)
- *"We will have strong policies on greenhouse gas emission reductions, energy efficiency and renewable energy, innovation, mobility and infrastructure investments, spatial planning, circular economy…"* (Policy Note Climate)

The Flemish Government chose to construct thematic Working Agendas, in line with thematic priorities identified by the European Commission, in close collaboration with industrial partners, research institutes, and civil society actors. Working Agendas have been identified in the fields of construction, plastics and chemistry, manufacturing industries, water, bioeconomy, and the food chain. Other supporting policy initiatives include the financial support of an interuniversity CE economic policy research center, the development of a monitoring instrument for the CE, earmarked innovation support for circular business models, and a moonshot program to reduce carbon emission (Government of Flanders, 2020a).

An interesting policy initiative at the crossroads of CE and work integration is the support of 12 social circular hubs for the period May 2021 – December 2023. These hubs are organised locally and try to establish collaborations between companies, WISEs, and local authorities to stimulate circular social economy initiatives. This initiative is co-funded by the Flemish department of Work and Social Economy and the European Social Fund (Dept. WSE, 2021a).

2.2.3 Circular and social economy support, and the COVID-19 pandemic

The COVID-19 pandemic urged the Flemish Government to compile a Recovery Plan, including measures and an envisioned budget of 4.3 billion EUR to restore the economic and social fabric. This plan rests on seven pillars, seven ambitions, and seven challenges. One of these ambitions is the transition to greater sustainability. Within this ambition line, Flanders envisions to become a recycling hub. Other ambitions to accelerate the transition to a CE include the support to companies for research projects on 'design to recycle', innovation support for the construction sector aiming at circular construction, and research and support of companies making the switch to a CE. With respect to labour market policies, the Flemish government expresses its ambition to reestablish an employment rate of 80%. In its 'All hands on deck' agreement, signed with the social partners, however, attention to social economy measures, remains rather limited (Government of Flanders, 2020b).

2.3 Literature

From a historical perspective, many WISEs in Europe were created after the second World War to create employment opportunities for people with disabilities. In the 1970s and 1980s, new social enterprises increasingly focused at environmental issues, but in the last decades, the main focus of many WISEs became predominantly employment creation and work experience for vulnerable target groups (Clark & Johansson, 2016; Vickers, 2010). In Flanders, for instance, this resulted in a field of traditional WISEs on the one hand, and a social enterprise reuse network combining social employment with environmental objectives on the other hand (De Mey et al., 2008; Delanoeije & Bachus, 2020).

In the other direction, the CE mainly focused on environmental challenges, while often neglecting the social dimension of sustainable development. Recent studies show the important role of labour in a CE (Mies & Gold, 2021; Moreau et al., 2017). In a systematic literature review on social aspects of a CE, employment turns out to be the social aspect most cited (Padilla-Rivera et al., 2020). The CE is referred to as having a potential to create employment opportunities, dealing with regional unemployment disparities and occupational mismatch. In a report commissioned by the European Commission, the net increase in jobs by moving towards a more CE is estimated at 700,000 through additional labour demand from recycling plants, repair services and rebounds in consumer demand (European Commission, DG Environment, 2018). In order to estimate these impacts, scholars developed input-output models (Dubois & Christis, 2014; Geerken et al., 2019; Wijkman & Skånberg, 2017), computable general equilibrium (CGE) models (Brusselaers et al., 2022), supply chain equilibrium models (Lahcen et al., 2022), and mixed-integer linear programming models (Pedram et al., 2017). Other studies focus on methodologies to define and monitor circular jobs (Circle

Economy & EHORE, 2017; Coats & Benton, 2015; Delanoeije & Bachus, 2020; Morgan & Mitchell, 2015).

Social enterprises have an institutional comparative advantage in addressing problems with positive externalities (Santos, 2012) and are used to deal with achieving multiple goals, combining financial sustainability and social purposes (Doherty et al., 2014). Therefore, the CE has been identified as a promising pathway for the further development of social enterprises (Kay et al., 2016; OECD & European Commission, 2022; Sacranie & Çetin, 2022; Willeghems & Bachus, 2018b). For WISEs in particular, the CE creates opportunities, since it is expected to positively affect employment for vulnerable groups (ILO, 2022b; Willeghems & Bachus, 2018a), including activities such as sorting, maintenance, repair, manual disassembly (Bachus et al., 2015), remanufacturing, refurbishment, and reuse operations (Delanoeije & Bachus, 2020; Parker et al., 2015; Versluys et al., 2021). RREUSE, the federation of social enterprise reuse networks, estimated that social enterprises create on average 70 jobs per 1,000 tons collected with a view of being reused (RREUSE, 2021). Reuse is considered to have a higher job creation potential than recycling because of its intrinsically labour-intensive tasks.

Another strand of studies uses qualitative company-level data to assess opportunities of the CE for WISEs and vice versa. These studies include the identification of key characteristics of WISEs with an ecological orientation (ECO-WISEs) based on interview data (Anastasiadis, 2016), the identification of opportunities for public-private partnerships based on case study research (França et al., 2022; Soufani et al., 2018), and focus group research and interviews (Banerjee & Anand, 2021). Lane & Gumley (2018) identify opportunities for reuse and recycling, based on interviews (Lane & Gumley, 2018). Qualitative research methods have been used as well to identify and investigate specific challenges for WISEs, including the use of storytelling in reuse shops (Schadenberg & Folmer, 2022), and ways to deal with CE opportunities in business innovation processes (Gorissen et al., 2016; Stratan, 2017). At a more conceptual level, case study research has been used to see how total quality management concepts can be used to assess the impact of COVID-19 in WISEs that engage in CE activities (Dezi et al., 2022), and how value as such can be redefined in a CE (Lekan et al., 2021).

Studies that use quantitative company-level data on this topic remain limited. RREUSE uses survey data to map circular activities and target group employment among their members (RREUSE, 2022b). Polish survey data has been applied to point out the importance of business models for social enterprises in their transition from a linear to a circular economy (Kurleto, 2019). Comparative survey data from Austria and Northern Macedonia on social entrepreneurship has been used to highlight key differences between startups and established firms (Halberstadt et al., 2021). Finally, survey data from 87 WISEs in Flanders is used to investigate to what extent they are embedded in the Flemish economy, by obtaining detailed micro-level data on client and

supplier transactions. Results show a strong regional and local embeddedness of WISEs: 92.1% of their clients are situated in Flanders, while over 70% is situated in the same province. The CE, however, accounts for about 5% of client transactions and less than 10% of all supplier transactions (Termote & Demeyere, 2021).

Quantitative research on circular startups remains scarce. In their white paper on business models for circular startups in the Netherlands, Bauwens et al. (2020) use administrative and publicly available data of 147 circular startups, complement them with data from 20 in-depth interviews, and compare them with data from another study on the sustainability reports of 46 established firms (Stewart & Niero, 2018). Henry et al. (2020) construct a dataset from 128 circular startups identified in three major CE ecosystems in Europe. They compile publicly available information, descriptions in grey literature, and complement this with semi-structured interviews with 30 of the identified startups. While this approach allows for frequency analysis and the conceptual construction of typologies, application possibilities for more sophisticated statistical techniques remains limited. Therefore, this paper is the first to our knowledge that uses survey-data from startups with varying degrees of ambition levels on a broad scale of circular strategies to assess their willingness to cooperate with WISEs or to engage in other forms of target group employment.

2.4 Methods and materials

To gather perspectives, opinions, and characteristics of startups in Flanders, we organised a survey in close collaboration with the most relevant organisations that are active in the circular startup ecosystem in Flanders, including Circular Flanders, Start it @KBC, and the Social Innovation Factory (see Appendix 2.1). A general and detailed presentation of this survey is reported in (Van Opstal & Borms, 2023), that describes profile differences, barriers, and enablers for circular startups in general, without focusing on work integration ambitions . Nevertheless, we briefly report the most relevant methodological aspects of our approach.

In our survey, we opted to prevent a dichotomous view on 'circular' versus 'non-circular' startups at the stage of data collection. Therefore, we tried to capture a nuanced empirical reality by allowing respondents to indicate their level of implementation on ten circular strategies. These implementation levels went from 'not', to 'limited', to 'extensive'. Respondents could also indicate 'not applicable'. In order to be easily recognizable for startups with various degrees of circular strategy implementation, we compiled a set of easily identifiable circular strategies based on practical policy work, including the widely used 9R framework (Potting et al., 2017) and its adaption to a business model context (Kishna et al., 2019). This combination has been used earlier to measure and evaluate the level of CE implementation in enterprises in Flanders (Borms, Brusselaers, et al., 2023).

In order to identify the ambitions of startups to employ disadvantaged groups, we used a set of answer options that can serve as an ordinal variable in two directions: from no intentions, over considerations, to actually employing disadvantaged groups on the one hand, and from no intensions, over cooperating with Work Integration Social Enterprises (WISEs), to directly employing disadvantaged groups on the other hand.

To prevent success bias, we included perspectives of startups that stopped their activity already. The questionnaire of this survey has been constructed based on existing literature on successful and failed startups (Cantamessa et al., 2018; Chhatwani et al., 2022; Marom & Lussier, 2014; Pisoni et al., 2020; Rizos et al., 2016; Skawińska & Zalewski, 2020), on earlier research on circular companies in Flanders (Borms, Brusselaers, et al., 2023), and on the input of partner organisations that were willing to reach out to startups within their network. Draft versions were iteratively tested by colleagues and partner organisations in the period July-September 2021. The questionnaire provided separate answer pathways for startups that did not establish their company yet, for startups that are active, and for enterprises that stopped their activities. While the questionnaire was compiled in Dutch, a translated version is included in Appendix 2.2.

Responses were gathered on SurveyMonkey by several outreaching actions of our partner organisations towards the startups within their networks, including invitations to fill-in the questionnaire by personalized e-mails, phone calls, and dedicated newsletter items. No material or financial incentives were given. Between September 30th, 2021 and February 2nd, 2022, our survey received full responses of 165 entrepreneurs. To put this number in perspective, note that Circular Flanders identified and showcased 358 circular companies, most of them being startups (Vlaanderen Circulair, 2022). The database of Flanders Dealroom, an ecosystem platform for intelligence on startups organised by the Flemish Government and Flanders Investment and Trade, reports 418 startups that have been founded in the last 5 years (Flanders Investment and Trade, 2022). Compared to these numbers, our dataset provides a rich and relevant sample of the circular startup population in Flanders.

To validate and illustrate our results, we performed semi-structured interviews with 9 experts on target group employment, CE, and the development of startups. The list of respondents and a translated version of questions is included in Appendix 2.3. These interviews were recorded and processed, after which all interview respondents received a draft version of this paper to refine arguments and prevent misinterpretations and factual errors.

2.5 Results and discussion

2.5.1 Who wants to work with target groups?

Taking an explorative view on descriptive statistics, we find that 42% of our respondents are not involved in work integration. They do not work with target groups and do not take this into consideration, nor by direct employment, neither by cooperating with WISEs. In Table 3 we provide an overview of bivariate differences among personal and company characteristics and test for significant differences in relative frequencies using F-tests. In column A we see for example that ICT-startups and startups in the go-to-market phase have a significant lower tendency to engage in work integration.

We can investigate the other startups (58%) in two ways. One way is to analyse who is considering target group employment (column B: 41%) and who is already working with target groups (column C: 16%). Startups in Business-to-Government markets, startups involved in manufacturing activities, and startups who choose a legal form with limited liability are among the respondents with a significant higher propensity to work with target groups already. Among startups that consider working with target groups, we notice a high propensity among entrepreneurs with a migrant background. Finally, we see an increased interest to work with target groups for startups in the ideation phase and startups with a moderate return, compared to their more mature counterparts.

Another way is to see who is considering or already working with WISEs (column B': 42%) and who is considering or already engaging in direct employment of target groups (column C': 16%). Startups in manufacturing and startups active in business-to-consumer markets show the highest propensity to collaborate with WISEs. Female startup entrepreneurs show a significantly higher propensity to hire target groups directly (with an odds ratio of 3.86).

Table 3 – Interest to involve in target group employment and interest to collaborate with WISEs versus hiring target groups directly – bivariate analysis

	Not involved in target group employment (A)	Considering working with target groups (B)	Already working with target groups (C)	Collaboration with WISEs (B')	Hiring target groups directly (C')
Full sample	42.14%	41.43%	16.43%	42.14%	15.71%
Female	30.00%	52.50%	17.50%	40.00%	30.00%**
Age ≤ 30	29.41%	44.12%	26.47%*	52.94%	17.65%
Age 31-40	40.82%	42.86%	16.33%	42.86%	16.33%
Age 41-50	48.48%	42.42%	9.09%	33.33%	18.18%
Age > 50	48.15%	40.74%	11.11%	29.63%	22.22%
Education: no higher education	38.89%	61.11%	0.00%	44.44%	16.67%
Education: bachelor	50.00%	42.11%	7.89%	28.95%*	21.05%
Education: master	33.78%*	39.19%	27.03%***	45.95%	20.27%
Education: PhD	57.14%	42.86%	0.00%	42.86%	0.00%*
Migrant	21.74%*	65.22%**	13.04%	56.52%	21.74%
Phase: ideation	28.57%	71.43%***	0.00%**	52.38%	19.05%
Phase: validation	30.91%*	47.27%	21.82%	49.09%	20.00%
Phase: go-to-market	55.81%**	30.23%**	13.95%	25.58%**	18.60%
Phase: mature	48.00%	32.00%	20.00%	40.00%	12.00%
Manufacturing	24.32%**	45.95%	29.73%**	54.05%*	21.62%
Services	33.33%	52.94%	13.73%	43.14%	23.53%
Trade	41.67%	33.33%	25.00%	41.67%	16.67%
ICT/Software	62.79%***	32.56%*	4.65%**	27.91%**	9.30%*
Secondary sector	33.96%	45.28%	20.75%	50.94%*	15.09%
Tertiary sector	45.90%	37.70%	16.39%	31.15%**	22.95%
Quarternary sector	44.44%	48.15%	7.41%	40.74%	14.81%
BtB market	43.40%	40.57%	16.04%	39.62%	16.98%
BtC market	30.88%**	50.00%	19.12%	50.00%**	19.12%
BtG market	40.74%	29.63%	29.63%**	33.33%	25.93%
BtBtC market	31.58%	44.74%	23.68%	44.74%	23.68%
Limited liability	43.75%	34.38%***	21.88%***	40.63%	15.63%
Return: no	46.15%	34.62%	19.23%	46.15%	7.69%
Return: < 10 000 EUR	27.78%	44.44%	27.78%	44.44%	27.78%
Return: 10 000 – 100 000 EUR	35.90%	53.85%**	10.26%	38.46%	25.64%
Return: > 100 000 EUR	53.85%	23.08%**	23.08%	33.33%	12.82%
No FTE employed	48.57%	45.71%	5.71%**	34.29%	17.14%
1-3 FTE employed	44.26%	34.43%	21.31%	39.34%	16.39%
> 3 FTE employed	30.77%	38.46%	30.77%*	46.15%	23.08%

Note: Columns A, B, and C add up to 100%, just as columns A, B', and C' add up to 100%. Significance levels: * at the 10% level, ** at the 5% level, *** at the 1% level, resulting from two-sided F-tests comparing the percentage in the column reported (i) with the percentage of respondents outside that column (-i).

In Table 4 we report the results of multivariate statistical analyses that control for personal and company characteristics. In column A we report estimates of an ordered probit regression explaining work integration ambitions in three levels, being none, considering, and actually working with target groups. Note that N is smaller than 165 in these regressions, because we had to drop (21) respondents that stopped their startup already. Since these respondents were not planning to engage into any future activity with their startup, the explanatory variable in this regression is not relevant anymore and therefore missing. Furthermore, other observations were dropped because of item non-response, mainly of startups at a very early ideation stage. After all, performing a multivariate analysis requires that data on all regressors must be complete[1].

We see that work integration ambition levels are higher among startup entrepreneurs with a master's degree, startups that are active in manufacturing, and startups that serve business-to-consumer markets and business-to-government markets. There is also a positive relation between work integration ambition levels and staff size of the company (in FTE). Startup entrepreneurs with more than 5 years of management experience, however, show a lower propensity to engage in work integration. When we add the implementation degree of circularity strategies as an explanatory variable (column A'), the fit of our model improves, and we find a strong significant positive relationship between circularity ambitions and work integration ambitions.

Furthermore, we ran probit regressions to investigate parameters that predict preferences to work with WISEs or to employ target groups directly. Since Chi-2-statistics of our baseline model show a significance level far above 0.1, we consider the explanatory power of these combined variables as too limited to report coefficients. When we add the implementation degree of circularity strategies, our model fit improved drastically for WISEs (column B'), but not for direct target group employment (column C'). Again, we find a strong positive relationship between the ambition level of circular strategies and the willingness to cooperate with WISEs. Furthermore, we see that startup entrepreneurs with more than 5 years of management experience show a lower interest to collaborate with WISEs.

[1] We kindly acknowledge the suggestion of a reviewer to check if the main explanatory variable of interest is balanced between the survey sample and the estimation samples in order to rule out potential selection bias in the response rate. A crosstab analysis of the explanatory variables with observations that are and are not included in the estimation reveals no significant differences at the 5% level. This indicates that the source of measurement error is as good as random.

Table 4 – Multivariate analysis: interest to engage in target group employment

	No plans, taking target groups into consideration, or actually working with target groups (Ordered Probit) (A)	No plans, taking target groups into consideration, or actually working with target groups (Ordered Probit) (A')	Collaboration with WISEs (Probit) (B')
N	121	118	118
Prob > Chi-2	0.0005	0.0000	0.0216
Pseudo R^2	0.1763	0.2433	0.2116
Constant 1	0.5274 (0.7389)	1.078 (0.7920)	-1.0008 (0.9118)
Constant 2	1.8968 (0.7568)	2.6223 (0.8156)	/
Female	-0.0699 (0.2687)	0.2633 (0.2870)	-0.1737 (0.3339)
Age	0.0012 (0.0144)	0.0018 (0.0150)	0.0094 (0.0172)
Education: bachelor	0.2256 (0.3976)	0.4378 (0.4227)	0.1328 (0.4764)
Education: master	0.8859 (0.3910)**	1.0291 (0.4041)**	0.1636 (0.4549)
Education: PhD	0.1615 (0.5763)	0.3549 (0.6096)	0.4504 (0.6671)
Migrant	0.2937 (0.3491)	0.1519 (0.3609)	0.0758 (0.4202)
≥ 5 years industry experience	-0.2182 (0.2824))	-0.2327 (0.2934)	-0.1168 (0.3297)
≥ 5 years management experience	-0.6484 (0.3524)*	-0.9206 (0.3723)**	-0.865 (0.4288)**
≥ 5 years entrepreneurial experience	0.2855 (0.3266)	0.2730 (0.3411)	0.0645 (0.3998)
Manufacturing	0.6891 (0.2911)**	0.6586 (0.3032)**	0.1186 (0.3429)
Secondary sector	0.0658 (0.2904)	-0.3283 (0.3130)	0.1332 (0.3534)
BtB market	0.0014 (0.2716)	-0.1188 (0.2865)	-0.1317 (0.3333)
BtC market	0.6293 (0.2524)**	0.5870 (0.2630)**	0.2485 (0.2935)
BtG market	0.5167 (0.2987)*	0.4847 (0.3078)	-0.1350 (0.3527)
BtBtC market	0.3944 (0.2497)	0.2533 (0.2603)	0.1641 (0.2979)
Limited liability	-0.3147 (0.3036)	-0.3919 (0.3167)	-0.1530 (0.3566)
Return (ordinal)	-0.0261 (0.0773)	0.0523 (0.0837)	-0.0337 (0.0942)
FTE employed	0.0628 (0.0313)**	0.0506 (0.0323)	0.0467 (0.0374)
Circular strategies (sum of ordinal scores)		0.0393 (0.0113)***	0.043 (0.0131)***

Notes: Significance levels: * at the 10% level, ** at the 5% level, *** at the 1% level. For educational attainment, we grouped all respondents with no degree in higher education as the excluded category. Multicollinearity tests show a maximum VIF of 3.12 and a mean VIF of 1.72 for the set of regressors in (A). For the expanded set of regressors in (A') and (B'), we obtain a maximum VIF of 3.07 and a mean VIF of 1.72. Therefore, our estimations only show a limited degree of multicollinearity.

The positive significant relationship between the implementation of circular strategies and the willingness to cooperate with WISEs can be illustrated with expert opinions we captured during semi-structured interviews. Asked about the comparative advantages WISEs have for circular startups, almost all respondents mentioned the ability to co-create innovative solutions. WISEs are reportedly familiar with the CE and can deal in a flexible way with small volumes. Interview respondents also mention the mutual and complementary focus on sustainability of both WISEs and circular startups. "*Interest in*

ecological sustainability often goes hand in hand with social sustainability" (respondent 2) and "*both circular startups and WISEs focus on the creation of societal added value"* (respondent 8). For WISEs, circular startups can provide an interesting entry point to access future-proof market segments. Startup entrepreneurs may also provide an external drive to change current linear business models WISEs may operate in today. Finally, multiple interview respondents mention that for WISEs, collaborating with startups may be an investment in the growth of a future loyal client base.

Our results also suggest a negative relationship between management experience and work integration ambitions of startup entrepreneurs. This invites us to formulate the hypothesis that experienced management professionals tend to get stuck into traditional models they already know from the normal economic circuit, not involving target group employment at all. While interview respondents mostly remain puzzled by this hypothesis, they often mention that young professionals may not be burdened with scepticism about the unknown as much as their more experienced counterparts do. One respondent formulated it as follows: "*when you already have a lot of experience, you tend to fall back on networks and knowledge you already have, while unexperienced professionals still have to start their exploration of possibilities*" (respondent 1). From a behavioural economy and psychology perspective, this finding could possibly be explained by a status quo bias (Kahneman et al., 1991; Smiley & Fisher, 2022), and the concepts of habit formation and shared beliefs on past social norms (Feldman & Albarracín, 2017; Schultz et al., 2007).

Controlling for both the industry startups work in and the kind of activity they perform, we see a positive relationship of manufacturing activities and work integration ambitions of startups. This suggests that startups with manufacturing activities tend to outsource a part of their production processes to WISEs. Therefore, it is also interesting to investigate the relationship between work integration ambitions and the skills startups need.

In Table 5 we report average scores on the degree upon which startups report to need certain skills and evaluate differences according to their work integration ambitions, using t-tests. We see that, in general, skills on research & development, on commerce, trade, and marketing receive the highest scores. Startups not engaging in work integration report lower needs for skills in general. Interestingly, startups that show interest in direct employment of target groups report a significantly higher need for skills on IT and digital communication, while we see significantly higher scores for almost all other skills needs among startups that (would like to) collaborate with WISEs. Startups that already work with target groups show the highest needs for transport & logistics, and production.

Table 5 – Skill needs and target group employment. Average scores of the degree upon which one needs certain skills (1 = definitely not, 4 = definitely yes).

	Not involved in target group employment (A)	Considering working with target groups (B)	Already working with target groups (C)	Collaboration with WISEs (B')	Hiring target groups directly (C')
Commerce, trade, and marketing	3.18**	3.58**	3.35	3.49	3.58
Crafts	2.11	2.42	2.57	2.62**	2.13
Wood and construction	1.88	1.92	2.05	2.04	1.75
IT and digital communication	3.17**	3.55*	3.50	2.47	3.68*
Ecology and green technology	2.65**	3.03	3.32*	3.14*	3.04
Research and development	3.16***	3.62**	3.65	3.64**	3.62
Production	2.54***	2.95	3.55***	3.28***	2.77
Technique	2.57*	2.98	2.91	3.09**	2.68
Transport and logistics	2.35***	3.05*	3.36**	3.39***	2.60

Note: Respondents in columns A, B, and C add up to 100%, just as respondents in columns A, B', and C' add up to 100%. Significance levels: * at the 10% level, ** at the 5% level, *** at the 1% level, resulting from two-sided t-tests comparing the averages in the column reported (i) with the averages of respondents outside that column (-i).

In other words, work integration ambitions of startups may differ according to the skills they need (and thus of the activities they perform). Startups who focus at hiring target groups directly need a different skill set than those who want to collaborate with WISEs. This result seems logical to all interview respondents. On the one hand, "*startups look at WISEs to unburden them in production, transportation, and logistics*" (respondent 8). WISEs reportedly have the ability to translate complex production processes into easy steps (respondents 1 and 9) and have the flexibility to co-create and optimize production processes according to changing designs or new iterations of minimal viable products (respondent 2 and 4). This way WISEs are a partner in research and development as well. On the other hand, specific skill needs may be an excellent match with other target group profiles that do not need the same kind of workplace support. The most renown example are people with autism who reportedly have a comparative advantage in certain ICT skills such as software testing (respondent 2, (Vogus & Taylor, 2018)). However, most respondents point out that companies should not underestimate the skills needed to provide workplace guidance themselves for target groups. One respondent formulates this as follows: "*WISEs are built around the employment and competence enhancement of people with a distance to the labour market. Startups having work integration ambitions themselves will need to invest in expertise and experience, while they should focus at starting up their own venture.*" (respondent 8).

2.5.2 Circular strategies and target group employment

Since activities in the CE may encompass a broad set of circular strategies, we examine the interlinkages between work integration ambitions and circular strategies startups aim to implement. In Table 6 we report work integration ambitions of startups according to the circular strategies they want to implement. As a baseline, the first line reports ambitions of companies that are not fully implementing any of these ten strategies. Here, we once again see the positive relationship between circularity ambitions and ambitions to collaborate with WISEs.

Table 6 – Target group employment and circular strategies. Target group employment preferences by companies who fully aspire circular strategies

	Not involved in target group employment (A)	Considering working with target groups (B)	Already working with target groups (C)	Collaboration with WISEs (B')	Hiring target groups directly (C')
Companies not fully aspiring circular strategies	52.63%**	36.84%	10.53%	29.82%**	17.54%
Design to lower material use	29.03%	35.48%	35.48%***	58.06%**	12.90%
Design for longer product use	22.92%***	54.17%*	22.92%	58.33%***	18.75%
Design for additive manufacturing	17.86%***	50.00%	32.14%**	71.43%***	10.71%
Use of renewable materials	20.00%**	40.00%	40.00%***	64.00%**	16.00%
Sharing of means of production	33.33%	47.62%	19.05%	47.62%	19.05%
Circular business models	32.50%	50.00%	17.50%	52.50%	15.00%
Maintenance and repair	32.26%	48.39%	19.35%	61.29%**	6.45%
Recuperation of waste	29.17%	33.33%	37.50%***	62.50%**	8.33%
Take-back systems for refurbishment or recycling	18.18%**	59.09%	22.73%	68.18%***	13.64%
Supporting services for circular entrepreneurship	35.48%	41.94%	22.58%	48.39%	16.13%

Note: Columns A, B, and C add up to 100%, just as columns A, B', and C' add up to 100%. Significance levels: * at the 10% level, ** at the 5% level, *** at the 1% level, resulting from two-sided F-tests comparing the percentage in the column reported (i) with the percentage of respondents outside that column (-i).

More specifically we see a strong interest to collaborate with WISEs for most circular strategies. WISEs are considered most to collaborate with when design for additive manufacturing, take-back systems for refurbishment or recycling, or the use of renewable materials are implemented as circular strategies. In sum, working with WISEs is not only considered by startups that focus on outer circle strategies, such as recycling, but also by startups that focus on inner circle strategies, such as circular design or the use or renewable materials. Interview respondents, however, nuance this result by stating that until now, most CE activities of WISEs focus on labour intensive

processes related to recycling and repair (respondents 1 and 2). On the other hand, most interview respondents admit that they see new developments as well where WISEs are intensifying value chain collaborations to contribute to inner circle processes.

2.5.3 Barriers and enablers for the circular social economy

When considering barriers and enablers for circular startups, we investigate differences according to different work integration ambition levels. Therefore, we partitioned our sample into four groups, depending on whether they want to collaborate with WISEs or not, and whether they try to implement at least one circular strategy in full or not. A multivariate statistical analysis of profile differences among these four groups is reported in Appendix 2.4. We only retrieve a significant model fit for the subgroups of startups combining CE strategies with a collaboration with WISEs on the one hand, and the group of startups showing no ambitions on both CE strategies and collaboration with WISEs. For the remaining two subgroups, our probit model does not result in a statistically significant model fit[1].

In Table 7 we see that startups face different barriers to implement circular strategies depending to the subgroup they belong to. Almost half (48.78%) of circular startups that (want to) collaborate with WISEs mentions a high initial investment cost as a barrier, compared to only 12.50% of non-circular startups that do not seek a collaboration with WISEs. Other main barriers indicated by startups that combine circular strategies with a collaboration with WISEs are the linear organisation of the industry they work in, and the fact virgin materials are less expensive. Interestingly, a lack of value chain collaboration is mentioned less among circular startups compared to other startups that collaborate with WISEs. This finding makes sense to multiple interview respondents, as they see the embeddedness of WISEs in their value chains as a competitive advantage. However, as one interview respondent points out *"WISEs could increase this comparative advantage if they do not only play a role as a subcontractor but fully engage in cocreation within the value chains they are active in"* (respondent 8).

[1] Chi-2 statistics with p-values of 0.3570 and 0.5602.

Table 7 – Barriers for the circular social economy

	No CE No WISEs	No CE WISEs	CE No WISEs	CE WISEs
N	40	17	41	41
Little or no personal interest	10.00%	0.00%	2.44%	0.00%
Customers are not interested	30.00%	11.76%	19.51%	24.39%
Lack of value-chain collaboration	20.00%	35.29%*	19.51%	9.76%*
Our industry is organised in a linear way (design-make-use-dispose)	17.50%*	17.65%	26.83%	46.34%***
Regulatory barriers	17.50%	17.65%	19.51%	26.83%
Lack of international regulatory cooperation	5.00%	0.00%	21.95%**	9.76%
Virgin materials are cheap(er)	17.50%*	41.18%	21.95%	41.46%**
Lack of standardization (labels, certifications, guarantees, …)	2.50%**	17.65%	21.95%*	14.63%
High initial investment costs	12.50%**	17.65%	26.83%	48.78%***
Technological limitations to deliver sufficiently high quality	7.50%	17.65%	2.44%	9.76%
Limited circular design of products	5.00%**	17.65%	26.83%**	17.07%
Too few examples that showcase that circularity works	0.00%***	5.88%	19.51%	19.51%
Lack of information on the environmental impact of products	15.00%	5.88%	26.83%	24.39%

"CE" indicates the startup implements at least one circular strategy in full.
"WISEs" indicates that the startup is willing to collaborate with WISEs (or already does).
Note: Significance levels: * at the 10% level, ** at the 5% level, *** at the 1% level, resulting from two-sided F-tests comparing the percentage in the column reported (i) with the percentage of respondents outside that column (-i).

We also asked interview respondents what barriers prevent a closer collaboration between circular startups and WISEs. Two barriers that were mentioned by all interview respondents were 'skepticism for the unknown' and 'supply and demand do not find each other'. Other barriers that were mentioned by multiple respondents are the complexity of legal aspects when dealing with innovations, including the division of intellectual ownership in cocreation processes and the division of investment risks, and financial uncertainties related to startups and circular business models. While most WISEs in Flanders operate in a Business-to-Business context, it is also important to point out that social enterprise reuse shops are conversely used to operate in a Business-to-Consumer setting (respondent 6).

With respect to enablers, Table 8 reports enabling policy measures indicated by respondents divided into the same four subgroups. Again, we find strong differences according to the subgroup startups belong to. Innovation and collaboration support (subsidies), and fiscal measures that support circular goods and services are mentioned most often by all startups and even significantly more by circular startups that aim at collaborating with WISEs. Public procurement is also mentioned most often by this latter group of startups. This comes to no surprise to most interview respondents. "*WISEs are used to work with subsidies, and some of them are very skilled in attracting combinations of European, regional and provincial subsidies while setting up broad*

networks with companies and knowledge institutions" (respondent 2). This is partially nuanced by another respondent stating that *"many circular or social companies cannot find their way within a tangle of subsidy schemes"* (respondent 1).

Table 8 – Enabling policy measures for the circular social economy

	No CE No WISEs	No CE WISEs	CE No WISEs	CE WISEs
N	40	17	41	41
Measures against unfair international competition	27.50%	5.88%**	31.71%	39.02%
Bank guarantees for investments	20.00%	17.65%	21.95%	19.51%
Removing regulatory barriers	37.50%	23.53%	31.71%	36.59%
Innovation and collaboration support (subsidies)	60.00%	52.94%	60.98%	78.05%**
Education and training for new and polyvalent skills	10.00%	29.41%***	4.88%	4.88%
Improved access to information and expertise	27.50%	29.41%	21.95%	19.51%
Liquidity support or subordinated loans	25.00%	35.29%	31.71%	43.90%
Enhance export opportunities and international knowledge transfers	15.00%	5.88%	31.71%*	24.39%
Fiscal measures that support circular goods and services	42.50%**	52.94%	63.41%	73.17%**
Public procurement for circular goods and services	27.50%	11.76%*	36.59%	46.34%**

"CE" indicates the startup implements at least one circular strategy in full.
"WISEs" indicates that the startup is willing to collaborate with WISEs (or already does).
Note: Significance levels: * at the 10% level, ** at the 5% level, *** at the 1% level, resulting from two-sided F-tests comparing the percentage in the column reported (i) with the percentage of respondents outside that column (-i).

Finally, we asked interview respondents about enablers that could enhance the collaboration between circular startups and WISEs. Almost all respondents pointed at initiatives that would improve matchmaking between startups and WISEs, which is in line with the major barrier that supply and demand do not find each other, as indicated earlier. Interview respondents point at initiatives to improve information flows enabling the selection of WISEs suitable to partner up with. The recently established social circular hubs we referred to in section 2 are mentioned as an important enabler as well, since their work includes sharing good practices, co-creation workshops, and matchmaking between WISEs and CE ventures. Enabling policy measures that were proposed include public procurement, earmarked innovation subsidies, earmarked growth paths for WISEs, and mandatory regulations on products to close resource loops locally. Other enablers include legal support, increased access to R&D and finance, business model support, and the sharing of fail experiences. Other suggestions include the creation of spin-offs and joint ventures and a collaboration between WISEs to pool risks.

The Social Economy Action Plan (SEAP) of the European Commission explicitly refers to circular activities as a pathway to mobilize the full potential of the social economy (European Commission, 2021). Conversely, the Circular Economy Action Plan (CEAP) of the European Commission refers to mutual benefits of supporting the green transition and strengthening social inclusion (European Commission, 2020a). Interview respondents recognize the ethical and mutually enforcing dimension of combining the social dimension of sustainability from WISEs with the environmental dimension of the CE, as highlighted earlier in (Goodwin Brown et al., 2020). It is remarkable, however, that the need for future-proof labour market skills and the potential beneficial impact of CE activities on upskilling and reskilling is barely or not referred to by interview respondents. Nevertheless, acknowledging the role of social enterprises in upskilling and reskilling to meet changing market needs was one of the main recommendations by the federation of social enterprise reuse networks (RREUSE, 2022a) when assessing the Social Economy Action Plan.

2.5.4 Limitations of this research

Limitations of this work include its geographical scope, the number of respondents, and the lack of perspectives of incumbent firms. Geographically, Flanders is a densely populated, industrialized, and open economy, characterized by a high number of startup companies and SMEs and a long tradition of WISEs (De Mey et al., 2008; Deman & Tchinda, 2021; Van Opstal et al., 2009). However, it is less suited to study the potential of a circular social economy in less affluent regions, while these are often most affected by the negative consequences of a linear economy. Moreover, the organisation and economic embeddedness of WISEs may vary significantly between industrialized countries as well (Spear & Bidet, 2005). Therefore, we would recommend comparative studies across countries as a future research avenue.

A second limitation of this study involves the number of respondents in our survey. Although the number of respondents in our dataset is comparable or higher than in most other studies on WISEs (Halberstadt et al., 2021; Kurleto, 2019; Termote & Demeyere, 2021) or circular startups (Bauwens, Mees, et al., 2020; Henry et al., 2020), it is still too limited to deepen our knowledge on cross-industry differences or combinations of circular strategies. Therefore, we suggest future research endeavours should focus on constructing panel data, allowing for an analysis of dynamics of startups and their relation to WISEs and target group employment. Moreover, we suggest an improved data collection on startups in general (e.g. in databases of Circular Flanders or Flanders Dealroom), allowing to compare profile differences and potential sampling biases when using survey research.

Finally, while we present a novel contribution on the collaboration between circular startups and WISEs, many insights could apply to incumbent firms as well. Therefore, we suggest future research could investigate the hybrid dynamics of startups, incumbents, and in-between combinations of corporate venturing.

2.6 Conclusions

In this study, we investigated ambition levels, profiles, barriers, and enablers of startups in the CE engaging in work integration of vulnerable groups. Making use of expert interviews and a novel data set on startups, including personal and company characteristics of 165 survey respondents, we can draw the following conclusions.

We find a significant positive relationship between the implementation of circular strategies and the willingness of startups to cooperate with WISEs. While ambition levels to engage in work integration are high during the ideation phase, they tend to decline during the go-to-market phase. However, as the staff of startups grows, we see an increasing interest to engage in target group employment in general and collaborate with WISEs in particular. Unlike their non-circular counterparts, circular startups that seek a collaboration with WISEs report a higher need for skills on transport, logistics, and production. Circular startups that mostly need IT and digital communication skills rather plan to hire target group employees themselves. When we investigate the relationship between work integration ambitions of startups and the implementation of different circular strategies, we see a strong interest to collaborate with WISEs for most circular strategies. Working with WISEs is not only taken into consideration by startups that focus on outer circle strategies such as recycling, but also by startups that focus on inner circle strategies such as repair and design for circularity.

A collaboration with WISEs is mostly considered by circular startups that face barriers with respect to initial investments costs and the linear organisation of the industry they work in. WISEs therefore appear to be renowned for their strong embeddedness in value chains and start to become recognized as interesting parties to co-create new innovative circular solutions. Barriers to establish a collaboration between circular startups and WISES are mostly scepticism for the unknown and the fact that supply and demand do not find each other. Therefore, initiatives that improve matchmaking between startups and WISEs or improve information flows enabling the selection of WISEs suitable to partner up with are identified as important enablers. Moreover, our results suggest that the circular social economy has dissimilar needs and requires different policy support measures than non-circular startups that do not engage in work integration.

While policy initiatives at the EU level, such as the Social Economy Action Plan and the Circular Economy Action Plan, explicitly refer to the mutually enforcing potential of the CE and the social economy to engage in reskilling and upskilling of the workforce, our interview respondents did not mention this aspect once. Rather, they focused on mutual business opportunities and a more general complementarity of both actors to contribute to a more sustainable society, combining economic, environmental, and social goals. While it may be possible that many WISEs and startups take reskilling and upskilling for granted, we recommend them to explicitly evaluate opportunities to upgrade skills that may follow from their collaboration.

Since our study is the first to our knowledge to investigate opportunities and barriers at the crossroads between circular startups and work integration, we identify some novel research gaps. A first research gap concerns the role of path dependency among management professionals to engage in work integration or not. Further research could benefit from developments in behavioural economics to investigate the role of past experiences (or its absence) with target group employment on beliefs, social norms, and habit formation. A second research gap addresses the transition pathway WISEs follow when implementing inner circle strategies such as repair and design for circularity. Do we see these strategies adopted by new players that were not active yet in CE activities, do we see how WISEs that perform recycling activities already diversify their activity portfolios, or do we rather see a transformation of activities from outer to inner circle activities? Finally, a third research gap involves a critical evaluation of the effects of social circular hubs on the collaboration between CE ventures and WISEs, as this would enable to transfer conclusions and recommendations to other regions.

3. Towards Sustainable Growth Paths for Work Integration Social Enterprises in the Circular Economy

Based on:

Van Opstal, W., Borms, L., Brusselaers, J., Bocken, N., Pals, E. & Dams, Y. (2024), Towards Sustainable Growth Paths for Work Integration Social Enterprises in the Circular Economy. Journal of Cleaner Production. https://doi.org/10.1016/j.jclepro.2024.143296 *[Paper III]*

Abstract

An important presumed social impact of the circular economy (CE) is job-creation for vulnerable groups. This creates opportunities for Work Integration Social Enterprises (WISEs), which are established to organise economic activities for workers with a distance to the labour market. In this paper, we identify challenges, opportunities, and sustainability aspects for WISEs in the CE. We apply Computable General Equilibrium (CGE) model results and conduct 20 expert interviews, providing an empirical contribution to recent research agendas on the social impact of the CE and the role of WISEs in Circular Societies. Our results show that WISEs should not take job-creating opportunities of the CE for granted, most specifically in the business-to-business (B2B) markets they are active in. While WISEs conceive competitive advantages to perform core CE jobs, they need to develop organisational capabilities to convert this potential into high added value activities within regionally embedded circular value chains. When identifying conditions for sustainable growth paths, we reveal a strong interconnectedness between social, environmental, and economic dimensions. We recommend management professionals and policy makers to measure, validate, and communicate social and circularity outcomes and invest in partnerships along value chains and across policy domains.

Keywords: circular economy, work integration social enterprises (WISEs), social economy, organisational capabilities, circular society

3.1 Introduction

While the concept of a circular economy (CE) and its focus on resources and a future-proof economy became popular among policymakers, scholars, and entrepreneurs, empirical research on measuring the progress towards a CE shows we are far from its implementation (Circle Economy, 2023). Moreover, the CE may be widely acknowledged as an enabler for environmental sustainability, yet as a concept it says little about its social impact (Geissdoerfer et al., 2017a; Velenturf & Purnell, 2021). Regions such as the European Union (EU) see the potential of the CE for job creation (OECD & European Commission, 2022) but more studies are needed to understand the social impact of the CE (Padilla-Rivera et al., 2020; Schröder et al., 2020; Valencia, Bocken, et al., 2023).

The most cited social impact of the CE is its potential to generate jobs (Padilla-Rivera et al., 2020). According to the ILO (2022a), a CE is expected to generate a shift from material-intensive to more labour-intensive activities and requires investing in new skills. The transition to a low-carbon, circular, and resource-efficient economy is estimated to generate 18 million new jobs worldwide and 1.2 million new jobs in the EU by 2030 (ILO, 2022b). While the important role of labour in the CE has been widely acknowledged (Mies & Gold, 2021; Moreau et al., 2017), there is a lack of studies on who would benefit from those jobs, and whether people would be willing to perform these jobs (as pointed out by Clube, 2022) and acquire the necessary skills for a green transition (European Commission, 2020a).

Many CE-related jobs are believed to create training and working opportunities for vulnerable groups at the labour market, such as people with disabilities, psychosocial problems, elderly people, migrants, refugees, and marginalised communities. Conversely, the employment of these vulnerable target groups is increasingly acknowledged as a social CE indicator (Pitkänen et al., 2023; UNEP, 2020; Walker et al., 2021). Work Integration Social Enterprises (WISEs), which are specifically established to identify and organise economic activities for workers with a distance to the labour market, are often considered as a strategic partner to accelerate the transition towards a circular and inclusive economy (OECD & European Commission, 2022). This has been recognized in both the Circular Economy Action Plan (CEAP) and the Social Economy Action Plan (SEAP) of the European Commission (European Commission, 2020a, 2021).

WISEs seek to help poorly qualified unemployed people, who are at risk of permanent exclusion from the labour market, return to work and to society in general through a productive activity (Vidal, 2005). WISEs activate a complementary skill set in the labour market by designing process flows and providing support in a way that vulnerable people at the labour market (e.g., because of a disability or psychosocial problems) are enabled to perform easy and repetitive tasks that are adapted to their capabilities

(Samoy & Waterplas, 2012). This design and guidance of these activities is performed by supporting staff that combine the necessary technical, social, and business-development skills (De Cuyper et al., 2015). Therefore, the skill set WISEs may offer could match both 'core' CE jobs requiring a lower educational level and manual skills, and 'enabling' CE jobs that require higher education and technical skills (Burger et al., 2019). Moreover, as WISEs include and empower workers that would have been unemployed or inactive otherwise, they contribute to a just transition (Purvis, Celebi, et al., 2023; Vanhuyse et al., 2022) and a circular society (Jaeger-Erben et al., 2021). However, aside from their potential to contribute to the CE, questions can be raised about the quality of jobs generated within WISEs, the genuine environmental contribution of the tasks WISEs perform, and the economic sustainability of shifting current activities towards circularity. Deepening our knowledge on these aspects is crucial to develop sustainable business model in WISEs, that requires a sound alignment of strong environmental, social, and economic value propositions (Bocken, 2021).

In this paper, we identify challenges and opportunities of a CE shift of WISEs and formulate boundary conditions for sustainable growth paths for WISEs towards a CE. We first apply post-calculations on a Computable General Equilibrium (CGE) model to illustrate the effects on jobs in WISEs of two specific CE supporting and enabling measures in the current linear economy WISEs operate in. Subsequently, we analyse and report the results of semi-structured interviews with 20 experts. This allows us to investigate the following research questions:

- RQ1 – What is the impact of CE supporting and enabling measures on jobs in WISEs?
- RQ2 – What are the challenges and opportunities of a shift of WISEs towards the CE?
- RQ3 – What are boundary conditions for a sustainable growth path for WISEs towards a CE?

This research contributes with deepening knowledge on the potential role of WISEs in a CE, thereby answering a call for further research as formulated by (Ziegler, Bauwens, et al., 2023). More broadly, it inquires whether job creation for target groups within a CE can be considered as an authentic, meaningful, and legitimate social benefit of the CE transition, as called for by (Clube, 2022). As a theoretical lens, we combine insights from comparative advantage theory, capability theory, and sustainable business model innovation. This allows us to formulate recommendations for policymakers, employment services, WISEs, and social partners who want to envision and implement strategies towards a social circular economy or a circular society.

Our results focus on WISEs in Belgium, which is an open industrialised economy largely embedded within globalized value chains of a linear economy. Belgium has a long tradition with WISEs and most particularly WISEs in Belgium are strongly embedded in business-to-business markets, as we will discuss in the next sections. Moreover, Belgium has been identified as a frontrunner towards a CE (D'Adamo, Favari, et al., 2024). We therefore believe lessons from the Belgian case can be insightful for and inspiring for regions with less complex and more regionally embedded value chains, as well as countries that are less involved in the CE. The remainder of this paper is structured as follows. In Section 3.2, we provide background information on the context WISEs operate in and we discuss relevant literature at the crossroads of WISEs and the CE. In Section 3.3, we present the methods, including a quantitative estimation of the size and embeddedness of WISEs in the Belgian economy. Section 3.4 includes the results and Section 3.5 discusses empirical contributions and practical implications. Finally, we conclude with novel research gaps.

3.2 Background

3.2.1 Work Integration Social Enterprises

As social enterprises, WISEs pursue a social mission while sustaining their operations through commercial activities. WISEs are therefore hybrid organisations that balance their social mission with economic productivity (Battilana et al., 2015; Ebrahim et al., 2014). They are part of the social and solidarity economy, which refers to *"cooperatives, associations, mutual societies, foundations, social enterprises, self-help groups"* and other groups with *"social or public purposes, engaged in economic activities based on voluntary cooperation, democratic and participatory governance, autonomy and independence, the rules of which prohibit or limit the distribution of profit"* (ILO, 2022a). Being private companies, WISEs are active in business-to-consumer activities, such as reuse shops, but are likewise integrated within business-to-business markets in global value-chains (RREUSE, 2021; Van Opstal & Borms, 2024).

Many WISEs in Europe were created after the Second World War to create employment opportunities for people with disabilities. In the 1970s and 1980s, new social enterprises increasingly focused on environmental issues, but in the last decades, the focus of many WISEs became predominantly the creation of employment and work experience for vulnerable target groups (Clark & Johansson, 2016; Vickers, 2010).

In a comparative report of social enterprises and their ecosystems in Europe, a significant number of EU countries have been identified for having specific statuses recognizing WISEs (European Commission, 2020c). Comparative analyses show clear differences in national contexts, but large similarities in the forms and characteristics

of WISEs across Europe (Defourny & Nyssens, 2021b, 2021a; Spear & Bidet, 2005). Outside Europe WISEs have been studied and documented, mostly in Asia (Bidet & Defourny, 2019), Latin America (Gaiger et al., 2019), and Canada (Lysaght et al., 2018).

3.2.2 WISEs in Belgium

The Belgian landscape of WISEs has been dominated by sheltered workshops and social workshops (the latter only in Flanders). Sheltered workshops aim at the employment of people with work disabilities and have a strong business-to-business (B2B) profile performing a wide array of economic activities including packaging, assembly, green area and park maintenance, wood manufacturing, bookbinding, and printing (Van Opstal et al., 2007). Social workshops, mostly established in the 1980s and 1990s as an answer to rising unemployment figures, put their focus on workers with a distance to the labour market because of physical, social, or psychological problems (De Mey et al., 2008). Most of them performed economic activities similar to sheltered workshops, characterized by manually intensive labour. An exception to this is a group of 22 social workshops that are active as social enterprise reuse shops ('Kringwinkels'), that combine social employment with ecological activities in Flanders (Delanoeije & Bachus, 2020).

Regulation on WISEs in Belgium is mainly a regional competence. In Flanders, the regulatory policy landscape for work integration evolved towards a dual framework for accredited WISEs ('collectief maatwerk', implemented on January 1st, 2019), and individual work integration support ('individueel maatwerk', implemented on July 1st, 2023). With this reform, sheltered and social workshops in Flanders were renamed to 'accredited WISEs' ('maatwerkbedrijven'). Individual work integration support is a framework that will provide subsidies for individual companies willing to hire people with a distance to the labour market (Vandekerkhove et al., 2021). In Brussels and the Walloon Region, sheltered workshops continue to exist, and except for the activity of social enterprise reuse shops (which is only organised in Flanders by WISEs), they perform activities that are comparable to accredited WISEs in Flanders.

The way WISEs hire, evaluate, and support target groups is regulated. For budgetary reasons, each accredited WISE is granted a quota defining the maximum number of target employees that can be hired. It is noteworthy that, in Flanders, developing activities in the field of CE or climate mitigation recently became a prerequisite for WISEs to apply for extended quota to hire target groups (Dept. WSE, 2022). Citizens with a work disability or psychosocial problems can become eligible to work in WISEs after screening and guidance by the Public Employment Services of their region or their partner organisations. In Flanders, this screening is based on an ICF-based methodology (International Classification of Functioning, Disability, and Health). For the unemployed

whose distance to the labour market is considered too large for paid employment, work and care programs have been established, which are often integrated in accredited WISEs (De Norre & Cabus, 2020).

3.2.3 WISEs and the Circular Economy

The CE has been identified as a promising pathway for the further development of social enterprises (Kay et al., 2016; OECD & European Commission, 2022; Suchek et al., 2022). For WISEs in particular, the CE creates opportunities, as it is expected to positively affect employment for vulnerable groups (ILO, 2022b; Willeghems & Bachus, 2018a), including activities such as sorting, maintenance, repair, manual disassembly (Bachus et al., 2015), remanufacturing, refurbishment, and reuse operations (Delanoeije & Bachus, 2020; Parker et al., 2015; Versluys et al., 2021). Nevertheless, this literature often considers any job created for vulnerable groups as a positive contribution of the CE, while neglecting its economic, environmental, or social sustainability.

Studies based on qualitative company-level data to assess opportunities at the crossroads of WISEs and the CE include the identification of key characteristics of WISEs with an ecological orientation (ECO-WISEs) (Anastasiadis, 2016), opportunities for public-private partnerships (França et al., 2022; Soufani et al., 2018), and the emerging role of WISEs in waste management (Banerjee & Anand, 2021), and reuse and recycling (Costanza, 2023; Lane & Gumley, 2018). Other studies identify and investigate specific challenges and ways to deal with CE opportunities in business innovation processes for WISEs (Gorissen et al., 2016; Schadenberg & Folmer, 2022; Stratan, 2017). Also here, these studies automatically consider a transformation towards a CE as a positive evolution and a means to invest in a future-proof strategy for WISEs. Moreover, these studies mostly focus on the potential role of WISEs to perform public services or provide reuse goods in consumer markets, largely neglecting the role of WISEs in B2B markets.

Studies using quantitative company-level data on this topic remain limited. Survey data has been used to map circular activities and target group employment (RREUSE, 2021, 2022b), investigate circular business models (CBM) for social enterprises (Kurleto, 2019), compare key differences between startups and established WISEs (Halberstadt et al., 2021) and analyse the mediating role of NGOs in stimulating social entrepreneurship (El Chaarani & Raimi, 2021). Survey data from 87 WISEs in Flanders was used to investigate to what extent they are embedded in the Flemish economy, by obtaining detailed micro-level data on client and supplier transactions. Results show a strong regional and local embeddedness of WISEs: 92% of their clients are situated in Flanders, and over 70% in the same province. The CE, however, accounts for about 5% of client transactions and less than 10% of all supplier transactions (Termote & Demeyere, 2021). Recently, survey data of startups in Flanders showed a strong and

positive relationship between circularity ambitions of startups and the degree upon which they want to collaborate with WISEs (Van Opstal & Borms, 2024). In that study, circular startups that seek a collaboration with WISEs report a higher need for skills on transport, logistics, and production. While these studies show the interlinkages and potential for further collaboration, they do not address the inherent quality of jobs involved, nor the economic viability or environmental contribution of these activities.

3.2.4 Research gap: Transitioning towards a circular society

Recently a theoretical framework of a social economy-based embedding of circularity was proposed by (Ziegler, Bauwens, et al., 2023), theorizing its impact on business models, citizen involvement, technology, and the promotion of regional economies. While they acknowledge reality may be far more nuanced than the ideal-typical propositions they formulate, they identify the social economy as an enabler to move from a CE to a circular society (CS). The CS concept has been introduced as an umbrella concept to include crucial social, political, and ecological implications of a circular transition, on top of the technocentric and market-based solutions CE propositions tend to focus on (Calisto Friant et al., 2023). While interest in CS is growing (Calisto Friant et al., 2021; Jaeger-Erben et al., 2021), its application to WISEs remains limited. A notable exception is (Villalba-Eguiluz et al., 2023a), who consider how the Social and Solidarity Economy may contribute to a transformational CS, by focusing on its non-distribution constraint (of profits) as a basis for a circularity approach towards sufficiency. Nevertheless, these studies start from benevolent assumptions on the contribution of WISEs towards a circular society. In many studies on WISEs (and on social entrepreneurship in general), there is a risk of confusing good intentions with actual good outcomes.

Therefore, we start from the theoretical lens of comparative advantages to understand the role WISEs may perform in an industrialised economy. As outlined by trade theory and economic geography, countries and regions that are relatively abundant of highly skilled labour can be expected to have comparative advantages in the production of goods that intensively use this production factor (Bergstrand, 1990; Leamer, 1995). A globalisation of our economies, supported by the creation of a unified European market and a multilateral framework for trade liberalisation, resulted in a decline of jobs for low-skilled workers, a downward pressure on their wages and working conditions, and unfavourable labour market conditions for vulnerable groups (Dumont et al., 2012; Trefler, 1995).

The establishment of a CE, conversely, favours the creation of locally embedded economic activities, which increases locally embedded labour market opportunities for low-skilled workers. At the macro-level, a well-functioning dual labour market that

complements enabling capabilities from highly-skilled workers with core capabilities from vulnerable groups, may constitute a comparative advantage for a CE (Burger et al., 2019). At the firm-level, this translates into the opportunity transform these combined skills sets into a competitive advantage (Porter, 2008). Moreover, when considering necessary conditions to build a sustainable business model, this combination could offer possibilities to combine strong economic, environmental, and social value propositions (Bocken, 2021).

These opportunities cannot be expected to result automatically in the development of competitive advantages at the firm level or comparative advantages at the macro-level. However, studies on boundary conditions to shape supporting labour market institutions aimed at combining capabilities of WISEs with their B2B clients towards a CE remain to the best of our knowledge non-existent. Likewise, studies taking a critical stance on the social conditions (including job quality), environmental conditions (including lifecycle assessment considerations and rebound effects), or even economic conditions (from a business model perspective) when discussing the potential of WISEs in a CE remain scarce to non-existent.

3.3 Materials and methods

In Figure 2 we summarize the overall design of our study. First, we performed post-estimation calculations on two scenarios that have been calculated in a CGE model. The background data to perform these calculations is outlined in Section 3.1 and background information on the CGE model and the interlinkage between the scenarios and WISEs is explained in Section 3.2. For technical details, we refer to Appendix 3.1. Next, we conducted semi-structured interviews with experts, as outlined in Section 3.3, which included a discussion of the post-estimation results and involves all three research questions. The analysis and reporting of our results were mainly inspired by theoretical frameworks including comparative advantage theory, capability theory, and sustainable business model innovation, as outlined in Section 2.4.

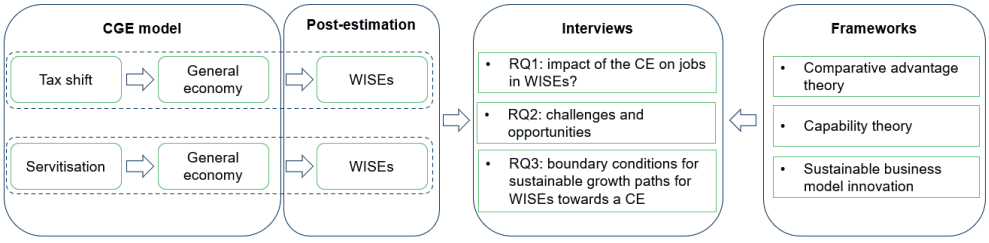


Figure 2 – Research design

3.3.1 Data on WISEs in Belgium

WISEs in Belgium can easily be identified because of a regulatory accreditation system. We focus on accredited sheltered workshops and social workshops, as both accreditations refer to social enterprises whose focus is work integration. Based on the lists of accredited WISEs, we link their company registration numbers to financial statements, and employment figures within the Belgian Crossroads Bank for Enterprises (CBE). Further information on target group employment and government subsidies could be retrieved from federations of WISEs and annual reports from the subsidizing regional departments. In Table 9, we report key figures on WISEs in Belgium and its regions. We deliberately report figures for 2018 because the Computable General Equilibrium (CGE) model we use is calibrated for that year. This choice does not significantly affect the outcomes of our results, as the number of WISEs, their employment, as well as their embeddedness within our economy did not shift significantly since then.

Table 9 – Key figures on WISEs in Belgium and its regions (2018)

	Flanders	Brussels	Walloon Region	Total
Number of accredited WISEs	122	14	50	186
Employment in WISEs	25,765	2,252	7,355	35,372
% Target group employment	83.57%	82.93%	80.58%	83.25%
Government subsidies (in mEUR)	392.90	30.09	101.86	524.85
Turnover (in mEUR)	468.66	33.46	147.92	650.04

Source: own calculations based on the Crossroads Bank of Enterprises (CBE), federations of WISEs, and subsidizing regional departments.

In Belgium, more than 180 accredited WISEs account for a total turnover of 650 million EUR. This is complemented with 525 million EUR of government subsidies, to compensate for the diminished productivity of their workers, to provide support and guidance, and to support WISEs at the organisational level. The size of WISEs in Belgium varies from 40 to over 2,000 employees (Van Waeyenberg & De Cuyper, 2016). In total, WISEs employ about 35,000 people, over 80% of them being target groups with a significant distance to the labour market. Other employment includes workplace supervision, social support, technical staff, management, and administrative staff.

WISEs in Belgium operate independently as a business, competing with firms both within and outside the social economy (Van Opstal et al., 2009). To capture their embeddedness within the Belgian economy, we make use of a recent and detailed survey by the Flemish provinces on B2B activities of WISEs in Flanders (Termote & Demeyere, 2021). This survey shows that WISEs deliver services to over 10,000 Belgian companies, often being an integrated part of globalized value chains with B2B customers in over 28 countries. While this survey refers to data from 2019, we use

relative shares of purchases and sales and calibrate them to financial statements data from 2018. Next to B2B activities, WISEs are also active as social enterprise reuse shops, which are mostly oriented at households. Data on their activities was retrieved from their sectoral federation, Herw!n. In Table 10, we report a general overview.

Table 10 – Embeddedness of WISEs within the Belgian economy (2018)

Sector	Purchases		Sales	
	in million euros	in %	in million euros	in %
Business-to-business activities	259.40	93%	601.14	92%
Agriculture	3.37	1%	1.20	0%
Mining	1.06	0%	0.34	0%
Manufacturing	32.43	12%	263.90	41%
Energy	5.69	2%	5.13	1%
Construction	24.38	9%	10.82	2%
Retail	88.46	32%	84.76	13%
Transportation and logistics	69.52	25%	101.59	16%
Market services	12.19	4%	20.44	3%
Non-market services	19.71	7%	90.77	14%
Waste & Recycling	2.58	1%	22.18	3%
Reuse shops	19.45	7%	48.90	8%
Total	278.85	100%	650.04	100%

Source: own calculations based on the Crossroads Bank of Enterprises (CBE), Termote & Demeyere (2021), and Herw!n

3.3.2 Scenario analysis through CGE modelling

A CGE model is an economic model that combines actual economic data with a theoretical framework to analyse how an economy might react to changes in policy, technology, or other external factors. CGE models provide a comprehensive view of an economy, capture complex interrelations between sectors, and allow to evaluate broad policy impacts (Burfisher, 2017). In this study, we apply post-calculations on scenario results that have been performed on a CGE model that has been calibrated to the Belgian economy. This model includes 13 sectors and 13 goods for 2018, one household, a government, and trade (Borms, Pals, Dams, et al., 2023; Brusselaers et al., 2022). The model builds on National Accounts data, including supply and use tables, and is complemented with labour statistics from the Flemish government.

In our CGE model, each economic sector is represented by a representative company that uses specific mathematical functions to model production decisions. These functions, which account for how easily different inputs can be substituted, are calibrated in line with (Van der Mensbrugghe & Peters, 2016). Firms in the model aim to maximize their profits while considering the availability of labour and capital, the technology they use, and the intermediate goods and services they need. The labour market in the model assumes that wages are influenced by the household's preference for leisure, thus only accounting for voluntary unemployment. Consumers make

decisions based on how easily they can substitute one good for another, following established consumption patterns in line with (Pollak & Wales, 1978). Government spending is determined by its budget, consumption prices, and how it values different types of spending. Investment demand is influenced by investment prices (capital costs) and how investment spending is valued. National income is divided among household consumption, public spending, and savings. The volume of exports is influenced by export prices. As Belgium is a small, open economy, it cannot impact the price levels at international markets. Imports depend on how easily they can be substituted with domestic goods, based on specific elasticities. All these elasticities are derived from the GEM-E3 model (Capros et al., 2013), except for those related to transport modes, which are based on (Mayeres, 1999).

CGE models have been applied to model the impact of CE scenarios and policy options, such as CE enhancing taxation frameworks and fiscal policies (Brusselaers et al., 2022; Freire-González et al., 2022; Milios, 2018), or regulations that stimulate the use of recycled inputs, reduce waste exports, or enable high-quality recycling (Borms, Pals, & Dams, 2023; Borms, Pals, Dams, et al., 2023). We focus on two scenarios that support or reflect a transition towards a CE and that may typically impact employment in WISEs: a tax shift from labour to resources, and a shift towards servitisation. For technical details on the CGE model and the underlying scenarios, we refer to Appendix 3.1.

In 2018, the year of calibration of the CGE model, Belgium had the second highest tax-to-GDP ratio of the European Union of 47.2% (Eurostat, 2023). Despite notable labour taxation reforms, Belgium still imposes heavy taxes on labour (the highest across OECD countries) with a tax rate on wages of 52.7% in 2018 for singles without children earning an average wage (OECD, 2023b). In contrast, environmental taxes are still an under-used tool: Belgian environmental revenues only account for 4.1% of total taxation in 2018 and only 0.1% are from resource taxes (OECD, 2023a). A decrease in the tax on labour might therefore lower production costs for firms and increase the incentive for households to work more and consume more. At the same time, we pose that a tax on resources might decrease environmental pressure on primary materials and will decrease the rebound effect of lower production costs (The Ex'tax Project, 2016). Given the perverse effects of high income taxes on labour market participation, contributing to the existence of unemployment traps for low-income workers (Jara et al., 2020), this scenario is particularly relevant when investigating social employment.

Servitisation, or the shift from selling new products towards using products to sell services, has been widely acknowledged as an effective enabler for a resource-efficient and circular economy (Han et al., 2020; Tukker, 2015). Therefore, this scenario models a shift of consumers from buying new product to using services. To the best of our knowledge, no papers have been published that apply CGE-models to capture the effects

from servitisation. Given the strong embeddedness of WISEs in the manufacturing industry, as shown in Table 10, the servitisation scenario is particularly relevant to investigate.

We perform post-calculations on the results of these two scenarios, using the embeddedness data of Table 10 to capture the impact of a changing demand from B2B clients. Consequently, we use the following implicit assumptions. First, in their B2B markets, WISEs are subcontractors for the industries reported in Table 10. Therefore, we assume that a relative change in labour demand within these industries results in an equal relative change in employment of WISEs that is attributed to these industries. Secondly, the attribution of employment within WISEs to specific industries is assumed to be distributed according to the relative share of sales towards these industries. This implicitly assumes a similar ratio of supporting staff and target group employment across activities WISEs perform for different industries, as well as a similar productivity and profitability of the work WISEs perform for different industries. Thirdly, we assume that the two scenarios only affect B2B activities of WISEs while not affecting the demand for goods in reuse shops.

3.3.3 Expert interviews

To explore and analyse impacts and boundary conditions for a sustainable growth path for WISEs in a CE, we conducted semi-structured interviews with 20 key stakeholders. This list includes management professionals of WISEs, experts from WISEs federations, policymakers, and experts from trade unions. Based on the experience and network of the first author at the crossroads between WISEs and CE in Belgium, interview respondents were selected based on purposive sampling, ensuring that participants had relevant knowledge and expertise. Sampling was concluded upon reaching saturation, the point at which no new themes or insights were emerging from the interviews. This decision was based on the recurrence of themes and the depth of the data collected. An anonymized version of the list of respondents and a translated version of questions is included in Appendix 3.2.

Interviews were conducted via MS Teams in June and July 2023, and lasted between 45 and 60 minutes. Respondents provided informed consent to process their input in an anonymised way and to record the interview. After transcribing the interviews, we employed a thematical analysis, using both deductive and inductive coding and involving a rigorous process of coding and categorization. Initial codes were derived from the research questions. Furthermore, challenges and opportunities have been coded in line with the reskilling and upskilling purposes as indicated by the SEAP and CEAP, and in line with major issues at stake in labour market policies in which policies for WISEs are embedded. Sustainability aspects were coded in line with social,

ecological, and economic aspects. For social aspects in particular, we iteratively aligned our inductive coding results with the OECD framework on job quality (Cazes et al., 2015) and the Flemish Workability Monitor (Stichting Innovatie & Arbeid, 2023).

Furthermore, additional inductive coding emerged from the data. We ensured that themes were data-driven and reflective of the participants' experiences and perspectives. To ensure data triangulation, modelling results have been discussed with interview respondents. Intermediate results were likewise discussed among co-authors and the follow up committee of the research project involving peer researchers experienced with the topic and senior policy experts at the crossroads between social employment policies and the CE. Finally, all interview respondents received a draft version of this paper to refine arguments and prevent misinterpretations and factual errors, which contributed to the reliability and validity of our findings. Interview respondents are referred to between brackets in superscript.

3.4 Results

In this section, we report results of the CGE model, showing the impact of circularity scenarios on WISEs in Belgium. We display the results from minimal (SC1) and maximum scenarios (SC9). Next, we discuss challenges and opportunities of a shift of WISEs towards a CE and identify boundary conditions for a sustainable growth path.

3.4.1 The impact on WISEs of a shift towards circularity

Tax shift from labour to resources

In Table 11 we report CGE model results of a tax shift from labour to resources. As a sensitivity analysis, we reported results from a minimal scenario (SC1) with a 2% tax increase on resources and a 1% decrease in income tax, and an extreme maximum scenario (SC9) entailing a 60% increase of resource taxes and a 16% decrease in income tax rates (see Appendix 3.1 for the details). While the net effect on jobs in these scenarios is positive both for WISEs and the wider economy, it remains very limited.

Interestingly, Table 11 also shows more important shifts between industries, including a decline in employment in retail and in the primary and secondary sectors, and an increase in jobs in other sectors. These results are a direct consequence of the burden shift on labour-intensive industries to resource-intensive sectors which causes a predicted growth of the former and a decline of the latter. We also notice some differential impacts for WISEs and the rest of the economy. Economy-wide, job destruction in terms of net employment figures is the largest in the construction sector and job creation is the largest in market and non-market services. Since WISEs are only

marginally active within these industries, the largest net effects on jobs can be found in other industries, being transportation and logistics and waste & recycling regarding job creation, and the energy sector regarding job destruction.

Table 11 – Impact of a tax shift from labour to resources (number of jobs)

Sector	Minimal scenario (SC1)			Maximum scenario (SC9)		
	Relative effect (%)	Net effect on jobs in Belgium	Net effect on jobs in WISEs	Relative effect (%)	Net effect on jobs in Belgium	Net effect on jobs in WISEs
Agriculture	-1.07%	-620	-1	-13.82%	-8 006	-9
Mining	-2.77%	-71	-1	-55.13%	-1 412	-10
Manufacturing	-0.06%	-305	-9	-0.41%	-2 062	-60
Energy	-2.20%	-495	-6	-45.84%	-10 297	-129
Construction	-0.51%	-1 414	-3	-7.71%	-21 515	-46
Retail	-0.11%	-837	-5	-1.36%	-10 011	-63
Transportation and logistics	0.32%	816	18	6.54%	16 601	366
Market services	0.20%	2 370	2	4.02%	48 908	45
Non-market services	0.08%	1 366	4	1.52%	25 223	76
Waste & Recycling	0.52%	132	6	10.11%	2 581	123
Total	0.02%	942	6	0.83%	40 010	292

Note: SC1 and SC9 refer to minimal versus maximum parameter assumptions, as described in Appendix 3.1.

Confronted with these results, some interview respondents take a critical stance on the combination of a decline in manufacturing and the increased importance of transportation and logistics. As pointed out by one respondent: “We should take into account the carbon footprint of production in the Global South” [2] (respondent number between brackets). An increased importance of the waste and recycling sector is welcomed by most interview respondents.

Servitisation

In Table 12, we report results of the servitisation scenario. This results in job destruction in the manufacturing industry, construction, and retail, and job creation in market and non-market services. Again, these results are a direct consequence of the shift in consumer demand from goods in resource-intensive sectors (e.g., manufacturing) to goods from labour-intensive activities (e.g., services). The relatively large job destruction within the manufacturing industry for WISEs is partially mitigated by the fact that WISEs are not very much involved in the construction industry. On the other hand, under business-as-usual conditions, WISEs cannot benefit from a large job creation in the market services as they are only limited active in this sector. In sum, this scenario results in a negative but rather limited net effect for both the Belgian labour market and WISEs. Note that the effect on WISEs in this case is relatively bigger, because WISEs stems from the strong dependency of WISEs on activities in the manufacturing industry in their B2B activities (see Table 10).

Table 12 – Impact of servitisation (number of jobs)

Sector	Minimal scenario (SC1)			Maximum scenario (SC9)		
	Relative effect (%)	Net effect on jobs in Belgium	Net effect on jobs in WISEs	Relative effect (%)	Net effect on jobs in Belgium	Net effect on jobs in WISEs
Agriculture	-0.17%	-101	0	-1.90%	-982	-1
Mining	0.52%	13	0	6.60%	135	1
Manufacturing	-0.50%	-2 511	-73	-5.40%	-25 129	-784
Energy	0.04%	8	0	0.20%	88	1
Construction	-1.11%	-3 095	-7	-9.20%	-31 279	-55
Retail	-0.49%	-3 576	-23	-4.90%	-35 673	-228
Transportation and logistics	-0.03%	-82	-2	-0.50%	-764	-28
Market services	0.62%	7 584	7	6.30%	76 599	71
Non-market services	0.05%	806	2	0.40%	8 142	20
Waste & Recycling	-0.07%	-17	-1	0.00%	-166	0
Total	-0.27%	-969	-95	-2.84%	-9 028	-1 004

Note: SC1 and SC9 refer to minimal versus maximum parameter assumptions, as described in Appendix 3.1.

When confronted with these results interview respondents refer to the decline of the European manufacturing industry during the last decades. WISEs perform labour-intensive activities that are outsourced by manufacturing companies, over time, many of these activities have been replaced by machines or production in the Global South (Van Opstal et al., 2007). While WISEs may support reshoring of economic activities to industrialised countries, helping to reconstruct regionally embedded value chains, the global tendency is towards a decline of the manufacturing industry in Europe. Given the current focus of WISEs on manufacturing, a transition towards circularity imposes a significant challenge to most WISEs in Belgium. A shift towards services also provides opportunities for WISEs. Interview respondents refer to the potential of WISEs to play a role in as-a-service models [2], digitalization [9], or supporting care activities for the elderly or people with disabilities [14]. This could also foster the inclusion of women within WISEs, as a majority of the current workforce in Belgian WISEs consists of men (Van Waeyenberg & De Cuyper, 2016).

In sum, both scenarios show that a transition to a CE is not necessarily favouring WISEs in their B2B activities. This should not come as a surprise, given their current role as an outsourcing partner for many linear activities, including assembly, packaging, handling, and logistics. Circularity scenarios that aim to limit resource use or servitisation will therefore create significant challenges for WISEs.

3.4.2 Challenges and opportunities

Reskilling and upskilling

A shift from a linear towards a CE induces a shift in required skills sets (Burger et al., 2019; Straub et al., 2023). While most interview respondents mention that technical skills required for CE activities are very activity specific, they acknowledge that WISEs have a comparative advantage to perform CE-related jobs. WISEs are renowned for their capability to translate complex tasks into easy tasks [2, 5-6, 9, 11-12, 19-20] and are known to work on processes that are too complex to robotize [3, 19]. Moreover, WISEs have a competitive advantage over low wage countries because of their flexibility to perform a variety of small-scale tasks [14], which has been acknowledged earlier by circular startups (Van Opstal & Borms, 2024). Finally, WISEs are sought after because of their ability to perform repetitive work [1] and the unravelling technical skills of their co-workers [3, 5-6, 14, 20], confirming earlier results of (Willeghems & Bachus, 2018a).

While the essence of these skills is already available in most WISEs, a shift to CE-related activities sheds light on some specific challenges. Some interview respondents point at the need for skills to deal with safety aspects that are linked to waste management, disassembly, and reverse logistics (e.g., hazardous or toxic waste streams, sharp objects, or mould formation) [10, 14, 20]. Other interview respondents mention the necessity of strong physical capabilities to deal with dismantling and demolishing activities [12, 14-15]. While this may be challenging for many target group workers, this provides an opportunity for those workers who are active in green area management – an activity that attracts target group workers with strong physical competences, but with a lack of work during winter. CE-related activities may therefore bring more variety and less technical unemployment for these target groups. Other activities may be less technically demanding but challenging on soft skills, including attitude development, communication skills, and social skills, the latter most specifically for the further development of reuse shops [1-2, 4-5, 9, 12, 16]. As pointed out by one respondent: "*Conflict management, stress management, and aggression training to deal with vulnerable client groups are increasingly important for employees in reuse shops*" [16].

Most respondents point at the importance of a well-trained supporting staff with a sufficient technical and technological background [2, 4, 8-9, 13, 17] and the ability to translate complex tasks into a feasible work organisation for target groups. Specific challenges that follow from a CE shift are acquiring knowledge on organising repair and refurbishment for different brands or machines, taking into account quality assessments, and technical standards at resource, component, and product levels [10]. This requires skills development, both for target groups [3-5, 10, 17]and their supporting staff [5-6, 8-10, 17]. An important challenge is therefore finding trainers to train supporting

staff and target groups for these tasks [13]. Interview respondents also mention the need for supporting capital goods, such as *co-bots* to dismantle goods in a safe way, or light guiding systems and augmented reality to perform complex tasks [2, 5, 8, 17, 20].

As stated by one respondent: *"Many CE-related tasks for WISEs have been focused on recycling with little added value. Many of these tasks will ultimately be done by machines, so WISEs must innovate and embrace e.g., artificial intelligence to perform smarter tasks with high added value"* [19]. Therefore, while WISEs have operational organisational capabilities to innovate with a focus on empowering target groups, WISEs are urged to invest in higher-order organisational capabilities to maintain a sustainable competitive advantage [5, 9, 13, 17, 19]. WISEs are therefore challenged to attract and develop skills and capabilities such as intrapreneurship [14, 18-20], circular value-chain management [13, 20], and matchmaking of resource and material streams [18]. A shift towards a CE also requires skills to organise reverse logistics [14] and strategic spatial planning capabilities that balances the operational costs and carbon footprint of transportation, the minimal and optimal scale to process resources and materials, and the degree of fluctuations of these streams in CE-related activities [14, 20].

Labour market policy

An important challenge is that both target groups and supporting staff are hard to find in a tight labour market [1-3, 7, 9-13]. In general, diminishing marginal productivities are expected when activating the lowest segments of the labour market [2-3, 12, 19] or those who are sought after by policymakers to activate, such as long-term ill [11], which has been partially documented by (Vandekerkhove et al., 2021). Expanding the scope of WISEs towards refugees [2, 8, 10-11, 14] incurs many specific challenges such as the absence of a contact language at work or a severe mismatch of competences because a poor recognition of foreign diplomas [2, 7]. Refugees, however, have a distance to the labour market from a very different nature, which may cause new opportunities and allow WISEs to enter new and CE-related market niches. Likewise, the introduction of individual work integration support in Flanders is seen by many interview respondents as an opportunity to attract a broader range of target groups with a bigger variety in skill sets. Since this employment measure is accessible for regular companies, some WISEs fear that their own set of activities is insufficiently varied for target group employment in a CE [8, 12, 14, 17]. For example, WISEs have little to no experience in the service sector, while the CE is expected to create jobs in this area, as confirmed by our results in 4.1.

A shift towards a CE is also challenging for the regional employment agencies, who are responsible for the accreditation and referral of unemployed target groups towards WISEs. No less than 18 out of 20 interview respondents mention this as a major

challenge. Half of them even call for a prioritization to resolve the current bottlenecks of the current referral system to enable WISEs to shift to CE activities. Some respondents also urge employment services to invest in specific training possibilities for CE-related jobs [4, 11, 19-20].

A specific challenge is the quota system WISEs face when attracting workers. The Flemish government currently links an expansion of these quota to climate jobs and CE activities, but target groups that are currently referred to WISEs are sometimes considered insufficiently able to perform these tasks [17]. An important bottleneck for policymakers to increase or abandon quota, is the mere fact that the costs of this measure (such as wage subsidies for target groups) are mainly borne by the regions, while most benefits (such as avoided social security allowances and extra tax income) accrue to the federal level [3, 6-7, 13]. This generates a split incentive problem between levels of competence in a federal state, leading to a suboptimal investment rate from a socio-economic cost-benefit perspective (Cantillon et al., 2019; Crucke & Decramer, 2016; De Smedt et al., 2021).

3.4.3 Boundary conditions for a sustainable growth path

While the CE is often believed to bring many opportunities for WISEs, previous sections show this cannot be taken for granted. Therefore, we identify boundary conditions for a sustainable growth path.

Social aspects

CE-related jobs do not automatically result in improved social outcomes for those involved. Job quality is the most salient boundary condition to safeguard during a shift towards circularity, according to many interview respondents [4-6, 8-10, 20]. The OECD approaches job quality as multi-dimensional and defines it in terms of earnings quality, labour market security, and quality of the working environment (Cazes et al., 2015). In Flanders, interprofessional social partners publish the Flemish Workability Monitor on a yearly basis, which is based on four dimensions: stress, motivation, learning possibilities, and the work-life balance (Stichting Innovatie & Arbeid, 2023). We use both frameworks to discuss our results.

Earnings quality is an important boundary condition to ensure sufficient labour supply of vulnerable workers and supporting staff [10, 14-15, 19-20]. Wages in WISEs are considered very low, which may cause unemployment traps and inactivity traps for vulnerable workers [11-12], and which makes supporting staff in WISEs a bottleneck profession [1, 12], as documented recently in (Lenaerts et al., 2024). Meanwhile, WISEs have the reputation to provide high labour market security for their co-workers. A shift towards

CE-related activities, however, may bring more fluctuations in the amount of work throughout the year, (e.g., as a result from irregular waste and reverse logistics streams), which may lead to temporary unemployment or a higher demand for flexibility between jobs within WISEs [1]. New activities also tend to start with short-term projects, lacking contractual certainties [1, 13]. Some interview respondents also underline the importance of social dialogue during a transition, both at the company level as at the sectoral level [1, 4-5, 10]. However, because the CE has impacts over many industries, social dialogue is not always easy to organise [4, 10].

Concerning the quality of the working environment within WISEs, most respondents underline the ability of WISEs to adapt work processes tailored towards target group employment, reducing both physical and mental stress for vulnerable workers. Often, this results in very repetitive work, which is an aspect that is criticized by some interview respondents: "*Research shows abundantly that repetitive work is not good for the wellbeing of workers. WISEs tend to say their workers need and even like these jobs, but there is no scientific empirical evidence on how target groups workers perceive this.*" [8]. Therefore, interview respondents recommend safeguarding flexibility for job rotation [11-13]. As stated before, this requires good supporting staff [1-2, 5, 8, 11] and supporting capital goods [2, 5-6, 9, 12], especially when a shift towards new activities takes place. Additionally, interview respondents point at the importance of ergonomics [1-2, 5, 12, 15], and safeguarding workloads and expectations from new clients [2, 4-5] when entering CE-related market segments. One interview respondent also refers to the risk of moral stress among supporting staff if WISEs would lose their focus on their core mission (the employment of vulnerable groups) because of a transition to new activities [1].

As shown in Section 4.2, a shift towards CE activities will provide plenty of learning possibilities for co-workers at all levels within WISEs. Learning possibilities is the aspect of workable jobs that is most referred to by interview respondents [4-6, 11, 13, 15]. One interview respondent takes a particularly broad perspective when looking at learning: "*Participative governance mechanisms are important learning experiences for vulnerable workers. If you have never learned to voice your opinion in a team meeting, it is difficult to vote in elections as a citizen.* [13]*.* The same respondent adds the need for social cohesion and exchange among colleagues to co-develop capabilities of vulnerable groups as workers and citizens. Another respondent adds to this stating that "*investing in innovation capabilities does not only enhance the resilience of a company, but also of its co-workers*" [15].

Remarkably, not a single interview respondent mentions the aspect of work-life balance when discussing social sustainability and job quality during a CE-shift of WISEs. Nevertheless, WISEs share some features that impact the work-life balance. Firstly,

there is overall a good spatial distribution of WISEs within Belgium, allowing vulnerable workers to find a job at a reasonable distance. CE-related activities will probably enhance this feature since it provides opportunities within locally embedded value chains [1, 2, 10, 19]. Secondly, the concern of unemployment and inactivity traps that has been raised by [11], is often at the core of finding a financially and organisationally feasible work-life balance. Finally, some interview respondents stress the contribution of a shift towards CE-activities to create meaningful jobs for vulnerable workers. This may add to a positive identity of target groups, such as a sense of belonging, while stimulating positive behavioural spillover effects towards workers and their families (e.g., increased attention for sorting, recycling, reuse, repair, etc.) [15, 18], and showcasing the feasibility of an inclusive and circular society [4, 11, 13, 18, 20].

An important overarching boundary condition remains that CE-related jobs are safe and dignifying [5, 14, 19] and that attention is being paid to quality systems and audits on working conditions [2, 5, 14, 19-20]. Interview respondents provide multiple examples of opportunities for collaboration with waste management companies they turned down because of a lack of safety and hygienic standards [14, 19-20]. As quoted by [20]: *"Working with waste does not imply our workers should be considered as society's waste bin".* Another respondent puts it as follows: "*For food products, we take it for granted that quality standards are high. Likewise, we should implement and safeguard job quality standards when we screen the clients we want to collaborate with*." [14]

Ecological aspects

The ecological impact of a CE-related shift of WISEs is sometimes cheered on because of their local embeddedness and potential for reshoring economic activities, resulting in a reduction of carbon footprints of value chains [1]. Unfortunately, a shift of WISEs towards CE-related activities does not necessarily imply superior ecological outcomes. Firstly, CE activities may cause rebound effects, for example when products created by WISEs are additional, and not substitutes to the "linear alternative" (Zink & Geyer, 2017). Secondly, as in many other companies, some WISEs perform CE-related activities with good intentions, not knowing that they cause an unintended deterioration of the functionality of material flows and components, or an unintended carbon footprint increase, because of many local transportation movements at a suboptimal scale. The former is sometimes the case in small-scale upcycling projects that involve mixing and shredding plastics waste streams into new products that are not recyclable anymore. While these products may have a nice sustainability narrative, they often do not meet an actual customer need [15, 20]. Therefore, a sustainable growth path of WISEs towards a CE should prevent transforming waste into rubbish.

Quite often, WISEs feel the need to develop their own product, and the shift towards a CE provides a new momentum to stimulate innovation with a focus on new product development [17-18, 20]. However, this requires an investment in innovation capabilities, including an awareness to involve the right expertise on material flows [9, 19-20]. Awareness building here is important, as many interviewees admit they were not aware that not every CE-related intervention would cause positive environmental effects. External expertise is sought after for auditing and impact measurement [11, 14, 18, 20]. Interview respondents expect sector federations of WISEs to validate and share good practices [9] or establish a point of contact to attract expertise on material flows [18, 20].

Apart from connecting to external CE-related skills, interview respondents highlight the importance of developing dynamic organisational capabilities such as learning to build CBMs and sustainable value propositions [14, 18], participating in and co-developing circular value chains [6, 20], and learning how to perform business experiments [13, 19]. Some interview respondents remain sceptical about the relative strategic attention the environmental aspect will receive within WISEs, as they are used to putting social aspects first, followed by profitability to sustain business operations [19-20].

Most interview respondents state that this challenge is not different for other companies [1-2, 5-6, 9, 17, 19-20]., as documented earlier by (Dong et al., 2018). This underlines the importance for WISEs to connect to existing innovation policy initiatives that support the shift towards a CE [9, 20]. Interview respondents ask for information sessions and awareness campaigns, organised by the government [6-7, 10, 20], as well as CBM developing toolkits [11, 18] and a knowledge database [14]. Importantly, there is hardly any reference from interview respondents to existing organisations such as Circular Flanders (funded by the Flemish government to stimulate the circular transition), and the social-circularity hubs (funded by the European Social Fund to stimulate the collaboration between WISEs and the manufacturing industry towards circularity). Other policy recommendations from interview respondents include establishing a proper environmental assessment when evaluating public procurement or innovation subsidies [3, 5, 9, 18, 20], monetary valuation of positive environmental impacts in public procurement [2, 13], and other policies that create a demand pull for CE-related activities, such as lower VAT tariffs and mandatory regulations [12].

Economic aspects

As WISEs are often integrated in linear value chains [13-14], they should reconsider their business models to remain future-proof [9, 13-14, 18]. However, this does not necessarily imply that CE-related activities are sufficiently rewarding from a financial perspective. Although the mission of WISEs is primarily driven by societal purposes, financial profitability remains a boundary condition on order to perform CE-related task in a

sustainable way. As stated previously, many of these aspects can only happen when there are sufficient financial means to invest in skills and organisational capabilities.

The most important remark of interview responds is the importance of a sound and self-supporting CBM. Many respondents point out the importance of the ability of WISEs to move into circularity without having to ask for more public funding [3, 6, 9, 11, 15, 20]. As quoted by [14]: "*Except for the first steps on the learning curve, we should not expect the government to subsidize CE-related activities in a structural way*." Therefore, support to build CBM business plans is requested [10]. One respondent stresses the importance to validate the environmental results of a CBM first before looking at (financial) value capturing [8]. Another respondent points at the importance of a sound cost accounting system, to identify and measure the financial viability of CBMs and CE-related activities.

Many interview respondents underline the importance of developing partnerships [2-3, 9, 13, 17, 19-20] and the ability to construct collective value propositions [20]. The latter has been identified earlier as an important value proposition of WISEs by circular startups (Van Opstal & Borms, 2024). Some respondents point at the need for an increased and structural collaboration between WISEs [5, 13, 17, 20], and strong partnerships with municipalities [2], social organisations [10-11, 13], and impact investors [9-10, 13]. Moreover, scaling and replication strategies are important to define the minimal and optimal scale of CE-related projects and tasks in the short and long term [1, 14, 20]. Another important aspect is the level of uncertainty with respect to required job modifications [5, 14] and the duration of contracts with clients [5]. Aspects of scale and uncertainty are by no means new for WISEs, but in the context of a CE these are more complex than business as usual since it requires a more intense value chain collaboration and is embedded in a much more immature ecosystem than tasks in a linear value chain.

Another important boundary condition for economic sustainability is the investment in human capital [1, 5, 20]. It includes a broader investment in innovation capabilities [5, 20], investing in knowledge transfers within and beyond organisational limits [18]), and a narrative shift: "*from a dependent subsidized sector to a resilient innovative one*" [20]. Building innovation capabilities also requires room for experimentation and learning from practice [9, 13, 17-18, 20], to showcase from practice that new business models are financially viable, as well as supporting an intrapreneurial stance towards developing new solutions for novel and shifting societal needs (as reuse shops once did) [6]. Investing in human capital also accounts for its surrounding entrepreneurial ecosystem, including banks, accountants [9], but also reversely to teach business developers and financial professionals within WISEs how financiers evaluate their business models [9]. Finally, the need for partnerships, innovation capabilities and human capital investments also invites WISEs to revisit their corporate governance and attract board

members with the right networks and skills [11, 17], while safeguarding organisational goals to prevent mission drift [1, 5, 7, 11, 16].

While there is a strong consensus on the need for subsidies as foreseen in the current support mechanisms, opinions on the role of the government in this circular transition differ among interview respondents. For example, some respondents ask for a monetary valuation of the positive environmental externalities CE activities may generate, e.g., within public procurement [2, 8]. Respondents likewise point at the importance of generic policy measures to support a circular transition, such as a lower VAT rate for CE related activities [12], or measures that require producers to incorporate externalities such as the recycling cost into their product prices [14]. CE-related project subsidies may create a momentum to invest in innovation [19], but sometimes project calls are considered too small to be impactful or even viable [2]. As stated by [2]: "*increasingly, we face the ethical dilemma whether we can ask co-workers to face the burden to engage in projects that are financially not viable".* Project calls should also aim at building collaborations along value chains and between WISEs [9]. Meanwhile, current bottlenecks that prevent WISEs to participate in these project calls should be reconsidered, such as bureaucratic and administrative barriers (which are particularly a deadweight loss in small projects), or the European de minimis regulation that prevents project calls of a larger scale [2, 19]. This does not preclude to maintain a critical stance to evaluate the entirety of public funds directed towards WISEs to prevent over-subsidizing and creating unfair competition with other companies [3, 11].

3.5 Discussion

3.5.1 Theoretical contributions

To date, the number of contributions investigating what a "Circular Society" might look like have been limited. This research specifically investigated the role of Work Integration Social Enterprises (WISEs) in the CE, organisations specifically established to organise economic activities for more vulnerable workers, with a distance to the labour market.

Our results provide an empirically based contribution to recent conceptual work on the social impacts of the CE. It provides a nuanced answer to the question of Clube (2022) on who would benefit from CE-related jobs. When comparing our results with a research agenda on the social dimension of the CE (Valencia, Bocken, et al., 2023), we find that WISEs may enhance several social outcomes of a CE. Concerning quality of life, CE-related activities may spur education, training, and skills development opportunities for vulnerable groups, with potential spillover effects to their direct environment. Regarding social cohesion, CE-related activities may create meaningful jobs, increasing

the sense of belonging to the broader community and encouraging the contribution of target groups towards the community. With respect to equity, the integration of CE activities within WISEs may showcase the viability of an inclusive CE. Regarding diversity and inclusion, WISEs may contribute strongly to illustrate that diversity within a CE is also about some 'eclipsed' dimensions that may put people in vulnerable positions, such as working disabilities or psychosocial problems. On the other hand, social dimensions such as democratic participation of and governance by these target groups should not be overestimated in the day-to-day reality WISEs operate in. From the perspective of a CS, these social impacts mostly refer to 'CE+' approaches, supplementing current CE strategies with social policy measures (Jaeger-Erben et al., 2021). Nevertheless, we acknowledge that democratic participation plays a bigger role in other types of WISEs in other regions (Defourny & Nyssens, 2017).

This work also sheds a light on the organisational and entrepreneurial challenges a shift towards CE-related activities may bring. For social enterprises, this is a poorly explored topic, as pointed out by (Suchek et al., 2022). This invites us to revisit the propositions stated by (Ziegler, Bauwens, et al., 2023) on the role of the social economy to embed circularity. First, Ziegler et al. (2023) state that WISEs are better protected from the value capture exhibited by capital enterprises as well as enabled to cooperate with other actors. While we find a strong support among interview respondents of a (social) mission-oriented focus among WISEs, we do not find evidence they are better at cooperating with other actors. Second, no evidence is found for the proposition that WISEs deliver CE activities through democratic deliberation and decision-making processes that promote CE along with a better recognition of the struggle of various social and cultural groups. A notable exception may be social enterprise reuse shops, that combine social employment with a CE offer that is accessible for vulnerable households (Pestoff & Hulgård, 2016; RREUSE, 2021). Moreover, no evidence has been found that WISEs contribute to sufficiency-oriented economies and a transformational CS, as predicted by (Villalba-Eguiluz et al., 2023a) and conceptualized by (Calisto Friant et al., 2021).

Thirdly, we find strong evidence on the Ziegler et al. (2023) proposition that WISEs choose their technologies based on the values of their users, being mostly supporting technologies for workers with a distance to the labour market. This partially answers the question of (Clube, 2022) on the impact of technology on CE employment, but does not liberate us from keeping a critical stance on the potential adverse impacts of technological developments on job opportunities for people with a distance to the labour market, including the risk of a potential commodification of labour in WISEs as such (Calisto Friant et al., 2023). This critique has been coined likewise by (Siderius & Zink, 2023) when discussing the role of value and markets in a CE and actually holds for the entire labour market.

Finally, the proposition of Ziegler et al. (2023) that WISEs promote CE activities with a focus on the regional economy and regional circular value chains has been widely confirmed in our research. This is also in line with comparative advantage theory, predicting that locally embedded economic activities support factor rewards for less abundant production factors (for Belgium, low-skilled workers) and economic activities that apply these production factors intensively (Leamer, 1995; Sölvell, 2015). Moreover, many CE activities, such as repair and refurbishment, are only viable if they can be organised at a sufficiently local or regional level (Arsova et al., 2022). Our results confirm that WISEs may have a competitive advantage to perform this role, confirming earlier results of (Lekan et al., 2021). Nevertheless, our results show that Ziegler et al. (2023) correctly have reasons to remain sceptical about the potential of WISEs as a transformative force as their current business models are indeed integrated into an overall linear economy, as shown by our CGE results. Likewise, we find evidence of a growth potential within CE-related activities combined with a risk of mission drift.

3.5.2 Practical implications

An implication for management is that our research underlines the need to measure, validate, and communicate impacts in order to substantiate the sustainability of their business model. While earlier scholarly attempts have been made to measure several societal impacts of WISEs (Crucke & Decramer, 2016), the European Commission recently adopted a mandatory regulation for all types of companies to report environmental, social, and governance impacts (ESG) (European Commission, 2022). As there is no standardized social economy reporting (Novkovic, 2022), WISEs will be challenged to show that they generate positive impacts on ESG aspects as well. Well-developed standards and measurement techniques may as well guide WISEs to select environmentally impactful CE-activities. Conversely, a sound ESG framework could help WISEs to strengthen their value proposition towards clients, and to audit job quality standards of their clients as well. It will likewise support them to design and communicate compelling sustainable value propositions, providing strong arguments for the social, environmental, and economic value they create, deliver, and capture (Bocken, 2021). Given their mixed funding by governments and private sector clients, this is a prerequisite for WISEs to remain future proof. This implication also holds for WISEs in other regions or WISEs that are active other market segments, serving customers or governments.

Our results also suggest that management of WISEs should invest in CE enabling organisational capabilities to strengthen the competitive advantage target group employment may generate to perform core CE jobs. Such an investment is not only relevant for WISEs, but also for their wider entrepreneurial ecosystem, including

clients, suppliers, sectoral federations, trade unions, employment agencies, and financial partners. In particular, this includes collaboration capabilities (Baah et al., 2023; Burger et al., 2019; Johnson, 2022), innovation capabilities (Straub et al., 2023), and dynamic capabilities (Bocken & Konietzko, 2022; Khan et al., 2020). Doing so would enable WISEs to reconsider the way they create, deliver, and capture value within the circular supply chains and business models they are embedded in (Lüdeke-Freund et al., 2019; Velter et al., 2020). Examples include the development of partnerships with intermunicipal organisations and waste management companies (value creation), screening industries that can expect huge challenges with upcoming waste streams or strict regulations on repairability (value delivery) or creating joint facilities to share production means and capture joint positive externalities (value capture). Therefore, we recommend WISEs to connect to innovation policy measures while collaborating with their clients and suppliers on joint value propositions, instead of merely focusing on compartmentalized support and project calls organised by the policy domain under which they fall. Likewise, we recommend them to join activities of entrepreneurial ecosystems aimed at supporting the development circular value propositions and take a proactive stance accordingly, as illustrated by multiple cases that experimented in the social-circularity hubs in Flanders that have been developed recently for this reason (see https://www.circulairwerkt.be/en/hubs).

Given the decline of the manufacturing industry and the increase of the service sector in most industrialised countries, policy makers are likewise challenged to invest in skills and organisational capabilities that enhance future-oriented competitive advantages. While current research often focuses on high-level jobs (e.g., (Straub et al., 2023) who have built a taxonomy based on LinkedIn profiles), labour market policies should support the joint development of core and enabling CE jobs that are mutually reinforcing. Our quantitative results may show limited net effects of CE supporting strategies for the general labour market, but our qualitative results highlight important shifts in the capabilities required within the industries confronted with this transition. Moreover, our results also show how a CE transition may also lead to net job losses in multiple industries. As pointed out recently, concerns about these job losses can hinder sustainability transformations unless policymakers strengthen their efforts towards implementing job reskilling programs (Hekkert, 2024). Likewise, we recommend investing in test capacity for new and transition-oriented jobs, to learn how people adapt future-oriented skills, and learn from new types of collaborations while including vulnerable groups on the labour market that may contribute to enhance comparative advantages of the economy. While these comparative advantages are relatively similar for most industrialised countries, the existence of specific factors, such as legacy industrial networks or specific primary resources, may differ and create different opportunities for WISEs in other countries.

Regarding regulations for the social economy, our results suggest that innovation support and subsidies are most appropriate to support switch costs and learning curves towards the development of circular value chains where WISEs play a role in. This may resolve past path dependencies and prevent WISEs to remain locked-in in linear value chains (Ziegler, Bauwens, et al., 2023). Both our quantitative and qualitative research results underline the importance of earmarking this support towards CE-related activities, as well as earmarking a growth of quota towards CE-related activities. To reach a sustainable and sustained support for increasing of abandoning the quota system, the current split-incentive problem between the regions (that bear the costs of a growth of WISEs) and the federal state (that benefits from a growth of WISEs) should be addressed.

Likewise, as WISEs are strongly embedded within industrialised economies, supporting their organisational capabilities towards a circular transition should be envisioned and organised from an integrated approach. Policymakers are therefore recommended to communicate the existence of supportive initiatives, such as Circular Flanders, and the social-circularity hubs, across the departmental borders of their competence. For other regions, we suggest both policymakers and social entrepreneurs to critically assess path dependencies, switch costs, and split incentives when performing an ex-ante analysis on the policy measures to be taken. As this may depend heavily on the embeddedness of WISEs in their economies, as well as in the institutional design of labour market policies and other policies supporting WISEs, specific recommendations to support this transition may differ accordingly.

3.5.3 Limitations and recommendations for further research

A first limitation of this research is its geographical scope. As Belgium has a long tradition of WISEs and other social economy institutions, many relevant lessons can be drawn from this region. Nevertheless, future research should revisit the consequences, challenges, and opportunities for WISEs in other countries, as their economic, cultural, and regulatory embedding may differ.

A second limitation is that the scope of this paper focuses on accredited WISEs in Belgium, including sheltered and social workshops. The Belgian social economy landscape, however, also includes other, more hybrid structures for the employment of target groups, including the recently implemented framework on individual work integration support in Flanders, and accreditations for “entreprises d’insertion” in the Walloon region. Further research should therefore investigate the crossroads between CE-strategies and more hybrid concepts of work integration, including models with non-monetary exchange (Lekan et al., 2021), informal structures (Clube & Tennant,

2023), and partnerships between WISEs and other business organisations (de Bell et al., 2023).

Thirdly, methodological shortcomings include the use of expert interviews and CGE modelling. Our sample did not include the perspective of the workers themselves (only partially mitigated by including trade union perspectives), which could be addressed by further research. Regarding the CGE modelling, more explicit modelling strategies could have been developed, as discussed at the end of Appendix 3.1. Albeit making use of micro-economic principles to model the agents' behaviour, CGE models are noy able to grasp micro-economic considerations that reflect the large heterogeneity of entrepreneurial preferences that go beyond profit maximization.

Likewise, more research is needed to measure and compare environmental, social, and governance (ESG) outcomes of WISEs and other companies. At the micro-level, this would enrich and empirically validate a strand of literature that discusses comparative institutional advantages of legal forms (Persson & Hinton, 2023; Staicu, 2021), enabling a critical evaluation of suitable organisational forms, an evaluation of potential mission drift (Costanza, 2023; Siegner et al., 2018), or even stimulating WISEs to become the best version of themselves. At the macro-level we recommend monitoring social entrepreneurship from a more integrated perspective, capturing the social and redistributive implications of a CE shift (Bouchard & Chaves, 2022a) and its contribution to a CS (Calisto Friant et al., 2023; Jaeger-Erben et al., 2021).

3.6 Conclusion

A shift towards the CE is often believed to create training and working opportunities for people with a distance to the labour market. Our results show that this cannot be taken for granted. WISEs are shown to be strongly embedded in our current linear economies. While they may develop comparative advantages to perform core CE jobs, WISEs and policymakers are challenged to invest in skills development of target group workers and supporting staff. Our results underline the importance of building organisational capabilities to capture this opportunity. This shift, however, is not a sufficient condition to ensure a sustainable growth path.

Ensuring job quality and other social sustainability conditions of a CE-transition of WISEs includes aspects of stress, work-life balances, safe and dignifying work, learning possibilities, safe labour market conditions, and decent earnings. These conditions can only be met if WISEs are either able to attract more public funding or engage in high value-added activities. The latter is only possible of WISEs can further develop a strong competitive advantage in regionally embedded value chains. Social sustainability thus goes hand in hand with economic sustainability, requiring investments in CE-specific

skills and organisational capabilities. Important aspects of the latter are the ability to co-develop joint value propositions and circular value chains that allow for scaling, replicating, and investments under uncertainty. In order to safeguard environmental sustainability, WISEs have to attract specific knowledge and develop innovation and collaboration capabilities.

This work provides an empirical contribution to recent research agenda's (Valencia, Bocken, et al., 2023) and conceptual work (Ziegler, Bauwens, et al., 2023), and provides a partial answer to the critical perspective of Clube (2022) whether job creation by the CE can be seen as an authentic, meaningful, and legitimate social benefit of the CE transition. Nevertheless, more research is needed to assess this from the perspective of vulnerable workers as well. Likewise, more empirical research is needed on the implications of the employment of vulnerable groups in a CS, including aspects of social and environmental justice, such as redistributive effects between workers within and between regions, and care economics, including the position of parents and siblings of vulnerable workers. Finally, we invite other scholars to deepen our knowledge on the development of joint value propositions between WISEs and their B2B clients in the context of a CE and identify further boundary conditions to translate this practice into a comparative advantage at the regional level.

4. Unlocking the social circular economy: value propositions and organisational design of social circular hubs

Based on:

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Abstract

A circular economy can only succeed through a circular society, ensuring equitable access to circular innovations for all social groups. Work Integration Social Enterprises (WISEs) foster inclusive labour markets by supporting disadvantaged individuals, yet their potential within the circular economy, particularly in business-to-business contexts, remains underexplored. In Flanders, the government launched social circular hubs to bridge this gap. Circular hubs are catalysts for circular transitions, connecting governments, knowledge institutions, businesses, and civil society to co-create circular economy initiatives. Their relevance, value propositions, and design requirements remain poorly understood. We investigate these, using a mixed-methods approach, combining survey data from circular enterprises in Flanders with interviews across European circular hubs. Findings highlight the potential of WISEs to offer flexibility and proximity, while emphasising the need for ecosystem value propositions and sustainable governance. This study advances understanding of how to integrate social goals within circular ecosystems, contributing to a just circular transition.

Keywords: circular economy; circular hubs; work integration social enterprises; social economy; circular business models; just transition

4.1 Introduction

A circular economy (CE) cannot succeed without a circular society, requiring the inclusion of all social groups to participate meaningfully in the transition (Calisto Friant et al., 2023; Jaeger-Erben et al., 2021). This involves ensuring access to the benefits of a circular transition from both consumption and production perspectives. Otherwise, a circular transition risks reinforcing existing inequalities and undermining its legitimacy and effectiveness (ETC CE, 2025a). Social inclusion is therefore not a peripheral concern but a precondition for a genuinely systemic shift towards a just circular transition, which also involves access to meaningful and sustainable work (Clube, 2022; OECD, 2020).

Work Integration Social Enterprises (WISEs) are social enterprises that aim to support unemployed individuals at risk of permanent labour market exclusion by facilitating their reintegration into work and society through productive activities (Vidal, 2005). WISE are increasingly considered as a strategic partner to accelerate the transition towards a circular and inclusive economy (OECD & European Commission, 2022). However, despite their importance, WISEs often remain embedded in linear economic activities, and businesses may not always look in the direction of WISEs when considering circular strategies (Van Opstal, Borms, et al., 2024). The interaction between WISEs and other businesses within a circular transition is worthwhile to study, given the ambition of the European Union to achieve a 78% employment rate and reduce poverty risks for 15 million individuals by 2030, as outlined in the European Pillar of Social Rights Action Plan (EC, 2021b). Aligning with sustainable development goal (SDG) 8 on decent work and economic growth, the integration of WISEs into the CE represents an opportunity for economic growth and a fair transition (United Nations, 2020). There is growing scholarly attention to what the CE can mean for WISEs and conversely (Van Opstal, Borms, et al., 2024; Ziegler, Bauwens, et al., 2023). The focus is primarily on business-to-consumer (B2C) and business-to-government (B2G) markets and is based on the perspective of the WISEs themselves. Given the significant scale of their B2B activities, it is therefore important to understand what WISEs can contribute to other businesses, particularly in the context of a circular transition.

Therefore, the Flemish government supported the creation of 12 social circular hubs in 2021, to bridge this gap by fostering collaboration between WISEs and businesses towards a circular transition. These hubs are created to stimulate social and circular entrepreneurship at the local level (Coen & Dewickere, 2023). This concept is novel and has not yet been the subject of scholarly investigation. To contextualise their emergence, it is important to situate them within the broader concept of circular hubs. Circular hubs serve as catalysts for the CE by connecting key stakeholders and translating circular ambitions into concrete initiatives. They exist at city, regional, national, and

international levels, bringing together frontrunners from government, knowledge institutions, businesses, and civil society (ECESP, 2023). They serve as facilitators and orchestrators within circular ecosystems, designed to connect companies and facilitate meaningful progress towards a circular transition (Hansen & Schmitt, 2021).

To the best of our knowledge, the social circular hubs in Flanders are the only circular hubs that explicitly focus on the employment of vulnerable groups. It is crucial for these hubs to understand the needs of the companies they envision to support to develop compelling ecosystem value propositions. Research on circular hubs in general, however, remains limited. Exceptions are studies on activities, tools, and ethical aspects of circular hubs (Garrido & Nunes, 2023; Mogos et al., 2021). Nonetheless, there is a lack of knowledge on the governance frameworks and business models of these circular hubs themselves. To ensure the long-term viability of these hubs beyond temporary project horizons, it is important to identify the boundary conditions that enable their sustained and effective operation.

In this paper, we address these gaps, addressing three research questions (RQ):

- RQ1 – what are the assets and disqualifiers of WISEs for companies that seek to implement circular strategies?
- RQ2 – what are relevant value propositions for social circular hubs, addressing needs of companies willing to progress towards a social circular economy?
- RQ3 – what can we learn from circular hubs in general to define organisational design conditions to develop and govern sustainable social circular hubs?

These research questions allow us to progress from identifying the opportunities and needs of WISEs and businesses (RQ1 and RQ2) to identifying solutions for the effective design and governance of social circular hubs (RQ3). To address them, we employ a mixed-methods design that integrates quantitative and qualitative data sources. We draw on original survey data collected from 115 circular enterprises in Flanders (Belgium), capturing company characteristics, experiences with WISEs, perceived barriers and enablers for circularity, and support needs. This is complemented by 14 semi-structured interviews with 16 executives from circular hubs and federations across Europe, aimed at identifying governance practices, value propositions, and organisational models. The survey allows us to capture generalisable patterns among frontrunner firms, while the interviews deepen our understanding of institutional and design-related dynamics across diverse national contexts. Together, these methods allow us to bridge the gap between what circular hubs should deliver and how they can be organisationally and institutionally sustained.

This work addresses a blind spot in current CE research: while the role of WISEs in B2C or public service contexts is increasingly acknowledged, their potential as strategic partners in business-to-business circular ecosystems remains underexplored. Equally, while the concept of circular hubs is gaining momentum, little is known about their value propositions, governance models, and design choices, especially in relation to social inclusion. Therefore, this work is relevant for circular hubs in general and for social circular hubs in particular. Flanders (Belgium) serves as a relevant context due to its advanced CE policy landscape (Claudio-Quiroga & Poza, 2024; D'Adamo, Favari, et al., 2024), dense network of WISEs, and the creation of 12 social circular hubs that explicitly aim to integrate disadvantaged groups into the circular transition (Coen & Dewickere, 2023). However, we do not treat Flanders as a representative case in itself. Rather, we use it as a starting point to explore more general design and governance challenges of circular hubs. By incorporating interview data from circular hubs across Europe, we aim to situate the Flemish experience within a broader context and enhance the international relevance of our findings. This approach allows us to derive insights applicable to other industrialised regions seeking to embed social goals in their CE ecosystems.

This paper is structured as follows: first, we provide background information on WISEs within the context of the CE, the concept of (social) circular hubs, and the identified research gap. Next, we outline our methods and materials. In Section 4.4, we present our findings, organised around the research questions. Section 4.5 discusses key trade-offs, practical implications, and the limitations of this study. Finally, Section 4.6 offers concluding remarks.

4.2 Background

4.2.1 The social and the circular economy

While the CE has traditionally focused on material efficiency, resource conservation, and environmental innovation, growing attention is being paid to its social dimensions. These include both direct impacts, such as employment creation, skills development, and health outcomes, and more systemic aspects including equity, stakeholder agency, inclusion, and governance (Purvis, Calzolari, et al., 2023; Scarpellini, 2022; Valencia, Bocken, et al., 2023). According to the Social Life Cycle Assessment (S-LCA) methodology, social impacts can be evaluated across key stakeholder groups including workers, local communities, consumers, value chain actors, and society at large (UNEP, 2020). Yet these impacts are not uniformly positive. An assessment of 40 CE-related social impacts revealed a nearly equal split between positive and negative effects, ranging from job creation and improved quality of life to social isolation, gender

inequality, and political risks (Luthin et al., 2023). These trade-offs highlight the need to integrate social dimensions into circular strategies and business models.

The *social economy* is a movement that seeks to embed social goals into economic practice. It comprises a diverse set of organisations, including associations, cooperatives, mutuals, foundations, and social enterprises, whose activities are driven by solidarity, the primacy of people over capital, and democratic and participatory governance (OECD & European Commission, 2022). While the terminology and legal recognition of the social economy vary across national contexts (Bouchard & Chaves, 2022b), these organisations share a core commitment to collective benefit, social inclusion, and reinvestment of surpluses into their mission (ILO, 2022a). *Social enterprises*, as entrepreneurial actors within this ecosystem, explicitly pursue social, societal, and/or environmental impact as their primary goal, rather than profit generation for owners or shareholders (Defourny & Nyssens, 2017). Their business models often centre around labour integration, community-based services, or circular activities such as repair, reuse, and recycling (Goodwin Brown et al., 2020; RREUSE, 2022a). In fact, social economy organisations have played a pioneering role in advancing CE practices for decades, from textile and electronics reuse to regenerative agriculture and eco-design, often operating in areas where private capital is scarce despite strong societal need (OECD & European Commission, 2022). These complementarities position the social economy as a key enabler of a just and inclusive circular transition, as acknowledged in both the Circular Economy Action Plan (European Commission, 2020d) and the Social Economy Action Plan (European Commission, 2021) of the European Commission. By embedding social goals into circular strategies, social economy actors not only contribute to environmental objectives but also strengthen resilience, inclusiveness, and local value creation. In this paper, we use the term *social circular economy* to conceptualise this integrative approach: a CE that deliberately incorporates social inclusion into its core practices, value chains, and business models.

WISEs are social enterprises that address labour market inequalities by providing tailored employment opportunities for disadvantaged populations, such as those with disabilities, psychosocial problems, or a fragile socio-economic position (Vidal, 2005). These jobs can be permanent or temporary positions, depending on the labour market policies WISEs are embedded in (Spear & Bidet, 2005). WISEs are hybrid organisations that blend social objectives with entrepreneurial strategies (Defourny & Nyssens, 2021b). They activate complementary skill sets in the labour market by designing process flows and providing support that enables vulnerable individuals to perform tasks demanded by industries and adapted to their capabilities.

As many CE-related jobs are believed to create training and working opportunities for vulnerable groups at the labour market, WISEs are often considered as a strategic

partner to accelerate the transition towards a circular and inclusive economy (European Commission, 2020d, 2021; OECD & European Commission, 2022). As such, WISEs may contribute to a just transition (Purvis, Celebi, et al., 2023; Ziegler, Bauwens, et al., 2023) and a circular society (Jaeger-Erben et al., 2021). Earlier studies identified activities such as sorting, maintenance, repair, manual disassembly, remanufacturing, refurbishment, and reuse operations as promising circular activities for WISEs (Delanoeije & Bachus, 2020; ILO, 2022a; Willeghems & Bachus, 2018a). Nevertheless, this literature often considers any job created for vulnerable groups as a positive contribution of the CE, which cannot be taken for granted. As pointed out by Van Opstal, Borms, et al. (2024), WISEs should invest in organisational capabilities, such as collaboration capabilities, innovation capabilities, and dynamic capabilities, to strengthen their competitive advantage within the supply chains they operate in.

4.2.2 Towards social circular hubs

Given their strong economic embeddedness in B2B activities, it is important to understand the *entrepreneurial ecosystems* within which WISEs operate. Entrepreneurial ecosystems consist of geographically and institutionally embedded networks that provide relational and infrastructural support to enterprises. These ecosystems typically include actors such as universities and research institutes, business incubators, financial institutions, and government bodies (R. Brown & Mason, 2017). They can be conceptualised as open systems that interact dynamically with their environment (Kanda, 2023), comprising hierarchically independent actors performing distinct roles in innovation and value creation (Engez et al., 2021). However, many of these ecosystem actors lack practical experience with CE principles (Klofsten et al., 2024), which stresses the need for collaboration, experimentation, and platformisation to drive circular ecosystem innovation (Konietzko et al., 2020).

In this context, the concept of a *circular ecosystem* is gaining attention. A circular ecosystem is a system of interdependent and heterogeneous actors that work across industrial and sectoral boundaries to advance circular value propositions while fostering both economic and environmental sustainability (Trevisan et al., 2022). Circular ecosystems may enable material flows (industrial ecosystems and urban ecosystems), knowledge flows (knowledge ecosystems and entrepreneurial ecosystems), and value flows (innovation, platform, and business ecosystems) (Aarikka-Stenroos et al., 2021).

Circular hubs emerge within such ecosystems as concrete, often place-based, interventions to facilitate and orchestrate circular collaborations. Rather than being equivalent to circular ecosystems, hubs can be understood as catalysts or nodes within them. They support ecosystem functioning by fostering multi-stakeholder

collaboration, piloting new initiatives, and connecting the right actors to translate circular ambitions into action. While some define circular hubs as regional clusters of interconnected companies and infrastructure advancing circularity and competitiveness (Mogos et al., 2021), others highlight their role as physical platforms, digital infrastructures, or network-based connectors across territories and value chains. For example, the European Union has created Hubs for Circularity (H4C) as an instrument for research and innovation, aimed at implementing cost-optimal pathways and new value chains for a net-zero CE (Garrido & Nunes, 2023; Tleuken et al., 2025). While this definition is open for cross-industry collaboration and civil society engagement, its focus is often limited to fostering industrial symbiosis. In other contexts, circular hubs may refer to physical logistics infrastructures, providing storage and trade of materials as well as integrated IT-platforms to enable upcycling (van Hees et al., 2025). Yet another perspective of circular hubs is that of networks of territorial actors, connected to existing networks (e.g., of startups or specific value chains) at both the local and supra-local level (Cuomo et al., 2020, 2021). In sum, the concept of circular hubs represents a rich tapestry of aims, activities, and scope. A leadership group of the European Circular Economy Stakeholder Platform on circular economy hubs (ECESP, 2023), comprising most of these initiatives, therefore defines circular hubs as follows:

> *"Circular hubs (or platforms or hotspots) are catalysts for the circular economy. They exist at city, regional, national and even international level. They consist of frontrunners and connect up all stakeholders needed for the circular transition (government, knowledge institutes, businesses and civil society representatives). They are coalitions of the willing and can combine top-down governance and bottom-up initiatives. The hubs translate ideas into action in line with the 10-R circularity model. This refers to circular systemic actions geared to the region's metabolism. From hub networks, dedicated communities emerge that start up initiatives that can scale up to viable business value chains."*

Note that the concept of circular hubs is dissimilar to the concept of 'living labs', which focus more specifically on involving users and co-creators in the development process to explore, examine, test, and evaluate new ideas and innovative solutions (Cuomo et al., 2021; Engez et al., 2021).

Since 2021, 12 *hubs for circular and social entrepreneurship* have been established in Flanders (Belgium), with the explicit aim of fostering collaboration between WISEs, conventional businesses, local governments, and a range of other partners, including higher education institutions, civil society organisations, and innovation actors. These initiatives, commonly referred to in policy and practice as *social circular hubs,* seek to strengthen both circular and social entrepreneurship at the local level (Coen & Dewickere, 2023). They distinguish themselves from traditional circular hubs by their dual ambition: enabling circular transitions while creating meaningful employment opportunities for vulnerable groups.

4.2.3 Research gap

In this paper we address three interrelated research gaps, to enhance our understanding of how to design and govern social circular hubs effectively and sustainably. A first research gap concerns the role of WISEs in a CE. Most studies focus on the potential role of WISEs to perform public services or provide reuse goods in consumer markets (Halberstadt et al., 2021; Kurleto, 2019; Schadenberg & Folmer, 2022), largely neglecting the role of WISEs in Business-to-Business (B2B) markets. Moreover, most of these studies focus on the impact of a circular transition on WISEs, leaving the perspective of their supply-chain partners a blind spot. A notable exception is a study from the perspective of startups, showing a strong and positive relationship between their circularity ambitions and their willingness to collaborate with WISEs (Van Opstal & Borms, 2024). Nevertheless, it is important to understand why companies implementing circular strategies would be interested (or not) in collaborating with WISEs. Path dependencies may play a role, with companies that have previously collaborated with WISEs showing greater interest, aligning with an '*insider-outsider hypothesis*'. Furthermore, companies interested in collaborating with WISEs might also express an interest in directly employing vulnerable groups in the labour or conversely, reflecting a '*contact hypothesis*'. These questions inform RQ1, which aims to identify the assets and disqualifiers of WISEs as partners for companies pursuing circular strategies.

Secondly, given the new concept of social circular hubs, there is no empirical evidence on how these hubs can help companies in their circular transition. This is relevant as the concept of a circular ecosystem in its current form (Aarikka-Stenroos et al., 2021; Trevisan et al., 2022) does not refer to social sustainability. Furthermore, social circular hubs are, to the best of our knowledge, the only type of circular hub that explicitly seeks to integrate social employment. Nevertheless, it is crucial for social circular hubs to develop a clear and compelling ecosystem *value proposition* that addresses the genuine needs of the companies they aim to serve. Such a circular ecosystem value proposition is a set of promised benefits to a target audience that encompasses principles and requirements concerning a CE (Gomes et al., 2023). These issues are addressed through RQ2, which examines relevant value propositions for social circular hubs that wish to support companies advancing toward a social circular economy.

Thirdly, the limited amount of research available on circular hubs focuses on its activities, scope, and tools (Bianchini & Maffei, 2023), how they integrate circular principles into existing business models (Mogos et al., 2021), and on ethical considerations (Garrido & Nunes, 2023). Nonetheless, there is a lack of attention to the *governance frameworks* and *business models* of circular hubs themselves. While the social circular hubs in Flanders represent a specific and recent initiative, they have limited track records or mature governance structures to analyse. We therefore draw

lessons from more established circular hubs across Europe to inform design conditions applicable to social circular hubs. Although these general circular hubs do not explicitly focus on WISE collaboration, they face comparable governance challenges, such as ensuring stakeholder alignment, developing viable service models, and scaling their activities sustainably. This motivates our third research question (RQ3), which asks what we can learn from circular hubs in general to define organisational design conditions for developing and governing sustainable social circular hubs. This includes attention to stakeholder engagement and mutual trust (Moggi & Dameri, 2021), value co-creation and fair value distribution (Bjartmarz & Bocken, 2024), and ecologies of business models, such as business model dependencies and interactions with existing business models (Bocken, Boons, et al., 2019). It also calls for understanding the ingredients for a minimum viable ecosystem for circularity, as conceptualised by Konietzko et al. (2024).

4.3 Methods and materials

In this section, we first present empirical background on WISEs and social circular hubs in Flanders. Next, we provide details on the collection and analysis of survey data among circular enterprises and interview data among European circular hubs and federations. This mixed-method approach is appropriate for this study because it allows for a comprehensive and nuanced exploration of the complex dynamics between WISEs, social circular hubs, and businesses in the context of the CE (Bell et al., 2022). Quantitative survey data provide generalisable insights into the experiences and needs of circular enterprises, while qualitative interviews enable a deeper understanding of the governance frameworks, value propositions, and organisational conditions essential for social circular hubs.

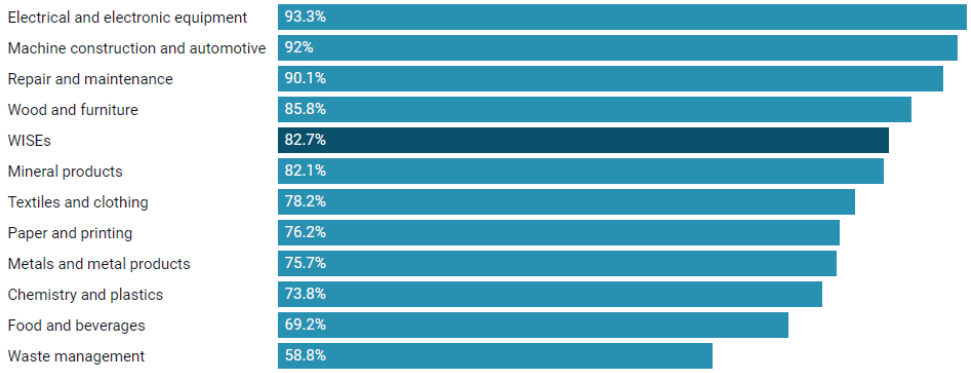
4.3.1 WISEs and social circular hubs in Flanders

In Flanders, accredited WISEs originate from sheltered workshops, aimed at the employment of people with work disabilities, and social workshops, focusing on workers with a distance to the labour market because of physical, social, or psychological problems. The majority of their activities take place in a business-to-business market, encompassing a diverse range of economic activities such as packaging, assembly, green area and park maintenance, wood manufacturing, bookbinding, and printing (Van Opstal, Borms, et al., 2024). An exception to this are WISEs that are active as social enterprise reuse shops (Kringwinkels), combining social employment with circular activities (Delanoeije & Bachus, 2020).

In 2022, 145 accredited WISEs in Flanders employed 24,312 target group employees (Dept. WSE, 2024). The size of WISEs in Flanders varies from 40 to over 2,000

employees (Van Waeyenberg & De Cuyper, 2016). In Flanders, WISEs operate as independent businesses, competing with companies both within and beyond the social economy (Van Opstal & Borms, 2024). They receive government subsidies to compensate for the diminished productivity of their workers, to provide support and guidance, and to support WISEs at the organisational level. They deliver services to over 10,000 Belgian companies, often as an integrated part of globalised value chains with B2B customers in over 28 countries (Termote & Demeyere, 2021).

WISEs perform a wide variety of economic activities, supplying labour-intensive services for industrial clients. In Figure 3 we report estimated labour intensities of WISEs compared to other industrial activities in Belgium, based on Cobb Douglas production function estimates (for more details we refer to Appendix 4.1). While this figure confirms the labour-intensive nature of their activities, it also reveals that this occurs in an industrialised organisation requiring capital goods comparable to many other manufacturing industries they are selling to. This figure also shows that WISEs are more labour intensive than waste management companies, but more capital intensive than the repair industry.



Source: Belfirst-data (see Appendix 4.1)

Figure 3 – Share of labour in the production process by industry, according to Cobb-Douglas production functions with constant returns to scale.

Social circular hubs have been established in Flanders since May 2021 following a call from the Flemish department of Work and Social Economy. These hubs are envisioned to establish collaboration between companies, WISEs, and local authorities to stimulate CE initiatives involving the employment of disadvantaged groups at the labour market. During the first 30 months, this initiative was co-funded by the European Social Fund (ESF) (Dept. WSE, 2021b). Complementary to the regional hub, Circular Flanders, social circular hubs were envisioned to boost social and circular entrepreneurship at the local level. Therefore, social circular hubs were required to start from a partnership between

a local government, a conventional enterprise (or entrepreneurial network), and the social economy (either WISEs, local associations of WISEs, or a social economy director). As a result, 12 social circular hubs were established. After 30 months, an evaluation report revealed that these hubs organised 201 events with 7,500 participants, launched 162 prototypes or pilots, provided guidance to 153 organisations, and successfully secured funding for 45 subsidised projects in collaboration with companies (Coen & Dewickere, 2023).

4.3.2 Survey data

To gather insights from enterprises in Flanders that are currently implementing or exploring circular strategies, hereafter referred to as '*circular enterprises*', we designed an online survey targeting this specific group. These include what we define as '*circular frontrunners*': companies that have already implemented one or more circular strategies and demonstrate a proactive stance towards CE transitions (Nurminen et al., 2024; Walker et al., 2021). The survey sample includes both conventional businesses and WISEs, reflecting the diverse range of organisations engaged in circular strategies and target groups of social circular hubs. Note that WISEs often procure services from other WISEs, rendering their perspective relevant to answer RQ 1.

To assure alignment with the variety of activities performed by the social circular hubs, the survey questionnaire was iteratively developed in collaboration with the steering group of a learning network of these social circular hubs. Draft versions of the survey were rigorously tested to refine the wording, optimise its relevance, and minimise survey fatigue. Firstly, the questionnaire included personal and enterprise characteristics, of which the descriptive statistics are reported in Appendix 4.2. Personal characteristics of survey respondents included their age, gender, and the role position(s) within the enterprise. Furthermore, a question was included asking the degree upon which the respondent generally enjoys taking risks. Enterprise characteristics included industry, company age, postal code, market segments served, turnover, and number of employees. The reference year for these questions was 2022. The development process followed established survey design principles for question clarity, cognitive load reduction, and iterative piloting (Bell et al., 2022; Sovacool et al., 2018).

Secondly, we asked respondents about the circular strategies implemented in their enterprise, as reported in Figure 4. To prevent applying a binary distinction of 'circular' versus 'non-circular' enterprises, we captured a nuanced empirical reality by allowing respondents to indicate their level of implementation on ten circular strategies, based on earlier empirical research on circular enterprises in Flanders (Borms, Brusselaers,

et al., 2023; Van Opstal & Borms, 2023). Note that this question serves as a control variable and not as an attempt to estimate the CE in Flanders.

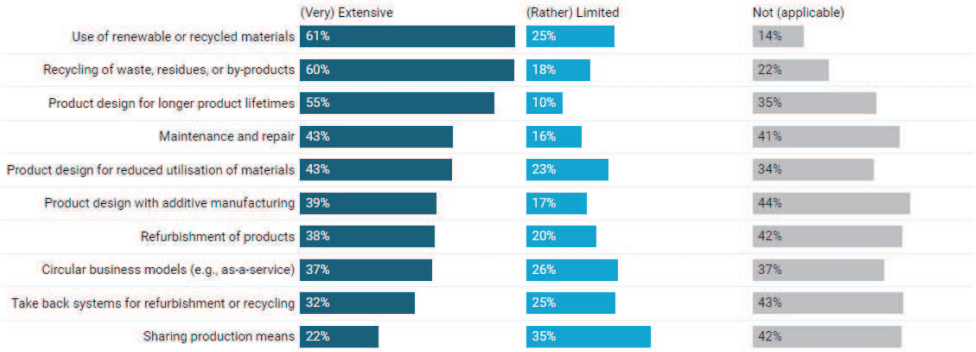


Figure 4 – Circular economy strategies implemented by respondents (n = 115)

Thirdly, respondents were asked about the barriers and enablers they experience to implement circular strategies. Regarding barriers, we based our answer options on Kirchherr et al. (2018), Cantamessa et al. (2018), Van Opstal & Borms (2023), and Geissdoerfer et al. (2023). The list of potential enablers was based on a participatory study, including policy and industry perspectives, to construct a working agenda for a circular manufacturing industry in Flanders (Versluys et al., 2021). Both lists were subsequently and iteratively refined by interactions with the steering committee. Respondent results, mostly serving as control variables in this study, are summarised in Figure 5.

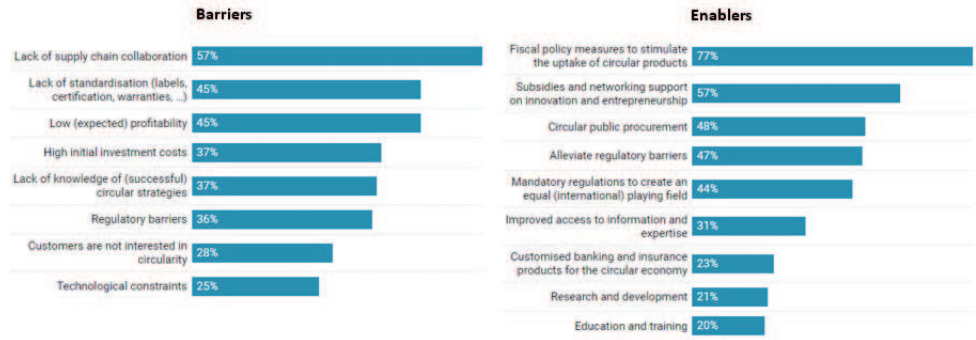


Figure 5 – Barriers and enablers for the circular economy according to respondents (n = 115)

Fourthly, we asked questions on perspectives to collaborate with WISEs and disadvantaged groups at the labour market. This included a question capturing the prevalence or intention to collaborate with WISEs on the one hand ('not interested', 'interested', or 'already collaborating'), and to employ disadvantaged groups at the

labour market themselves (‘not interested’, ‘interested’, ‘already hiring’), on the other hand. Additionally, we assessed which attributes of WISEs are perceived as assets or disqualifiers for collaboration, using a 5-point Likert scale supplemented with a 'not applicable' option. Finally, we asked respondents about their need for support and guidance in the process of transitioning to a CE, as well as their initial experiences (if any) with social circular hubs.

Survey responses were collected through SurveyMonkey between June and November 2023. Companies were contacted via three channels: (1) outreach by the regional hub Circular Flanders, (2) distribution by the 12 social circular hubs, and (3) targeted communication from the research institute of the lead author to its existing network of enterprises engaged in circular innovation. Contact was made through personalised emails, phone calls, dedicated newsletter items, and targeted LinkedIn messages. No material or financial incentives were given. While the total number of enterprises contacted cannot be precisely determined due to the decentralised outreach, based on mailing lists and network size estimates we conservatively estimate outreach to 400–450 companies. The survey yielded 115 complete responses, indicating a minimum response rate of approximately 26–29%. After closing the survey, data cleaning processes included checking data consistency (e.g., outliers and consistency between qualitative remarks and answer categories), and calibrating data types.

Over 90% over the 115 respondents is engaging in one or multiple circular strategies. This way, we gathered insights of frontrunner enterprises in Flanders to understand perspectives on a potential collaboration with WISEs and identify relevant value propositions that social circular hubs could offer. In the discussion section, we address limitations of this sample. Bivariate statistical tests included t-tests for mean differences, F-tests for comparing proportions between groups, complemented with non-parametric tests such as Kruskal-Wallis tests. Multivariate statistics included probit regressions to explain dichotomous dependent variables, Poisson regressions to explain count data, and ordinary least squares (OLS) to explain ratio-variable data. Variance Inflation Factors (VIF) were calculated to test for multicollinearity.

4.3.3 Interviews

To validate our results and ensure greater geographical relevance of our insights, we conducted 14 semi-structured interviews with 16 executives of circular hubs and federations across Europe. These interviews also aimed to gather perspectives on the organisational design of these hubs, including value propositions, governance frameworks, and business models, drawing on experiences from other hubs. Interview respondents were selected based on participation at events of the European Circular Economy Stakeholder Platform (ECESP) Leadership Group towards a European

Network of Circular Economy Hubs. Sampling stopped when the level of data saturation was reached, meaning that further data collection and coding resulted in minimal or no new insights (Francis et al., 2010). The list of respondents and their organisations, and a translated version of the interview questionnaire, is included in Appendix 4.3. Although the interviews did include a question on WISE collaboration, they mainly aimed to identify broader governance, service design, and sustainability conditions in circular hub ecosystems. These structural and strategic patterns are relevant for understanding how social circular hubs might embed social and circularity goals. Moreover, this enabled us to situate the Flemish case within a wider European landscape of hub experimentation and extract transferable insights.

During the semi-structured interviews, we asked targeted follow-up questions to make implicit assumptions and tacit knowledge explicit. Therefore, we asked each interview respondent as a last question to perform a premortem analysis explicating why the circular hub of the respondent would fail within the next five years. This technique, originating from behavioural economics (Gallop et al., 2016; Thaler & Sunstein, 2008), helps to mitigate cognitive biases among interview respondents such as confirmation bias, hindsight bias, and groupthink.

Interview participants provided informed consent for an online interview conducted via MS Teams, lasting between 40 and 70 minutes. The interview transcripts and supplementary documentation of these hubs were subsequently coded using Atlas.ti. Coding involved themes such as the activities performed (or deliberately not performed) by the hubs and the underlying reasons substantiating these choices, stakeholder engagement, ecosystem value propositions, value capturing by the hubs, and governance and monitoring frameworks. Additionally, coding involved identifying barriers and enablers for a sustainable growth of these hubs, as well as indications of their optimal size and scope. Quotations are reported in an anonymised way. All interview respondents received a draft version of this paper to refine arguments and prevent misinterpretations and factual errors.

4.4 Results

4.4.1 Assets and disqualifiers of WISEs

Addressing RQ1, it is first important to understand which companies are already collaborating with WISEs, as this may define how they perceive the assets and disqualifiers of WISEs. As reported in Table 13, nearly half of the companies in our sample (49%) – excluding WISEs themselves – are already engaged in collaborations with WISEs, with an additional quarter (26%) expressing interest in such partnerships. WISEs were excluded from this specific analysis because, by their very nature, they all

hire employees from target groups. These frequencies are considerable, given the fact that WISEs in Flanders are estimated to deliver services to 10,000 Belgian companies (Termote & Demeyere, 2021) and the general number of Belgian companies is estimated at almost 900,000 companies (Statbel, 2023). These figures also indicate that a clear majority of companies in our sample are aware of the offerings of WISEs. Furthermore, there is also a strong and significant positive relationship between collaborating with WISEs and hiring individuals from target groups as direct employees (e.g., through forms of supported employment), supporting the contact hypothesis formulated earlier.

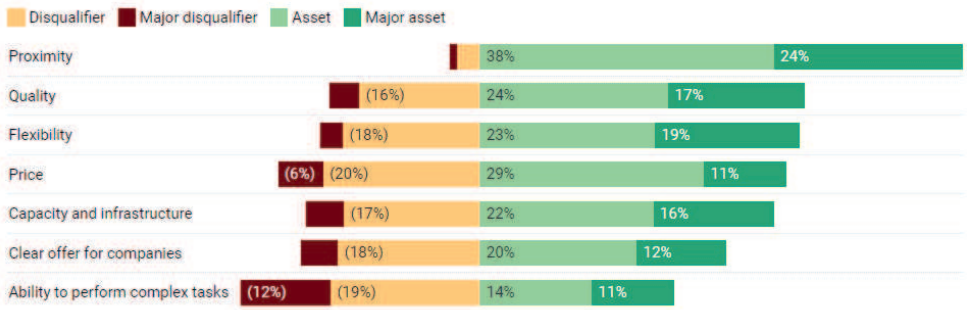
Table 13 – Collaboration with WISEs and hiring target group employees

		Collaboration with WISEs			
		Not interested	Interested	Already collaborating	Total
Hiring target group employees	Not interested	45%	18%	37%	100%
	Interested	0%	64%	36%	100%
	Already hiring	11%	7%	81%	100%
Total		25%	26%	49%	100%

n= 103 (full sample, excluding WISEs); F-test comparing proportions between groups. p-value: 0.000

Interestingly, applying F-tests reveals that there appear to be no statistically significant differences between the circular strategies applied by the respondents and the degree to which companies are already collaborating, are interested in doing so, or are not interested. This may suggest that WISEs are not automatically considered as natural collaboration partners among companies implementing circular strategies. Nevertheless, applying a Poisson regression ($p < 0.05$) on the number of circular strategies applied, we did find a positive relationship with collaborating with WISEs ($p < 0.01$) or showing interest to collaborate ($p < 0.01$). The latter, however, could as well follow from the fact that companies addressing multiple circular strategies are more open to collaborate with other companies, regardless WISEs or not. Similarly, implementing multiple circular strategies often requires a diverse range of activities, increasing the likelihood that WISEs can offer valuable and relevant contributions.

Experiences with WISEs among survey respondents vary, including both positive reflections, such as *"We did highly successful projects with the social economy! They are strongly integrated into our operations."*, and negative sentiments, such as *"I am no longer interested due to negative past experiences."* More importantly, we aim to understand which aspects of collaboration with WISEs are perceived as assets and which are regarded as barriers, as reported in Figure 6. Proximity is considered a major asset, followed by quality and flexibility to adapt to the needs of clients. A lack of ability to perform complex task is considered a (major) disqualifier by 31% of the respondents, while the ability to perform complex tasks is considered an asset by 25% of the respondents.



Note: Proximity relates to geographic proximity to the client. Quality relates to perceived service quality. Flexibility relates to operational flexibility (e.g., to deal with shifts in volumes and configurations). Price refers to cost competitiveness. Capacity and infrastructure refer to the operational capacity and physical infrastructure of WISEs. A clear offer for companies refers to the clarity of the value proposition. The ability to perform complex tasks refers to the technical capability of WISEs to perform advanced or specialised tasks.

Figure 6 – Assets or disqualifiers of collaborating with WISEs, according to survey respondents (excluded category: 'neither an asset, nor a disqualifier')

Interestingly, no significant differences (based on F-tests) on assets and disqualifiers could be found between those who already collaborate with WISEs, those who are interested to do so, and those who are not interested in doing so. In other words, 'insiders' with experience in collaborating with WISEs have not different opinions when evaluating WISEs compared to 'outsiders'. Similarly, no significant differences were observed in relation to the circular strategies employed, with one exception: organisations developing circular business models were significantly more likely to indicate that WISEs have a clear offer ($p < 0.05$), with 44% of those engaged in CBM reporting this compared to 24% of others.

Further bivariate statistical tests show a wide variety of statistically significant relationships, as summarized in Table 14. This table reads as follows: 'price' is considered less often as an attribute by incumbent firms, and more often as a barrier among respondents who indicate high initial investment costs as a barrier. Another example: quality is considered an asset less often among respondents having no experience with target group employees, and it is considered more often a disqualifier among risk preferent respondents and respondents who think customers are not interested in a CE. For more details we refer to Appendix 4.4. This overarching picture reveals that WISEs cannot be reduced to one overarching 'one feature fits all'. Rather, our results suggest a varying relevance of these attributes to different potential B2B customers.

Table 14 – Assets and disqualifiers of WISEs according to respondent characteristics.

Attributes of WISEs	Who considers this as an asset?	Who considers this as a disqualifier?
Proximity	Respondents indicating as an enabler: subsidies and networking support* (+) Construction industry* (-)	Respondents indicating as an enabler: customized banking and insurance* (+)
Quality	No experience with target group employees* (-)	Risk preferent respondents* (+) Respondents indicating as a barrier: customers are not interested in CE* (+)
Flexibility	Manufacturing companies* (+) Respondents indicating as an enabler: subsidies and networking support** (+) Service industry* (-)	Respondents indicating as an enabler: improved access to information and expertise* (-) Respondents indicating as an enabler: training* (-) Respondents indicating as an enabler: R&D* (-)
Price	Incumbent firms* (-)	Respondents indicating as a barrier: high initial investment costs* (+)
Capacity and infrastructure	Respondents indicating as an enabler: subsidies and networking support** (+)	No significant relationships
Clear offer for companies	No significant relationships	No significant relationships
Ability to perform complex tasks	Respondents indicating as a barrier: lack of knowledge** (+)	No significant relationships

Note: * significant at the 5% level, ** significant at the 1% level. Based on t-tests for mean differences (regarding risk preference and age) and F-tests for comparing proportions between groups (all other variables).

4.4.2 Value propositions of social-circular hubs

Understanding the needs of companies

In response to RQ2, a clear understanding of the needs of companies transitioning towards circularity is crucial to develop meaningful support services and enable progress. By identifying and addressing these needs, circular hubs can develop value propositions that resonate with the companies they target. In Figure 7 we provide an overview of current and prospective activities of social circular hubs and the degree upon which they align with support needs by survey respondents. Sharing best practices, referral to experts, as well as assistance in preparing subsidy applications and matchmaking between companies are most frequently indicated. Additionally, a majority of respondents indicates a need for support in circular supply chain design or assistance in finding financing. Even the two least indicated options, support for public procurement or circular product design and prototyping, was selected by over 45% of all survey respondents.

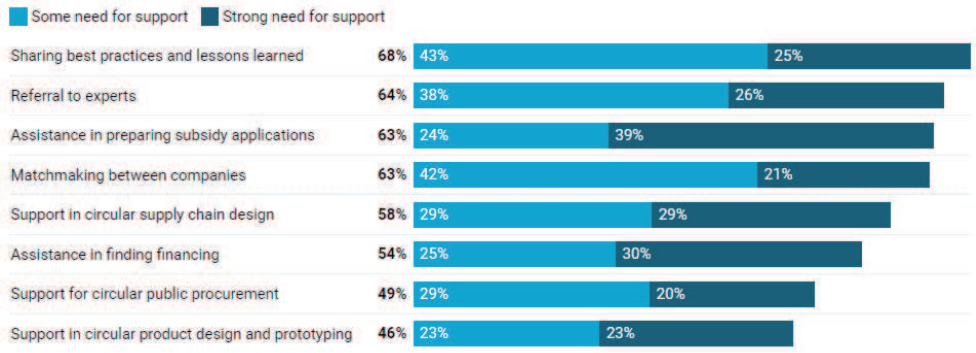


Figure 7 – Support needs of companies as key ingredients for value propositions for social circular hubs, as identified by survey respondents.

Interestingly, again we did not find significant differences (applying F-tests) between aspired circular strategies (e.g., repair, refurbishment, recycling, etc.) and support needs.

In Table 15 we report probit regression results on indicated needs for support of the varying options demonstrated in Figure 7. This is regressed on dummy variables such as prior experience with the offering of social circular hubs ('Hub experience'), already collaborating with WISEs ('WISEalready'), showing interest to collaborate with WISEs ('WISEperhaps'), being a manufacturing industry company ('Manufacturing industry'), or a WISE itself. We also included the number of barriers ('BarrierCount') and the number of enablers ('EnablerCount') (as reported in Figure 5) indicated by the respondents. Including these barriers and enablers separately would result in collinearity problems. Finally, we included dummy variables on being a startup company (i.e., younger than 5 years), a female respondent, the owner of the company, and the number of circular strategies implemented ('CEcount). Note that the size of the company, in terms of turnover or staff, was not included because of collinearity problems with company age. Also note that, while the WISEs in our sample (9% of the respondents) do collaborate with other WISEs, this did not cause any collinearity issues.

Respondents with prior experience with the social circular hubs do not reflect different needs compared to those having no prior experience. Likewise, startups do not reveal different needs compared to their incumbent counterparts. The need to organise matchmaking is pointed out the least by those respondents already collaborating with WISEs, and most by WISEs themselves, female respondents, owners, and those who identify many barriers to implement circular strategies. The latter two groups also indicate a higher need for referral to experts and sharing best practices. Female respondents likewise indicate a need for best practices, while respondents from the manufacturing industry show less interest. Assistance in preparing subsidy

applications is indicated most by those who see many barriers but also by those seeing many enablers to proceed to a circular transition.

Table 15 – Probit regression results on support for value propositions of social circular hubs (n = 113)

	Matchmaking	Referral to experts	Best practices	Subsidy assistance	Circular Procurement	Finance	Product design
Prob > chi2	0.0321	0.0236	0.0019	0.0439	0.0179	0.0023	0.0166
Pseudo R2	0.1407	0.1505	0.2066	0.1348	0.1466	0.1857	0.1484
Hub experience	-0.2237	-0.2475	-0.2642	0.0119	-0.0123	0.0465	0.0074
	(0.1909)	(0.1911)	(0.1988)	(0.1887)	(0.1874)	(0.1920)	(0.1843)
WISEalready	-0.6347*	-0.3797	0.0525	-0.1511	-0.1272	0.4152	-0.3627
	(0.3546)	(0.3682)	(0.3679)	(0.3463)	(0.3385)	(0.3491)	(0.3556)
WISEperhaps	-0.0722	-0.6061	0.0619	0.3631	0.6944*	1.1865***	-0.5186
	(0.4339)	(0.4454)	(0.4473)	(0.4272)	(0.4150)	(0.6368)	(0.4214)
Manufacuring	-0.1014	-0.0261	-0.6995**	0.0086	0.5466*	-0.5329*	0.4243
industry	(0.2873)	(0.3005)	(0.3056)	(0.2986)	(0.2953)	(0.3011)	(0.2950)
WISE	1.2799**	-0.0407	0.4783	0.2674	-0.1010	-0.3601	0.0333
	(0.5829)	(0.5225)	(0.5981)	(0.5174)	(0.5075)	(0.5045)	(0.5074)
BarrierCount	0.1679*	0.2731***	0.3329***	0.1569*	0.1710**	0.2351**	0.4081***
	(0.0873)	(0.0381)	(0.1083)	(0.0904)	(0.0846)	(0.0947)	(0.1040)
EnablerCount	0.02535	0.0858	-0.0187	0.1903*	0.0802	0.0179	-0.1680*
	(0.0923)	(0.1032)	(0.1044)	(0.0985)	(0.0943)	(0.0960)	(0.0987)
Startup	0.0000	-0.5216	-0.3436	0.5448	0.1196	0.4659	-0.1066
	(0.3362)	(0.3380)	(0.3451)	(0.3634)	(0.3305)	(0.3539)	(0.3252)
Female	0.7262**	0.2587	0.5865*	0.1393	-0.2594	-0.0332	0.4538
	(0.3106)	(0.3080)	(0.3350)	(0.3103)	(0.3049)	(0.3114)	(0.3044)
Owner	0.4915*	0.5368*	0.6570**	-0.0179	0.5049*	0.2886	0.5276**
	(0.2712)	(0.2777)	(0.2946)	(0.2701)	(0.2661)	(0.2728)	(0.2679)
CEcount	0.0167	-0.0193	0.0518	0.0359	-0.0110	0.0310	0.0487
	(0.0487)	(0.0488)	(0.0539)	(0.0493)	(0.0468)	(0.0485)	(0.0486)
Constant	-0.2789	-0.2369	-0.5922	-1.1398**	-1.1694**	-1.3243**	-1.0805**
	(0.4524)	(0.4716)	(0.4934)	(0.4864)	(0.4580)	(0.4966)	(0.4672)

Note: * significant at the 10% level, ** significant at the 5% level, *** significant at the 1% level. Standard errors between parentheses. VIF-tests reveal an average of 1.37 and a maximum value of 1.96, indicating no multicollinearity. Probit regression results on 'support in circular supply chain design' as value proposition returned a chi-2 test statistic with a p-value of 0.1537. Therefore, we did not report coefficients of this regression, as its overall model does do return results that are significantly different from zero.

Respondents from the manufacturing industry are more interested in support to learn about circular procurement. This need is also expressed most by owners, those seeing many barriers, and those interested in collaborating with WISEs. The latter two groups also express a higher need for assistance in finding financing, which is again less expressed by respondents from the manufacturing industry. Finally, support in circular product design and prototyping is indicated most by owners, and those who see many barriers and fewer enablers.

Importantly, the number of barriers indicated by survey respondents is positively related to all potential value propositions of social circular hubs. We included the number of barriers as a regressor, as mentioning all of them separately would lead to collinearity problems. Therefore, we proceeded with a bivariate analysis of these barriers and the needs expressed. The results of these tests are reported in Table 16, which also reports the statistically significant relationships identified in Table 15. This table reads as follows: 'matchmaking between companies' is considered as a value

proposition for social circular hubs more often by female respondents, company owners, WISEs, and those who face a lack of supply chain collaboration as a barrier. It is considered less as a relevant value proposition by companies who already work with WISEs. Another example: assistance in finding financing is considered more often a value proposition among companies interested to collaborate with WISEs but less often among manufacturing companies. Moreover, assistance in finding financing is more often considered a value proposition for respondents facing regulatory barriers and a lack of knowledge on the CE. Note that no statistically significant relationship was found with the size of the company as measured by turnover and staff size.

Table 16 – Value propositions for social circular hubs versus respondent characteristics and barriers to implement circular strategies (n = 113)

Value proposition	Company and personal characteristics	Barriers experienced by respondents
Matchmaking between companies	Female respondents* (+) Company owners (+) WISEs* (+) Companies already working with WISEs (-)	Lack of supply chain collaboration** (+)
Referral to experts	Company owners (+)	Lack of supply chain collaboration* (+) Lack of standardisation* (+) Regulatory barriers* (+) Lack of knowledge** (+)
Sharing best practices	Female respondents (+) Company owners* (+) Manufacturing companies* (-)	Lack of customer interest* (+) Regulatory barriers** (+)
Assistance in preparing subsidy applications	Respondents who see many enablers (+)	Lack of standardisation** (+) Regulatory barriers* (+)
Support for circular public procurement	Companies interested in WISEs (+) Manufacturing companies (+) Company owners (+)	Lack of supply chain collaboration* (+) Lack of standardisation* (+)
Support in circular supply chain design	No significant relationship	Lack of supply chain collaboration** (+) Lack of standardisation* (+) Regulatory barriers** (+) Lack of knowledge* (+)
Assistance in finding financing	Companies interested in WISEs* (+) Manufacturing companies (-)	Regulatory barriers** (+) Lack of knowledge* (+)
Support in circular product design and prototyping	Company owners* (+) Respondents who see many enablers (-)	Lack of supply chain collaboration* (+) Regulatory barriers* (+) Low expected profitability* (+)

Note: * significant at the 5% level, ** significant at the 1% level. All other covariates reported are significant at the 10% level. Based on t-tests for mean differences (regarding risk preference and age) and F-tests for comparing proportions between groups (all other variables).

Value propositions of 'regular' circular hubs

The hubs interviewed (Appendix 4.3) engage in a variety of activities differing in their geographical scopes, which range from local to national and international levels. Key activities of most hubs include fostering ecosystem collaboration, supporting startups, and promoting awareness. Holland Circular Hotspot takes an explicit international stance, connecting circular ventures with relevant global value chain partners through Dutch embassies. Most other hubs act as connectors within their regions, fostering

multi-actor partnerships that include businesses, research institutions, and government entities. They organise matchmaking events, bringing stakeholders together to form synergies in material flows or innovation.

Public outreach is also a common feature, with hubs investing in communication campaigns, training and education programmes, and policy recommendations to build societal and political support for circularity. Some hubs, such as Circular Valley and Mixi, also operate accelerators that support startups with circular business model solutions, offering networking opportunities with established companies and research partners. In Montenegro, the circular hub assists companies in implementing EU-aligned regulations and advocating on their behalf to develop tailored, more effective legislation. Likewise, Circular Flanders connects public authorities and business in developing and implementing working agendas on the CE. Similarly, the Italian Circular Economy Stakeholder Platform (ICESP) acts as a voluntary platform for discussing and identifying hot-spots and proposals on CE implementation, delivering value through the co-cocreation of position papers, knowledge sharing, dissemination of good practices, and stakeholder engagement activities.

Every hub interviewed deliberately avoids offering consultancy services to individual companies, emphasising their focus on open-source collaboration and ecosystem-wide impact. Similarly, they avoid providing extensive coaching or ongoing support for collaborative projects, focusing instead on matchmaking, guidance, and initiating connections. Many hubs explicitly do not conduct research or operate as think tanks, as formulated by one respondent: "*we are not a think tank, we are a do thank*". Furthermore, the European sample of 'regular' circular hubs largely does not engage into social employment, and when such involvement does occur, it remains mostly peripheral to their primary focus. Hubs often acknowledge the indirect impact of circular strategies on employment, such as preserving industrial jobs or creating opportunities for manual and semi-skilled labour. Some include trade unions or other civil society organisations in working groups to ensure that the labour market perspective is considered, while others explore integrating social objectives into specific projects when opportunities arise.

4.4.3 Organisational design of circular hubs

Addressing RQ3, this section draws on interviews with executives of circular hubs and federations across Europe. While these hubs were not explicitly social in nature, they offered valuable insights into the organisational and governance arrangements necessary to coordinate circular collaborations. Understanding these design choices is important to supporting social circular hubs, which combine the complexities of both circular transitions and inclusive employment. The lessons presented here can also help

to inform how social circular hubs structure their relationships with actors like WISEs, conventional businesses, and local governments.

Governance

Social circular hubs are set up as a partnership between different manufacturing companies, WISEs, and local governments. These hubs are also open to additional support from other relevant partners, such as knowledge institutes, inter-municipal organisations, and regional authorities, etc. (Coen & Dewickere, 2023). As is the case with other circular hubs, its governance design involves structuring collaboration at the hub-level, including the choice of legal structures and stakeholder engagement strategies, and collaboration between hubs.

The *governance structures* of the circular hubs in our sample show a shared emphasis on collaboration and flexibility. Most hubs adopt governance models that involve multiple stakeholders, including public entities, private companies, and civil society organisations. These structures aim to ensure the representation and engagement of stakeholders deemed necessary for a circular transition. This often occurs through steering committees, advisory boards, or assemblies of members. The governance frameworks are typically tied to their operational focus, such as accelerating projects, promoting knowledge sharing, and facilitating policy dialogues.

Volunteer contributions frequently play a vital role, with many hubs relying on unpaid board members or stakeholder participation to reduce operational costs and foster community-driven initiatives. Across regions, hubs also aim to remain neutral platforms, focusing on fostering partnerships and avoiding alignment with specific corporate or political interests. This is illustrated by a respondent as follows: "*Our network is a neutral one: we don't work for the interest of one party. We try to do our best to let stakeholders freely express their opinion and suggestion regarding the implementation of the CE. We want all the voices about CE implementation at the same table*."

Nevertheless, the specific governance models and *legal structures* of hubs vary widely. Many hubs adopt non-profit models, such as foundations or non-profit associations, with the latter allowing for membership participation. This non-profit status enables them to act as neutral coordinators when developing partnerships with businesses, municipalities, and civil society organisations. Non-profits may also have easier access to public funding, but their reliance on volunteer-based governance can pose resource challenges. In contrast, some hubs opt for for-profit structures to access broader funding opportunities and signal professionalism.

Interestingly, multiple hybrid forms can be noticed. One example are social enterprise legal structures that combine features of traditional companies (e.g., economic activities and issuing shares) with elements of non-profit associations (e.g., an asset lock and a non-distribution constraint). This allows to attract equity funding while signalling credible claims that the social mission of the organisation is locked and avoids the administrative burden of managing a large member base. However, such legal forms do not exist in every country. Another example of the combined use of legal forms, such as a mission-locked foundation with an operational arm under the form of a traditional company. Finally, some hubs lack a separate legal status, as they are embedded within local authorities or chambers of commerce. This is also the case for the social circular hubs in Flanders. It allows them to benefit from integrated resources and networks of their hosting organisations, but may constrain their independence, limiting access to certain funding opportunities, and hindering effective stakeholder participation to determine their strategic direction.

Regardless their legal form, *stakeholder engagement* is a central focus for CE hubs. Most interview respondents point out that it requires significant effort to build relationships and create collaborative networks. Engagement strategies are mostly tailored approaches to address specific needs, such as targeting industry-specific challenges or aligning with local and regional priorities. Most hubs foster collaboration by connecting businesses, public institutions, and civil society organisations, often through matchmaking events, workshops, or collaborative projects. The hubs frequently aim to integrate these stakeholders into their activities, but many of them lack familiarity with CE concepts. As illustrated by one respondent: "*I think that circularity also conveys a sense of all the obligations that come with it. For many companies, it feels overwhelming. They might be willing to embrace it, but they feel like they have to completely overhaul everything and don't know where to start.*" Therefore, hubs often provide practical guidance and incremental pathways for engagement, making the transition less overwhelming.

All circular hubs in our sample try to establish *networks of hubs*, both nationally and internationally, to foster collaboration, knowledge sharing, and mutual support. These networks operate on a bottom-up basis, emphasising the importance of regional and local autonomy while striving for alignment on shared goals. They employ platforms, regular meetings, workshops, sharing resources and identifying joint opportunities, such as funding or project calls. The networks often include a mix of public and private stakeholders, integrating government agencies, research organisations, (federations of) companies, and NGOs. Examples include the Nordic Circular Hotspot and the leadership group of the European Circular Economy Stakeholder Platform. The structure and formality of network governance varies significantly across networks. For instance, the Nordic Circular Hotspot operates under a formalised governance

model, supported by the Nordic Council of Ministers. In contrast, other networks, such as the network of social circular hubs in Flanders, remain informal, relying on voluntary contributions and ad hoc cooperation driven by individual hubs.

Business models

Social circular hubs currently depend largely on government subsidies. Most circular hubs in our European sample rely on a mix of *funding* streams, including public grants, private sector contributions, membership fees, and project-based funding. However, the specifics of value capturing by circular hubs differ significantly. Some hubs, such as Circular Groningen, reportedly draw substantial funding from private sector members or partnerships, while most others rely heavily on public funding or project subsidies. In Finland, for example, public funding opportunities and city-funded projects play a central role, while other hubs, such as the Circular Economy Forum (Austria) and ICESP (Italy) mainly drive on volunteer contributions. In other cases, circular hubs entirely work with the resources of organisations they are embedded in, such as the Circular hub Montenegro. Some hubs, such as Circular Blackforest or Circular Valley, aim at connecting to regionally embedded, historically family-owned businesses to establish dedicated funds. Differences also emerge in the extent to which hubs monetise their services; for instance, Circular Economy Forum Austria deliberately avoid consulting with individual companies, while others integrate service provision as a key revenue stream.

Monitoring impacts is important both for effective governance and for demonstrating the value created and delivered to stakeholders and funding bodies. Yet, monitoring remains a work in progress, with a shared recognition of its importance but varying levels of implementation and sophistication. Many hubs, both in Flanders and beyond, employ basic tracking methods, such as participant numbers, events, surveys, and interactions with stakeholders, as initial indicators of activity and engagement. Certain hubs measure specific areas of impact more systematically. For instance, the Circular Valley accelerator assesses the progress of startups through questionnaires and interviews, tracking metrics such as venture capital acquisition, network growth, and collaboration outcomes. When it comes to measuring deeper impacts, such as environmental, social, or economic outcomes, monitoring remains largely intuitive, relying on gut feeling or indirect indicators. A frequently expressed challenge is the difficulty of attributing indirect impacts to specific hub activities. Many hubs operate as enablers or facilitators, which makes it complex to measure and attribute outcomes such as business growth, employment generation, or systemic change.

Regarding scaling and replication, the *optimal size and scope* of a circular hub is considered highly contextual among interview respondents. For highly complex

regions with diverse economic activities, such as Lombardy or the Randstad, larger and more specialised hubs are deemed necessary to address its broad range of challenges and opportunities. In contrast, smaller regions or municipalities may require leaner structures. In other cases, the geographical scope of circular hubs connects to regional identities, allowing them to tap into identity-related non-market resources including trust and reciprocity. The scope should remain broad enough to avoid clustering around a single value chain, ensuring cross-sectoral innovation and collaboration. Ultimately, hubs must strike a balance between scalability and focus, exploring specific topics such as the bio-economy and reverse logistics. Notably, the ultimate vision of some hubs is to render themselves obsolete, with their goals fully integrated into societal and economic norms, highlighting that success is measured not by perpetual existence but by transformative change achieved.

Boundary conditions

Regarding *drivers* towards a sustainable growth of circular hubs, collaboration across networks is identified as a first key driver. A second driver is a strategic alignment of circular hubs with regional or national policies, as it strengthens their legitimacy. Next, showcasing tangible contributions, such as supporting local businesses or advancing circular procurement, helps to attract continued support for circular hubs by public and private funders. Finally, cultural shifts towards sustainability, especially among younger generations, are highlighted as drivers for circular hubs, as they reflect a growing demand for circular products and services.

Circular hubs also reportedly face significant *barriers*, with funding being the most pressing challenge. Many hubs struggle with the unpredictability of project-based financing and the absence of stable, institutional support. The lack of alignment between funding mechanisms and the mostly intangible outputs of hubs, such as networking and facilitation, further complicates their sustainability. Cultural resistance to change is also highlighted as an important barrier for the uptake of CE practices. This is aggravated when economic pressures, such as competition from linear products, highlight the need to create a level playing field. Furthermore, internal challenges, such as limited human resources and the difficulty of managing growth, impede the ability of hubs to scale effectively. Moreover, hubs often struggle with stakeholder engagement issues, including free-riding behaviour, resulting in insufficient contributions from partners.

4.5 Discussion

Our results show the importance of earlier contacts with target employees when considering collaboration with WISEs, or conversely. While this ‘contact hypothesis’

requires further research, our results underscore the importance of awareness building on the offer of WISEs to foster a social circular economy. This is particularly considered valuable for companies who are particularly ambitious in implementing circular strategies, confirming earlier results from circular startups (Van Opstal & Borms, 2024).

Social circular hubs can reduce asymmetric information between WISEs and potential industrial clients. Their activities align with the needs expressed by a broad group of circular enterprises, including both startups and incumbents, regardless the circular strategies they aim for. Yet, our results show nuanced results on which groups are more in favour for specific activities. Important variables to consider are the industry involved, earlier experiences with WISEs, and gender. Company owners (compared to staff members and hired CEOs) often express their needs more expressively, as well as respondents who are conscious about the number of barriers they encounter when trying to implement circular strategies. The deployment of hub activities, however, should align with organisational design configurations which involve multiple governance and business model trade-offs. In this section, we therefore identify these trade-offs, present a framework for multi-level organisational configurations, and discuss practical implications and limitations of this work.

4.5.1 Strategic trade-offs and design configurations for circular hubs

Designing social circular hubs involves developing ways to understand what is necessary to develop a circular ecosystem and understand its underlying elements (Trevisan et al., 2022). As for 'regular' circular hubs, this includes fostering collaboration, experimentation, and platformisation, driving circular ecosystem innovation (Konietzko et al., 2020). Circular hubs are envisioned to be central actors in circular ecosystems, which is why their organisation entails making fundamental choices in their design and governance (Konietzko et al., 2024). In Table 17, we report an overview of key options and their underlying trade-offs. These trade-offs apply to both 'regular' and 'social' circular hubs. For example, it is possible for social circular hubs to focus on the added value of WISEs from a business-oriented perspective, focusing on matchmaking between companies to unlock a social circular economy and foster circular supply chains. Similarly, social circular hubs can cover a rather broad geographical scope or focus on needs at the level of one city.

Table 17 – Key options and trade-offs for the design and governance of (social) circular hubs

Aspect	Options	Trade-offs
Vision	• Business-oriented • Focus on broader sustainability considerations	• Easier to measure outcomes and identify the alignment of incentives. Focus on future-proof business models and value chain resilience. • Attention for a just transition and a circular society, but with a risk of diluting focus and effectiveness.
Ecosystem value proposition	• General support • Tailored assistance	• Enables wide engagement but may dilute focus and value capturing • Enhances impact and willingness to contribute, but limits reach
	• Broad geographical scope • Local geographical scope	• Drives systemic change along global value chains but may lack stakeholder engagement from local communities • Addresses community needs while being locally embedded
	• Cross-sectoral focus • Sector-specific focus	• Allows exploration of cross-sector synergies and broader systemic opportunities • Provides deep expertise and focus
Stakeholder engagement	• Deep engagement with frontrunners • Broad participation to new actors	• Easier to identify aligned interests, mutual trust, and value capturing • Broader outreach, fostering inclusivity but with a higher risk of freeriding and inefficiency
	• Voluntary engagement • Paid staff members	• Reduces costs but may limit scale and continuity. • Offer professional expertise but increase operating costs and may crowd out stakeholder engagement
Governance	• Separate legal entity • Embedded in existing organisations • Informal networks	• Autonomy, flexibility, and independence to engage in formal partnerships and attract funding, but higher administrative burdens • Access to organisational resources, but lacking independence and flexibility to engage in projects or attract funding • Flexible but difficult to attract funding
	• Non-profit legal form • For-profit legal form • Hybrid legal form	• Fosters trust, aligns with grants and public funding • Enables scalability, access to enterprise-oriented funding • Combines benefits, but may face legal and administrative complexity
Value capturing	• Public funding • Private revenue streams • Membership fees	• Ensures public alignment, but with a higher risk of dependency • Provides autonomy, but may conflict with general interests • Promotes stakeholder engagement, but requires clear value creation for members
Monitoring	• Basic tracking of activities • Advanced metrics	• Cost-effective, but lacking credible evidence • Increased credibility, but requiring significant expertise and resources

These options can be combined in multiple ways but eventually narrow down to a limited number of configurations with two underlying dimensions, as depicted in Figure 8. One dimension involves the choice between operating on a voluntary basis, relying on in-kind contributions and strong mechanisms of trust and reciprocity, and adopting a formalised approach with professional staff, requiring contributions in cash. Given the non-market nature of the former option, circular hubs do not have access to legal instruments to make such a contribution binding, except for sociopsychological instruments such as trust (Moggi & Dameri, 2021), reciprocity (Bowles & Gintis, 2011), or identity (Agyabeng-Mensah et al., 2021). The second dimension involves the choice between focusing on the development of mutual value, e.g., by collaborating with frontrunners who share clear objectives, or focusing on the development of broader societal value, e.g., by activities for a broader stakeholder group. The latter option has a greater potential to embrace a wider systemic approach that may achieve greater impact but at a slower pace. While the former option may quickly lead to locked-in innovations (Hetemi et al., 2020), it may help to enable incentive alignment, which is necessary to implement circular innovations (Van Opstal, Smeets, et al., 2024).

This framework results in four distinct quadrants of activities, each characterised by their underlying nature, stakeholder engagement strategies, and associated business models. Hubs can combine these activities but should realise that it could require hybrid governance models and mixed funding. The *first* quadrant (top right) involves public engagement activities, such as broad societal awareness campaigns, educational activities, or public events, which have public good characteristics by nature, and require public funding to deliver. If governments feel the need to support circular hubs, this is the scope of activities they should mainly focus on. Importantly, circular hubs should consider addressing policy domains and levels that directly benefit from the outcomes of these activities, thereby aligning incentives to allocate budgets accordingly.

The *second* quadrant (top left) involves collaborative, enterprise-focused activities where aligned incentives drive shared business and supply chain development. Examples include business matchmaking events, developing shared infrastructure, and supporting collective R&D projects. An important boundary condition to succeed is the extent upon which incentive alignment and incentive compatible value capturing is achievable. The *third* quadrant (bottom left) involves relational value development activities, such as informal knowledge-sharing networks, peer-to-peer mentoring programmes, or collaborative pilot projects. Finally, the *fourth* quadrant (bottom right) includes activities requiring the voluntary use of community resources to create public goods, reflecting inclusivity and grassroots action. Examples include volunteer-led awareness programmes, supporting grassroots upcycling initiatives, or hosting local CE fairs.

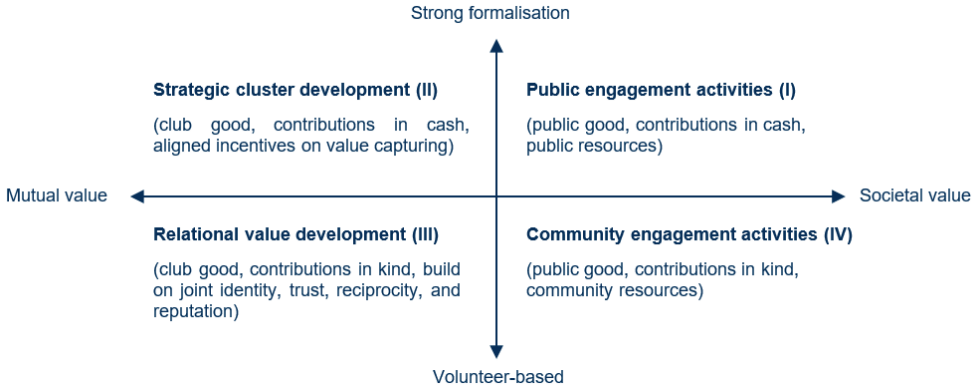


Figure 8 – Multilevel organisational configurations for (social) circular hubs

Designing and constructing circular hubs, even when they emerged in a very informal bottom-up way, requires consideration on these dimensions in order to remain effective and relevant (Gomes et al., 2023). Regardless these options, participating stakeholders will be challenged to innovative beyond the boundaries of their organisations (Bjartmarz & Bocken, 2024). Similarly, the success of circular hubs will depend on the ability of participants to foster cultural transformation within their organisations, building the dynamic capabilities essential for advancing a circular transition (Coffay et al., 2024). These conditions hold likewise for the design of *social* circular hubs, where support for B2B activities, as is the case in Flanders, should be mostly expected in the upper quadrants, while support for B2C activities, such as reuse centres and repair cafés, should involve activities in the fourth quadrant. Activities in the third quadrant could help to develop trust and joint knowledge building among WISEs themselves, and between WISEs and their current and prospective clients.

4.5.2 Practical implications

Based on our findings, we recommend *circular hubs* to adopt organisational structures that align with the design parameters presented in Table 17 and Figure 8. Furthermore, their scope and size should aim to match their regional contexts, stakeholder engagement, and potential economies of scale. Hubs must cultivate a deep understanding of the business models they aim to influence (Bocken, Boons, et al., 2019). Furthermore, the need to develop collaboration and innovation capabilities, enabling both hubs and their participants to contribute to a circular transition. This need has been highlighted for WISEs as well, as their participation in a circular transition cannot be taken for granted (Van Opstal, Borms, et al., 2024).

The extension from circular hubs towards *social circular hubs* involves putting deliberate attention to social impacts of a circular transition on the radar. In many cases, this involves opportunities for job creation, most particularly for vulnerable groups in the labour market, as aimed for by the social circular hubs in Flanders. Integrating job creation in general, and collaboration with WISEs in particular, may enhance social inclusion and foster broad public support for the circular transition. Moreover, WISEs offer advantages, such as their proximity and flexibility, making them valuable partners in circular projects, as identified earlier in research on circular startups (Van Opstal & Borms, 2024). To address perceived limitations of WISEs, such as challenges in performing complex tasks, hubs should implement capacity-building programmes to strengthen their innovation and operational capabilities. This will not only enhance their competitiveness but also make their value propositions clearer and more compelling, particularly to businesses already engaged in circular business models. Moreover, social circular hubs should actively promote awareness of the potential of WISEs, especially in regions with significant labour market inequalities or high levels of socio-economic vulnerability, contributing to a just circular transition and a more resilient society (Garrido & Nunes, 2023).

Regarding *policy implications*, public funding should support circular hubs in delivering public goods, such as awareness campaigns or public events, enabling long-term sustainable value propositions while transcending short-term project horizons. While accrediting and funding circular hubs in public-private partnerships, public authorities can require them to comply with key considerations. Firstly, circular hubs could be expected to collaborate and develop economies of scale to limit administrative overhead costs. Secondly, circular hubs should be able to tap into existing knowledge on material streams and circularity impacts by collaborating with universities and research institutes. Next, circular hubs can be expected to translate stakeholder participation into project-based funding streams, developing tangible outcomes for key value chains and regionally embedded partners. Conversely, public authorities can incentivise stakeholders, including WISEs, to actively engage with and within these hubs.

Meanwhile, public authorities could enable and enhance monitoring efforts of circular hubs, providing methodological support by stimulating institutional support to develop effective, scalable frameworks, ensuring that data collection aligns with macro-level government efforts while avoiding unnecessary administrative burdens. A critical assessment of the added value of circular hubs remains essential to ensure accountability and transparency for all funding contributors. Policymakers should also foster cross-border cooperation to address geopolitical resource dependencies and climate challenges. Finally, policymakers should encourage hubs to integrate social objectives into their core missions, promoting the establishment of social circular hubs

that embed social fairness within their ambitions towards an environmentally sustainable and economically viable circular transition.

4.5.3 Limitations and recommendations for future research

This study has several limitations that offer avenues for further research. Firstly, while our survey data provides valuable insights from circular frontrunners, its sample size remains relatively small and biased. Therefore, further research is required to gather insights from a broader set of companies and to incorporate dynamic data, enabling a deeper understanding of a wider array of experiences and perspectives. Secondly, the geographical scope of the research is limited to a relevant but specific region, so replication studies in other countries would be welcomed to account for contextual differences. Thirdly, further exploration of opportunities for collaboration with WISEs in business-to-consumer markets, e.g., in reuse networks, and business-to-government collaborations, e.g., in waste management, would provide a more comprehensive understanding the potential of social circular hubs.

4.6 Conclusion

This study highlights a critical gap in CE research: the limited attention to social inclusion, particularly the role of WISEs in circular ecosystems. Our contribution is threefold. *First*, we examine how WISEs are perceived by circular businesses, identifying proximity, flexibility, and labour-intensive capabilities as key assets, while also noting that the collaboration likelihood increases with the adoption of multiple circular strategies. *Second*, we identify relevant value propositions for social circular hubs, including matchmaking, best practice sharing, and technical or financial support tailored to the needs of circular businesses, while actively promoting WISEs as collaborative partners. *Third*, we draw on European hub experiences to examine organisational design conditions for sustainable hubs and identifying multiple configurations involving their activities, stakeholder engagement strategies, and business models. By focusing on WISEs and social circular hubs in Flanders, this study advances understanding of how inclusive employment can be embedded in circular transitions. These insights contribute to both CE research and social enterprises studies. Moreover, these insights are not just relevant locally but offer lessons for developing socially inclusive circular ecosystems elsewhere. Therefore, we believe that expanding these insights across geographies would contribute to fostering a circular society and a just circular transition.

5. Cooperating for Circularity? Perspectives of Citizen Energy Cooperative Members on Circular Solar Business Models

Based on:

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Abstract

Solar photovoltaics (PV) play a critical role in advancing the sustainable energy transition, but growing concerns about PV waste highlight the need for circular economy solutions within the solar value chain. Meanwhile, concerns for the social impact of the circular economy call for a circular society, emphasizing social and environmental justice and requiring organisational forms that enable economic democracy. In many European countries, citizen energy cooperatives have successfully promoted renewable energy adoption in a democratically controlled and participatory way. However, evidence on the role of cooperatives in a circular economy remains limited. In this paper, we use survey data from Flanders (Belgium), to investigate perspectives of citizen energy cooperative members and non-members on circular solar business models. Our findings reveal that cooperative members exhibit greater interest and trust in solar Product-Service Systems models and PV reuse, driven not only by financial considerations but also by environmental consciousness and cooperative values. This study provides empirical evidence supporting the role of citizen energy cooperatives in fostering the circular economy and recommends cooperatives to ensure participation of disadvantaged communities to contribute to a circular society. The research identifies avenues for future research and contributes to the broader discourse on organising circular societies.

Keywords: solar photovoltaics; citizen energy cooperatives; circular economy; just transition; circular business models; renewable energy

5.1 Introduction

Solar photovoltaics (PV) has been recognized as a key contributor to a sustainable energy transition (IEA, 2023). While they contribute to narrowing *energy* loops (Ellen MacArthur Foundation, 2013; Geissdoerfer et al., 2017a), PV panels will cause an increasing waste problem of *material* loops in the decades ahead, if no significant action is taken. The International Renewable Energy Agency (IRENA) projects that waste from cumulative solar PV projects globally will increase from 0.2 Mt in 2021 to almost 50 Mt in 2040 and more than 200 Mt by 2050 (IRENA, 2024). This challenges companies, policymakers and scholars to reconsider the PV value chain and adopt circular strategies that also focus on slowing, closing, and narrowing material loops (Bocken, Pauw, et al., 2016; Nyffenegger et al., 2024). This involves the entire lifecycle of solar PV and its ecosystem, from design (Franco & Groesser, 2021; Radavičius et al., 2021) to recycling (Cheema et al., 2024; D'Adamo et al., 2023; Gautam et al., 2021), including facilitating services in its ecosystem (Boukhatmi et al., 2023).

Likewise, *circular business models for solar PV* have been investigated to maintain the functionality of products and materials, reduce environmental impacts, and deliver customer value (Bocken, Strupeit, et al., 2019; Strupeit et al., 2024). Mainly Product-Service Systems (PSS) have been taken into consideration, as they have the possibility to incentivize manufacturers to increase lifetimes and make design choices that enable circular strategies such as repair, reuse, remanufacturing, or high-quality recycling (Tukker, 2015), which could lead to environmental savings of up to 90% compared to selling a product (Sarasini et al., 2024; Tukker, 2004). PSS models have to be designed carefully, considering product design, production processes, infrastructure, and consumer behaviour, as they do not automatically imply improved circularity or sustainability outcomes or even may cause rebound effects (Moro et al., 2022; Zink & Geyer, 2017). Nevertheless, solar PSS have been shown to create value for households and organisations who do not have financial, technical, or legal access to solar PV to participate in the potential of this renewable energy source (Schmidt-Costa et al., 2019; Van Opstal & Smeets, 2023a, 2023b). Moreover, PSS models have been shown to enable business cases for the reuse of decommissioned PV panels (Strupeit et al., 2024; Van Opstal & Smeets, 2022).

The uptake of solar PV has been recognized earlier to worsen demographic inequities and unfair adoption patterns within social groups (Sovacool et al., 2022). Likewise, implementing circular strategies does not automatically ensure a just transition (Purvis, Celebi, et al., 2023). Scholarly attention on the social aspects of the CE makes clear that a transition to a 'circular society' will be necessary in order to achieve a 'circular economy' (Jaeger-Erben et al., 2021). This embodies aspects such as behavioural change, redistributive and participatory justice, and economic and political democracy

as necessary conditions to render a CE truly sustainable (Bauwens, Hekkert, et al., 2020). Therefore, the concept of a circular society looks beyond resource efficiency in order to ensure the participation of all societal actors involved to tackle the double challenge of a just transition towards renewable energy and the waste streams following from it (Calisto Friant et al., 2023). It also calls for an investigation of fitting organisational forms that are able to combine both economic and societal concerns. Cooperatives may conceive an enabling potential to construct circular societies, as they are deeply rooted in the communities where they operate (Novkovic, 2008). Because of its democratic governance, cooperatives have been described by Ostrom (1990) as one of the most effective solutions for the management of common resources.

Cooperatives are autonomous associations of people who join voluntarily to meet their common economic, social, and cultural needs and aspirations through jointly owned and democratically controlled businesses (ICA, 1995). Members in a cooperative can be workers, customers, producers, or a variety of stakeholders, the latter being referred to as multistakeholder cooperatives. Over the past few decades, cooperatives have been established to attract investments in renewable energy (ILO, 2013; Wierling et al., 2018). Also referred to as RESCOOPs, citizen energy cooperatives apply business models where membership consists of citizens who jointly own and participate in renewable energy or energy efficiency projects. Their European network covers 2,250 citizen energy cooperatives and their 1.5 million members (REScoop, 2024). Citizen energy cooperatives have been found to be important enablers of the energy transition in multiple European countries (Wierling et al., 2018) and contributed to the social acceptance of renewable energy solutions (Klagge & Meister, 2018). However, little is known about the ways in which citizen energy cooperatives could differentiate themselves in a transition towards a circular economy and society.

Research on cooperatives and the CE is scarce and research at the crossroads of circular solar business models and RESCOOPs is to the best of our knowledge non-existent. A defining characteristic of cooperatives is that they are owned and governed by their members, while mainstream companies are often characterised by third-party ownership (Hansmann, 1999). Survey research based on opinions of cooperative managers reveals the potential of the cooperative model in a circular transition (Ziegler, Poirier, et al., 2023), but for existing cooperatives, perspectives of members are crucial for their future direction. However, to the best of our knowledge, no research has been performed yet on preferences of citizen energy cooperatives for circular business models. Members, however, are pivotal to the long-term strategy and daily operations of their cooperatives, given their combined role as patrons, owners, and users. Therefore, it is important that cooperatives understand the perspectives of their members, and how these may differ from non-members in the communities they are active in.

In this paper, we use survey research of residential households to compare perspectives on circular solar business models of both members of citizen energy cooperatives and households who are not a member of a REScoop (non-members) in Flanders (Belgium). It aims to investigate the following research questions:

- RQ 1 – What are differences in perspectives of households who are members of citizen energy cooperatives and household who are not (non-members), when considering (non-)adoption of solar PV?
- RQ 2 – Do members and non-members of citizen energy cooperatives take different perspectives regarding value propositions and barriers for solar PSS models and for the reuse of decommissioned PV panels (PV reuse)?

To our knowledge, this is the first paper that surveys differential perspectives of cooperative members on circular business models. Our survey (n = 3,884) allows to control for personal and housing characteristics, installation parameters, and trust in institutions, which enables a more robust analysis compared to case-based deduction. As pointed out by one anonymous reviewer, it may appear common sense that people who collaborate share a greater interest in a CE or sustainability. Nevertheless, plenty of empirical evidence exists illustrating unsustainable and unfair practices in cooperatives (Ajates, 2020; Grandinetti, 2017; Hale & Carolan, 2018). Therefore, we cannot simply assume that cooperative members would automatically engage towards a circular economy and society.

While we focus on citizen energy cooperatives and their activities within solar energy, lessons can be translated to other domains where cooperatives are challenged to implement circular business models while mobilising communities to invest in semi-public goods. This work aims to contribute with empirical evidence on the research agenda of organising circular societies and formulates recommendations for policy makers and cooperative management. The geographical scope of this work focuses on Flanders (Belgium), a small, industrialised, and open economy, which is a frontrunner in adopting solar PV, and has decades of experience with citizen energy cooperatives.

The remainder of this paper is structured as follows. In section 5.2 we provide background information on cooperatives and their potential role in a circular economy and society, and on citizen energy cooperatives. We report our methods and results in sections 5.3 and 5.4. In section 5.5 we discuss the empirical contribution and practical implications of our results and identify limitations and recommendations for further research. In section 5.6 we conclude and identify novel research gaps.

5.2 Background

Over the past decade, the 'circular economy' has attracted growing attention from the scientific community, businesses, and policymakers. It is defined as an economic system that replaces the 'end-of-life' concept with reducing, reusing, recycling, and recovering materials in production, distribution, and consumption processes (Kirchherr et al., 2017). A CE aims to close, narrow, and slow down product and material loops (Bocken et al., 2016). Closing loops involves actions such as recycling and recovering materials, narrowing loops focuses on reducing resource use in production processes and design, while slowing down loops, can be achieved through strategies such as reuse, repair, refurbishment, and remanufacturing, which extend product and component lifespans and delay the need for new resources over time (Bocken, Pauw, et al., 2016; Geissdoerfer et al., 2017a). As a CE requires involvement of all parties in society, a 'circular society' is deemed a necessary condition for a successful circular transition. In this section, we therefore provide background information on the role of cooperatives in a circular society in general and on the role of citizen energy cooperatives in particular. We also substantiate the research gap.

5.2.1 Cooperatives and the circular society

Throughout history, people have been cooperating to resolve mutual challenges and common-pool resource problems. From an historical perspective, guilds, mutual aid societies, and friendly societies predate the cooperative as effective forms to tackle common problems. Similar structures evolved all over the world, including structures from indigenous people for resource sharing in Fiji (Ward, 1995) or mechanism to govern reciprocal labour and collective land ownership in the Andes (Mayer, 2018). More recent forms of collaborative organisational forms to foster sustainable outcomes include time banks for mutual support (Seyfang, 2004), community land trusts (Meehan et al., 2013), and intentional communities (Meijering et al., 2007). Most of these models share similarities and build upon experiences from the cooperative model, as proliferated by the International Cooperative Alliance (ICA) and originated in its modern form by pioneers such as Raiffeisen and the Rochdale Pioneers.

From a transaction cost perspective, cooperatives are established when making key stakeholders the *owner* of a firm is a less costly solution than performing market contracting with these stakeholders (Coase, 1937; Huybrechts & Mertens, 2014). Mostly, cooperatives are created as a vehicle to achieve common (or mutual) goals of their members, such as agricultural cooperatives strengthening the economic position of farmers, or financial cooperatives enabling access to credit for their members. Cooperatives are characterised by a set of principles that serve as a compass for their governance and daily operations, as defined by the International Cooperative Alliance

(ICA, 1995) and often embedded in national legislations on cooperatives (Fici, 2013). In Table 18 we present the ICA cooperative principles and its rationale from a governance perspective. This set of principles lies at the heart of the prevalence of cooperatives in market economies to resolve market and contract failures (Huybrechts & Mertens, 2014; Novkovic, 2008), to attract capital to invest in semi-public goods (Mori, 2014), or to build countervailing power in situations of excessive market power (Russo et al., 2023; Spear, 2000).

Table 18 – The cooperative principles, as defined by the ICA (1995)

Principle	Rationale from a governance perspective
1. Voluntary and open membership	Variable equity capital, resulting from flexible entrance or exit of cooperative members (according to criteria defined by the articles of association).
2. Democratic member control	Decoupling equity capital and voting rights, safeguarding cooperatives from potential hostile takeovers.
3. Member economic participation	Restricting access to services of the cooperative to its members, and conversely incentivizing (e.g., by cooperative refunds) or even obligating cooperative members to perform economic transactions with the cooperative.
4. Autonomy and independence	Limiting dividend payments (by law or by articles of association), which results in a focus on the user value of the cooperative instead of its investor value, preventing mission drift. A distribution constraint also allows to build cooperative reserves that increase autonomy and independence from unexpected market shocks or policy changes.
5. Education, training, and information	Investing in cooperative and financial literacy to empower members to perform high-quality corporate governance of their cooperative.
6. Cooperation among cooperatives	Building external and dynamic economies of scale by exchanging experiences in cooperative governance mechanisms and making cooperatives recognisable, accessible, and comprehensible for the general public.
7. Concern for community	As cooperatives are an economic vehicle of their members, cooperative members may be inclined to use the cooperative as an instrument to address other problems and challenges within their communities. This may result in investing in community resilience and internalising externalities by cooperative investments in semi-public goods.

This set of principles resulted in the recognition of the potential of cooperatives to contribute to sustainable development by the International Labour Organisation (ILO, 2002), the European Commission (European Commission, 2020b), and the United Nations (UN, n.d.). The 7th principle of 'concern for community' could reflect why cooperatives are not only established to pursue mutual objectives but also broader societal objectives, such as investing in renewable energy or poverty eradication (Lafont et al., 2023). Empirical evidence shows that cooperatives are more resilient to systemic shocks (Caselli et al., 2022), allowing them to maintain focus on their initial goal and missions (Fernandez-Guadaño et al., 2020). As an explanation, the defining features of

a cooperative and the ICA principles have been documented to result in specific resource efficiencies (Baranchenko & Oglethorpe, 2012) and intangible assets (Castilla-Polo & Sánchez-Hernández, 2020) that are less available in investor-owned firms.

When assessing its comparative institutional advantages, the cooperative model also faces some structural challenges. A first challenge consists of costly decision-making processes stemming from the democratic governance of the cooperative. An increased heterogeneity of membership may even aggravate this problem (Elliott et al., 2018). Democratic governance may also incentivize members to freeride on monitoring and control activities, creating a principal-agent problem (Giannakas et al., 2016; Nilsson & Svendsen, 2011). A second challenge may be limited access to equity capital, as this is member-based. Therefore, cooperatives may face barriers to scale and compete with large multinational firms (Royer, 2023). Thirdly, a major challenge is a lack of cognitive legitimacy, following from the fact that cooperatives are often unknown to the general public and policymakers, resulting in suboptimal access to accreditation mechanisms and subsidy schemes or inconsistent legal frameworks(Coates & Van Opstal, 2009, 2015).

Nonetheless, literature on the potential role of cooperatives in a CE transition remains scarce. In reviews of circular business models and approaches to circular business model innovation (Geissdoerfer et al., 2023; Hina et al., 2022; Lüdeke-Freund et al., 2019; Padilla-Rivera et al., 2020; Pieroni et al., 2019), the role of cooperatives remains unexplored. The focus is often on companies and how they might innovate towards a circular business model (Bocken & Konietzko, 2022). Notable exceptions are studies on the role of recycling cooperatives in reverse logistics (Okano et al., 2019) and the formal management of municipal waste management (Miranda et al., 2020), and a study on potential routes for agro-industrial cooperatives to contribute to the CE (Barros et al., 2022). Only recently, a survey among 165 cooperatives in Québec on a broad set of CE strategies pointed at the potential role of cooperatives to embed circularity goals in the economy and wider society (Ziegler, Poirier, et al., 2023).

Recent discussions on pathways to achieve a sustainable CE point at the importance to establish a *circular society*. CE transitions are deemed impossible without the commitment and participation of all societal actors (Jaeger-Erben et al., 2021). Moreover, circular societies call for ways to change capitalism and its organisations (Friant et al., 2020), including economic decentralization while increasing ways to deepen and strengthen democracies (Bauwens, Hekkert, et al., 2020). Cooperatives may conceive an enabling potential to construct circular societies, as they are deeply rooted in the communities where they operate (Novkovic, 2008). As hybrid organisations, they connect economic and social goals by internalizing externalities while enabling economic participation of community members (Limnios et al., 2018; Puusa et al.,

2013). Moreover, cooperatives are recognized to promote local development and the stability of local communities in a globalising economy (Bretos & Marcuello, 2017). In sum, cooperatives can play a role in fostering a circular society by emphasizing the needs of their members over investor profits and by anchoring regional economies and value chains of proximity (Ziegler, Poirier, et al., 2023). An illustration of the latter is documented in studies on the role of cooperatives to integrate waste pickers into the formal economy while empowering them through education and capacity strengthening (Buch et al., 2021; Zisopoulos et al., 2023).

5.2.2 Citizen energy cooperatives

Cooperatives have a long tradition in financing and organising energy systems. Given the collective management challenges and externalities involved in energy production and consumption, energy systems induce common pool resource problems. Cooperatives have been studied extensively to resolve these common resource problems, particularly to improve markets and socio-political acceptance to foster the uptake of renewables (Grimley & Chan, 2023; Lammers & Hoppe, 2019; Martin et al., 2018; Wolsink, 2012). In the US, rural electric cooperatives have been established for more than a century to electrify rural areas, representing 38% of total utilities in 2019 (Gilcrease et al., 2022). Cooperatives for rural electrification were likewise present in European countries such as Germany, Italy, and Spain at the beginning of the 20th century (Candelise & Ruggieri, 2020). During the last decades, cooperatives have been identified as interesting vehicles to attract investments in renewable energy (Bergek et al., 2013; ILO, 2013; Mignon & Bergek, 2016; Wierling et al., 2018). The main activities of these renewable energy cooperatives include producing and trading renewable energy and providing demand side management (DSM) services. Cooperative members of these renewable energy cooperatives can be energy producers, energy consumers, or energy prosumers (Akasiadis, 2017).

While energy cooperatives can be established by profit-oriented firms to attract equity-based crowdfunding and improve community acceptance of renewable energy investments, citizen energy cooperatives are specifically defined as energy cooperatives that adhere to the ICA principles. Cooperatives in the former model are sometimes referred to as FINCOOPS referring to their focus on financing projects, while the latter model is mostly identified as RESCOOPs highlighting their focus on cooperatively governing renewable energy projects. A key defining characteristic of RESCOOPs is the democratic and participatory way they involve cooperative members, allowing them to control its operations in full which is not the case when a cooperative rather serves as a funding mechanism, as is the case in FINCOOPs. Earlier work on this difference includes Yildiz (2014), who discusses differences in liabilities and the management of these cooperatives, and Tews (2018) who describes the difficulty of identifying eligible

criteria and actors that are not vulnerable to 'abuse' of subsidy schemes. Tarhan (2025) refers to 'cooperatives of convenience', and how private energy corporations are appropriating policy instruments reserved for community groups by forming initiatives that fit their organisational requirements.

Adhering to the ICA principles results in the fact that citizen energy cooperatives do not focus on maximizing shareholder value, but maximizing common member goals such as ensuring access to renewable energy (Yildiz et al., 2015), educational communication and local offers with complementary services (Viardot, 2013), or nurturing a culture of conservation and sustainability (M. Tarhan, 2015). Meanwhile, they invest in semi-public goods, generating positive externalities and counterbalancing market power by traditional operators in the electricity market (Huybrechts & Mertens, 2014). The strong involvement of users contributes to market formation (Punt et al., 2022) and the social acceptance of the energy transition (Klagge & Meister, 2018; Vernay et al., 2023; Viardot, 2013).

The extent to which adherence to ICA principles facilitates a circular transition remains largely understudied. From research on the role of cooperatives in the energy transition, we learn that voluntary participation may aid community-building and trust (Huybrechts & Mertens, 2014). Moreover, this principle encourages a diverse participation of members with different motivations (Bauwens, 2016; Candelise & Ruggieri, 2020), which can bring innovative ideas for CE practices, fostering a community that values resource efficiency and sustainable consumption (Akasiadis, 2017). Democratic member control facilitates active participation and collective decision-making, ensuring that decisions are made with community input, which can support CE initiatives (Mignon & Rüdinger, 2016). The proximity of cooperatives to their members enables them to intervene and influence social structures and norms (Coenen & Hoppe, 2018). This suggests that cooperatives could have a comparative advantage to other organisational forms to foster a just circular transition. Earlier work already showed how community-based social market initiatives such as education communication helped cooperatives attract members while lowering barriers for the uptake of renewable energy (Viardot, 2013). Finally, regarding the 7th principle, cooperatives could contribute to embedding a CE in a circular society based on relying on the priorities of its members' needs rather than investors' profits (Ziegler et al., 2023).

The presence of citizen energy cooperatives varies significantly across Europe, with limited initiatives in South and Central Eastern Europe, a moderate number in Belgium, the UK, and the Netherlands, and a substantial presence in Germany and Denmark (Capellán-Pérez et al., 2018; Heras-Saizarbitoria et al., 2018; Huybrechts et al., 2018). This can be explained by differential barriers for the growth of citizen energy

cooperatives, such as regulatory barriers to entry, difficulties to gather sufficient capital, and lack of normative (in post-communist countries) or cognitive (due to poor knowledge of cooperatives) legitimacy (Candelise & Ruggieri, 2020; Huybrechts & Mertens, 2014; Mignon & Rüdinger, 2016). Institutional parameters, such as trust, social norms, community identity, and environmental concerns have been shown to play an important role to motivate citizens to participate (Ruggiero et al., 2021; Soeiro & Ferreira Dias, 2020). Civil society organisations have been shown to play an intermediary role, as they have access to non-market resources such as trust, reducing asymmetric information and transaction costs (Magnani & Osti, 2016).

Democratic governance of a citizen energy cooperative poses challenges, potentially causing delays in decision-making processes and fostering inefficiencies, particularly when members have diverging interests (Huybrechts & Mertens, 2014; Iliopoulos & Valentinov, 2022). Survey research among potential solar PV adopters in Austria revealed that financial beliefs are the main driver behind participation (Fleiß et al., 2017). Survey-based studies from Germany revealed nuanced findings, identifying return on investment as a predominant motive while emphasizing notable distinctions among community energy companies (Holstenkamp & Kahla, 2016), and confirming the impact of community identity, trust, social norms, and environmental concerns on the willingness to participate in community energy projects (Kalkbrenner & Roosen, 2016). A Belgian study that takes into account multiple cohorts of cooperative members, being early adopting 'community' driven members and late entry 'market' driven members, reveals the interplay between social interactions and economic incentives, showing how financial rewards may crowd out behaviours that are based on social preferences (Bauwens, 2016).

In a follow-up study on drivers on the size of investments (Bauwens, 2019), results show that return on investment is the most important determinant for members of large communities of interest, while environmental, social, and other non-economic drivers tend to dominate financial motives for members of smaller communities of place. More recent German survey research reveals the importance of economic preferences, as well as political preferences and the habit of talking about investments to explain citizen willingness to participate in renewable energy cooperatives (Fischer et al., 2021).

5.2.3 Research gap

Literature on citizen energy cooperatives and CE strategies is scarce to non-existent. The only references that can be directly linked to circularity are studies on how citizen energy cooperatives stimulate sufficiency strategies and try to limit energy consumption of their members, contributing both to circular energy loops and material

loops (Coenen & Hoppe, 2018; Villalba-Eguiluz et al., 2023b). A statistical analysis of consumption data of two citizen energy cooperatives revealed that becoming a cooperative member led to on average to a reduction of the CO_2-footprint by 235-274 kg (Akasiadis et al., 2017). More recently, a study on organisational market segments reported how the central purchasing office of Catholic schools in Flanders started a collaboration with citizen energy cooperatives to organise solar PSS contracts in schools while allowing citizens to participate in these projects (Van Opstal & Smeets, 2022). While solar PSS contracts may enable higher circularity outcomes, such as improved repair and maintenance options, the main objective, however, was to lower CAPEX for schools and spur solar PV adoption rates.

While cooperatives could be an interesting vehicle to organise a circular society, we cannot take for granted that cooperative members of existing cooperatives are eager to adopt sustainability practices beyond the mutual goals the cooperative was established for (Seguí-Mas et al., 2015). Sustainability challenges ask for fitting organisational structures and corporate governance regimes (Camargo Benavides & Ehrenhard, 2021). Survey research, drawing on the insights of cooperative managers, indicates the potential of the cooperative model in a circular transition (Ziegler, Poirier, et al., 2023), but for existing cooperatives perspectives of members are pivotal for their future direction. However, to the best of our knowledge, no research has been performed yet on preferences of citizen energy cooperatives for circular business models.

Changing regulations, market developments and technological possibilities require citizen energy cooperatives to adapt their business models. During the last decade companies in the solar PV value chain had to reinvent themselves during a shift from a heavy subsidized to a post-subsidy environment (Herbes et al., 2017; Nolden et al., 2020; Reis et al., 2021). Over time, it became increasingly challenging for citizen energy cooperatives to differentiate themselves from their commercial counterparts who are often considered faster in adopting new technologies (Martens, 2022). Citizen energy cooperatives have been found important enablers of the energy transition (Wierling et al., 2018) and contributed to the social acceptance of renewable energy solutions (Klagge & Meister, 2018). It is yet underexplored how citizen energy cooperatives could differentiate themselves in a transition towards a circular economy and society. Therefore, it is important that these cooperatives understand differential perspectives of members and non-members within their communities.

5.3 Methods

In this paper, we use original online survey data from CIRCUSOL, a Horizon 2020 project (2018-2022) on solar circular business models. The use of online surveys is a well-established research practice to capture opinions and beliefs from large groups of

respondents. While individual case-studies could reveal deep and nuanced insights on motivations and considerations of individual households, quantitative research methods that combine data of many households while controlling for household characteristics allow to establish more robust and generalizable results. Survey research on members of citizen energy cooperatives has been adopted earlier to investigate their motivations (Bauwens, 2016; Fischer et al., 2021; Fleiß et al., 2017; Holstenkamp & Kahla, 2016; Kalkbrenner & Roosen, 2016; Soeiro & Ferreira Dias, 2020), and the size of their investments (Bauwens, 2019). While online surveys pose specific challenges in terms of sampling, it is important to control for socio-economic and demographic characteristics and be cautious with generalising survey results to larger populations (Bell et al., 2022). Therefore, it is important to use these characteristics as control variables in our linear (OLS) and Probit regressions and perform non-response analyses wherever necessary.

This survey was developed in close collaboration with Ecopower, the largest citizen energy cooperative in Belgium and founding member of REScoop.eu, the European federation of citizen energy cooperatives. Following a preliminary trial of a small-scale survey in the city of Eeklo (Belgium), we refined our questionnaire to accommodate distinct pathways for households without solar PV, households who own solar PV, and households utilizing rented solar PV systems. Survey respondents in all three pathways were asked about their interest in a use-oriented PSS model, specifically the rental of solar PV with a transfer of ownership after 20 years, using a 0 to 100 scale. Subsequently, respondents were prompted to select potential value propositions and barriers associated with adopting this business model. Similarly, respondents were asked to express their preference for second-life PV panels on a 0 to 100 scale. The concept of PV reuse was explained to respondents as the reuse of decommissioned PV panels of high quality that were offered in a use-oriented PSS model, aiming to mitigate potential concerns regarding the malfunctioning of second-hand PV panels. Although our inquiry omitted technical and financial specifics, it underscored the assurance that the operation of second-hand PV panels would be guaranteed by the service provider.

Questions on personal characteristics included gender, age, activity status, educational level, household size, and net monthly household income. We also asked whether one of the grandparents of the respondent is born outside the European Union, as a proxy for migrant background. We asked about previous experiences with Netflix, Spotify, or car lease to capture previous experiences with PSS models. As a proxy for risk aversion, we asked respondents to position themselves on a continuous scale between two lotteries: receiving 1 million euro with a 1% probability and receiving 100 euro with certainty, where the former extreme indicates low risk aversion and the latter high risk aversion (Abdellaoui, 2002). Finally, we asked whether respondents were a member of citizen energy cooperative, which we will refer to as RESCOOP members in the remainder of this article. Questions on housing

characteristics included ownership status, housing type, the number of building layers, construction year, roof type, and a self-assessment of the roof quality on a 0 to 100 scale. Next, we asked the ZIP code to identify whether respondents live in a city or not, and included a question whether respondents consider themselves living in an urban, a semi-urban, or a rural area. We also included questions on meter type, household and HVAC applications running on electricity, and the year of the PV installation (in case respondents have solar PV). Finally, we included questions on institutional trust, asking respondents to score trust in governments, service suppliers, nuclear energy, technology, and the green political party on a 5-point Likert scale, the latter being used as a proxy for environmental consciousness similarly to (Palm, 2020).

A visualisation of this survey design and the number of respondents is depicted in Figure 9. Summary statistics are reported in Appendix 5.1 (Table A.5.1), showing statistical differences between RESCOOP members and non-RESCOOP members, using a two-sided F-test for differences in ratios and a Mann-Whitney U test for differences between distributions. Compared to other respondents, RESCOOP members appear to be more highly educated and are more often active as a civil servant or in education. Moreover, RESCOOP members tend to be living in more sustainable housing situations (in cities, in closed housing types, with more building layers) and opt for more sustainable installation parameters (having a lower propensity to use electricity for heating, boilers, or air-conditioning). RESCOOP members also show higher trust in governments, service suppliers and the green political party, compared to other respondents. Conversely, RESCOOP members report lower trust values in nuclear energy.

Responses were collected using SurveyMonkey. The survey was distributed via the most important newsletters on building and reconstructing in Flanders (Livios, Bouwen en Wonen, Ilumen), via direct mailings of the CIRCUSOL project partners (Ecopower, which is a large citizen energy cooperative, and Futech, a commercial energy service provider) to their members and clients in Flanders, and via the newsletter and social media of the first author's research institute. Respondents provided informed consent and were incentivized with a lottery of 20 sets of 6 LED lamps (E27 fitting).

The survey was online between January 3rd, 2022, and February 28th, 2022, resulting in 3996 responses of which 3884 full responses on PV ownership status and RESCOOP membership, and 3583 full responses on all survey variables. As the number of respondents who are already in a solar PSS contract turned out to be low (n=82), which is in line with the small market share of solar PSS models in Flanders, we focused on households that do not have solar PV panels yet and households who own their installation. Comparing sample characteristics with the population in Flanders, highly educated, male, and older individuals are overrepresented (Rousseau & Raïsa, 2021).

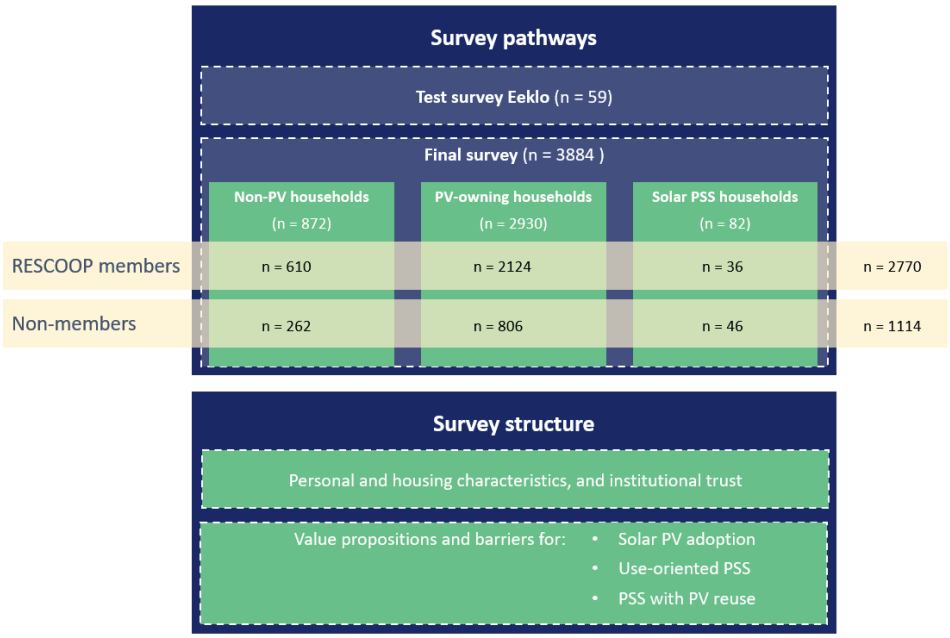


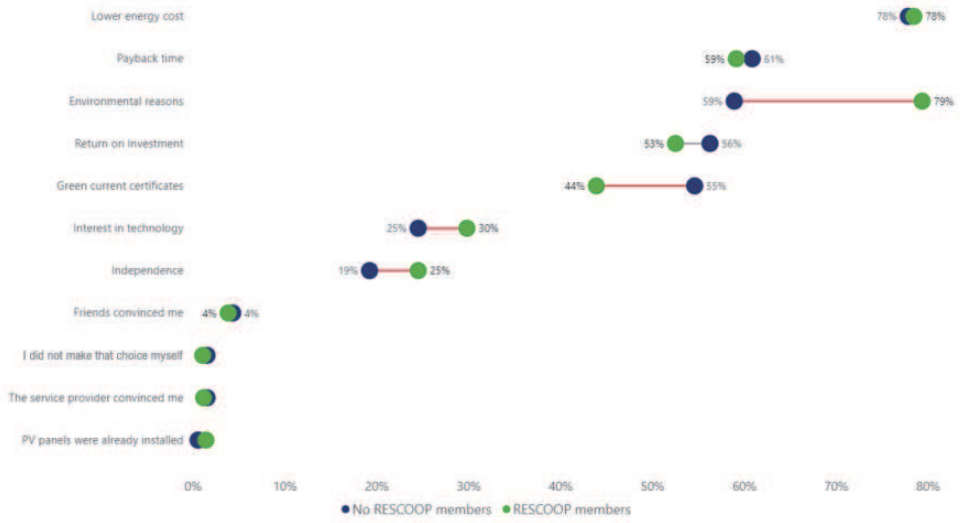
Figure 9 – Survey design and response

An analysis of item nonresponse learns that survey dropouts are relatively older, less educated, and lower income respondents. We also notice lower item nonresponse rates among RESCOOP members. Since we do not aim to extrapolate our results to infer frequencies of the entire population, or study household behaviour at extreme distributional tails of personal or housing characteristics, we did not apply imputation techniques to resolve item nonresponse (S. Chen & Haziza, 2019). For similar reasons, we did not apply post-stratification weights to survey respondents, as we do not seek to extrapolate our results to infer macro-economic statistics. In our statistical analysis, we tested for heteroskedasticity in linear regressions using a Breusch-Pagan test and corrected whenever appropriate with robust standard errors. Likewise, we tested for collinearity problems by performing a VIF-test.

5.4 Results

5.4.1 RESCOOP membership and solar PV adoption

While our survey results show higher solar PV adoption rates among RESCOOP members compared to non-members (Table A.5.1), we are mainly interested in exploring differences among the reasons why homeowners invested in solar PV. In Figure 10 we report the major reasons why homeowners who own PV panels invested in solar PV, comparing differences between RESCOOP members and non-members and indicating significance differences based on a two-sided F-test. Importantly, we should take into account that these are reasons that are provided at the time of the survey, which may reflect hindsight bias as the decision to adopt solar PV has been made earlier.



Note: Red lines represent significant differences at the 1% level, grey lines represent non-significant differences at the 5% level (according to a two-sided F test). Independence relates to perceived energy autonomy through solar PV adoption.

Figure 10 – Major reasons of homeowners who own PV panels to invest in solar PV

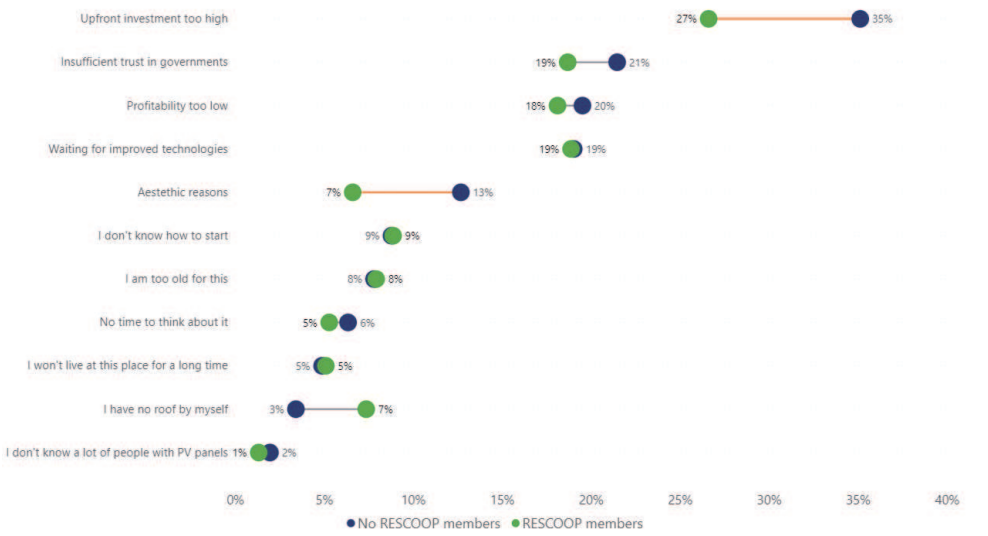
For a large majority of both members and non-members, financial reasons, including lower energy costs and a beneficial payback time, were the reasons reported most frequently for residential solar PV investments. Interestingly, RESCOOP members reported environmental reasons with a similar relative frequency as lower energy costs (i.e., in 79% of the cases), compared to less than 60% of non-members indicating environmental reasons. Other significant differences include a larger incentive from

green current certificates[1] for non-members, and a larger interest in technology and reported importance of energy independence among RESCOOP members. In sum, RESCOOP members consider financial drivers to be very important, but other motivations are more prominent among RESCOOP members compared to non-members.

We investigated the major barriers reported by homeowners who did not invest in solar PV and compared relative frequencies of RESCOOP members and non-members. In Figure 11 we see that a high upfront capital expenditure is considered the most important barrier, followed by insufficient trust in governments, a perceived low profitability, and a fear for technological obsolescence. Significant differences between RESCOOP members and non-members include a lower relative frequency to report the upfront investment as a barrier, and less difficulties with the aesthetics of solar PV. More importantly, for other barriers we did not find a significant difference between RESCOOP members and non-members.

A multivariate analysis controlling for personal and housing characteristics, as well as trust parameters, revealed similar results on significant differences as reported in Figures 10 and 11, except for the difference in upfront investments being considered too high as a barrier to invest in solar PV. We report the latter analysis in Appendix 5.2, Table A.5.2. This reveals that upfront investments are considered less a barrier for highly educated respondents living in more recent houses, which are characteristics we have found more often among RESCOOP members, as pointed out earlier and reported in Table A.5.1.

[1] In 2002, the Flemish (regional) Government initiated a Tradeable Green Current (TGC) certificate scheme to support investments in renewable energy. Since 2015, newly installed PV installations smaller than 10 kW no longer received green current certificates. For bigger installations, this system was only disbanded in 2021 and replaced by a subsidy scheme (Van Opstal & Smeets, 2022).



Note: Orange lines represent significant differences at the 5% level, grey lines represent non-significant differences at the 5% level (according to a two-sided F test). The item "I do not know how to start" refers to uncertainty about administrative procedures, technical requirements, or practical steps needed to initiate solar PV installation. "Profitability too low" reflects the perception that expected financial returns or payback periods are insufficient relative to the upfront investment.

Figure 11 – Major barriers of homeowners without PV panels to invest in solar PV

5.4.2 Preferences for solar PSS-models

Preferences for solar PSS models have been asked on a 0 to 100 scale. When we do not control for any covariates, we find an average interest of 32.40 in solar PSS among RESCOOP members compared to 29.34 points non-members. While this difference is significant at a 5% level (using a Wilcoxon rank-sum test), it remains rather limited. Given the socio-economic and demographic differences between RESCOOP members and non-members (as reported in Table A.5.1), we performed a regression analysis (OLS) among homeowners to control for these covariates. The OLS regression, as reported in Table 19, shows that in general, interest in solar PSS is significantly higher among RESCOOP members compared to non-members. For the former we find a significant constant term of 40.93, compared to a non-significant constant term of 25.75 for the latter. Interest in solar PSS models is lower among households who already have PV, but this negative effect is smaller for RESCOOP members than for non-members.

As a robustness check and to capture potential non-linearities, we also performed probit regressions to explain profile differences among homeowners who show a high interest in solar PSS models (i.e., a score 80 or higher on 100), and respondents who show no interest in solar PSS models at all (i.e., a score of 0 on 100). A combined reading of these results shows that household size does not appear to matter for RESCOOP

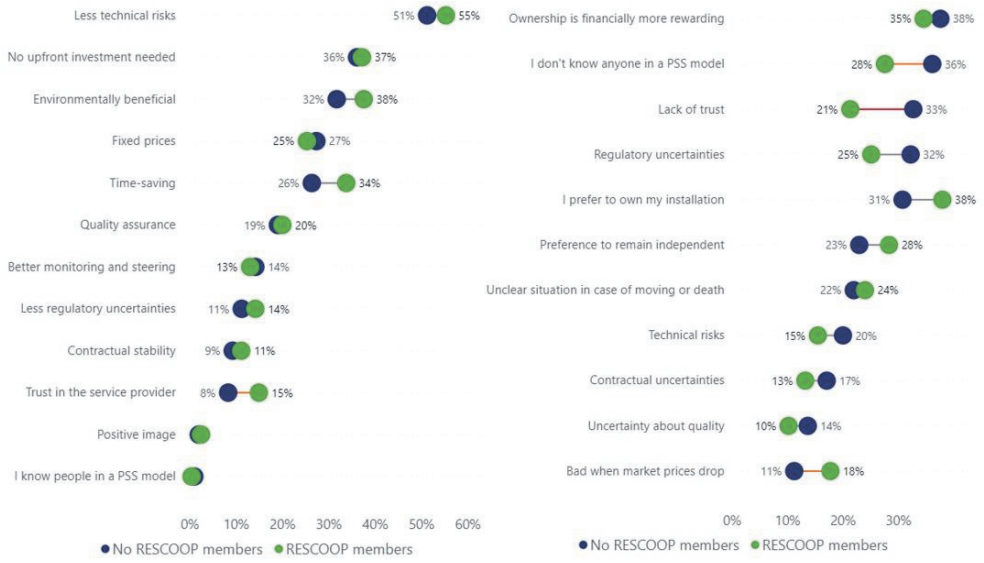
members, while it does for other respondents when considering solar PSS, partially confirming the lower relative importance of monetary motivations among RESCOOP members. Government trust and trust in technology appears to be less salient for RESCOOP members in their decision to opt for solar PSS, while conversely, trust in the green political party matters significantly for RESCOOP members. Furthermore, male respondents show less interest in PSS models, which holds for both members and non-members. Age only marginally affects interest in PSS models and no significant differences have been found on covariates such as educational background, migrant status, income, or living in a city or not. Finally, occupational status does not appear to play a role, with a notable exception of independent professionals who appear to be slightly more in favour of ownership models.

Table 19 –OLS and Probit regression estimates on profile differences of preferences for solar PSS contracts among homeowners

	Interest in PSS (OLS)		High PSS interest (Probit)		No PSS interest (Probit)	
	RESCOOP members	Non-members	RESCOOP members	Non-members	RESCOOP members	Non-members
n =	2280	789	2280	789	2280	789
Prob > F	0.0000	0.0000				
Prob > chi²			0.0000	0.0000	0.0000	0.0000
R^2	0.0838	0.1435				
Pseudo R^2			0.0546	0.1388	0.0640	0.0960
Constant term	40.9321	25.7535	-2.7237	-1.4937	-2.4069	-1.2572
	(8.2980)**	(13.71)	(0.4671)**	(0.7679)	(0.3809)**	(0.6236)*
Male	-6.4424	-4.6069	-0.2188	-0.1037	0.2849	0.3604
	(1.8640)**	(3.1160)	(0.0940)*	(0.1643)	(0.0907)**	(0.1555)*
Age	-0.1079	-0.1949	0.0070	-0.0107	0.0089	0.0028
	(0.0858)	(0.1408)	(0.0047)	(0.0074)	(0.0039)*	(0.0064)
Activity status: white collar worker (omitted)						
Activity status: independent	-7.0253	-9.2472	-0.3403	0.0491	0.2337	0.3189
	(2.4842)**	(4.6695)*	(0.1582)*	(0.2721)	(0.1153)*	(0.2187)
Activity status: blue collar worker	2.4542	-0.1502	0.2650	-0.6880	0.2750	0.0922
	(4.4811)	(5.7429)	(0.2042)	(0.5234)	(0.1730)	(0.2751)
Activity status: civil servant	1.2798	-3.3787	0.0464	-0.1671	-0.0826	-0.1084
	(2.0257)	(3.6546)	(0.1084)	(0.2280)	(0.0966)	(0.1867)
Activity status: inactive	-0.1214	4.4751	0.0197	0.4272	0.1319	-0.0003
	(2.3434)	(4.0422)	(0.1266)	(0.2476)	(0.1063)	(0.1799)
Education: no higher education (omitted)						
Education: higher education	1.3259	-1.1569	-0.0006	-0.2679	0.0137	-0.0768
	(1.8360)	(2.7931)	(0.0987)	(0.1659)	(0.0808)	(0.1277)
Education: university	-0.6318	1.0862	-0.0591	-0.0351	-0.0006	-0.2410
	(1.9750)	(3.1350)	(0.1059)	(0.1667)	(0.0879)	(0.1434)
Migrant background	-4.5351	-4.9860	-0.0470	-0.3144	0.1715	0.0576
	(2.7587)	(4.2486)	(0.1508)	(0.2740)	(0.1192)	(0.2051)
Household size	-0.3350	3.6734	0.0386	0.2005	0.0478	-0.1442
	(0.6956)	(1.1792)**	(0.0385)	(0.0645)**	(0.0306)	(0.0569)*
Income (ordinal)	-0.3510	-0.4808	0.0008	-0.0882	0.0046	0.0856
	(0.5857)	(1.0067)	(0.0321)	(0.0593)	(0.0251)	(0.0448)
Risk aversion	-0.0106	-0.0078	0.0007	0.0021	0.0022	0.0008
	(0.0220)	(0.0347)	(0.0012)	(0.0022)	(0.0010)*	(0.0017)
City	0.4609	-0.5531	0.0159	0.0678	-0.0209	0.1170
	(1.3777)	(2.3675)	(0.0745)	(0.1384)	(0.0622)	(0.1090)
Type: closed and apartment (omitted)						
Type: semi-open	-0.2129	-4.3602	-0.0225	-0.3721	0.0521	0.2330
	(2.1259)	(4.0373)	(0.1080)	(0.2238)	(0.0965)	(0.2036)
Type: open	-2.8364	-2.9532	-0.01413	-0.0488	0.1114	0.4827
	(2.2084)	(4.0545)	(0.1152)	(0.2081)	(0.0997)	(0.1872)**
Building layers	0.6009	1.1959	0.0311	-0.0088	0.0186	0.0340
	(1.2035)	(4.0545)	(0.0609)	(0.1119)	(0.0528)	(0.0887)
Flat roof	6.5095	-1.6869	0.2539	0.0480	-0.1410	0.0174
	(2.0977)**	(3.7368)	(0.0986)**	(0.1899)	(0.0942)	(0.1646)
Roof quality	-0.0070	0.0402	0.0062	0.0042	0.0068	0.0046
	(0.0348)	(0.0578)	(0.0020)**	(0.0033)	(0.0017)**	(0.0027)
Construction year (ordinal)	-0.4849	-0.3449	-0.0165	-0.0168	0.0131	-0.0187
	(0.3055)	(0.5735)	(0.0157)	(0.0301)	(0.0135)	(0.0255)
Trust: government	0.5913	4.0310	0.0389	0.0154	-0.0062	-0.1373
	(0.7809)	(1.3560)**	(0.0408)	(0.0773)	(0.0345)	(0.0640)*
Trust: service suppliers	1.2463	0.3560	0.0314	-0.0270	-0.0404	-0.0319
	(0.7921)	(1.4214)	(0.0425)	(0.0810)	(0.0347)	(0.0661)
Trust: nuclear energy	-0.0225	-1.1089	0.0119	-0.0532	0.0185	-0.0289
	(0.6189)	(1.0185)	(0.0329)	(0.0570)	(0.0274)	(0.0495)
Trust: technology	0.3415	3.0269	0.1320	0.1767	0.0713	-0.0709
	(1.0016)	(1.3705)*	(0.0564)**	(0.0817)*	(0.0435)	(0.0728)
Trust: green political party	2.8446	0.6526	0.0342	0.0906	-0.1347	-0.0850
	(0.7272)**	(1.2379)	(0.0394)	(0.0663)	(0.0322)**	(0.0603)
Experience: car lease	0.8991	0.7125	0.0670	0.1980	-0.0539	0.0294
	(1.6591)	(2.6678)	(0.0877)	(0.1458)	(0.0732)	(0.1196)
Experience: Netflix	3.4568	4.8106	0.01482	0.1933	0.0119	-0.1693
	(1.6220)*	(2.6474)	(0.0884)	(0.1484)	(0.0729)	(0.1196)
Experience: Spotify	2.2162	-0.3468	0.0903	0.0641	-0.1000	-0.1336
	(1.6345)	(2.8280)	(0.0876)	(0.1540)	(0.0762)	(0.1291)
PV owner	-9.7065	-14.75	-0.3629	-1.4937	0.0826	0.4038
	(1.8093)**	(3.3462)**	(0.0873)**	(0.7779)	(0.0807)	(0.1513)**

Note: Households who are already in a PSS contract are excluded. Robust standard errors in OLS to correct for heteroskedasticity. * significant at the 5% level, ** significant at the 1% level. Standard errors between brackets.

In Figure 12 we see that in most cases, value propositions and barriers are alike between member and non-member homeowners without solar PV. Exceptions are lower social informational barriers (i.e., not knowing anyone in a PSS model), higher trust, and a lower inclination to expect decreasing energy prices among RESCOOP members.



Note: Red lines represent significant differences at the 1% level, orange lines represent significant differences at the 5% level, grey lines represent non-significant differences at the 5% level (according to a two-sided F test). "Fixed prices" refers to predictable and contractually agreed payment structures. "Better monitoring and steering" denotes improved system oversight and optimisation provided by the service provider. "Preference to remain independent" captures the desire to avoid long-term contractual dependence on a provider. "Bad when market prices drop" captures concerns that fixed contractual payments may become disadvantageous if energy market prices decline.

Figure 12 – Major value propositions (left) and barriers (right) for solar PSS among homeowners without PV

5.4.3 Preferences for PV reuse

Similarly, we asked respondents to indicate on a 0 to 100 scale to what extent they would be interested in the installation of second-life PV panels. This offer entailed the reuse of decommissioned PV panels in a PSS-contract, unburdening the risk of repair and maintenance because there is a lack of certification and warranties for second-life PV. Not controlling for any covariates, we see an average interest of 34.48 in PV reuse among RESCOOP members compared to 27.71 among non-members. This difference is significant at the 1% level in a Wilcoxon rank-sum test.

In Table 20, we report results of a linear regression (OLS) to explain differences in interest in PV reuse, accompanied with probit regression results to explain high interest in PV reuse (i.e., a score of 80 or more) and no interest in PV reuse (i.e., a score of 0 on

100). Again, OLS results show a significant higher interest in PV reuse among RESCOOP members, with a significant constant term of 44.83 compared to a non-significant constant term of 14.06 for non-members.

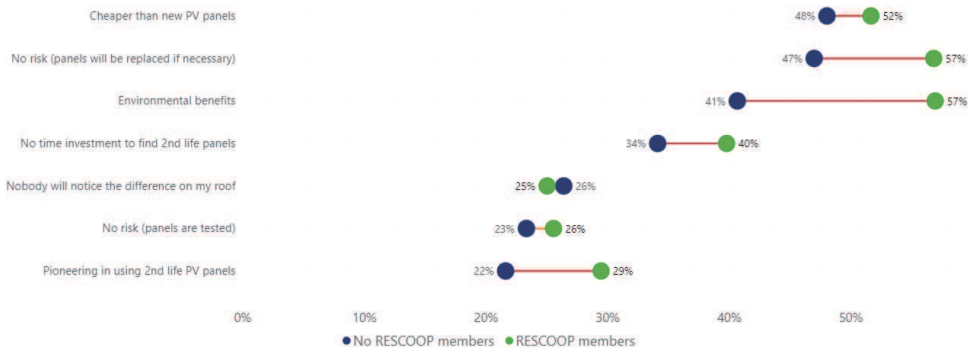
In general, interest in PV reuse is higher among respondents living in older houses or houses with flat roofs (reducing the burden of any aesthetic impact of potentially heterogeneous PV modules), among respondents with a university background, and among respondents with high trust in the green political party (reflecting environmental concerns). Older respondents show less interest in PV reuse, but this relation is weaker among RESCOOP members. Likewise, trust in technology appears to matter less for RESCOOP members. RESCOOP members who already own solar PV show a higher interest in PV reuse than non-members. Furthermore, our results mostly show similarities between respondents regarding gender, activity status, migration background, household size, income, and most housing characteristics (apart from construction year and flat roofs), which holds for both members and non-members.

Table 20 – OLS and Probit regression estimates on profile differences of preferences for 2nd life PV in a PSS model among homeowners

	Interest in 2nd life (OLS)		High 2nd life interest (Probit)		No 2nd life interest (Probit)	
	RESCOOP members	Non-members	RESCOOP members	Non-members	RESCOOP members	Non-members
n =	2281	789	2281	789	2281	789
Prob > F	0.0000	0.0000				
Prob > chi²			0.0000	0.0000	0.0000	0.0000
R^2	0.1295	0.1456	0.0692	0.1458	0.0935	0.0781
Pseudo R^2						
Constant term	44.8305	14.0551	-1.1451	-2.1455	-2.1459	-0.9365
	(8.4190)**	(12.4913)	(0.4269)**	(0.8476)*	(0.3991)**	(0.6086)
Male	1.6615	0.8556	0.0762	0.1845	0.2052	0.1538
	(1.7994)	(2.8237)	(0.0954)	(0.2070)	(0.0954)*	(0.1498)
Age	-0.5386	-0.3712	-0.0186	-0.0066	0.0166	0.0058
	(0.0864)**	(0.1247)**	(0.0043)**	(0.0079)	(0.0041)**	(0.0062
Activity status: white collar worker (omitted)						
Activity status: independent	3.9184	-4.5768	0.1108	-0.7259	-0.0283	0.0520
	(2.7737)	(4.4900)	(0.1235)	(0.3362)*	(0.2178)	(0.2298)
Activity status: blue collar worker	0.9307	3.1724	0.0758	-0.3192	0.2011	0.2169
	(4.2103)	(5.3866)	(0.2027)	(0.3816)	(0.1857)	(0.2711)
Activity status: civil servant	0.7482	-2.3913	-0.0770	-0.1498	-0.1909	0.0000
	(2.0350)	(3.6870)	(0.1026)	(0.2465)	(0.1055)	(0.1827)
Activity status: inactive	-1.3749	-0.9701	0.0503	-0.0951	0.0671	0.4455
	(2.2820)	(3.9780)	(0.1208)	(0.2427)	(0.1086)	(0.1802)*
Education: no higher education (omitted)						
Education: higher education	1.2235	1.2538	0.0454	-0.4153	0.0481	-0.1218
	(1.7862)	(2.6313)	(0.1018)	(0.1980)*	(0.0833)	(0.1271)
Education: university	3.8252	4.9732	0.2137	0.4158	-0.0491	-0.1455
	(1.9642)	(2.9951)	(0.1057)*	(0.1645)*	(0.0921)	(0.1440)
Migrant background	-0.3778	7.5941	0.2012	0.5355	0.1905	-0.4319
	(3.0863)	(4.6858)	(0.1327)	(0.2372)*	(0.1260)	(0.2333)
Household size	-0.1983	0.2665	-0.0081	-0.0130	-0.0078	-0.0712
	(0.6833)	(1.0958)	(0.0336)	(0.0675)	(0.0333)	(0.0534)
Income (ordinal)	-1.0853	-1.0122	-0.0343	-0.0783	0.0271	0.0811
	(0.5656)	(0.9066)	(0.0299)	(0.0605)	(0.0267)	(0.0439)
Risk aversion	-0.0105	0.0077	-0.0009	-0.0018	0.0019	0.0017
	(0.0221)	(0.0350)	(0.0011)	(0.0023)	(0.0010)	(0.0017)
City	1.0190	-0.0295	0.0215	-0.0019	-0.0757	-0.0513
	(1.3928)	(2.2593)	(0.0729)	(0.1539)	(0.0659)	(0.1070)
Type: closed and apartment (omitted)						
Type: semi-open	-0.6455	-3.4310	-0.0562	-0.5544	0.0664	0.1553
	(2.1441)	(3.8981)	(0.1055)	(0.2510)*	(0.1024)	(0.1918)
Type: open	-0.1711	1.3264	-0.0558	-0.1125	0.2629	0.2213
	(2.2702)	(3.8232)	(0.1139)	(0.2234)	(0.1040)	(0.1827)
Building layers	1.0539	2.4271	0.0828	0.0510	-0.0383	0.0435
	(1.1985)	(1.7432)	(0.0617)	(0.1024)	(0.0540)	(0.0864)
Flat roof	7.1091	7.0941	0.2542	0.2320	-0.2134	0.1659
	(2.1293)**	(3.5883)*	(0.0964)**	(0.2039)	(0.1021)*	(0.1600)
Roof quality	-0.0090	0.0035	0.0029	0.0039	0.0047	0.0026
	(0.0360)	(0.0555)	(0.0020)	(0.0041)	(0.0018)**	(0.0026)
Construction year (ordinal)	-1.0846	-1.7359	-0.0357	-0.0600	0.0389	0.0030
	(0.3141)**	(0.5063)**	(0.0153)*	(0.2689)*	(0.0146)**	(0.0246)
Trust: government	0.1968	1.3780	-0.0671	0.0456	-0.0432	-0.1102
	(0.7748)	(1.3366)	(0.0381)	(0.0802)	(0.0378)	(0.0628)
Trust: service suppliers	1.5526	0.7716	0.0857	0.1122	0.0028	-0.0023
	(0.8028)	(1.4134)	(0.0418)*	(0.0839)	(0.0369)	(0.0644)
Trust: nuclear energy	-0.9648	1.0239	-0.0509	0.0608	0.0366	0.0353
	(0.6378)	(0.9975)	(0.0323)	(0.0676)	(0.0292)	(0.0502)
Trust: technology	1.7935	4.4822	0.0923	0.1810	0.0432	-0.1920
	(0.9971)	(1.3221)**	(0.0547)	(0.0963)	(0.0457)	(0.0709)**
Trust: green political party	4.8265	5.2681	0.1184	0.0331	-0.1720	-0.0996
	(0.7380)**	(1.2124)**	(0.0368)**	(0.0767)	(0.0355)**	(0.0575)
Experience: car lease	0.1399	-2.3560	0.0391	-0.3873	0.0027	-0.0707
	(1.6448)	(2.5237)	(0.0820)	(0.1741)*	(0.0775)	(0.1206)
Experience: Netflix	-2.5344	3.7003	-0.0827	0.4134	0.0378	0.1515
	(1.6214)	(2.5616)	(0.0828)	(0.1542)**	(0.0766)	(0.1187)
Experience: Spotify	1.5459	-3.0485	0.0513	-0.1490	-0.0108	0.1230
	(1.6622)	(2.7630)	(0.0821)	(0.1835)	(0.0809)	(0.1280)
PV owner	3.2302	-0.5423	0.1857	-0.0664	-0.3080	-0.0243
	(1.7175)	(2.7851)	(0.0913)*	(0.1815)	(0.0824)**	(0.1360)

Note: Households who are already in a PSS contract are excluded. Robust standard errors in OLS to correct for heteroskedasticity. * significant at the 5% level, ** significant at the 1% level. Standard errors between brackets.

Figure 13 reports relative frequencies of homeowner respondents that state the value propositions reported as convincing for PV reuse in a PSS model. Comparing RESCOOP members and non-members results in significant differences and ranking reversals. While non-members could be convinced most by financial propositions, RESCOOP members value environmental and maintenance propositions most. Noteworthy, RESCOOP members also show higher frequencies for financial aspects and unburdening costs following from asymmetric information issues. Finally, RESCOOP members show themselves more prone to pioneer in PV reuse.



Note: Red lines represent significant differences at the 1% level, orange lines represent significant differences at the 5% level, grey lines represent non-significant differences at the 5% level (according to a two-sided F test).

Figure 13 – Convincing value propositions for PV reuse in a PSS model among homeowners

5.5 Discussion

5.5.1 Empirical contribution

In this study we compare perspectives of members and non-members of citizen energy cooperations on the adoption of solar PV (RQ1) and circular solar value propositions (RQ2). We revisit the answers to our research questions in an integrated manner, facilitating a comparative approach.

Firstly, our results confirm earlier research that members of citizen energy cooperatives are equally concerned about financial aspects as non-members (Fleiß et al., 2017), but that additional perspectives play a distinctive role (Holstenkamp & Kahla, 2016). This applies to (ex-post evaluations of) investment decisions on solar PV in general but is also found in this study for motivations to engage in solar PSS models or PV reuse. Likewise, our findings (in Table A.1) confirm higher levels of trust and environmental concerns among cooperative members compared to non-members, which is also reflected in the ways they perceive solar PV uptake (Figures 10 and 11 and Table A.2), as well as in their higher interest in circular solar business models (Tables 19-20 and

Figures 12-13). Regarding solar PV uptake, these findings align with earlier findings (Kalkbrenner & Roosen, 2016; Magnani & Osti, 2016), whereas the connection to circular solar business models has not been previously established.

Secondly, our results suggest that cooperative members face lower social informational barriers while showing greater social acceptance for circular solar business models. Similar findings pointing at mechanisms fostering social information exchange and social acceptance among cooperative members when adopting innovations have been documented in the field of agriculture (Kolade & Harpham, 2014; Manda et al., 2020) and renewable energy (Klagge & Meister, 2018; Viardot, 2013), but are new in the field of adopting circular business models.

Thirdly, our results suggest that citizen energy cooperative members show a higher inclination to apply total cost of ownership considerations (i.e., higher interest in maintenance-related value propositions) when considering solar PV and circular solar business models (Figures 10-13). Furthermore, they attach greater value to pioneer in adopting new sustainability solutions compared to non-members. These findings offer new insights into the role of cooperatives in fostering their members to incorporate positive externalities into their decision-making processes, reflecting an internalisation of the 7th ICA principle at the individual member level. While (Herbes et al., 2017) mention a higher risk aversion among cooperative members as a significant barrier for the development of citizen energy cooperatives, our results do not show differences in risk-aversion between members and non-members.

Finally, these findings, complemented with earlier findings on the importance of community identity, trust, environmental concerns, and social norms to participate in community energy schemes (Kalkbrenner & Roosen, 2016), illustrate the claim of Jaeger-Erben et al. (2021) that for the transition towards widespread use of renewables, a circular *society* is necessary and not merely a circular *economy*. Cooperatives are examples of economic decentralisation (Bauwens, Hekkert, et al., 2020) , and a way to deepen and strengthen democracy by practicing direct participatory democracy. Moreover, cooperative identity and the ICA principles have been identified as a blueprint for transformative change towards sustainability (Novkovic, 2022). Nevertheless, inclusion and participatory justice are a necessary condition for a circular society as well. Citizen energy cooperatives, however, have been criticized to be dominated by the middle class and technophile eco-modernists (Rommel et al., 2018), which can be partially confirmed by our results (see Table A.1). Without the participation of pluralistic groups of individuals, citizen energy cooperatives could even contribute to the widening of social gaps within communities. Therefore, a major effort is needed by citizen energy cooperatives to open initiatives to less affluent groups to build a truly transformative circular society. Although this call has previously been made earlier in the literature on the energy transition (D. Tarhan, 2022; M. Tarhan,

2015), it has not been articulated in relation to the role of cooperatives in a circular transition.

5.5.2 Practical implications

Citizen energy cooperatives have been proven to be frontrunners in adopting renewable energy while contributing to its social acceptance (Klagge & Meister, 2018). Our results suggest that citizen energy cooperatives could play a similar role to the adoption of circular solar solutions. As the strong involvement of cooperative members contributed to market formation in renewable energy solutions (Punt et al., 2022), the organisational knowledge and legitimacy of citizen energy cooperatives could as well play an important role to foster social acceptance and a market pull for circular solutions in solar energy or even other product groups. A major barrier for energy cooperatives to involve citizens, however, is a lack of familiarity with energy cooperatives among non-members (Fischer et al., 2021). Policymakers could therefore resolve this cognitive legitimacy problem by supporting and showcasing the cooperative model, most specifically towards communities that have been least involved.

While cooperatives can enhance trust and lower transaction costs among members, they can only act effectively when being supported by sound and well-aligned regulatory frameworks (Ruggiero et al., 2021), as well as popular trust in governmental policies, and (semi-)public institutions that govern the energy market (Van Opstal & Manshoven, 2024). Participation of citizen energy cooperatives in semi-public institutions, such as intermunicipal organisations and agencies that govern energy transmission and distribution, would enhance institutional trust, and contribute to the economic and political democratisation of these institutions while further enabling the transition to a circular economy and society. Moreover, it would place cooperatives at the core of their comparative institutional advantage, where membership entails the possibility to participate in deliberation and decision-making processes, transcending consumerist perspectives of being mere users.

Our results show that cooperative members value financial considerations as much as other citizens. Therefore, citizen energy cooperatives are not exempt from offering attractive value propositions. Depending on the focus of an energy cooperative on mutual interests or on general interests, (Bauwens, Huybrechts, et al., 2020) find that the former would benefit most from ‘scale up’ business growth strategies, while the latter may lead to less growth-focused strategies to enhance the impact on their beneficiaries or broaden the diversity of services to their target audience. Citizen energy cooperatives could as well start to experiment with circular business models as a peripheral activity, which can be an appropriate business model diversification strategy when members have heterogeneous preferences (Geissdoerfer et al., 2018; Iliopoulos & Valentinov, 2022). In that case, early adopting members can showcase how circular

solar solutions may work, increasing social acceptance of other members while triggering internal deliberation processes, and shifting the core activities of the cooperative over time.

To gain normative legitimacy in a transition towards a circular society, citizen energy cooperatives should investigate strategies to stimulate member diversity. Examples include reconsidering minimum investment requirements and targeting disadvantaged communities in their outreach activities (D. Tarhan, 2022). Cooperatives are hybrid organisations by design, combining market and community orientations (Caselli et al., 2022), providing them a comparative institutional advantage over organisational forms to deal with membership heterogeneity. A major challenge, however, to deal with membership heterogeneity and multistakeholder governance is that it increases costs of collective decision-making and agency costs (Huybrechts & Mertens, 2014). Agency costs, stemming from monitoring management by members, are traditionally higher in cooperatives compared to third-party owned companies, given the decoupling between shares and voting rights which often results in an atomistic membership with a high probability to freeride on costly monitoring. Therefore, investing in cooperative identity and showcasing the cooperative difference in value propositions towards members will remain crucial if cooperatives want to pick up a salient role in a circular society.

5.5.3 Limitations and recommendations for further research

A first limitation of our research is its geographical scope. With an installed capacity of 750 W per capita at the end of 2022, the region of Flanders in Belgium can be considered as a frontrunner to adopt solar PV. Within Europe, only the Netherlands (1072 W per capita) and Germany (810 W per capita) show higher adoption rates (Flemish Government, 2024). Meanwhile, Flanders has a tradition with citizen energy cooperatives for multiple decades. While experiences from a frontrunner region may be interesting for other industrialised regions, more research is recommended for solar circular PSS models in less developed regions that may be more sunlit but suffer from entirely different institutional and infrastructural challenges.

A second limitation of our research stems from the timing of our survey, predating the war in Ukraine. While this war mostly shed light on resource and energy dependencies in most European countries, we can reasonably expect that attention for both renewables and circular options only increased since. Nevertheless, follow-up research to compare pre-war, wartime, and (future) post-war perspectives would be recommended.

Thirdly, our research provides a static cross-section perspective on perspectives of members and non-members. Value propositions and comparative advantages of citizen energy cooperatives vis-a-vis their commercial counterparts, however, evolve over time depending on evolving market parameters, regulatory environments, and technological

innovations. Many new business models for solar energy, entailing for example demand response management, self-consumption plans, or data-enhanced grid services, are currently only adopted by a small fraction of frontrunners. We therefore recommend future research on both the evolving comparative advantages of citizen energy cooperatives in this evolving field, as well as the potential of these new business models to enable further steps in a transition towards a circular economy and society. Case studies and interviews could provide meaningful insights to achieve a better in-depth understanding of motivations, barriers, and enablers in this regard.

Fourthly, a dynamic research framework could enable future research to identify to which extent the cooperative difference we find in this study can be explained by auto-selection of membership or by mechanism that are induced by cooperative membership itself. One example of such a mechanism is that agency may spur increased personal knowledge and personal relationships (Von Jacobi et al., 2019). As shown in studies on housing cooperatives (Arbell et al., 2020; Avilla-Royo et al., 2021), cooperative membership may foster understanding of complex issues, increasing environmental awareness, seeking sustainable solutions, develop peer learning, and thereby become a drive of social transformation itself. Longitudinal panel data surveys and interviews could help to gain a better in-depth understanding of these underlying mechanisms.

As our research focuses on motivations and barriers, as registered at the time of the survey, it may bias insights on past motivations predating past decisions as is the case in gathering information on motivations to invest in solar PV in our work. As this challenge is acknowledged in market research studies (Geissmar et al., 2023), cognitive biases appear to play a role before, during, and after a purchase decision. Nevertheless, future research would be welcomed to compare both ex ante and ex post narratives on investment and purchase decisions of households in a CE. Conversely, another limitation stems from the fact that we ask for customer interest in solar PSS and PV reuse, reflecting motivations that may not necessarily lead to actual behaviour (Conner & Norman, 2022). Further research would be welcomed to deepen our knowledge on the role cooperative membership may have on intention-behaviour gap in adopting circular business models.

5.6 Conclusions

This is the first paper that surveys differential perspectives of cooperative members on circular business models. We conducted a unique survey that enables us to investigate differential perspectives of both members and non-members of citizen energy cooperatives towards circular solar business models while controlling for an extensive set of personal and housing characteristics and trust parameters. First, we addressed differential value propositions and barriers to invest in solar PV in general. Results show that members and non-members both report financial concerns, but other drivers such as environmental consciousness, independence, and interests in technology play a

greater role among cooperative members, partially confirming earlier research. Secondly, our results show a higher interest among cooperative members in solar PSS models and PV reuse compared to non-members. Confirming earlier results on the role of cooperatives in sustainability investments, cooperative members show comparatively high trust levels in the cooperatives they own and govern, facilitating them to overcome barriers to adopt new sustainability innovations such as circular solar business models. Moreover, they show higher social acceptance and willingness to pioneer in circular strategies compared to non-members. Therefore, policymakers are recommended to stimulate the development of cooperatives to embrace CE strategies.

Cooperatives can be seen as an interesting organisational form to support the transition to a circular society. Cooperatives have an institutional comparative advantage to enable and embed economic democracy, which may become crucial to gain and maintain support for a circular transition that may require significant economic and psychological switch costs from the general public. Nevertheless, citizen energy cooperatives are challenged to address social and inequality mechanisms that may deteriorate participatory and redistributive justice outcomes. Apart from ethical considerations, these aspects of a just transition matter if we want to preclude that a circular transition would only benefit affluent segments within our society, rendering a circular transition incomplete and ineffective. While this challenge exists since the early beginnings of the cooperative movement, we identify novel research gaps to support this endeavour.

In terms of future research, we suggest the following. *Firstly*, more research is needed on the potential role of cooperatives to enable a circular society, including the identification of barriers and enablers within legislations and cooperative governance mechanisms and the potential of multistakeholder cooperatives to include all relevant stakeholder groups in this transition. This also includes the need for actionable criteria for cooperatives to develop transparent rules on how far they can go with combining solidarity mechanisms on the one hand while safeguarding the financial viability of the cooperative on the other hand. *Secondly*, since a CE transition may require economies of scale and vertical integration, we recommend further research on the role of cooperatives as a vehicle for economic participation in semi-public institutions that are key during a circular transition. This way, cooperatives may mitigate market concentration and develop countervailing power and support the normative legitimacy of a circular transition. *Finally*, we recommend further research on the corrective and prospective function of cooperatives when adopting circular business models and embedding circularity goals across product groups and industries. Likewise, more research would be recommended on the supportive role of networks of cooperatives during a circular transition, as they may reinforce each other through information exchange and developing supportive ecosystems.

6. Smart, circular and renewable: the role of cooperative governance in accelerating a sustainable energy transition

Based on:

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Abstract

The proliferation of renewable energy contributes to the Sustainable Development Goals but also leads to waste issues and critical raw material dependencies. It is therefore important to study circular economy (CE) strategies for renewables to mitigate these challenges, while ensuring broad social participation and enhancing community and business resilience. We apply market failure and cooperative theory to explore how cooperative governance can enable and embed circularity in smart grids. Using a case study of a smart grid project in Belgium, we identify key barriers and enablers for fostering circular outcomes. Our findings suggest that cooperative governance can mitigate market failures involved, such as split incentives and asymmetric information, resolving missing markets and facilitating the integration of CE strategies in smart grids. Analysing design-implementation gaps and boundary conditions for scaling and replication highlights the importance of overcoming regulatory barriers and engaging stakeholders through compelling value propositions. While cooperatives are a promising model for advancing sustainable energy transitions, they require regulatory support and community involvement to realise their full potential. Smart grid development may be shaped by regional institutional contexts but the insights on cooperatives derived from this study have a broad international relevance given the globally applied and comparable framework employed.

Keywords: circular economy; renewables; circular business model; circular society; market failure; cooperatives

6.1 Introduction

Renewable energy generation has been acknowledged as an important contributor to the Sustainable Development Goals (SDGs) by reducing greenhouse gas emissions and reducing energy dependence on fossil fuels (Strielkowski et al., 2021). Moreover, the Covid-19 crisis, the war in Ukraine, and geopolitical tensions in the Middle East show the vulnerability of the global economy to systemic shocks, urging policymakers and firms to investigate alternatives for fossil fuels, increasing resilience of businesses and communities (Gatto et al., 2024; Zhou et al., 2023).

The successful proliferation of renewables, however, causes an upcoming waste problem. For example, the International Renewable Energy Agency (IRENA) projects that waste from cumulative solar PV projects alone will increase from 0.2 Mt in 2021 to almost 50 Mt in 2040 and more than 200 Mt by 2050 at the global level (IRENA, 2024). Additionally, for some components of renewables, such as solar PV, wind turbines, or batteries, we are dependent on critical raw materials, including rare earth elements, cobalt, and lithium, that originate from a very limited number of countries, increasing geopolitical dependencies (European Commission, 2023). Extraction of these resources results in environmental, societal, and political risks in the extracting regions and countries (Wolters & Brusselaers, 2024). Therefore, it is relevant to study circular economy (CE) strategies for renewables.

The CE is an economic system that replaces the 'end-of-life' concept with reducing, alternatively reusing, recycling, and recovering materials in production/distribution and consumption processes (Kirchherr et al., 2017). Applied to renewable energy systems, this does not only involve high-quality recycling (Chowdhury et al., 2020), remanufacturing (Deng et al., 2021), or repurposing (J. Chen et al., 2023), but also new business models that aim at improved maintenance, repair, and reuse of renewable energy sources (Strupeit et al., 2024), and sufficiency strategies that reduce total energy usage in the first place to reduce the overall energy need (Temiz & Dincer, 2023). These strategies will not eliminate the waste problem nor the demand for virgin critical raw materials, but by supporting lifetime extension and resource efficient design, they can significantly mitigate it, contributing to the slowing and narrowing of material loops.

To achieve a sustainable CE, scholars increasingly point at the importance of creating a ‘circular society’ as a boundary condition (Calisto Friant et al., 2023; Jaeger-Erben et al., 2021). This concept of a circular society encompasses distributional, procedural, and recognitional justice. The circular economy and society transitions require participation of all members of society, enhancing resilience of both communities and businesses. During the last 180 years, cooperatives have been proven to be an organisational form that is able to tackle societal problems while strengthening resilience of its members and their communities (ILO, 2002; Novkovic, 2022). Cooperatives, as defined by the International Cooperative Alliance (ICA) (ICA, 1995), are open and voluntary

associations, allowing individuals to join to meet shared economic, social, and cultural needs. In the last few decades, renewable energy source cooperatives (REScoops) played an important role in increasing social acceptance and attracting financial means for investments in renewables (Huybrechts & Mertens, 2014). Nevertheless, research on the role of cooperatives in a circular transition remains relatively unexplored. Notable exceptions include Ziegler et al. (Ziegler, Poirier, et al., 2023), providing a theoretical discussion, and research on the role of waste picker cooperatives in circular supply chains in emerging countries (Batista et al., 2019; Braz & Marotti de Mello, 2022a). Nonetheless, it is not clear why and how cooperative members, who are both using, owning, and governing their cooperatives, would support and embed circularity goals over a long period of time.

Smart grids have been proposed as a solution for local, digitally enabled renewable energy provision in communities. This paper examines how cooperatives can enable and embed circularity goals into smart grid governance. A smart grid is "an electricity network that can intelligently integrate the actions of all users connected to it, in order to efficiently deliver sustainable, economic, and secure electricity supplies" (European Commission, 2006). It is 'smart' because it integrates advanced technologies, digital communication, and automation to optimise electricity generation, distribution, and consumption. Smart grids can be implemented by various actors, including public authorities, utility companies, REScoops, cooperatives of complex campuses, and cultural heritage projects (Kojonsaari & Palm, 2023). They are complex sociotechnical networks, combining novel technologies, user behaviours, and diverse sources for energy generation, storage, and distribution (Wolsink, 2012). Smart grids may enhance community resilience by reducing the risk of power outages, ensuring community access to renewable energy, or developing services for marginalised groups and civil society organisations (Hotaling et al., 2021; Tarasova & Rohracher, 2023).

Research on the social aspects of smart grids has been identified to be lagging to knowledge development of its technical aspects, resulting in major research gaps on energy democracy (Kojonsaari & Palm, 2023; Wolsink, 2024). Moreover, to the best of our knowledge, no research has been published earlier on governance aspects of CE strategies in smart grids. Therefore, we aim to answer the following research questions:

- RQ 1: What are barriers and enablers to foster circular outcomes in a smart grid?
- RQ 2: How can cooperative stakeholder governance enable and embed circularity goals in a smart grid?
- RQ 3: What lessons can we learn from a smart grid demonstrator to foster the uptake of circular strategies?

We analyse a case study of a smart grid project in Zwevegem (Belgium) that was conducted between 2019 and 2024 and had explicit aims to incorporate circular strategies and a cooperative governance. The smart grid project was envisioned to

combine mixed user profiles (including SMEs, associations, and social housing) and encompassed multiple technical and regulatory challenges. We utilise empirical material from participatory observation, project documentation, and 30 interviews that were conducted with relevant stakeholders and experts. This material is analysed through a conceptual framework building on insights from market failure and cooperative theories.

The remainder of this paper is structured as follows. In Section 6.2 we present background information on smart grids and the CE, on cooperative smart grid governance, and on the research gap we address. Next, in Section 6.3, we present methods and materials. In Section 6.4 we present the results, followed by a discussion and conclusions in Section 6.5.

6.2 Background

In this section, we provide a brief overview of relevance literature on smart grids and the CE and on the role of cooperatives in smart grid governance. Furthermore, we substantiate the research gap addressed.

6.2.1 Smart grids and the circular economy

While smart grids are conceived to optimise the distribution and use of energy, research on optimizing resource streams in smart grids remains scarce. Examples include research on optimizing the design of eco-industrial parks encompassing both circularity and smart grids (Kuznetsova et al., 2016), or research on fuel for smart grid power management stemming from municipal and industrial waste (Thomas & Mishra, 2022) or livestock waste (Pereira et al., 2023), which all focus on recycling and recovery as CE strategies.

Studies on higher-level circular strategies are mostly found at the component level. While smart grids neither design nor recycle components, their maintenance and governance practices may significantly influence their ability to slow and narrow material loops at the component level. Regarding renewable energy generation, Rabaia (Rabaia et al., 2024) presents an overview of 10 circular strategies for solar PV, including strategies to extend the lifespan of PV panels, such as reusing discarded models, improved maintenance, and refurbishment of older PV modules. The latter strategy was found to be least implemented, while further research on PV reuse is called upon (notable exceptions are (Nyffenegger et al., 2024; Van Opstal & Smeets, 2023b, 2023a)). Recently, Hu et al. (Hu et al., 2024) established PV reuse as the preferred strategy to mitigate carbon emissions for the four major metals in solar PV (i.e., aluminium, copper, nickel, and lead). For wind turbines, Mendoza & Pigosso (Mendoza & Pigosso, 2023) discuss the steep pathway of the wind industry towards circularity

beyond the already challenging theme of recycling, calling for a prioritization of circular criteria in procurement, component tracking and monitoring, reverse logistics, and alternative business models. Regarding energy storage solutions applicable to smart grids, research on slowing and narrowing materials loops mostly focuses on the repurposing of EV batteries into stationary batteries (Baars et al., 2021; Kastanaki & Giannis, 2023).

A more integrated approach can be found in studies on the design of low-voltage direct current transmission systems, or 'DC grids'. These studies propose using a DC backbone as an alternative to alternative current (AC) backbones in smart grids by connecting various DC-based renewable energy generation systems, storage systems (Azaioud et al., 2021), and loads such as EV chargers (Azaioud et al., 2024; Cleenwerck et al., 2023). This strategy rethinks the smart grid set up and contributes to slowing loops by reducing energy conversion losses and extending equipment lifespan (Azaioud et al., 2023). Another integrated approach can be found in work on the CE aspects of virtual power plants (Xie et al., 2024). A virtual power plant is a technologically constructed energy management system able to manage the inherent conflict between dispersed electricity generation and user demand.

Smart grids are often installed on existing campuses but also in adaptive reuse of cultural heritage (ARCH) projects. ARCH has been receiving recognition for its diversified applicability of a CE (Ikiz Kaya et al., 2021; Owojori et al., 2021). Foster (Foster, 2020) identifies no less than 46 strategies for CE implementation in ARCH, encompassing extending the lifespan of buildings and sites whilst maintaining cultural heritage values, reducing and avoiding waste from demolition, and capturing the energy expended in the original construction while retaining building materials in use (Foster, 2020; Foster & Kreinin, 2020). ARCH projects are challenging as the number of sites recognized as cultural heritage are increasing and the costs for functional maintenance are growing (Girard & Gravagnuolo, 2017). The development of smart grids on these sites provides opportunities to combine and integrate local community involvement, the efficient use of renewable energy, and the deployment of CE strategies in ARCH projects (Foster & Saleh, 2021).

In sum, a smart grid may contribute to closing resource loops by enabling the recycling and recovery of its components as well as other waste streams, to narrowing resource loops by optimizing energy efficiency requiring a smaller grid dimensioning, and to slowing resource loops by extending the lifespan of its components through maintenance, repair, and refurbishment (Bocken, de Pauw, et al., 2016). This however requires smart governance, combining insights and collective action from many stakeholders.

6.2.2 Cooperative smart grid governance

Governing smart grids involves monitoring a wide variety of aspects. In a study on a campus smart grid, no less than 74 KPIs in 15 service areas were listed (Alrashed, 2020). Apart from technical, safety, reliability, data privacy, and regulatory aspects, it involves monitoring its business model including the value proposition, supply chain aspects, customer interfaces, financial model, and governance model (D. Brown et al., 2024). Important governance aspects involved in designing, implementing, and operating a smart grid include ownership, decision-making processes, and the relationship between funders, installers, owners, users, and the host community. Importantly, the key underlying question remains: why was the smart grid developed and who benefits from it? (Rommens et al., 2024) To align this with preferences, behaviours, and identities of prospective users and communities, it is important to acknowledge that governing a smart grid is above all a socio-technical challenge (Kojonsaari & Palm, 2023).

Smart grid innovation projects have been studied as collective action problems since smart grids cannot be realised by one single actor (de Reuver et al., 2016). Therefore, smart grid governance design should consider institutional conditions that enable decision-making processes in complex multistakeholder configurations, also referred to as 'polycentric governance', while limiting transaction costs and incentives to free-ride (Engels & Münch, 2015; Lammers & Hoppe, 2019). This requires the alignment of incentives, stemming from financial or non-financial rewards (e.g., status, reputation) or from penalties and punishments for those not contributing (Ostrom, 1990). Smart grids increase system complexity and involve uncertainty and risk for all parties, requiring an organisational architecture of trust and confidence (Büscher & Sumpf, 2015). As the number of realised smart grid projects remains low, scholars increasingly document the institutional failures of both for-profit and public sector solutions (Kojonsaari & Palm, 2023). Given the documented importance to involve users in smart grid design and operations (Geelen et al., 2013; Throndsen, 2017), including their willingness to engage in energy management systems and demand response (Sovacool et al., 2017), we focus on the potential role of hybrid organisations, such as cooperatives, in smart grid governance.

Cooperatives are distinct from for-profit organisational forms as their members are both owners and beneficiaries (or users) of the cooperative, and participate in the decision-making in a democratic way (Limnios et al., 2018). They have a long tradition of mobilizing people and resources to establish common goals, and are often regarded as an inclusive governance mechanism for energy projects as they allow citizens direct participation in decision-making (Martin et al., 2018). This participation is crucial, as smart grids will not thrive when there are hardly actors that are willing to become part of them (Wolsink, 2012). In the United States, cooperatives have been active for over 70 years to electrify rural parts of the country (Gilcrease et al., 2022; Grimley & Chan,

2023). In Brazil, waste picker cooperatives are involved energy recovery from waste by incineration and biomass (Batista et al., 2019; Lino & Ismail, 2018). In Europe, REScoops have been studied extensively as a leading format within energy communities, representing a major cooperative enterprise model for investing in renewable energy (Huybrechts & Mertens, 2014). REScoops contributed to community acceptance and customer adoption of renewables (Klagge & Meister, 2018; Yildiz et al., 2015). Nevertheless, they suffer from a lack of awareness and acceptance among the general public (Fischer et al., 2021; M. Tarhan, 2015) or unfavourable institutional conditions to operate in the energy market, leading to an unequal geographical distribution of REScoops in Europe (Candelise & Ruggieri, 2020; Capellán-Pérez et al., 2018). It is also noteworthy that research among REScoop members showed that financial beliefs are often more important than environmental outcomes to participate (Bauwens, 2016; Fleiß et al., 2017; Holstenkamp & Kahla, 2016).

While REScoops primarily focus on investing, operating, and managing distributed energy resources, such as wind turbines or solar photovoltaics, cooperatives governing entire smart grids remain scarce. Nevertheless, REScoops are beginning to engage in multiagent demand-side management and grid services development (Akasiadis, 2017; Hamwi & Lizarralde, 2017). Recently, an association of 69 electric cooperative in the US announced plans to deploy smart grid technologies (Latief, 2023). In the Netherlands, a leading country in REScoop numbers, energy cooperatives are starting smart grid projects such as RESCHOOL (Amsterdam), Sterk op Stroom (The Hague), Endona (Heeten), and De Ecofactorij (Apeldoorn). However, most of these projects remain small in size and scope.

6.2.3 Research gap

Cooperative solutions can mitigate market failures in competitive markets (Siderius & Zink, 2023). They may help to internalise externalities and build countervailing power in supply chains (Batista et al., 2019), and reduce asymmetric information through cooperative governance (Limnios et al., 2018) as shown in many industries including agriculture (Giannakas et al., 2016; Stattman & Mol, 2014), manufacturing industries, banking (Groeneveld, 2020), and waste management (Buch et al., 2021). Ziegler et al. (2023) presented a study on the potential contribution of cooperatives to the CE, showing their potential to anchor circularity in the hearth of the cooperative model. Their narrative resonates with earlier calls that cooperatives can serve as a normative yardstick for transformative change (Novkovic, 2022) or evidence on the intangible assets and resource efficiencies cooperatives have in organising collective action, providing them a comparative advantage to deliver climate change benefits (Baranchenko & Oglethorpe, 2012; Castilla-Polo & Sánchez-Hernández, 2020). Applied to the context of renewable energy cooperatives, Rupp et al. (Rupp et al., 2025) point at the role of trust and awareness triggered by cooperatives to foster collective interests, bridging cognitive gaps between energy generation and consumption.

Cooperatives can also help to embed a CE in a circular society (CS) based on the priority of needs of members rather than profits of investors, and of their anchoring in regional economies and value chains of proximity (Ziegler, Poirier, et al., 2023). Likewise, Bauwens et al. (2020) highlighted the importance of economic and political decentralisation as a governance mechanism to achieve a circular future. Cooperatives may support the governance of a CS, as they are deeply rooted in the communities where they operate (Novkovic, 2008). This is specifically important in the context of smart grids, as their potential to enable a just transition depends on the governing ability of its founders to ensure social acceptance and participation of the community they are embedded in (Jacobs & Owen, 2023; Milchram et al., 2020).

Cooperative smart grid governance has been studied to address collective action challenges in their design and implementation. Wolsink (2012) considers renewables as common pool resources and explores cooperatives to improve community, market, and socio-political acceptance. Martin et al. (2018) examine platform cooperatives that combine users and service providers for smart city development. Other research highlights the role of self-enforced arrangements in fostering long-term stakeholder relations (de Reuver et al., 2016) and the need for polycentric governance to manage competitive and cooperative tensions (Grimley & Chan, 2023). Lammers & Heldeweg (2016) apply Ostrom's institutional analysis to smart grid design, refined in later studies on decision-making practices (Lammers & Hoppe, 2019) and comparative institutional frameworks for energy decentralisation (Heldeweg & Saintier, 2020).

Research on the role of cooperatives as a governance structure supporting a circular transition remains scarce. A notable exception is research on the enabling role of recycling cooperatives owned and governed by informal waste pickers in Latin America (Buch et al., 2021; Miranda et al., 2020), formalising their activities and enabling these actors to participate in the development of circular supply chains (Batista et al., 2019; Braz & Marotti de Mello, 2022b). Another exception is Van Opstal et al. (2025a), who discuss governance aspects of energy cooperatives when investigating differential perspectives of members and non-members towards circular business models for solar PV. To the best of our knowledge, however, there are no published scholarly articles on how cooperative governance can mitigate or resolve market failures in the design and implementation of a complex socio-technical configuration such as a circular smart grid.

6.3 Methods and materials

In this section, we outline the conceptual framework underpinning this study, introduce the case under investigation, and describe the materials utilised for this research.

6.3.1 Conceptual framework

In this paper we analyse barriers and enablers of implementing circular strategies in a smart grid through the lens of market failures. Market failures may arise when not all conditions for a fully competitive market are fulfilled. This means markets may fail if there is demand or supply side market power, asymmetric information, when prices do not fully reflect the full social costs and benefits of the underlying products traded. In the latter case, positive or negative externalities may arise, which may lead to suboptimal production and consumption levels. Externalities may occur between parties, resulting in split incentives among market players or public authorities, or across time, resulting in dynamic split incentives between generations (Van Opstal, Smeets, et al., 2024).

Market failures increase the costs of market contracting and can result in missing or incomplete markets. For example, asymmetric information may result in costly screening or signalling activities, which may challenge value capturing and undermine market formation (Akerlof, 1970). Missing markets may also lead to a lack of standards, warranties, and supporting institutions, which has been reported earlier as an important impeding factor to develop circular business models (Grafström & Aasma, 2021). Markets may be missing as well because they have public goods characteristics, encompassing the challenge to resolve collective action problems (Ostrom, 1990; Patala et al., 2022). The governance model of cooperatives has been described by Ostrom (1990) as one of the best solutions for the management of common resources (Huybrechts & Mertens, 2014).

We therefore utilise cooperative theory as a theoretical lens to study stakeholder collaboration to govern a circular smart grid. Cooperatives, rely on a set of organisational governance principles (see Table 21) that define the cooperative difference compared to other organisational forms (ICA, 1995). These principles, even when not legally obliged, serve as a compass for cooperative governance and provide cooperatives a comparative institutional advantage to resolve or mitigate market failures (Grimley & Chan, 2023; Novkovic, 2008). Members of cooperatives are both owners and users of the firm, which reduces the costs of market contracting under market failures while keeping costs of ownership and collective decision-making low (Hansmann, 1999; Spear, 2000). The set of ICA principles helps them to limit opportunistic behaviour of their members by having strong mechanisms for monitoring and control (Huybrechts & Mertens, 2014).

Table 21 – The cooperative principles (ICA, 1995) and their rationale to resolve collective action problems

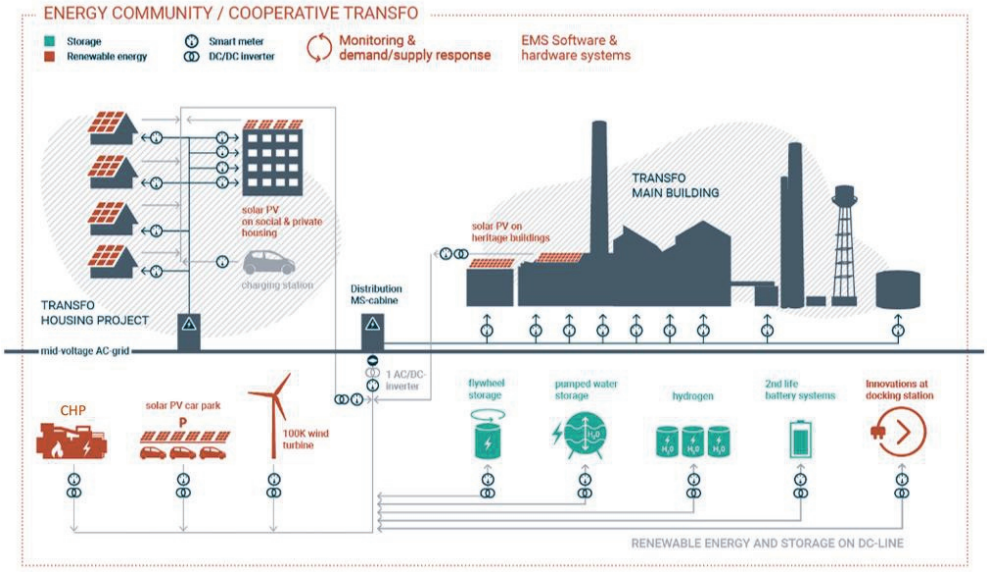
ICA Principle	Rationale to resolve collective action problems
8. Voluntary and open membership	Promotes inclusiveness and equality, which are key factors in fostering cooperation, ensuring equal opportunities for all members (Bowles & Gintis, 2002).
9. Democratic member control	Allows members to influence strategic decisions, promoting transparency and trust while preventing managers to engage in opportunistic behaviour (Rupp et al., 2025; Spear, 2000).
10. Member economic participation	Supports reciprocal altruism and helps to align interests. When members have a financial stake, they are motivated to contribute because they benefit directly from the cooperative's success, fostering trust and cooperation (Gintis, 2005).
11. Autonomy and independence	Helps to preserve the cooperative's integrity and self-management, supporting the development of internally motivated norms and behaviours, while enabling trust and cooperation (Ostrom, 1990).
12. Education, training, and information	Enhances the ability of members to contribute effectively to their cooperative while empowering members to engage in cooperative behaviour and the enforcement of norms of reciprocity (Fehr & Fischbacher, 2003).
13. Cooperation among cooperatives	Enhances network reciprocity and a cooperative culture (Henrich et al., 2001). By collaborating, local cooperatives can retain democratic member control while achieving economies of scale, building countervailing power or fostering market formation when markets are incomplete or missing (Grimley & Chan, 2023).
14. Concern for community	Cooperatives are rooted in the communities where they operate, providing a comparative institutional advantage to internalise market externalities and address community concerns (Novkovic, 2008).

The degree to which cooperative governance may resolve market failures involved in designing, implementing, and operating a circular smart grid is the key research question addressed in this work.

6.3.2 Case description

Given the complex socio-technical challenge of designing and implementing a circular smart grid cooperative, we conducted a case study from 2020 to 2024. Most research on smart grids, as noted in a recent systematic literature review of 111 papers, uses a single case study approach but over shorter periods (Kojonsaari & Palm, 2023). Our case focuses on developing a circular smart grid cooperative at the Transfo site in Zwevegem (Belgium), a former electricity production plant now recognised as a cultural heritage project. The site hosts various activities, including offices, leisure facilities, and educational spaces, and is envisioned as a living lab for sustainable energy and CE practices. It is owned by an intermunicipal organisation, the municipality, and the province, with a site manager overseeing daily operations. Given the explicit circularity ambitions embedded in this case from its inception, we regard it as a unique and highly pertinent example for our study (Leiedal, 2024; Rommens et al., 2024).

As the redevelopment of the Transfo site emphasises sustainability, an Urban Innovative Actions (UIA) project was developed to create a circular smart grid that optimises renewable energy use while enhancing resources efficiency. Project partners included the intermunicipal organisation, municipality, and province, alongside two academic partners, a regional smart energy development organisation, and the European federation of REScoops. The project aimed to serve as a replicable model, demonstrating how historical sites can be transformed into modern, sustainable energy hubs. The initial smart grid set up, shown in Figure 14, includes solar photovoltaics, a small wind turbine, and combined heath power (CHP) for distributed energy generation, with flywheel storage, pumped water storage, hydrogen, and second-life batteries for distributed energy storage. Energy loads envisioned include an EV charging station, offices, site facilities, and nearby private and social housing projects. A key innovation is the DC-grid, designed to reduce energy losses and the need for inverters. The project also includes smart metering, monitoring, demand/supply response, and optimisation of Energy Management System (EMS) software and hardware systems.



Source: https://www.leiedal.be/resourced

Figure 14 – Initial smart grid setup

The Transfo smart grid envisioned to incorporate CE principles across its various components. The project aimed to reuse and refurbish decommissioned renewable energy devices and parts of the physical infrastructure of the cultural heritage site. For energy storage, the project aimed to repurpose batteries from electric vehicles, pumped water storage, and flywheel storage. Furthermore, the rethink strategy was applied to

the grid infrastructure itself by envisioning a DC-grid. Finally, the EMS complement these efforts by enabling predictive maintenance and improved repair, extending equipment lifespans, and optimising energy consumption to avoid unnecessary grid expansions (reduce).

6.3.3 Data collection and analysis

Empirical data were collected during the four-year RE/SOURCED project the first author participated in. In this study, the design and implementation of a smart grid cooperative served as an action-based case study (Robson, 2002). Firstly, data collection over this four-year period helped to observe how processes unfold over time (Langley et al., 2013). Secondly, our participatory action-led research method was considered valuable in its capacity to investigate this previously unexplored phenomenon in collaboration with a wide range of relevant stakeholders (Van de Ven, 2007).

Data collection included participatory observation during meetings, workshops, and document analysis throughout 4 years, complemented with 30 formal semi-structured interviews with 33 stakeholders during the last stage of the project. For a full overview of interview respondents and the interview questionnaire, we refer to Appendix 6.1. Project documentation included vision documents, project plans, project deliverables, the design of circular procurement guidelines, and meeting notes. For an overview of meetings and workshops the first author participated in, we refer to Appendix 6.2. A similar approach has been conducted in other research on sociotechnical aspects of smart grid innovations (Lammers & Heldeweg, 2016; Verkade & Höffken, 2018).

Interview respondents were selected based on their stakeholder position towards the project. Given the conceptual stage of the smart grid throughout most of the project, sociotechnical imaginaries on prospective users, owners, and smart grid management were constructed (Kojonsaari & Palm, 2023). To capture insights from early adopters, we expanded the set of direct stakeholders to include frontrunners experienced in cooperating on circular projects on renewables among the interview respondents. In sum, interview respondents included owners of the site, local municipalities and public-sector organisations, service suppliers and energy consultants, on-site companies and organisations, research institutes, regulatory bodies, citizen energy cooperatives, local and regional civil society organisations, and representatives of projects that gained experience with CE strategies in renewables. Important to mention is the international scope and experience of multiple service suppliers, energy consultants, research institutes, and citizen energy cooperatives we interviewed, allowing us to safeguard the broader geographical applicability of our results. This broad set of respondents allowed for data triangulation, comparing and cross-verifying evidence from different angles. Note that interview respondents are referred to between brackets.

Interview respondents provided formal informed consent, followed by a recorded online MS Teams interview, which lasted between 45 and 80 minutes. During the semi-structured interviews, we asked targeted follow-up questions to make implicit assumptions and tacit knowledge explicit. Therefore, we asked each interview respondent as a last question to perform a premortem analysis explicating why the smart grid project would fail within the next five years. This technique, originating from behavioural economics (Gallop et al., 2016; Thaler & Sunstein, 2008), helps to mitigate cognitive biases among interview respondents such as confirmation bias, hindsight bias, and groupthink.

Interview transcriptions (in Dutch or English) and project documents were coded in ATLAS.ti. The coding process followed a structured approach combining content analysis, narrative analysis, and thematic co-occurrence analysis to systematically interpret the data. In the first coding round, major interview themes from the questionnaire and meta-data on the stakeholder position were identified. In the second phrase, a deductive coding round was applied, identifying phrases that referred to smart grid components, market failures, and ICA principles. Here, content analysis was first used, followed by narrative analysis to examine how respondents described their experiences, justifications, and concerns in relation to these topics (Sovacool et al., 2018). This was important, as interview respondents mostly did not frame their responses using the theoretical concepts applied in this paper. For an overview of the retained coding structure, we refer to Appendix 6.3.

In a final stage, a cross-coding analysis was performed to explore relationships between the key conceptual frameworks in this paper. Co-occurrences between smart grid components and market failures, and between ICA principles and market failures were systematically analysed to uncover underlying mechanisms. This process required further thematic analysis, integrating theoretical insights from market failure theory and cooperative theory to explain patterns. Given that the analysis involved interpreting how respondents, often implicitly, constructed meaning around these concepts, elements of discourse analysis were also incorporated. In Figure 15 we depict an overview of our research design.

To ensure the validity of our research, we employed a combination of methodological, source, and theoretical triangulation (Bell et al., 2022; Sovacool et al., 2018). Methodological triangulation involved integrating data from participatory observations, semi-structured interviews, and document analysis, allowing us to cross-verify insights and capture a comprehensive understanding of the phenomenon. Source triangulation was achieved by including a diverse range of stakeholders, ensuring that multiple perspectives were considered. Theoretical triangulation was applied by using established frameworks, including market failure theory and cooperative theory, to interpret findings systematically and reduce subjective bias. During analysis, a structured coding process in ATLAS.ti further facilitated the integration of primary and

secondary data, with themes from different sources cross-referenced for consistency. To enhance reliability, we documented interview procedures, meeting notes, and project deliverables, ensuring traceability and replicability. Additionally, the premortem analysis used in interviews encouraged respondents to critically reflect on assumptions, mitigating cognitive biases and enriching robustness of our data.

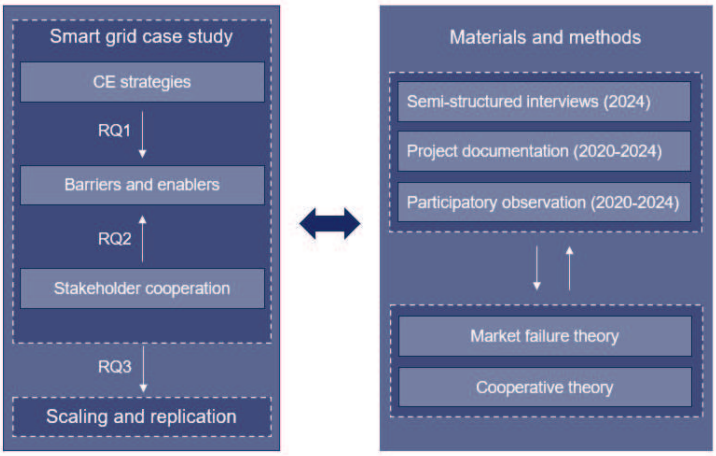


Figure 15 – Research design

6.4 Results

In this section, we will first discuss the relationship between CE strategies for smart grids and market failures. Secondly, we will present our findings on the degree upon which cooperative stakeholder governance may enable and embed circularity goals in a smart grid. Finally, we present lessons from the smart grid demonstrator to foster the uptake of CE strategies.

6.4.1 Smart grids and the circular economy

According to interview respondents, applying CE strategies in a smart grid offers value in several areas. First, it improves resource efficiency, extending the lifecycle of components such as batteries and PV panels, mitigating waste and resource use. Secondly, although the initial capital expenditure (CAPEX) may be higher, innovations such as DC grids reduce conversion losses and improve energy efficiency, benefiting operational expenditures (OPEX). Thirdly, over time, CE strategies could promote new business models, such as service contracts and performance-based systems, aligning financial incentives with asset longevity. Finally, CE in smart grids can engage local communities by demonstrating the tangible benefits of sustainability, showcasing that successful CE applications can serve as educational tools. In this subsection, we answer RQ1, identifying barriers and enablers to implement circular strategies in a smart grid

and analysing them from a market failure perspective. The main insights are illustrated in Figure 16.

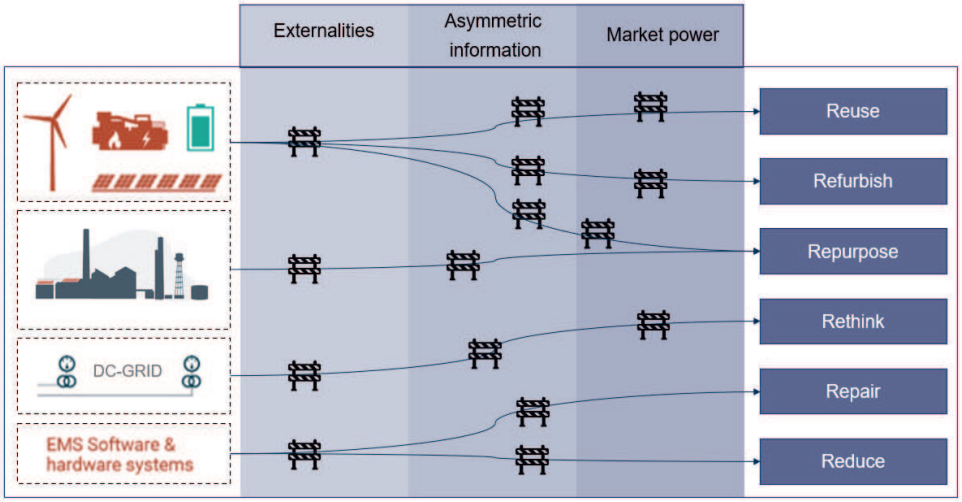


Figure 16 – Smart grid components (renewables, loads, DC grid, and EMS), CE strategies, and market failures

Distributed energy generation

Throughout the project, and as acknowledged by most interview respondents, the reuse of early decommissioned renewableas have been recognised as both an opportunity and a challenge to implement CE strategies within the smart grid. A first barrier involves asymmetric information, as reuse involves large screening costs to find second-life devices, resulting in incomplete markets. Insufficient regulations and standards for reuse and refurbishment lead to challenges in ensuring consistent quality and performance, causing concerns about hidden defects and reduced performance, which can lead to additional maintenance and early replacement. Secondly, both environmental as social externalities of using new renewables are unaccounted for, resulting in a market failure to prioritise reuse. The design of these technologies likewise encompasses intertemporal externalities, as it is insufficiently adapted for repair, reuse, refurbishment, or disassembly over the product lifecycle. Moreover, high labour costs to dismantle, test, and recommission renewables, as well as decreasing prices of new devices render the business case for reuse unattractive. As pointed out by an interview respondent [nr. 2]: “PV has become so cheap that it actually makes up only about 20% of a project’s cost”. For Combined Heat and Power (CHP) this was nuanced: “Unlike PV, the expensive components in CHP make it worthwhile to consider reuse markets in the future” [nr. 3]. Finally, the concentration of market power limits the development of a competitive market for refurbished and reuse applications, as stated by experts during interviews and by suppliers throughout the procurement process.

Enablers mentioned by interview respondents therefore focus on the development of markets for second-hand energy generation systems. However, public procurement processes in this case study revealed that introducing public procurement criteria rewarding the use of second-hand materials and components was insufficient to spur the development of reuse markets. This calls for public procurement leadership and coordination to generate demand-side economies of scale. A second enabler identified is reducing informational asymmetries by means of improved digital product passport or a coherent system of warranties. Thirdly, market development would also benefit from the establishment of infrastructure and support systems for the collection, testing, and refurbishment of used energy generation systems and components. The development of an industry of specialised firms and services dedicated to these activities could be supported. Fourth, mandatory requirements to engage in a modular design that facilitates repair and upgrading of these systems would reduce intertemporal externalities. Finally, internalising externalities in product taxes on new energy generation systems would help to render their business case positive.

Distributed energy storage

Repurposing EV batteries was the main circular strategy regarding energy storage in this case7. Contrary to the reuse of energy generation appliances, the procurement stage of this case revealed that markets are clearly developing to offer repurposed EV batteries, resulting in a tangible offer by multiple parties responding to the public tender in this project. A first market failure involves asymmetric information on battery performance of repurposed EV batteries, rendering the business case of repurposed batteries vulnerable. This is reinforced by a lack of access to historical data from battery management systems (BMS) which is a consequence of market power by car manufacturers. Finally, interview respondents point at a lack of incorporating environmental and social externalities of producing new batteries. Interview respondents therefore identify battery product passports and eco-design rules as major enablers for repurposed batteries. This would also serve the cause of keeping materials within Europe, addressing human rights issues related to raw material extraction, and promoting circular ecosystems in general.

[7] Other storage options included the repurposing of a water tower (pumped storage) and flywheel storage. However, for *pumped storage*, the costs of cleaning the water tank, reinforcing the structure, and repurposing the infrastructure into a battery were much higher than the returns of its storage capacity (5 kWh). Moreover, each pumped storage project is unique due to varying conditions, making it impossible to implement a standard, off-the-shelf solution. This customisation adds to the complexity and costs. For *flywheel storage*, an existing flywheel in a ventilator room was envisioned to serve as a dynamic battery, using its rotating inertia. Nevertheless, its low efficiency did not counterbalance the need to have this room demolished in the wider plans to repurpose the site.

The physical network

Regarding the physical network, the case study considered circular aspects of reusing the heritage sites, the DC-grid, and the inverters. Repurposing the heritage site inherently contributes to circularity outcomes but encompasses some specific challenges as well. First, integrating modern energy solutions into heritage sites often involves significant costs for restoration and adaptation, as became clear throughout the project. Ensuring that new installations comply with the aesthetic requirements of heritage sites can be costly as it often involves additional expenses for designing and implementing solutions that are visually acceptable. Secondly, the process for obtaining approvals to modify heritage sites is often lengthy and complex. Such uncertainties can delay projects and add to the overall cost and complexity. Finally, the heritage site caused multiple underground uncertainties: not knowing the full legacy of underground cables, tanks, and other infrastructure caused multiple challenges to install a new grid. In sum, building a circular smart grid on a repurposed heritage site involves dealing with asymmetric information and intertemporal externalities. Moreover, the heritage site has multiple public good characteristics, as its societal value exceeds the private value of the site owners which may cause split incentives and positive externalities.

Regarding the DC-grid, a key circular design goal was to demonstrate its potential for greater energy and resource efficiency compared to AC grids. However, installing DC-grids is challenging, firstly because of the need for specialised DC components, which soon appeared to be less available or standardised than AC components. Secondly, the apparent absence of standardised protocols and certifications for DC grids further complicates interoperability and reliability, leading to higher costs and risks. Additionally, unclear regulatory frameworks for DC systems add uncertainty and risk for developers, including a lack of guidelines for certification and approval of DC installations, which became clear throughout the project. In sum, DC grids suffer from incomplete markets stemming from incomplete regulatory standards and frameworks. This subsequently causes an absence of proven business models, which in turn leads to a near-absent demand from market players, leaving DC grids invisible for most policy makers and confirming the regulatory lock-in of the mainstream AC-solution. Moreover, split incentives between grid designers and end users who eventually pay the bills of energy use, lead to suboptimal adoption rates. Therefore, most interview respondents identified it as a key achievement that the demonstrator succeeded in showcasing the viability of installing a DC-grid, including codeveloping certification and test protocols for DC installations in close collaboration with academic partners, the Distribution System Operator (DSO), and a major certification company. This helps to build a knowledge base and reduce costs and risks of subsequent projects, triggering dynamic economies of scale and contributing to the market development of DC grids.

A third crucial component of physical network is the inverters, which can be designed more resource-efficiently in a DC-grid due to reduced energy losses (DC-DC instead of

DC-AC-DC). However, the procurement stage pointed out that there is a limited supply of advanced inverters that can handle the specific requirements of DC-grids. Moreover, integrating inverters into a DC-grid with both DC and AC components can be complex, which often necessitates specialised technical knowledge, leading to higher installation and operational costs and a slower implementation of the project. From a circularity perspective, the expected lifespan of inverters is a key but very uncertain parameter, as pointed out by suppliers and experts. Therefore, ensuring consistent performance over time requires regular maintenance, as inverters are expensive to replace or repair. Markets for DC-DC inverters are mostly under development, resulting in high prices and a suboptimal pace of technological development. According to interview respondents, their proliferation mostly depends on the uptake of DC grids.

Loads

EV chargers turned out to be the most important load in this smart grid project. To grasp the benefits of the DC-grid, it would have been useful to install DC-chargers. However, at the time of the public procurement procedure, DC-chargers were insufficiently available at the market, resulting in the procurement of AC-chargers. The most pressing uncertainty of the entire project, however, boils down to the question to what extent EV chargers will be utilised, which is linked to the uptake of electrical vehicles in general, as well as the use of the parking on the Transfo site in particular. In case of a success, multiple new EV chargers could be installed that adhere to these new CE solutions (DC-grid proof, design-for-upgradeability, renewable materials). In case of failure, however, the entire business model of the smart grid will go down. We once again identify incomplete markets, which are increasingly developing into maturity along the pace of the proliferation of EV. Nevertheless, a limited supply of DC chargers will eventually lead to relatively high prices and a suboptimal pace of technological development and integration. As an enabler, interview respondents pointed at public procurement to spur market development of modular and upgradeable EV charging systems that allow for easier repair and scalability.

Energy management system

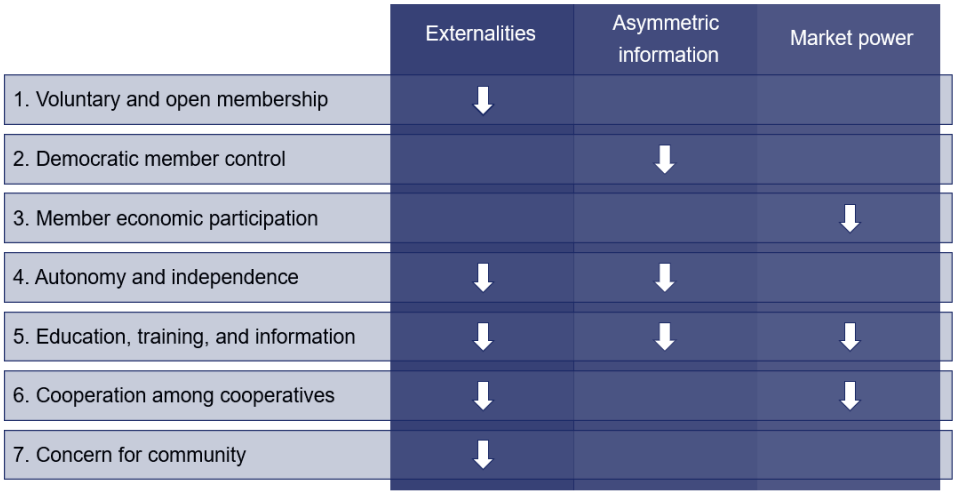
Energy management systems (EMS) enable smart grids to steer energy consumption etc., fostering circular outcomes. Firstly, EMS can optimise energy consumption by monitoring and controlling energy use in real time and adjusting energy demand in response to supply conditions. EMS can thus reduce the need for additional energy production and reduce the overall grid dimension. Secondly, EMS can extend the lifecycle of equipment by ensuring they operate within optimal parameters and predicting when maintenance is required. This enhances the longevity of the equipment and decreases the need for frequent replacements.

A first barrier, apart from its CAPEX, involves ongoing maintenance requiring dedicated contracts and agreements to keep circularity on the radar and installing upgrades to perform circularity enhancing activities over the grid lifetime. Governance problems such as principal agent problems and mission drift may render the intertemporal embeddedness of circularity goals difficult, as deducted from offers from suppliers and interviews. Secondly, end-users need to engage with the EMS system and its possibilities. Interview respondents point at the gap between user awareness and the willingness to adapt behaviours to optimise energy use. While the scope of the smart grid is currently limited to EV charging, even there, flexible and smart charging business models are, according to the supplier, less likely to be adopted compared to (higher) charging high-speed tariffs that do not take energy production into account. Adopting the possibilities of EMS to enhance circularity is therefore prone to externalities and public good characteristics of individuals sharing the responsibility to change their behaviour in relation to energy production. While EMS systems may enable peak shaving and demand control, suppliers and energy experts point out that only a few customers will be willing to adapt their behaviour accordingly as long as real-time pricing and dynamic tariffs are not or incompletely implemented.

Enablers mentioned by interview respondents include technological advancements, such as the further development of smart and integrated solutions that can automatically manage and optimise energy use, and the use of data analytics to predict and manage energy consumption patterns allowing for more efficient energy use and cost savings. This should be backed up by policy and regulatory support, providing incentives to adopt business models that promote demand-side flexibility, such as dynamic pricing and tariffs that reflect real-time energy costs. Likewise, legislation that encourages the standardisation of smart technologies and their integration into the grid can facilitate a broader adoption. Finally, community development, such as implementing cooperative models, have been suggested to provide shared smart services that are both more accessible and attractive to a wider range of users, as well as incentivizing to keep on engaging stakeholders to embrace circular solutions in the long term.

6.4.2 Stakeholder collaboration to enable and embed circular strategies

As an alternative to markets and hierarchies, cooperatives are subject to particular organisational constraints (Yildiz et al., 2015), which have been defined in the ICA statement on cooperative identity (ICA, 1995). In this subsection we answer RQ2, building upon ICA principles guiding cooperative governance and applying it to stakeholder collaboration to enable and embed circular strategies in a smart grid. Likewise, we connect it to the market failures identified in Subsection 4.1, as summarised in Figure 17.



Note: Downward arrows indicate a reduced market failure risk

Figure 17 – ICA Cooperative principles and market failures

Voluntary and open membership

Most interview respondents support open and voluntary membership for its inclusivity and community engagement, emphasizing the need for clear obligations and tangible benefits. This holds for both project partners and beneficiaries, while the latter argument is also stressed by suppliers and external experts. From a CE perspective, this principle can enhance cooperation by internalizing externalities among members. Firstly, open membership may enable those without legal, financial, or technical access to renewable energy to have access to the benefits of the energy transition. Secondly, respondents emphasise that membership should provide tangible benefits, such as access to green energy, financial stability, or returns on investment, while accounting for specific needs and interests of different groups, such as homeowners, social housing residents, and commercial entities, to foster inclusive participation and ownership. This aligns with findings from studies on energy communities (D'Adamo, Gastaldi, et al., 2024) and renewable energy cooperatives (Fleiß et al., 2017).

Thirdly, this principle encourages the identification of stakeholders and the organisation of stakeholder engagement. In the case of the Transfo smart grid, its founding partners (the municipality, the province, and the intermunicipal organisation) could be considered a natural founding members of the cooperative. This conflicts, however, with the viewpoint of some interview respondents who claim that energy cooperatives should be based on citizen-membership alone, precluding multistakeholder models. Other respondents prefer a multistakeholder setting in which

citizens, businesses, and public authorities would join as different stakeholders, each having different stakes and expectations that need to be balanced. Finally, open and voluntary membership could enhance cooperation to internalise externalities between members. More importantly, cooperative membership may be open, but does not have to be without obligation. As stated by one respondent [nr. 18]: "If you set up a cooperative, you must anchor circular goals into its statutes. If you become a member of the club, then you will have to adhere to those rules". Such membership obligations, however, can only be as strict as members are willing to commit to. Clear exit regulations are therefore an important closing piece in designing smart grid governance.

Democratic member control

While cooperative smart grid governance may involve diverse stakeholders, it remains crucial to embed CE goals in the statutes to prevent mission drift while maintaining member engagement. Firstly, many respondents highlight the importance of including a broad range of stakeholders in governance, including public authorities, companies, residents, and the wider community, to ensure a diverse representation in decision-making. Transparent communication and regular meetings with these stakeholders have been identified as essential to maintain trust and accountability. Secondly, interview respondents point out that balancing broad member involvement with efficient governance can be challenging, as democratic control by a wide variety of groups may slow down decision-making. While decoupling voting rights from financial contributions may promote inclusivity, respondents highlight that community building and cohesion is more critical for long-term member engagement than having a formal vote. A specific challenge for a smart grid cooperative is that its governance should be informed by the necessary technical expertise and competence in areas such as energy management, finance, and legal matters, which cannot always be expected to come from their members. Therefore, the board of directors should be complemented by independent individuals with relevant expertise in these areas, and democratic control should be balanced with effective leadership.

Thirdly, embedding CE goals in the cooperative's statutes and operational procedures (e.g., on procurement and maintenance) is deemed vital to prevent mission drift, as future members may consider circularity goals less relevant in the short term. In general, statutes and decision-making procedures should be aligned in such a way that members are incentivised to focus on long-term goals rather than short-term financial gains. Finally, decision-making procedures need to incentivise members to effectively monitor smart grid management. Literature on principal agent problems within cooperatives pointed out earlier that a heterogeneous membership may spur freeriding in this regard (Bauwens, 2016; Huybrechts & Mertens, 2014; Novkovic, 2008). Moreover, governance design should not overestimate the potential involvement of members in costly monitoring activities (in terms of time and effort). As pointed out by

respondent [nr. 10]: “In our cohousing project, the number of participants in the interactive sessions was large as first, but then it decreased. For me and you, energy is interesting, but this is not the case for many others.”

Member economic participation

Respondents highlight the importance of incorporating CE principles and total cost of ownership (TCO) into cooperative operations, fostering sustainable practices and proactive maintenance alongside financial incentives for members. Firstly, members who adapt their behaviour to benefit the cooperative should receive economic incentives. As stated by one respondent: “Everyone who can adjust their behaviour so that the cooperative can make more profit should have an incentive to participate and invest." [nr. 2]. While a cooperative may offer dividends or reduced energy costs for members, also non-financial returns such as a sense of ownership and pride among members may be crucial to increase the social acceptance of its activities. Secondly, balancing the need for financial viability and the social and environmental goals of the cooperative is essential for a sustainable economic participation. Therefore, ensuring a positive business case for cooperative projects is essential. Following lessons from project meetings, this involves realising economies of scale, optimizing energy production and energy use, and reducing the burden on the main grid, which requires EMS and a continuous monitoring and optimisation of the smart grid. Clear agreements and automated systems can help manage the distribution of costs and benefits, making participation easier and more transparent for members.

Finally, prospective cooperative members that would utilise the smart grid as a vehicle to maximise user value instead of financial value stress the importance of sustainable economic practices, including the incorporation of CE principles in the operations and investment strategies of the cooperative. Therefore, this principle is also interlinked with the principle of voluntary and open membership, as exemplified by one respondent: “you need members that are willing to invest, but who are also willing to reason in terms of total cost of ownership” [nr. 2]. These TCO concerns may help to internalise intertemporal externalities and engenders a smart grid governance that fosters proactive maintenance and repair.

Autonomy and independence

Respondents stress the importance of embedding CE and social goals in governance, while leveraging economies of scale to safeguard mission alignment and ensuring clear authority over CAPEX and OPEX decisions. Firstly, achieving an efficient and sustainable scale is crucial, particularly in terms of governance, accounting, and administrative overhead costs. Likewise, a minimal scale enables paid leadership positions, ensuring accountability and sustained engagement while reducing reliance on voluntary efforts that may wane over time. As illustrated by an interview respondent: “Voluntary citizens'

engagement sometimes fades. This can be demotivating for employees of cooperatives. You mainly need a strong internal organisation and someone who is paid and accountable based on budgets, financial plans, etc." [nr. 3].

Secondly, to safeguard autonomy towards powerful stakeholders, respondents point at the need of a well-defined authority of the cooperative to decide on capital expenditures (CAPEX) and operational expenditures (OPEX), and clear criteria to monitor and safeguard CE and social objectives over time. These criteria should be embedded in statutory frameworks and monitored by an aligned governance framework that mitigates the risk of mission drift. This involves a governance design that supports a long-term engagement and commitment from members and requires alignment with the first three principles discussed. Again, economies of scale are a crucial enabler for cooperatives to mitigate or resolve market failures. As stated by one respondent: "A cooperative's strength lies in the soft power: creating a large support base with many people. People can put their shoulders under energy decisions and push the market" [nr. 4].

Education, training, and information

As outlined from the start of the smart grid project and repeated by many interview respondents, a circular smart grid requires technical expertise, ongoing education, and outreach to ensure that cooperative members understand smart grid management and the mission of the cooperative. A recurring item during project meetings and interviews was that technical expertise is crucial for managing the smart grid, which cannot be expected from the members themselves, necessitating skilled professionals throughout the lifecycle of the grid. Secondly, cooperative members need to understand the importance of TCO considerations and the long-term benefits of their investment. Regular training and documentation of best practices are therefore considered vital to help members grasp both the technical aspects that need to be taken care of by professionals and the ever-evolving regulatory environment they are operating in. Thirdly, cooperative members must understand the importance of the cooperative principles to engage in a proper monitoring of its management ensuring that the cooperative remains focused on its mission.

Finally, respondents highlight the importance of outreach activities including workshops, information sessions, or interactive tools to educate the broader community about the benefits and operations of the smart grid. This aspect was also envisioned in the project from the very beginning. This way, cooperatives can partially internalise the positive externality of education if they apply an open membership model. Also non-household stakeholders refer to the importance of this principle, as illustrated by a company located at the site: "We tell our customers the story of this circular smart grid, but we want to be involved to be able to tell it correctly and ensure that people can tell their friends and relatives: wow, it is impressive that circularity and

energy are taken care of so properly here" [nr. 12]. Another respondent, working at the municipality states this as follows: "We want to explain what we do on the site and how it is implemented to other departments and applications within our organisation, and we and our colleagues learn also useful lessons we can apply in our own homes" [nr. 23b].

Cooperation among cooperatives

Interview respondents stress the importance of collaboration among cooperatives to achieve economies of scale, reducing overhead costs, and acquiring access to technical, financial, and legal skills and knowledge. A multilevel organisational structure would be welcomed, as recurrently pointed out during project meetings, combining a locally embedded organisation with a larger cooperative network. As illustrated by one respondent: "When scaling, make sure that you never lose the link with your base and prevent the deployment of a Mexican army, with many people in the office and no bond in the field" [nr. 18]. Partnerships envisioned among interview respondents include other (energy) cooperatives as well as public sector stakeholders, academic institutions, and specialised service producers with whom a long-term collaboration is necessary to achieve circular outcomes. Furthermore, interview respondents involved in the development of the Transfo demonstrator project claim to be open to sharing best practices and lessons learned with other cooperative and non-cooperative networks as to minimise their learning curve.

Concern for community

Interview respondents often point out they would like the smart grid to provide access to low-income households at beneficial conditions. This was also addressed during a workshop with stakeholders of the Transfo site. Many interview respondents are aware that energy cooperatives tend to attract higher-educated and better-earning households while the smart grid encompasses a potential to create value for households in energy poverty or lacking financial, technical, or legal access to renewables on their own roof. Once more, interview respondents refer to the importance of educational pathways to engage and inform all community members. As stated by one respondent: "the knowledge we develop on the site should be translated to the wider community, allowing them to deal with their installations in a more smart and circular way" [nr. 3]. Another pathway, mentioned by some respondents, is creating a fund for social projects, or collaborating with social organisations. This, however, requires the smart grid to be financially viable in the first place.

6.4.3 Fostering the uptake of circular smart grids

In this subsection, we explore design-implementation gaps and identify conditions for scaling and replication, answering RQ3.

Design-implementation gaps

To move from 'circular utopia' and 'circular paralysis' towards a circular economy and society, it is important to understand design-implementation gaps (Bocken et al., 2023).

First, the implementation of this project faced significant delays due to the COVID-19 pandemic, particularly affecting the procurement of key technologies. Secondly, the project was unable to utilise a regulatory sandbox due to lack of support from key energy industry stakeholders, resulting in a prolonged negotiation process involving the Flemish Energy Agency, the Flanders Energy Regulator, and the DSO. Ultimately, the project team negotiated a solution with the DSO to construct and maintain the network as a test bed for DC circuits for ten years (Leiedal, 2024). Thirdly, legislative hurdles complicated the project, such as the Flemish decree on energy communities (2021) that created financial disincentives for electricity sharing (Leiedal, 2024). This forced the project to seek cooperation with an existing energy cooperative to sustain operations. However, a combination of high initial investment costs, coupled with unclear financial returns and institutional uncertainty, deterred stakeholder commitment.

Fourth, the project faced a lack of market maturity for many CE solutions. As an illustration, procurement procedures explicitly rewarding offerings applying circular strategies did not turn out in any offering involving PV reuse. Finally, while interview respondents agree that energy cooperatives could partially resolve split incentives and embed circularity goals, a lack of stakeholder engagement from regulatory bodies and a resulting lack of economic involvement from potential users was a major reason for not establishing a cooperative at the Transfo site. Site-based companies expressed interest in participating but the engagement of private households remained limited to non-existent. As smart grid development often develops along an incremental process (Kumar, 2019), future developments may help to increase its scope. Reflections on the project highlight the missed opportunity of involving the DSO and a regional REScoop from the outset, which could have enhanced stakeholder participation and the overall success of the project (Leiedal, 2024).

Scaling and replication

Given the current suboptimal scale of the Transfo project, interview respondents were asked to reflect on pathways to scale the smart grid. Firstly, a major barrier for scaling, being a common thread throughout the project and referred to by many interview

respondents, is the current Flemish decree on energy-sharing which precludes any further scaling that incentivises residents and site users to participate. A revision of this decree would create multiple ways to scale the smart grid towards a broader set of users and applications. Anyhow, multiple locally embedded stakeholders underline their interest to participate in such a setting. A second scaling pathway is incorporating heat management into the smart grid. However, characteristics of the heritage site, and path dependencies following from earlier architectural decisions and choices regarding the distribution of property rights precluded the inclusion of heat management into its scope. Nevertheless, the inclusion of a CHP in the smart grid could leave room for future optimisation. A third pathway involves the development of strong partnerships with energy companies, suppliers, technology firms, and academic partners to develop new projects on this site while securing resources and expertise. Some project stakeholders likewise see the smart grid as a potential hub to include larger sustainability and community benefits. Finally, the establishment of a community centre for education and engagement to inform and inspire the general public on energy use and circularity is envisioned to leverage the impact of this smart grid demonstrator beyond its local community.

Concerning replication, this case calls for caution. Following on lengthy discussions during project meetings and interviews, it is important to assess the financial and technical performance of the current system thoroughly before replicating this model. Nevertheless, the availability of detailed project documentation, including tender documents and blueprints that outline CE principles and technical requirements, helps to develop dynamic economies of scale. Individual project stakeholders likewise benefitted from this demonstrator project, building upon experiences in developing testing and certification protocols for DC grids, or learning from the importance of early and consistent stakeholder involvement to align expectations and timely address potential issues. Other suggestions include the creation of a knowledge database to collect best practices on circular smart grids, and the design of a conceptual format that can be adapted to local conditions and requirements. Nevertheless, the development of robust legal and contractual frameworks, including a sound alignment with energy grid governance partners (DSO, TSO, etc.) and public authorities, is considered as a key condition for further replication of this model.

6.5 Discussion and conclusions

In this paper, we identify barriers and enablers to foster circular outcomes in a smart grid (RQ1). Next, we explain how cooperative stakeholder governance helps to enable and embed circularity goals in a smart grid (RQ2). We base ourselves on a case study, drawing lesson for the uptake of circular strategies in smart grids (RQ3). In this section, we discuss the empirical contributions of our study, followed by its policy implications, as well as the limitations and accompanying recommendations for future research.

6.5.1 Empirical contributions

Our first contribution to the literature follows from connecting experiences with designing and implementing circular smart grid strategies explicitly to market failure theory. This helps to gain a deeper understanding of the barriers to implement circular strategies in the complex sociotechnical environment of a smart grid. In Table 22, we provide a summary of the main market failures involved in implementing reuse and repurpose strategies for distributed energy generation and storage, in rethinking smart grid design by implementing a DC grid, and by reducing energy and recourse use through an EMS. For each aspect, we reference the relevant literature where our empirical findings extend existing insights through this analytical lens. Our results identify market failures and how they could be resolved by means of cooperative stakeholder collaboration, such as reducing intertemporal externalities, split incentives, agency problems, and behavioural externalities of members.

Our second contribution is applying a market failure and cooperative governance lens to identify the areas where cooperative governance can address market failures in circular smart grid development, and where their impact is limited, which is a novel contribution to both the literature on smart grids (Kojonsaari & Palm, 2023; Wolsink, 2024) as on cooperatives (Huybrechts & Mertens, 2014; Novkovic, 2022; Spear, 2000; Ziegler, Poirier, et al., 2023). While previous work highlighted the potential of cooperatives to resolve market failures in general (Hansmann, 1999; Novkovic, 2008; Spear, 2000), or regarding the uptake of renewable energy in particular (Huybrechts & Mertens, 2014; Van Opstal, Bocken, et al., 2025a), this study adds to the literature an explicit connection with circular strategies.

Table 22 – Circular smart grid strategies, market failures, and literature this study contributes to

CE strategy	Externalities	Asymmetric information	Market power	Literature
Reuse or repurpose distributed energy generation (solar PV and CHP) or storage (EV batteries)	Environmental and social externalities of virgin materials are unaccounted for. Intertemporal externalities as decision-makers focus on CAPEX and neglect TCO considerations.	Lack of information on remaining qualities. Incomplete markets: lack of warranties and matchmaking between demand and supply.	Concentration of market power limits the uptake of reuse markets.	(Baars et al., 2021; J. Chen et al., 2023; Hu et al., 2024; Kastanaki & Giannis, 2023; Mendoza & Pigosso, 2023; Nyffenegger et al., 2024; Rabaia et al., 2024; Radavičius et al., 2021; Strupeit et al., 2024; Temiz & Dincer, 2023; Thomas & Mishra, 2022; Tsanakas et al., 2020; Van Opstal & Manshoven, 2024; Van Opstal & Smeets, 2023a)
Rethink the smart grid configuration by installing a DC grid	Split incentives between those who decide, pay, and use the grid.	Lack of experience with DC-grids (no dynamic economies of scale), resulting in incomplete markets.	Incomplete markets stemming from path dependency towards AC-grids and a subsequential institutional lock-in.	(Azaioud et al., 2021, 2023, 2024; Cleenwerck et al., 2023; Kojonsaari & Palm, 2023; Wolsink, 2012, 2024)
Reducing energy and resource use through an EMS	Behavioural externalities on peak consumption, leading to a limited willingness to adopt demand control systems. Intertemporal externalities as decision-makers focus on CAPEX and neglect TCO considerations.	Agency problems following from a lack of legitimacy on who is ought to control the system, including privacy concerns.		(Alrashed, 2020; de Reuver et al., 2016; Engels & Münch, 2015; Hamwi & Lizarralde, 2017; Hotaling et al., 2021; Kojonsaari & Palm, 2023; Lammers & Heldeweg, 2016; Sovacool et al., 2017; Tarasova & Rohracher, 2023; Wolsink, 2012, 2024; Xie et al., 2024)

In Table 23 we report the market failure mitigating potential of these principles and highlight practical considerations. These considerations stem from lessons learned from the Transfo project and help to explain the design-implementation gap. In this case, regulatory barriers resulted in a lacking viable business case, causing failure on

achieving the 3rd and 4th ICA principle, which in turn rendered the first two principles redundant. This contributes to a deeper understanding of the interdependencies among these principles, particularly in the context of a complex sociotechnical system.

Table 23 – ICA principles and market failures: mitigating potential and practical considerations

ICA Principle	Mitigating potential	Practical considerations
1. Voluntary and open membership	Investing in community acceptance by inviting stakeholders to participate, enabling an internalisation of externalities.	Stakeholders should be eligible and incentivised to participate, aligned with statutory obligations and exit rules.
2. Democratic member control	Promoting transparency and trust, and investing in social capital development, reducing agency problems and improving capabilities for collective action.	Incentivise members to exert costly monitoring, reducing agency problems. Need for aligned goals which is challenging under heterogeneous membership.
3. Member economic participation	Investing in the economic viability of the cooperative by maintaining a strong transaction relation with members.	Need for a viable business case, providing a compelling value proposition based on user needs, supported by a regulatory framework allowing to deliver this value.
4. Autonomy and independence	Organisational design and development to embed a focus on user value instead of investor value, preventing mission drift.	Need for a sufficient scale to cover organisational costs.
5. Education, training, and information	Internalising positive externalities by educating members on circular and cooperative principles, reducing agency problems, and promoting cooperative behaviour to enable collective action.	Identification of a clear 'community of place' or 'community of need' addressing the basin of attraction of potential members to mobilise towards collective action.
6. Cooperation among cooperatives	Developing external and dynamic economies of scale to organise market formation, countervailing power, and internalise externalities.	Identify similar innovative projects to share experiences with and learn how to develop external economies of scale to break through an institutional lock-in.
7. Concern for community	Internalising externalities at the community level through membership governance.	Connecting to local communities is crucial to identify community needs and translate them into cooperative value propositions.

Given the globalised value chains of renewables, the comparability of their technologies and implementation challenges in industrialised countries, and the international scope and experience of relevant interview respondents, this analysis in Table 22 is applicable to a broad geographical area. Additionally, the considerations mentioned in Table 23 help to understand barriers and enablers documented by other smart grid projects in multiple countries. Examples include the importance of clear governance rules and

compelling value propositions (D. Brown et al., 2024), of aligning incentives (Lammers & Hoppe, 2019), and of aligning implicit and explicit projects goals among members with multiple interests (de Wildt et al., 2019; Verkade & Höffken, 2018). Given the global relevance of the ICA framework, this framework can be easily applied to most other industrialised countries and regions.

6.5.2 Policy implications

Climate change, energy dependencies, and challenges stemming from the proliferation of renewables, such as upcoming waste problems and critical material dependencies, call for circular solutions when designing energy systems. Designing and implementing smart grids holds potential for envisioning strategies to slow and narrow material loops, both at the component level and the system level. It also touches upon multiple SDGs, including 'affordable and clean energy' (SDG 7), 'responsible consumption and production' (SDG 12), and 'climate action' (SDG 13). Moreover, the application of circular strategies to smart grids may foster 'sustainable cities and communities' (SDG 11) while stimulating a sustainable 'industry, innovation, and infrastructure (SDG 9), at least when designed and governed in an inclusive and resource-efficient way.

Our analysis shows that deploying circular strategies in smart grids faces multiple market failures. Policies should therefore address environmental and social externalities of virgin products, components, and materials to support reuse markets. Policy instruments such as true price models, and mandatory trade regulations, including product standards for technology imports, could facilitate this. Intertemporal externalities could be addressed by incentivizing value chain partners to align business models with TCO concerns, such as mandatory regulations on repairability and upgradeability of smart grid components, or product-as-a-service systems. To tackle asymmetric information and incomplete markets, policies should focus on connecting supply and demand in reuse markets, facilitated by digital data platforms, and developing testing protocols and warranties. Likewise, digital product passports, containing digital documentation for components such as batteries, and PV panels, help address asymmetric information, facilitating the development of secondary markets and enhancing knowledge management to ensure sustainable smart grid operations over time. Additionally, policymakers should be aware of institutional lock-in, which can hinder innovation, as is the case in the development of DC-grids. Therefore, it is important for policymakers, as well as regulatory and supporting ecosystems, to capture lessons proactively from innovation projects funded by multiple governmental levels. Mitigating these market failures will contribute to a future-proof industry, innovation, and infrastructure (SDG 9).

An important lesson from the Transfo project is the need for joint innovation projects by cooperatives and their regulating energy ecosystem to identify specific regulatory barriers and challenges while developing value propositions in close connection with

the communities they aim to serve. Both transmission and distribution system operators (TSO and DSO) would benefit from collaborations in grid innovation projects to pilot innovative technologies. This would help to establish technical standards that ensure compatibility and allow for market development of new technologies. Regulatory sandboxes are crucial to create experimental regulatory environments that allow to test circular strategies and grid innovations such as DC grids, second-life components, or advanced energy management systems involving multiple stakeholders. Community involvement in these projects is also important, given the significance of early engagement with citizens and communities in infrastructure projects (Boyle et al., 2025). This is particularly relevant in an era where the introduction of dynamic pricing and demand response systems may support the development of circular business models in the energy market, as households will be increasingly called upon their responsibility towards the use of grid infrastructure. Municipalities and local governments may play a pivotal role in fostering community participation, as well as lead by example by incorporating circular energy solutions into public buildings and schools.

Local and regional governments can actively support the development of cooperatives to address market failures and enhance the governance of multistakeholder smart grid projects. Cooperatives uniquely align economic and social goals by encouraging active participation from members as both users and owners. By leveraging trust and collective interests, cooperatives bridge cognitive gaps between energy generation and consumption, incentivising local stakeholders to engage with decentralised energy systems (Rupp et al., 2025). Policymakers should provide financial support, technical guidance, and capacity-building initiatives to establish cooperatives that are grounded in CE principles. Regulatory frameworks must thereby differentiate between genuinely community-oriented cooperatives and profit-oriented 'cooperatives of convenience', sometimes referred to as FINcoops (Van Opstal, Bocken, et al., 2025a), ensuring support is directed toward organisations that embed sustainability and inclusivity in their operations (D. Tarhan, 2025).

Scaling and replicating circular smart grids require targeted interventions to address regulatory barriers and support cooperative innovations. For example, for the Transfo site, revising energy-sharing regulations, such as the Flemish decree on energy communities, is a critical first step to incentivise shared energy use and cooperative ownership models. Simplifying these frameworks can encourage broader participation and create viable pathways for cooperatives to expand their activities. Beyond regulatory reform, governments should document and disseminate best practices from pilot projects to provide replicable models for diverse contexts. Meanwhile, existing energy cooperatives could be supported in the development of innovative activities that go beyond their core activities, but which remain within current regulatory boundaries. This would also enhance the agility and resilience of these cooperatives to adapt to evolving subsidy schemes, economic conditions, and technological developments, as

called for by (Nolden et al., 2020). It would also enable scale-out and scale-deep strategies (versus scale-up strategies) focused on broadening the diversity of services offered to the same target audience and improving processes to enhance the impact on beneficiaries, respectively, which have been identified as suitable scaling strategies for general interest cooperatives such as REScoops (Bauwens, Huybrechts, et al., 2020). This is important, as REScoops struggle to break out of their niches, largely due to their reliance on volunteers for management and operations. This calls for supporting the development of second-tier cooperative networks can further enhance resource sharing, governance efficiency, and the ability to scale innovative solutions across regions (Boucher & Pigeon, 2024).

Furthermore, it is important to realise that innovative cooperative smart grid projects are most likely to attract community members with high interests in technology (Bauwens, 2016), which may lead to a risk of overlooking broader community needs the cooperative could address. This may also increase socio-economic disparities, mostly paying attention to the needs of a technophile middle class (de Wildt et al., 2019; Rommel et al., 2018) or even generating forms of energy elitism (Jacobs & Owen, 2023), hindering affordable and clean energy (SDG 7) for all groups in society. To ensure cooperatives can contribute effectively to a circular society, they must be able to attract diverse societal groups, even when this further complicates decision-making processes. This requires that members from diverse backgrounds should perceive a direct economic advantage to participate (Caferra et al., 2024). Moreover, as there is no automatic link between the theoretical assets of an organisational model and its diffusion, both cooperatives and policymakers should invest in increasing the normative and cognitive legitimacy of cooperatives (Huybrechts & Mertens, 2014). This involves educational programmes and public awareness campaigns that highlight the benefits of this model for all groups in society. It also requires transparent governance processes and active community involvement in the planning and operations of the cooperative, involving these groups from the very beginning. This could foster social acceptance that this organisational model can serve community needs and generate trust, reducing the risk premium of investing in circular strategies (Van Opstal & Manshoven, 2024).

Effective management mechanisms are critical to embedding CE principles in smart grid projects. Firstly, EMS are crucial for optimising demand-supply dynamics, enabling predictive maintenance, and fostering user engagement, all of which contribute to extending equipment lifecycles and mitigating waste. Secondly, integrating distributed energy resources, such as second-life batteries and renewable energy systems, requires leadership that promotes modularity, reuse, and circular procurement practices, while addressing regulatory barriers such as unclear standards for DC grids. Thirdly, education and training initiatives are critical for ensuring technical understanding among members and engaging the broader community. Additionally, the creation of detailed documentation, including tender documents and blueprints, facilitates scalability and replication by providing a reference for future projects.

Finally, effective governance is fundamental to the success of circular smart grid cooperatives. Transparent decision-making processes, inclusivity, and robust accountability mechanisms build trust and foster long-term member engagement. Embedding CE principles into cooperative statutes and operations is essential to align short-term actions with long-term sustainability goals and prevent mission drift. To monitor and evaluate progress, cooperatives should adopt KPIs that measure material circularity, energy efficiency, and social inclusivity. Metrics such as material reuse rates, energy loss reduction, membership diversity, and financial savings for members provide actionable insights into the overall performance of the cooperative. Regular reporting on these KPIs can also enhance transparency and accountability while providing valuable data for adaptive learning. Governments and regulatory authorities could mandate the use of such KPIs, ensuring cooperatives align their activities with broader policy goals and maintain their focus on delivering equitable and sustainable outcomes.

6.5.3 Limitations and recommendations for further research

Limitations of this work include that is based on a single case study, which encountered multiple barriers to implement its initial ambitions, including the development of a full-scaled operational cooperative. While our focus on a single case study that lasted for more than 4 years allows to capture many project and process dynamics, future research would be welcomed to validate lessons learned in other geographies with different regulatory environments and stakeholder configurations involved. The regulatory context of Belgium, in this case, consists of a rich and multi-layered institutional ecosystem with multiple complementary actors that sometimes fail to develop, implement, and retain consistent and coherent energy policies (Van Opstal & Manshoven, 2024). Therefore, we believe that lessons drawn from this region are relevant for many European countries that operate under similar or less complex legislative conditions and path dependencies. Nevertheless, as highlighted by Bauwens et al. (Bauwens et al., 2024) and Kojonsaari & Palm (Kojonsaari & Palm, 2023), further research exploring broader geographic perspectives in this field, more particularly in the Global South, would be highly valuable.

While the present paper contributes by applying theoretical insights from market failure theory and cooperative theory to address challenges in the dual transition within the complex sociotechnical configuration of smart grids, these theoretical frameworks have inherent limitations. Firstly, examining market failures may involve accepting significant blind spots associated with the assumption that market can align with a circular transition. As noted by Siderius & Zink (Siderius & Zink, 2023), markets inherently assume infinite growth, often incentivise practices that undermine material circularity and product durability, and may distort value as failing to fully account the worth of materials, resources, products, and labour within market prices. Secondly,

although the conceptual framework of the ICA principles has demonstrated its applicability and value in studying cooperative governance (Huybrechts & Mertens, 2014; Novkovic, 2022), its practical implementation often falls short of its idealtypical representation.

As smart grids are sociotechnical and incremental grids, they can only be truly smart when there are people within it, as indicated earlier by (Kojonsaari & Palm, 2023) and (Kumar, 2019). Therefore, follow-up research on this case would be relevant to capture the dynamic evolution of implicit and explicit expectations of stakeholders involved, as well as their commitment to the initial CE ambitions of the project. Finally, while our research connects to the broader research agenda on the development circular societies, future research is required to address just transition aspects of a combined transition towards renewable and circular energy systems. An empirically informed comparative institutional analysis of different governance systems, including cooperatives, non-profit associations, private companies, and public sector organisations, would be welcomed in that respect.

Finally, this research highlights several avenues for future investigation. Firstly, further research is needed on regulatory sandboxes for circular smart grids to examine how adaptive regulations can facilitate experimentation with new technologies, business models, and governance approaches while maintaining grid safety. Studying regulatory sandboxes also necessitates developing insights into overcoming institutional lock-ins and path dependencies arising from existing regulatory and market practices. Secondly, research into the behavioural economics of integrating circularity ambitions into smart grid participation is crucial. This includes exploring how dynamic pricing, demand-response mechanisms, and cooperative incentives shape user behaviours over time, particularly in encouraging circular practices such as energy sharing, reuse, and demand flexibility. Likewise, the role of cooperative innovations in EMS warrants investigation. This could focus on how cooperatives can leverage EMS to optimise energy demand, enable predictive maintenance, and extend system longevity while fostering trust and transparency among members. Finally, more research is needed on barriers and enablers that define the scalability and replication of cooperative smart grids across diverse geographical and regulatory contexts.

7. Enabling and embedding circularity goals in housing cooperatives

Based on:

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Abstract

Shifting towards a circular economy in the built environment is considered an important step toward fostering environmentally sustainable and socially resilient cities. Housing cooperatives, established to provide affordable and democratically governed housing, may offer structural advantages for embedding circularity - but their role in circular transitions remains underexplored. This study investigates how cooperative governance may influence the implementation of circular strategies, including circular design, product-service systems, and shared resource models, across different housing types. Drawing on semi-structured interviews with housing professionals, cooperative representatives, service providers, and policymakers, we assess the comparative institutional advantages and limitations of cooperatives in enabling circular transitions. Our findings indicate that housing cooperatives can mitigate market failures and overcome split incentives through collective ownership, long-term planning, and participatory governance. These features help facilitate lifecycle-based investments, bundled procurement, and shared infrastructure. However, cooperatives also face key challenges, including complex decision-making, limited access to finance, and regulatory barriers. This paper contributes to the understanding of alternative housing models for urban sustainability by offering insights into how cooperative-led initiatives can support circular innovation. It identifies boundary conditions for aligning stakeholder perspectives and embedding circular strategies within cooperative housing, helping to inform inclusive, community-based responses to climate and resource challenges.

Keywords: governance; circular economy; circular society; circular business models; market failures; just transition

7.1 Introduction

Housing plays a critical role in the transition to a CE, given its significant environmental footprint. The construction and operation of buildings account for over 40% of total waste by volume and represent the largest share of global resource consumption (Circle Economy, 2024a). Recognising this impact, the Circular Economy Action Plan of the European Commission has identified the building sector as a priority area for circular interventions (European Commission, 2020b). As one of the four key urban systems, alongside mobility, products, and food, housing is pivotal in addressing resource efficiency and emissions reduction (Marchesi & Tweed, 2021). However, transitioning to circular housing requires a broader perspective that extends beyond material and technological innovations to include social and governance dimensions. This is especially relevant as affordable housing has been globally recognised as a critical hotspot in sustainable housing, as acknowledged in Sustainable Development Goal 11.1 (United Nations, 2020). Sustainable consumption and production approaches for cities therefore highlight the necessity of engaging non-traditional stakeholders, such as citizen groups, social initiatives, and informal sector representatives, in urban planning and decision-making (Schröder et al., 2019). Social aspects of housing circularity, however, remain relatively underexplored (Vanhuyse et al., 2021).

Housing cooperatives have been established as a model to foster investments in affordable housing, with specific attention to democratic governance and strong stakeholder participation (Türeli, 2022). They are defined as autonomous organisations, collectively owned and democratically governed by their members (ICA, 2012). This means that residents voluntarily unite and purchase shares in the cooperative, granting them specific rights to a dwelling within the cooperative without acquiring ownership of an individual property. Housing cooperatives exist across all continents, though their prevalence and structures vary significantly within and across regions (Lang & Stoeger, 2018). Many operate under rental-based models, where cooperative members receive a discount depending on the number of shares they hold, while other models allow residents to become homeowners (Khatibi, 2023). This housing form is sometimes referred to as a ‘third’ form of housing, offering an alternative to conventional homeownership and rental models, including social housing (Ahedo et al., 2023), or as an alternative to both the capitalist market economy and the state (Brysch et al., 2024).

Housing cooperatives can contribute to a just transition by investing in renewable energy (Lukkarinen et al., 2022) and by translating principles of participatory and distributional justice into possibilities of affordable housing for a broad range of income groups, cultures, and age groups (Aernouts & Ryckewaert, 2019). The way housing cooperatives may enable or embed circular strategies, however, remains a research gap. In this paper, we explore the comparative organisational advantages and disadvantages of housing cooperatives to enable and embed circular strategies. These circular

strategies include design-related strategies, circular business models that address total cost of ownership considerations, such as as-a-service models, and sharing models implemented among cooperative members. We consider different housing types and account for stakeholder engagement and alignment, which can be considered key in designing ethical CE interventions in the built environment (Rios et al., 2022). Therefore, we conducted semi-structured interviews with 23 professionals involved in the development, operationalisation, or evaluation of housing cooperatives or housing-related circular strategies. This enables us to investigate how housing cooperatives can enable and embed circularity goals, structured around the following (sub)research questions:

- RQ1: How can cooperative governance influence the implementation of circular strategies in housing?
- RQ2: How does this cooperative difference relate to different circular strategies in different housing types?
- RQ3: How can housing cooperatives align stakeholder positions to implement circular strategies?
- RQ4: What are comparative institutional (dis)advantages of housing cooperatives compared to traditional alternatives in implementing circular strategies?

Belgium provides a relevant setting for this study, as cooperative housing remains a niche model rather than the default housing option, allowing for an external perspective on its potential and limitations in enabling circular housing solutions. Meanwhile, Belgium can be considered as a frontrunner in adopting circular strategies (Claudio-Quiroga & Poza, 2024; D'Adamo, Favari, et al., 2024). By addressing the institutional conditions shaping cooperative circular housing models, this research contributes to broader debates on governance, economic viability, and regulatory frameworks in the circular built environment.

The rest of this paper is structured as follows. In Section 7.2, we provide background information on housing and the CE, on the role of cooperatives and the circular transition, and on the research gaps we address. In Section 7.3, we discuss our methods and materials, including the conceptual and empirical framework of this study. In Section 7.4 we present our results, and in Section 7.5 we discuss the empirical contributions, policy implications, and limitations of this work.

7.2 Literature

7.2.1 Housing and the circular economy

The transition to a circular housing economy requires systemic change across design, business models, and social practices. A circular transition in housing involves a shift from resource-intensive construction and individual ownership models to approaches

that prioritise material efficiency, longevity, and shared use. Design principles are central to enabling circularity in housing. Standardisation of building components facilitates reuse, while design for disassembly and modularity ensures that materials and structures can be repurposed rather than discarded (Arora et al., 2019; Kedir et al., 2023). Procurement policies and building codes that promote recyclability and remanufacturing can further embed circularity in the built environment (Adabre et al., 2022). Additionally, digital tools such as material passports, housing passports, and building information modelling support circular design by improving material traceability and enabling informed decision-making across the construction and renovation phases (Çetin et al., 2022, 2023; Keena et al., 2025). Beyond material considerations, design-related circularity in housing also involves the adaptive reuse of buildings to respond to evolving societal needs. Repurposing large homes into multiple smaller units can extend the functional lifespan of buildings, reducing the need for new construction while answering changing urban needs (Çimen, 2021). Proper design allowing for retrofitting, materials reuse, and recycling can save money and reduce environmental impacts (de Feijter, 2023; Galle et al., 2021), as well as increase the value of properties (Suzuki & Shibata, 2022).

A complementary approach to promote circularity in buildings is shifting from ownership-based housing models to Product-Service Systems (PSS) (Tukker, 2015). In a PSS model, housing-related assets - such as kitchens, façades, or heating systems - are provided as services rather than products, potentially extending product lifetimes and reducing material consumption (Ghafoor et al., 2024). PSS can promote efficiency, longevity and sufficiency in energy, material and space usage levels (Ghafoor et al., 2023). By aligning financial incentives with long-term performance, PSS encourages maintenance, refurbishment, and reuse rather than premature replacement. Performance-based contracts, such as on solar photovoltaics, allow providers to retain ownership of materials, ensuring their optimal use and recovery (Mont, 2002; Van Opstal & Smeets, 2023a). However, poorly implemented PSS models risk rebound effects, where increased service availability leads to higher overall resource use (Ackermann & Tunn, 2024; Kjaer et al., 2019). Careful design of service contracts and regulatory oversight is therefore necessary to maximise the circular potential of PSS in housing.

A third approach, sharing, touches upon the crossroads between design and social practices. It may involve shared living spaces, as in co-housing and mixed-use buildings, reducing the need for redundant construction and minimising material demand (Christis et al., 2019). Furthermore, it may include short-term service models, such as sharing tools and equipment, or cars and bicycles (Encarnación et al., 2024; Marchesi & Tweed, 2021). Sharing models offer circular benefits by reducing material and energy consumption per capita (Cherry & Pidgeon, 2018; Cuomo et al., 2021). Digital platforms and smart technologies can further support shared housing models by enabling flexible access to communal spaces and resources (Tunn et al., 2020). However, the success of

such initiatives depends on social acceptance and governance structures that enable mutual trust, ensure equitable access, and replicate dynamics that have been taken-for-granted by many generations in informal economies (Holmes, 2018).

7.2.2 Cooperatives and the circular transition

Cooperatives have long played an important role in fostering economic and social resilience, particularly in addressing common-pool resource challenges and market failures (Van Opstal, Bocken, et al., 2025b). Historically, cooperative structures have evolved from guilds, mutual aid societies, and indigenous forms of resource governance, demonstrating the fundamental role of collective organisation in achieving shared goals (Mayer, 2018; Ward, 1995). In modern economies, cooperatives are well-established across diverse sectors, including agriculture, finance, energy, and housing, providing alternatives to investor-owned firms (Hansmann, 1999; Novkovic, 2022). The International Cooperative Alliance (ICA) has formalised a set of cooperative principles that underpin their governance and operations, ensuring that cooperatives remain accountable to their members rather than external shareholders (ICA, 1995). These principles align with broader objectives of sustainability and inclusivity, making cooperatives an organisational form worthwhile to investigate in search of a circular transition (Van Opstal, Bocken, et al., 2025a; Ziegler, Poirier, et al., 2023). As a circular transition requires systemic change, involving collaboration among multiple stakeholders, including consumers, businesses, policymakers, and civil society actors (Schröder et al., 2019), the cooperative model may offer institutional advantages that align with circular objectives. Cooperatives prioritise collective ownership, resource pooling, and democratic governance, enabling the prioritisation of long-term sustainability over short-term profit maximisation (Novkovic, 2008). Moreover, their embeddedness in local communities allows them to foster circularity in regional economies, strengthening socio-economic resilience (Bretos & Marcuello, 2017).

Empirical studies highlight advantages of cooperatives in enabling circularity. For example, recycling cooperatives have been instrumental in integrating informal waste pickers into formal waste management systems, enhancing both social equity and material recovery efficiency (Buch et al., 2021; Valencia, Solíz, et al., 2023). Agro-industrial cooperatives have also demonstrated potential in closing resource loops through symbiotic industrial processes and waste valorisation strategies (Barros et al., 2023). The commitment of cooperatives to member benefits and joint-user value instead of profit-maximisation helps to focus on long-term community goals and reinvesting profits into sustainable initiatives, distinguishing them from conventional firms that often prioritise shareholder returns (Baranchenko & Oglethorpe, 2012; Lafont et al., 2023).

However, cooperatives also face structural constraints. On the one hand, some challenges arise from inherent characteristics of cooperatives, including complexities

following from democratic decision-making processes and specific challenges such as the 'horizon problem,' which occurs when a member's residual claim on an asset is shorter than the life of the asset; 'free-rider problems' stemming from joint asset ownership; and the risk of 'demutualisation,' where growth may lead to a dilution of cooperative identity and member commitment (Novkovic, 2008). On the other hand, cooperatives also face external constraints linked to market structures, financial systems, and regulatory frameworks that are designed around investor-owned enterprises. As cooperatives do not always align with these dominant institutional logics, they may encounter barriers to accessing capital, policy support, and market integration, which can limit their scalability and long-term viability (Royer, 2023).

Recent academic work on circular societies suggests that circular transitions must go beyond technological solutions and embrace governance models that prioritise participatory decision-making and economic decentralisation (Bauwens, Hekkert, et al., 2020; Jaeger-Erben et al., 2021). In this context, cooperatives offer a viable institutional framework for embedding circularity in local economies by enabling shared ownership models, reducing market-driven pressures, and fostering democratic participation (Limnios et al., 2018; Puusa et al., 2013). Their ability to internalise externalities, reduce transaction costs, generate economies of scale, and enhance social cohesion render cooperatives a promising organisational model for advancing a circular economy and society (Huybrechts & Mertens, 2014; Ziegler, Poirier, et al., 2023).

7.2.3 Research gap

Despite the growing attention to the CE in the built environment, limited research has explored how cooperative governance structures facilitate or hinder the implementation of circular strategies in housing. This is particularly relevant given the importance of user needs and governance in sustainable housing (Adefila et al., 2020). While previous studies have recognised the role of social housing communities in CE transitions (Marchesi & Tweed, 2021), bottom-up cooperative initiatives remain understudied.

Therefore, we address four research gaps. *Firstly*, by investigating how cooperative governance fosters or challenges circular strategies in housing, this research complements existing literature that predominantly focuses on investor-driven CE initiatives (Geissdoerfer et al., 2023; Hina et al., 2022; Lüdeke-Freund et al., 2019).

Secondly, the relationship between cooperative governance and different circular strategies in various housing types also remains unexplored. Housing typologies play a significant role in determining the environmental and material implications of circular construction and renovation (Soonsawad et al., 2024). However, the cooperative model introduces additional complexities, as different governance structures may influence the feasibility and effectiveness of certain CE interventions.

A *third* research gap concerns whether and how housing cooperatives align stakeholder positions to implement circular strategies effectively. Circular business models in housing require the engagement of multiple stakeholders, including residents, local authorities, financial institutions, and service providers (Ghafoor et al., 2024). However, stakeholders often have divergent priorities, with cooperatives seeking to balance economic sustainability with social and environmental goals, while external actors may prioritise financial returns or regulatory compliance (Schröder et al., 2019).

Finally, little is known about the comparative institutional (dis)advantages and disadvantages of cooperatives in implementing circular housing strategies, compared to commercial real-estate companies, social housing associations, and public authorities. This comparative perspective is crucial, as cooperative housing models often struggle against conventional homeownership due to entrenched financial and policy frameworks favouring individual ownership (Galle et al., 2021).

7.3 Methods and materials

7.3.1 Conceptual framework

Housing cooperatives typically focus on ensuring long-term affordability by sharing ownership and management responsibilities while prioritising user-value over profit-driven motives. They are fundamentally defined by shared ownership and governance of physical infrastructure, a legal framework, and collective economic responsibility (Avilla-Royo et al., 2021). Moreover, the model of housing cooperatives is distinguished by its adherence to cooperative principles as a governance framework and is often designed to provide affordable, sustainable, and community-oriented housing solutions (Cooperative Housing International, 2024).

Cooperatives, rely on a set of organisational governance principles, defined by the International Cooperative Alliance (ICA) (see Table 24) that define the cooperative difference compared to other organisational forms (ICA, 1995). Cooperative members wear multiple hats, being both owners and users of the firm, which reduces the costs of market contracting under market failures while keeping costs of ownership and collective decision-making low (Hansmann, 1999; Spear, 2000). The set of ICA principles enables them to limit opportunistic behaviour of their members by having strong mechanisms for monitoring and control (Herbst & Prüfer, 2016; Huybrechts & Mertens, 2014), including sociopsychological mechanisms such as reputation, reciprocity, and punishment strategies (Bowles & Gintis, 1998; Ostrom, 2000). These ICA-principles serve as a guiding framework to govern and safeguard the cooperative mission, member participation, and stakeholder interaction (Grimley & Chan, 2023; Novkovic, 2008).

Table 24 – The cooperative principles (ICA, 1995) and their rationale, applied to housing

ICA Principle	Rationale, applied to housing
1. Voluntary and open membership	The design of admission and exit criteria is crucial to attracting a balanced mix of residents and ensuring long-term incentives for contributing to the cooperative.
2. Democratic member control	Safeguarding the mission and vision of the housing cooperative to ensure long-term affordability and alignment with the needs of residents.
3. Member economic participation	When members have a financial stake, this may resolve 'split incentives' among residents and foster trust and collaboration to contribute technical and experiential knowledge.
4. Autonomy and independence	Housing cooperatives can collaborate with other stakeholders (governments, civil society organisations, etc.) while securing their mission and vision in their statutes.
5. Education, training, and information	Enhances the ability of members to contribute effectively to their cooperative while empowering members to engage in cooperative behaviour and the enforcement of norms of reciprocity.
6. Cooperation among cooperatives	Enhances network reciprocity and a cooperative culture. By collaborating, local cooperatives can retain democratic member control while achieving economies of scale, building countervailing power or fostering market formation when markets are incomplete or missing.
7. Concern for community	Cooperatives are rooted in the communities where they operate, providing a comparative institutional advantage to internalise externalities and address community concerns.

Based on Henrich et al. (2001), Limnios (2018), Novkovic (2008), and Van Opstal et al. (2025a)

Although millions of families worldwide live in housing cooperatives, the model remains relatively obscure in many countries (Cooperative Housing International, 2024). Therefore, we focus on intrinsic design parameters of housing cooperatives and remain agnostic to specific technologies and market parameters (including wages, energy prices, and prices of materials and components). Analytically, this involves insights from law and economics, investigating the comparative institutional advantages of housing cooperatives to achieve economies of scale and resolve market failures.

Regarding economies of scale, we consider supply-side economies of scale, both internal (where higher volumes lead to lower average costs) and external (where a sufficiently developed ecosystem of firms fosters good market and institutional conditions). We also consider demand-side economies of scale, which lead to network effects following from a sufficient number of households to participate in a market (Varian, 2018). Furthermore, we investigate the importance of dynamic economies of scale, which reflects learning effects. Regarding market failures, we investigate the role of externalities, which may result in split incentives between and among residents, owners, and surrounding communities (Bird & Hernández, 2012) of the suboptimal provision of innovation and public goods (Jaffe et al., 2005). Furthermore, circular strategies may involve asymmetric information between market players, resulting in

costly screening and signalling behaviour, moral hazard, and principal agent problems (Siderius & Zink, 2023; Van Opstal, Smeets, et al., 2024). Finally, bargaining, monitoring, and governance costs may cause transaction and search costs between market participants, precluding the uptake of circular strategies (Hansmann, 1991; Nygaard, 2022).

7.3.2 Empirical framework

To evaluate the potential role of housing cooperatives in enabling and embedding circular strategies, we need to combine perspectives from different stakeholder groups, including housing cooperatives, providers of circular solutions, real estate actors, and experts and policymakers that have a broader perspective. It is important to capture the undocumented and implicit knowledge of stakeholders who are directly experienced with implementation barriers and possess expertise in housing cooperatives or circular housing strategies. Therefore, we conducted 23 semi-structured interviews with professionals involved in the development, operationalisation, or evaluation of housing cooperatives or housing-related circular strategies. This sample size was deemed appropriate to achieve thematic saturation (Francis et al., 2010) and to ensure representation of the most relevant stakeholder groups involved in enabling or assessing circular transitions in housing. The stakeholders were selected to reflect the full spectrum of actors relevant to circular housing transitions, including housing cooperatives (as demand-side implementers), service providers (as supply-side enablers), real estate actors (as developers and infrastructure managers), finance providers (as financial enablers), and policymakers and experts (as systemic enablers and evaluators).

Semi-structured interviews are widely recognised as an effective method for gaining an in-depth understanding of complex and multifaceted issues, capturing perceptions, opinions, and feelings or respondents underlying their behaviour (Bell et al., 2022). Semi-structured interviews are a valuable qualitative research tool, providing the flexibility to explore unexpected perspectives while maintaining a clear focus on the core research questions (Galletta, 2013). They allow us to capture positivist cognitive elements but also enables an interpretivist qualitative research approach, paying attention to subjective understandings and contextual sensitivities by interview respondents (Gehman et al., 2018).

A first groups of interview respondents was selected according to their commitment to a ‘Living Lab’ project on ‘Hybrid housing’, funded by the Flemish Government. This project brings together multiple stakeholders to explore how affordability and circularity can be aligned and integrated into alternative housing configurations. In this project, we actively screened, identified, and interviewed cooperative housing solutions in Belgium. Next, we selected service providers with expertise in delivering as-a-service solutions for solar photovoltaics, heat pumps, and kitchens. These systems are

integrated into homes and as-a-services can be considered as non-default solutions in Belgium, where ownership models predominantly govern these markets. Thirdly, we selected real estate actors, finance providers, policymakers and experts that have been experimenting with housing cooperatives and circular strategies, as documented in earlier projects or referred to by interview respondents. The broad set of consortium members of the Living Lab project helped to identify stakeholders and reflect on the proposed set of interview respondents. Likewise, during the interviews we applied a snowballing sampling technique, asking interview respondents which stakeholders we should include in our sample, further validating the set of interview respondents to include in our sample. Sampling stopped when the level of data saturation was reached, meaning that further data collection and coding resulted in minimal or no new insights (Francis et al., 2010).

During the semi-structured interviews, we asked targeted follow-up questions to make implicit assumptions and tacit knowledge explicit. Therefore, we asked each interview respondent as a last question to perform a premortem analysis explicating why, by 2030, it would become clear that the combination of housing cooperatives with affordable housing and the implementation of circular strategies would turn out to be a complete failure. This technique, originating from behavioural economics (Gallop et al., 2016; Thaler & Sunstein, 2008), helps to mitigate cognitive biases among interview respondents such as confirmation bias, hindsight bias, and groupthink.

A translated version of questions and an anonymized version of the list of respondents is included in Appendix 7.1. Interviews were conducted with informed consent via MS Teams and lasted between 50 and 85 min. A first round of interviews occurred between May and June 2024, followed by an initial analysis and feedback rounds. A second round of interviews took place between December 2024 and February 2025. All interviews were recorded, transcribed, and coded in Atlas.ti. The coding process started with a deductive coding of the interview transcripts based on circular strategies, cooperative governance, housing typologies, and stakeholder roles. Next, an inductive approach was applied to identify themes and patterns within and between data categories, and to link themes and underlying insights to the analytical framework described in Section 3.1 (Creswell & Poth, 2016). Finally, all interview respondents received a draft version of this paper to refine arguments and prevent misinterpretations and factual errors.

7.4 Results

7.4.1 Cooperative governance and circularity in housing

In Table 25, we summarize organisational advantages and disadvantages of housing cooperatives to enable and embed circularity goals, structured along cooperative governance principles.

Table 25 – Organisational (dis)advantages of cooperative governance to implement circular strategies in housing

ICA principle	Organisational advantages for CE	Organisational disadvantages for CE
1. Voluntary and open membership	Housing cooperatives can attract members committed to sustainability, fostering a shared vision for circular housing	Membership models may limit scalability; cooperatives rely on individuals opting in, limiting their potential for a widespread adoption of circular principles
2. Democratic member control	Enables participatory governance, allowing members to co-decide on circular strategies	Decision-making can be slower and conflict-prone, especially when balancing affordability, circular investments, and diverse member preferences
3. Member economic participation	Encourages collective investment in circular housing features Cooperatives retain value locally rather than extracting profits, aligning with long-term CE goals	Financing large-scale circular investments may be challenging (limited member investment capacity). Likewise, older cooperatives may struggle to retrofit circular solutions without external financial support.
4. Autonomy and independence	Cooperatives can prioritise long-term CE goals rather than short-term profitability, as they do not feel pressure from short-term investors	In countries where housing cooperatives are 'niche' players, they suffer from limited bargaining power with banks and policymakers Dependence on external regulation (e.g., VAT on renovation, cooperative legal status) can hinder circular innovation
5. Education, training, and information	Culture of knowledge sharing, enabling members to adopt circular practices Housing cooperatives can foster skill-development for members in sustainable housing maintenance	Requires ongoing investment in educational programmes, which may be deprioritised when financial and time constraints arise
6. Cooperation among cooperatives	Collaboration with other cooperatives enables scaling of best practices and joint procurement power	Lack of incentives to collaborate between cooperatives with strong mission-oriented identities, lack of network governance, and lack of standardisation among cooperatives may slow systemic change
7. Concern for community	Cooperatives are mission-driven and embedded within their communities, enabling them to generate positive externalities, including social and environmental goals in housing	Potential exclusion effects stemming from high membership engagement requirements, making it harder for less resource-full groups to participate (insider-outsider problem)

A *first* overarching advantage of cooperatives is their long-term ownership of housing stock, coupled with the alignment of ownership and tenancy, which provides clear economic incentives to invest in sustainable construction methods and energy-efficient retrofits. As put by an interview respondent: "*compared to traditional ownership – and even among other cooperatives – housing cooperatives involve an investment on a truly long term". Secondly*, the cooperative model also encourages shared spaces and pooled resources, leading to higher use intensity of common facilities, such as kitchens, laundries, and communal tools, which decreases per capita material consumption while reducing costs. *Thirdly,* democratic decision-making within cooperatives fosters collective responsibility for maintenance and sustainability initiatives, supported by psychological mechanisms such as trust, reciprocity, and reputation, which also reduces agency costs. Likewise, given strong behavioural externalities within housing cooperatives, there is a strong incentive to educate members. *Fourthly,* by pooling purchasing power, resources, and experiences, cooperatives can lower costs and enhance financial access to durable materials and construction techniques, and service and sharing models that may be inaccessible to individual homeowners or landlords. *Finally,* cooperative governance enhances coordination among members, facilitating the establishment and enforcement of sustainability standards from the outset.

Cooperative governance also presents structural challenges that may impede the implementation of circular strategies. A *first* overarching challenge is that cooperative decision-making, while democratic, can be slow and complex, particularly when members have diverse preferences regarding affordability, circular investments, and long-term sustainability trade-offs. The dual role of cooperative members as both users and owners complicates decision-making compared to external ownership models, where governance is primarily driven by financial returns. Assortative matching among cooperative members with shared preferences and beliefs helps mitigate this challenge but can also limit the openness and inclusivity of cooperatives and even create an insider-outsider dynamic.

A *second* challenge also stems from democratic governance, as it may result in a lack of in-house expertise. This could be partially resolved by cooperating between cooperatives, but also there, mission heterogeneity can impede collaboration, which can be considered as a *third* barrier. A *fourth* barrier is a lacking supporting ecosystem, resulting in higher transaction costs. This mostly applies to regions where cooperatives are relatively unknown (Bengtsson, 2024; Czischke et al., 2025; Noureldin et al., 2024). This results in underdeveloped financial services, rendering access to finance challenging as banks consider housing cooperatives as high-risk due to their non-traditional ownership structure and the collective nature of their financial obligations. Is also applies to regulatory frameworks that favour individual homeownership over alternative housing models, imposing higher VAT rates on renovations or limiting access to subsidy schemes for renewable energy.

7.4.2 The cooperative difference across housing types

In Table 26, we examine the cooperative difference when implementing circular strategies in three different housing types: single houses, apartment buildings, and cohousing projects. In *single-family housing*, cooperative models face challenges due to relatively high individual autonomy and diseconomies of scale. Moral hazard is more pronounced as there is limited peer monitoring, making it harder to ensure sustainable use of shared infrastructure or performance-based service models. Additionally, circular investments, such as modular construction or shared energy solutions, become more expensive per unit compared to multi-unit housing models, reducing their feasibility.

In *apartment buildings*, the combination of cooperative governance and economies of scale may foster the development and resource-efficient use of shared infrastructure, and the uptake of PSS and sharing models. As illustrated by a service provider: *"The collective nature of apartments is essential for us. It justifies for residents that the installation does not belong to them."* Additionally, collective contracting reduces transaction costs, simplifying the negotiation of long-term agreements for maintenance, energy services, and resource efficiency improvements. However, governance complexity increases with larger resident groups, particularly when preferences are diverse. Therefore, PSS models involving installations subject to strong and divergent user preferences, such as kitchens, are considered less suitable for cooperatives. PSS models for technical systems, such as solar PV and heat pumps, typically involve weaker and more homogeneous preferences and are therefore generally more viable in housing cooperatives. Furthermore, decision-making can be slow and prone to conflict, especially in mixed-ownership settings where cooperative members must coordinate with private landlords and non-member residents.

Cohousing provides the strongest alignment between cooperative governance and circularity principles, as it is inherently structured around shared ownership and collective decision-making. Residents are more likely to engage in shared services, such as mobility solutions, community energy infrastructure, and centralised resource management, due to their commitment to collaborative living. Furthermore, the behavioural externalities within cohousing communities reduce information asymmetries, supporting the viability of long-term circular service contracts. As illustrated by a respondent: *"Once people are living together, it brings people together. In these intentional communities, there are structured ways to exchange and share resources. This is common – they know and trust each other."* However, regulatory barriers, such as restrictions on energy sharing, may complicate the implementation of circular models. Additionally, a smaller resale market for modular cohousing units may create uncertainty around future investments.

Table 26 – Barriers for the uptake of circular strategies, housing types, and the cooperative difference

	Single houses	Apartments	Cohousing
Barriers for the uptake of…			
Design-based strategies	High upfront cost for circular design, often unaffordable for individual homeowners Existing single-family houses are often difficult to retrofit for circularity	Building codes often favour traditional designs and traditional parking spaces	Unique cohousing projects make it harder to mainstream circular design Lack of resale market for modular cohousing units.
PSS	High customer acquisition cost (lack of economies of scale) Moral hazard among users in sharing and service models, with limited peer-control Payment risk of assets that become immovable by destination (e.g., kitchens, solar PV, …), limiting access to bank finance	Lack of functional governance of associations of co-owners Regulatory barriers on energy sharing in apartments, limiting shared PSS models	Cohousing communities may hesitate to commit to long-term PSS contracts Regulations may hinder shared ownership of (energy) infrastructure in cohousing
Sharing models	Residents of single-family houses often prefer individual access and ownership Energy and mobility sharing is often restricted and insufficiently available in rural areas	If residents do not see clear cost savings, they may not engage in sharing initiatives Existing apartments are mostly not designed for shared services (e.g., common laundry, shared storage)	Residents may resist sharing due to privacy and trust concerns Decision-making over shared assets can be prone to conflict and moral hazard
Cooperative (dis)advantages to resolve these barriers			
	✅ Cooperative governance can incentivise shared infrastructure and provide a market pull for circular solutions. ❌ Cooperative single-house projects suffer from diseconomies of scale in implementing circular strategies ❌ Cooperative single-house projects lack peer-monitoring on user behaviour, and cooperative members have limited social interactions to foster learning	✅ Cooperatives can organise and govern sharing models for their members and local communities ❌ In mixed-ownership apartments, cooperative models may conflict with non-member preferences	✅ Cohousing is intrinsically aligned with non-ownership and sharing models ✅ Collective decision-making fosters long-term viability of shared infrastructure.

Note: ✅ indicates where cooperatives have a comparative organisational advantage, whereas ❌ indicates a comparative disadvantage

7.4.3 Housing cooperatives and stakeholder perspectives

In this section, we address different stakeholder perspectives related to circular strategies in cooperative housing and explore to which extent housing cooperatives can align stakeholder incentives, as depicted in Table 27.

For *residents*, cooperatives can mitigate financial, cognitive, and cultural barriers by bundling demand and financial resources, offering participatory education, and fostering trust in shared ownership and leasing models. The long-term co-ownership structure allows for lifecycle-oriented investments that prioritise sustainability over short-term savings while enabling affordable access to higher-quality materials and appliances. As illustrated by a finance provider: *"Most people overlook maintenance expenses, making it extremely difficult to convince them to pay from day one for a model that includes maintenance costs. I believe the only viable market entry is through situations where the developer is responsible for long-term management, as is the case in housing cooperatives"*. However, cooperative governance also introduces challenges, such as high entry barriers that may attract only highly motivated individuals that are willing to invest time and resources in democratic decision-making and monitoring activities. For *landlords*, the split incentive problem remains a key barrier in traditional housing models, where they bear the cost of circular investments while tenants reap the benefits. Cooperatives inherently resolve this issue, as residents are both tenants and co-owners, ensuring that incentives for sustainability investments are aligned.

Financial institutions, including banks and investors, often struggle to assess the value and risks of cooperative housing models, particularly when financing circular assets such as renewable energy infrastructure, modular construction, and shared services. Risk aversion towards housing cooperatives and a lack of familiarity with PSS-based models contribute to higher interest rates and limited access to capital for cooperatives compared to traditional homeowners. However, cooperatives can offer risk-pooling mechanisms and structured governance that can enhance financial stability. As claimed by a respondent: *"In Switzerland, banks reportedly approach housing cooperatives, because they acknowledge them as a highly stable investment - not only because it involves real estate, but also because the cooperative model provides confidence in proper management."*

Table 27 – Stakeholder positions, main barriers to implement circular strategies, and cooperative enablers and challenges

Stakeholders	Main barriers	Cooperative enablers	Cooperative challenges
Residents	Higher upfront costs of circular design solutions deter interest Lack of knowledge about circular benefits Preference for conventional 'ownership' models Myopic choice behaviour, neglecting total cost of ownership Trust issues in long-term leasing contracts Concerns over privacy and control in shared resources Potential free-rider problems in shared services	Economies of scale by bundling demand and financial resources. Education and awareness-raising via participatory design Cooperative models showcase the importance of access over ownership Long-term co-ownership model allows a lifecycle approach to investment. Community-driven leasing models provide transparency and trust Strong community governance, fostering fair use of shared spaces Improved access to social psychological mechanisms, such as reputation and reciprocity, increasing trust and cooperative behaviour	Lack of access to external funding Lack of knowledge among cooperative members Increased entry barriers, attracting converted crowds Bargaining cost of alignment, resulting in slow decision-making Monitoring and enforcement costs by members
Landlord	Split incentives: landlords bear costs, residents enjoy benefits Higher initial investments with unclear return and impact on resale values Risk of moral hazard by residents in circular models (e.g., repair, maintenance, sharing) Risk of provider bankruptcy, service failure, or contractual lock-in by PSS providers	Double role of cooperative members: residents are co-owners Cooperative investments driven by user-oriented instead of financial motivations Shared risk through cooperative contracting and governance structures Stronger bargaining power from (large-scale) cooperatives compared to individual households	Bargaining cost of alignment, resulting in slow decision-making Increased entry barriers, attracting converted crowds Monitoring and enforcement costs by members Need for economies of scale to provide countervailing power and capability development
Financial institutions	Difficulties valuing circular properties for loans (high-risk remarked value) Lack of PSS-oriented funding structures Uncertainty in financing shared assets vs. individual assets (moral hazard)	Risk pooling through cooperative contracting and governance structures Cooperative governance mechanisms may stimulate monitoring and enforcement	Higher interest rates for coops (bankruptcy laws) compared to individual citizens Switch cost to adapt credit decision processes and software to less known models, such as housing cooperatives

Suppliers Service providers	Incomplete circular supply chains and ecosystems for circular housing solutions Lack of customer experience with PSS models, leading to high customer acquisition costs Market preference for individual ownership models Moral hazard problems with service and sharing models Payment risk for assets that become immovable by destination	By bundling purchasing power, cooperatives may create a market pull for circular solutions. Given the long-term horizon of housing cooperatives, service suppliers may develop long-term partnerships Cooperatives can establish service and sharing models as 'default' options, nudging residents into circular strategies Cooperatives can serve as frontrunner market segments, allowing supplier to demonstrate the viability of their circular solution Cooperative governance may include sociopsychological mechanisms to monitor residential behaviour	Assortative matching of resourceful cooperative members Bargaining cost of alignment, resulting in slow decision-making
Policymakers	Regulatory frameworks (e.g., zoning laws) favour conventional building Circular housing solutions are not well-integrated into public tenders Regulatory barriers to energy sharing and leasing models Public funding schemes favour ownership models	Cooperatives may leverage their non-profit status to qualify for exemptions or special provisions Bottom-up initiatives may provide living labs to demonstrate feasibility of circular housing policies, energy sharing, and sustainable mobility solutions	Unknown model in many countries and regions Hard to make a case to prioritise cooperative over social housing, if they fail to provide affordable housing

Service providers, such as providers of PSS and sharing models, can benefit from cooperatives as early adopters of circular solutions, using them as first-mover markets to demonstrate the viability of new business models. Cooperatives can facilitate this by bundling demand, negotiating long-term service contracts, and embedding circularity as a default within their governance frameworks. *Policymakers* also play a crucial role in enabling cooperatives to drive circularity, particularly by reforming fiscal policies to support repair and maintenance rather than new construction. Expanding subsidy schemes for individual homeowners to include cooperative members could further enhance their capacity to implement circular strategies. However, the cooperative model remains relatively unknown in many policy contexts, making it difficult to prioritise over social housing unless it can demonstrably deliver affordability alongside sustainability. As illustrated by a respondent: *"Some civil society organisations oppose public support for housing cooperatives, advocating instead for prioritising investments in social housing."*

7.4.4 Comparative organisational (dis)advantages

Finally, we compare housing cooperatives with other housing initiators and identify their comparative organisational (dis)advantages in Table 28.

Table 28 – Comparative organisational (dis)advantages for integrating circular principles in housing

Housing cooperatives	Social Housing Associations	Public authorities	Commercial Real Estate Developers
✅ Long-term orientation aligns with investment in durability and TCO considerations ✅ Can embed circularity principles from the start ✅ Strong community trust may enable shared resource use ❌ Larger governance costs under heterogeneous membership ❌ Attracting debt capital can be costly (higher financial risk perception from banks) ❌ Volunteer-driven governance may slow decision-making on technical issues ❌ Assortative matching of resourceful members and converted crowds	✅ Large housing portfolios may allow for economies of scale ✅ Shared spaces may reduce costs ❌ Budget constraints and a strong focus on affordability may result in prioritising low-cost solutions over circularity ❌ Public procurement frameworks may create barriers to adopt as-a-service models ❌ Split incentives between social housing associations and tenants ❌ Budget cycles may cause myopia towards TCO considerations	✅ Political power to create demonstrator projects, financial incentives, and regulations for circular solutions ❌ Lack of circularity criteria in public procurement, resulting in a tendency to select lowest-cost bids ❌ Political cycles reduce long-term commitment to circular projects ❌ Budget cycles may cause myopia towards TCO considerations	✅ Large-scale projects can drive demand for circular solutions ✅ Some developers integrate as-a-service models to lower upfront costs, unburden maintenance concerns, and differentiate for green customers ❌ High upfront costs make sustainable construction competitively unattractive ❌ Value creation may exceed value capturing when adding circular solutions ❌ Sales models may cause myopia towards TCO considerations

Note: ✅ indicates where cooperatives have a comparative organisational advantage, whereas ❌ indicates a comparative disadvantage

Housing cooperatives possess structural organisational traits that help to enable and embed circular principles, as discussed throughout this paper. *Firstly*, they have a long-term perspective, just as public authorities, which aligns well with circular investment strategies. However, political and budgetary cycles often lead to short-term prioritisation in public sector decision-making. In contrast, commercial real estate developers operate under strong financial constraints that favour short-term returns, making circular investments less attractive. Social housing associations often prioritise affordability due to budgetary constraints, limiting their ability to engage in higher upfront investments for circular solutions.

Secondly, cooperative governance is user-driven, which may allow members to embed circularity from the outset, making service and sharing models the default option, which may render it economically viable. On the contrary, commercial developers are

primarily driven by financial incentives. Public authorities and social housing associations are socially driven, focusing on affordability and sustainability, but operating within political and bureaucratic frameworks, which can reduce flexibility in adopting circular innovations.

Thirdly, the ability to drive systemic change through market influence varies across housing models. Housing cooperatives, despite their sustainability commitments, often operate at a relatively small scale, limiting their ability to influence suppliers and construction markets. However, in countries where this model is sufficiently established, housing cooperatives can, through collective purchasing and standard setting, generate a market pull for circular solutions. Social housing associations, due to their large portfolios, have significant potential to scale circular solutions but require structural policy support to overcome financial barriers. Public authorities can act as market enablers by integrating circular requirements into procurement and land-use policies, but their impact is often constrained by regulatory limitations. Commercial real estate developers, particularly those engaged in large-scale projects, have the capacity to standardise circular practices, but their willingness to do so depends on financial viability and regulatory pressures rather than inherent organisational priorities.

Finally, access to capital presents a major challenge for housing cooperatives, as banks and financial institutions often perceive them as high-risk borrowers, primarily due to their non-traditional ownership structures rather than their intrinsic organisational design. This limits their willingness to secure funding for large-scale circular renovations or new developments. Social housing associations and public authorities, on the other hand, have relatively stable funding sources but may face regulatory and budgetary constraints that prioritise cost-cutting over sustainability. Public procurement frameworks frequently favour the lowest-cost solutions, making it difficult to integrate circular principles unless specific policy incentives are introduced. Commercial real estate developers, despite having stronger access to capital, often struggle with value capture in circular investments, as they tend to operate on a sales-driven model that does not reward long-term resource efficiency.

7.5 Discussion and conclusions

7.5.1 Empirical contributions

In this study, we investigated how housing cooperatives can enable and embed circular strategies. A *first* empirical contribution stems from applying cooperative theory (Novkovic, 2008; Spear, 2000) to housing cooperatives within the context of CE strategies. Our findings illustrate how cooperative governance structures can enable circularity through collective decision-making, shared resource use, and long-term investment in sustainable housing. By systematically analysing the role of the ICA cooperative principles in housing cooperatives, we provide empirical evidence on how

different governance mechanisms foster or hinder the implementation of circular strategies across various housing typologies.

Secondly, our study advances insights on aligning incentives among diverse stakeholders in circular housing. The successful implementation of circular strategies depends on collaboration among value-chain stakeholders (Asgari & Asgari, 2021), and requires a sound alignment of incentives (Van Opstal, Smeets, et al., 2024). In housing, this requires collaboration between a wide variety of stakeholders, including residents, financial institutions, policymakers, and service providers. Our findings indicate that cooperative governance mitigates some of the misaligned incentives present in traditional housing markets. For instance, cooperatives inherently mitigate the split-incentive problem between landlords and tenants, as residents are both co-owners and users, leading to a stronger alignment of sustainability and affordability objectives. Moreover, cooperatives can act as early adopters of circular solutions, creating a market pull for service-based business models and shared infrastructure.

Thirdly, from a law and economics perspective (Ben-Ner, 2018; Hansmann, 1991, 1999), this research sheds light on the comparative institutional advantages and disadvantages of cooperatives in implementing circular housing strategies. While housing cooperatives benefit from long-term investment horizons and community-driven decision-making, they also encounter financial and regulatory barriers that limit their scalability. Our analysis highlights that cooperatives may face higher transaction costs due to underdeveloped financial services and policy frameworks that favour individual homeownership.

Fourthly, while future research could more explicitly assess which specific circular strategies are most compatible with cooperative governance, our findings suggest several promising areas. First, design for long-term adaptability (e.g. modular construction, standardised components) aligns well with the long-term orientation and lifecycle planning inherent in cooperative housing. Second, shared infrastructure designs (e.g. centralised energy or laundry systems) benefit from cooperative governance and bundled procurement. Third, cooperatives may be well placed to implement design-for-maintenance and repair features, as their ownership structure enables collective maintenance planning and reinvestment. However, more individualised strategies, such as highly customisable interior fittings, may be less compatible due to governance complexity and diverging user preferences.

Finally, although this study is based on the Belgian context, the mechanisms identified, such as participatory governance, long-term ownership, collective investment structures, and stakeholder alignment, are relevant in three ways. First, they offer practical guidance for countries where cooperative housing is still emerging and where new institutional models are currently under design. Second, in regions with established cooperative sectors, these findings can support the integration of circularity

objectives into existing governance frameworks. Thirdly, by focusing on its organisational design characteristics, the empirical contribution of this paper extends beyond the specific cooperative model. Public housing, co-housing schemes, and emerging hybrid models may equally benefit from applying these principles to enable and embed circular housing strategies. In this sense, the paper contributes to wider debates on how to operationalise circular housing transitions through governance innovation, even in contexts where formal cooperative structures are lacking or unsupported.

7.5.2 Policy implications

Policymakers and cooperative federations should recognise that many housing cooperatives do not inherently prioritise circularity. Affordability and basic functionality often dominate cooperative agendas, particularly in contexts with constrained resources or limited governance capacity. Therefore, circular interventions must be made not only technically feasible and financially viable but also desirable from the perspective of cooperative members (Bocken et al., 2022). Building on this, the following sections outline how housing cooperatives can capitalise on their organisational comparative advantages and how policy support can address systemic barriers and create enabling conditions at multiple governance levels.

Policy implications for housing cooperatives

Housing cooperatives have the potential to act as frontrunners in embedding circularity into housing models, but they must align their governance structures, financial models, and stakeholder engagement practices to maximise their impact. One key policy implication is the opportunity to integrate CE principles into cooperative governance and business models from the outset. By clearly defining CE objectives in their bylaws, cooperatives can establish internal incentives that encourage lifecycle thinking and prevent short-term cost-cutting measures that undermine sustainability. It also sets CE as the default option, reducing future bargaining costs among members and attracting new members who prioritise sustainability. This transforms the adoption of circular solutions from a prisoners' dilemma into a coordination game, making switching to the non-circular option costly in both monetary and social terms (Bowles & Gintis, 1998). Nevertheless, housing cooperatives face challenges in motivating their members to engage in costly monitoring and enforcement efforts, as members may have an incentive to freeride (Hansmann, 1991).

While aligned preferences reduce internal governance costs, assortative matching mechanisms may turn housing cooperatives into exclusive enclaves (Ferreri & Vidal, 2022). Therefore, governance should be structured to balance inclusivity with efficient decision-making, safeguarding affordability when considering circular solutions. However, cooperatives must also avoid goal overload (Greve, 2008) stemming from a

multitude of missions, resulting in excessive complexity that may hinder implementation of any goal. Importantly, circularity is a pathway to sustainability, not a destination (C.-W. Chen, 2021). Nevertheless, providing education and training on repair, maintenance, and shared resource governance can enhance both member participation and long-term commitment to CE principles.

Next, housing cooperatives should collaborate to benefit from economies of scale. Internal supply-side economies of scale arise when housing cooperatives coordinate procurement strategies and standardise circular construction processes across multiple projects. Cooperatives should safeguard that cost savings involved do not lead to rebound effects, as established by Shinde et al. (2022) who found that cooperative residents tend to spend the 'extra' income on housing and travel expenditures, jeopardizing environmental goals. External supply-side economies of scale emerge when housing cooperatives collaborate to develop supportive ecosystems, such as tailored financial products and enabling policy frameworks. To achieve this, cooperation among cooperatives is essential, requiring a focus on shared objectives rather than differences. This could result in 'secondary' cooperatives, servicing tenant-managed 'primary' cooperatives with professional expertise (Lang et al., 2020), or in partnerships between large cooperatives and new cooperative initiatives (Lang & Stoeger, 2018). However, strong mission-driven identities within individual cooperatives can hinder collaboration. This mechanism resembles the "*Life of Brian"* problem (Baturo & Mikhaylov, 2013), reflecting how groups prioritise their own belief systems over broader collective goals, leading to a lack of incentive compatibility for cooperation. Finally, housing cooperatives can foster dynamic economies of scale by sharing knowledge and developing best practices through collaboration within and across borders.

Policy implications for governments

Housing cooperatives offer a bottom-up approach to circularity, but their success largely depends on the existence of supportive policies and ecosystems (Aernouts & Ryckewaert, 2019; Ahedo et al., 2023). As Elster (1989) famously questioned – and as Bengtsson (2024) applies to housing cooperatives – *if cooperatives are so desirable, why are there so few of them?* This paradox highlights the structural and policy barriers that limit their widespread adoption. As stressed by Ferreri & Vidal (2022), the role of the state across different policy levels is a crucial determinant in whether housing cooperatives remain a 'niche' solution or scale into a broader movement. Consequently, policymakers at different government levels play a role in enabling cooperatives to contribute to affordable and circular housing.

Municipal governments can support the uptake of circular strategies by housing cooperatives by providing access to land, streamlining permitting processes, and incentivising circular building practices. Offering long-term land leases or reduced land

costs for cooperatives that integrate CE principles can improve feasibility, as it unburdens housing cooperatives from one of their largest barriers, improving mental bandwidth to consider affordability and circularity in their project. Zoning regulations and permitting processes should be adjusted to recognise alternative housing models that prioritise shared ownership, energy efficiency, and material reuse. Furthermore, cities can serve as living labs for cooperative circular housing initiatives, facilitating pilot projects that demonstrate feasibility and scalability (Galle et al., 2021), supporting capacity building and partnership development, as well as providing government guarantees to back loans of housing cooperatives.

At the *regional and national levels*, fiscal policies should be revised to create an equal playing field between cooperative and individual ownership models. Firstly, this includes ensuring that renovation and deconstruction activities undertaken by cooperatives benefit from the same (reduced) VAT rates and expanding subsidy schemes from individual owner-based models to access-based business models in cooperatives. Secondly, regulatory reforms could also consider cooperative structures for investments in circularity and energy efficiency to resolve the split incentive problem between landlords and tenants. Thirdly, a formal legal recognition of housing cooperatives as a distinct category - separate from traditional rental and ownership models - can pave the way for tailored financial and governance frameworks. Finally, knowledge transfer and capacity building among cooperatives should also be actively supported, facilitating collaboration between established cooperatives and new initiatives to share best practices and strengthen the cooperative ecosystem.

At the *European and international levels*, knowledge-sharing platforms that document best practices and provide technical guidance for integrating CE principles into cooperative housing should be supported. Establishing EU-wide regulatory guidelines for cooperative housing models can enhance policy coherence and improve legal recognition across member states. Funding mechanisms under the European Green Deal, Horizon Europe, and regional development programmes could explicitly support cooperative-led circular housing initiatives. Financial instruments from the European Investment Bank and regional development banks could foster shared ownership structures and circular financing models, making it easier for cooperatives to access affordable capital for long-term investments. Finally, cooperative housing should be acknowledged as a key instrument in delivering on the Sustainable Development Goals (SDGs), particularly SDG 11 on sustainable cities and communities.

7.5.3 Limitations and recommendations for further research

This study provides an initial exploration of how housing cooperatives can enable and embed circular strategies, highlighting both their comparative organisational advantages and structural challenges. However, some limitations must be acknowledged.

First, our findings are mostly drawn from the context of Belgium, which has a frontrunner position implementing a CE (Claudio-Quiroga & Poza, 2024; D'Adamo, Favari, et al., 2024) but lacks a strong tradition in housing cooperatives. While countries with well-established cooperative housing sectors have been extensively studied and documented, those where cooperatives remain a small niche are substantially understudied. This leaves it unclear to what extent observed advantages and challenges stem from the intrinsic design qualities of cooperatives or from broader institutional path dependencies. Examining cooperatives in a context where they remain a niche model allows for a focus on market-, and technology-agnostic organisational design aspects, reducing potential bias from specific national policies or historical contingencies. Nevertheless, future research should explore both regions with longer traditions as regions lacking experience with housing cooperatives to examine whether the findings hold in different institutional contexts.

A *second* limitation, stemming from the first, is that this study primarily draws on perspectives from professionals involved in the development, operationalisation, or evaluation of housing cooperatives and circular housing strategies. While this approach enables an analysis of organisational and policy-level factors, it does not include direct input from current residents. Given the early stage of many cooperative initiatives in Belgium, respondents often relied on sociotechnical imaginaries about prospective users, owners, and ecosystem players, similar to research on other complex sociotechnical systems such as smart grids (Kojonsaari & Palm, 2023; Van Opstal, Bocken, et al., 2025b). Future research should incorporate perspectives from cooperative residents to examine how governance structures influence circular decision-making in practice.

Finally, further empirical studies are needed to measure the actual differences between housing cooperatives and traditional housing models in enabling circular strategies. Quantitative research could help assess the impact of cooperative governance on circular investments and the adoption of PSS and sharing models. However, such studies should carefully account for potential selection biases. Housing cooperatives may attract a resource-rich subset of the population, particularly individuals with a strong commitment to sustainability or higher levels of social and financial capital. This creates endogeneity risks in statistical inference, making it difficult to determine whether observed differences result from cooperative governance structures or the characteristics of the members themselves, generating biased findings on the potential of housing cooperatives to a circular economy and society.

8. The roles of civil society associations in organising the informal circular economy

Based on:

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Abstract

A circular economy (CE) transition requires more than technological innovation and market-based solutions. It demands a circular society that values informal repair, reuse, and sharing practices. This study investigates how civil society associations (CSAs) support such practices in an industrialised setting. We apply a mixed-methods approach, combining survey data from 820 households in Flanders (Belgium) with 24 interviews involving CSA representatives at local, regional, and European levels. Findings indicate that CSA membership increases participation in informal CE activities by strengthening trust, skills, and accessibility, enabling activities less viable through market mechanisms alone. Respondents identify barriers to distributive, procedural, and recognitional justice, which can be reduced by CSAs. We draw lessons for policymakers: providing structural support, reducing regulatory barriers, and integrating informal CE practices into policies at municipal, regional, and European levels. These measures can help communities scale citizen-driven CE practices, enhancing resilience, and supporting vulnerable groups throughout the CE transition.

Keywords: circular economy; circular society; civil society; just transition; circular business model; social capital

8.1 Introduction

The concept of a circular economy (CE) has attracted significant attention from scholars and policymakers, contributing with technical solutions, business models, and policy measures to slow, narrow, and close material loops (Geissdoerfer et al., 2017a). A CE, however, also requires a circular society, incorporating social implications and just transition considerations, on top of technocentric and market-based solutions (Calisto Friant et al., 2023; Jaeger-Erben et al., 2021; Kirchherr, 2021). Transitioning to a CE also entails reconfiguring how people work, consume, and collaborate, necessitating a broader conceptualisation that includes an analysis of social aspects of a transition. Most research, even on social implications of a CE, concentrates on activities within the formal economy, overlooking the numerous informal activities across society that also contribute to a circular transition (Galarza-María et al., 2024). The informal economy consists of all the productive activities in an economy that are not (directly) measured by national statistics (OECD, 2002). Most research on the informal CE has concentrated on the Global South, especially on informal waste pickers and recycling systems (Cook et al., 2024; Dewick et al., 2022). In contrast, informal CE activities in industrialised regions have received limited empirical attention.

Within the context of industrialised countries, informal activities in the CE involve mostly repair, reuse, and sharing activities within households and social networks, and initiatives taken by civil society organisations. The sparse literature that does exist focuses on behavioural drivers of household self-repair (Amend et al., 2022; Sandez et al., 2023) or community repair (Bradley & Persson, 2022; Parajuly et al., 2024; van der Velden, 2021). Likewise, research on sharing (Encarnación et al., 2024; Holmes, 2018) acknowledges the existence of informal activities. Regarding product reuse, Delanoeije & Bachus (2021, 2022) include informal activities when measuring the magnitude of this market. A broader mapping exercise by Van Opstal et al. (2025) estimated the size of the informal CE in monetary terms and employment. However, these studies often note that many households do not consciously link their informal repair, reuse, and sharing activities to the concept of a CE and tend to take them for granted.

Civil society associations (CSAs) play a role both in organising informal CE activities, such as repair cafés, as well as in raising awareness of citizens, policymakers, and businesses on the importance of a circular transition (Ghisellini & Ulgiati, 2020). CSAs are non-profit associations that are not controlled by the state and the market (Arenas et al., 2013), making them part of the 'third sector' (Evers & Laville, 2004; Gui, 1991). They are created by individual and collective actions, organisations, and institutions to advance shared interests, acting in the space between the state, business, and family (Ho et al., 2022). Ho et al. (2022) investigated the dynamic interplay between business and civil society in circular transitions, showing that their interactions can range from collaborative engagement to conflicting interests. As pointed out by Spekkink et al. (2022), civil society actors cannot simply be reduced to consumers, because they may

also increase consumer awareness about the unsustainability of certain products and services, and develop connections with other actors to develop and sustain their activities. Nevertheless, their role in enabling a just and community-driven circular transition remains poorly understood in academic literature.

Our study addresses a critical gap in the existing literature by empirically examining the role of CSAs in the CE, an perspective often treated hypothetically with limited empirical engagement in sustainable transition studies (Vetters et al., 2025). Given that civil society plays a recognised role in managing eco-innovation and is a key element in the quadruple and quintuple innovation helix frameworks (Carayannis & Campbell, 2009; Shkarupeta & Babkin, 2024), understanding its function in circular ecosystem innovation is essential. Involving new actors, such as CSAs, stimulate 'out-of-the-box' thinking within the development of circular ecosystems (Konietzko et al., 2020).

In this paper, we investigate the roles of CSA in organising the informal CE. We apply a mixed-methods approach that combines household survey data from 820 respondents in Flanders (Belgium) with 24 interviews with CSA representatives at local, regional, and EU levels. Our approach allows us to answer the following research questions:

- RQ 1: What is the relationship between membership of civil society associations and participation in the informal CE?
- RQ 2: What are barriers and enablers for the informal CE, according to members, non-members, and staff members of civil society associations?
- RQ 3: What are the roles of civil society associations in organising a just informal CE?

The study contributes to ongoing debates in several ways. First, we empirically assess whether and how CSA membership influences participation in informal repair, reuse, and sharing, addressing a research gap in circular transition scholarship. Second, we uncover multi-level justice barriers (distributive, procedural, recognitional) that hinder broader participation in informal CE practices. Third, we offer an institutional and behavioural analysis of how CSAs generate positive externalities, facilitate trust-based collaboration, and act as intermediaries between citizens and CE policymaking. Our findings contribute new empirical knowledge about how civil society can contribute to circular ecosystems.

Empirical material for this study is mostly gathered in Flanders (Belgium), a highly educated and densely populated region with a well-organised civil society. This region can be considered as a frontrunner in the CE (Claudio-Quiroga & Poza, 2024; D'Adamo, Favari, et al., 2024). Furthermore, by incorporating perspectives from European CSAs, we enhance the transferability of our findings to other industrialised contexts, offering insights and reflections for policymakers and practitioners on the interplay between the formal and informal CE in a just circular transition.

The remainder of this paper is structured as follows. In Section 8.2 we discuss methods and materials used. In Section 8.3 we report and discuss our results, structured along our research questions. Finally, we conclude with a discussion on the implications for CSA and policymakers and the limitations of our work.

8.2 Methods and materials

8.2.1 Conceptual background

CE policies and scholarship have largely focused on resource efficiency, technological innovation, and economic competitiveness, while neglecting the *societal implications of circular transitions* (Luthin et al., 2023; Siderius & Zink, 2023). However, circular systems deeply redefine how people work, consume, and interact, calling for a broader conceptualisation that includes informal and community-driven forms of circularity. In many contexts, informal CE activities such as repair, reuse, and material recovery occur outside formal market or state control, creating employment, delivering services, and strengthening community resilience (Leclerc & Badami, 2023; Thapa et al., 2024). Ignoring these dynamics risks reinforcing exclusion and undervaluing the contribution of actors operating outside formal policy and business frameworks (K. Liu, 2025; Purvis et al., 2025). A circular society therefore requires closer attention to community governance, social capital, and informal labour relations that underpin everyday circular practices (Calisto Friant et al., 2023; Jaeger-Erben et al., 2021).

A *just circular transition* moves beyond material flows and environmental indicators to assess how circularity affects people, communities, and institutional arrangements. It requires integrating three interdependent justice dimensions: distributive, procedural, and recognitional justice (Kirchherr, 2021; Schlosberg, 2007). Distributive justice addresses how circular strategies allocate costs and benefits across different groups, for example, whether circular jobs provide fair pay, safety, and social security, or whether circular infrastructures displace marginalised communities (Deutz et al., 2024; ETC CE, 2025a). Procedural justice concerns who has a voice in designing and governing circular systems, emphasising the need to include informal workers, low-income consumers, and community actors in policy and planning processes (Eiselein & Langenus, 2025; Malcolm et al., 2024). Recognitional justice calls for acknowledging the value systems, lived experiences, and contributions of underrepresented groups, such as Indigenous communities, repair artisans, or informal recyclers, whose work and knowledge often remain invisible in CE narratives (Lebrón, 2025; Pansera et al., 2024). A just circular transition, therefore, not only transforms what is produced and consumed, but also reconfigures power relations, social institutions, and cultural norms in pursuit of equity, dignity, and sustainability.

In this paper, we highlight the role of *civil society associations* (CSA) in a just informal CE. CSA are non-profit associations that are not controlled by the state and the market (Arenas et al., 2013), making them part of the 'third sector' (Evers & Laville, 2004; Gui, 1991). While civil society organisations also include cooperatives and foundations, we focus on non-profit associations in this paper. CSAs combine citizen membership with mechanisms that ensure to embed their societal mission. These mechanisms include governance based on demographic membership (unlike foundations), a non-distribution constraint that prohibits the distribution of dividends and an asset lock (unlike cooperatives) (Glaeser & Shleifer, 2001). The asset lock ensures that all assets of the organisation are used solely for the purposes for which it was established, including after its dissolution (Coates & Van Opstal, 2009).

The underlying rationale of the non-distribution constraint is that it eliminates speculative or profit-driven motivations, thereby mitigating agency problems and signalling trustworthiness towards clients, workers, and other stakeholders (Hansmann, 1979, 2021; Herbst & Prüfer, 2016). This gives CSAs a *comparative institutional advantage* in generating positive external effects (Santos, 2012), attracting 'motivated agents' (Besley & Ghatak, 2005), and ensuring 'mission congruence' between stakeholders (Barrenechea-Mendez & Ben-Ner, 2017). As the generation of positive externalities results in a greater value creation than value capture by organisations, it requires the involvement of mission-oriented stakeholders who are not driven by profit. Therefore, CSA can be regarded as an organisational form that helps to address and mitigate market failures, such as externalities and asymmetric information, which are impeding a CE (Grafström & Aasma, 2021; Siderius & Zink, 2023).

The rationale of CSA activities can be explained according to a 'vacuum hypothesis', an 'influence hypothesis', and a 'local-global' hypothesis, as formulated by Westerdahl & Westlund (1998). Firstly, market failures and budgetary, organisational, and informational limitations of government interventions leave room for CSA to identify and fill a vacuum. Secondly, citizens can organise themselves in CSA to identify and address needs they consider important. Thirdly, doing so fulfils a need of citizens to help each other in projects where they feel a sense of ownership in a globalised world. Civil society plays roles that extend beyond those of consumers and producers, positioning it as a pivotal actor in the development of a circular society. These hypotheses align with Nässén et al. (2025), who argue that community-level organisation is a precondition for effective environmental commons, which cannot rely solely on state-based or market mechanisms.

Spekking et al. (2022) looks beyond the roles of CSA at the local level when investigating translocal networks for a CE, identifying the ability of CSA to develop a critical mass, a shared identity, and political voice. This shared identity enables CSA to leverage their activities, creating economies of scale and fostering learning externalities between members. The latter is particularly relevant for activities where the product is partly the

interaction among members itself (Ben-Ner, 2006). Given the absence of monetary incentives, important enabling drivers for CSA are sociopsychological mechanisms, such as trust, reciprocity, and reputation, which drives investments in identity (Akerlof & Kranton, 2000) and help to resolve collective action problems (Bowles & Gintis, 1998; Ostrom, 1990). This requires but also contributes to the development of social capital (Bowles & Gintis, 2002; Putnam, 2001) and enables CSA to play a corrective and prospective role towards the development of a circular society.

8.2.2 Empirical materials

The social dimension of a circular transition still needs better understanding and exploration, calling for empirical research for understanding its actual implications (K. Liu, 2025). We applied a mixed-method approach, combining insights from a survey conducted among households in Flanders and 24 semi-structured interviews with local, regional, and European CSAs and experts. This mixed-method approach is appropriate for this study because it allows for a comprehensive and nuanced exploration of the complex dynamics between households performing informal CE activities and CSAs. Quantitative survey data provided insights into relationships between activities in the informal CE, socio-demographic covariates, and CSA membership, while qualitative interviews help to ensure the generalisability of the research findings and identify the major roles of CSAs towards a just circular transition from multiple perspectives.

Figure 18 outlines our sequential exploratory mixed-methods approach, in which the initial set of interviews in 2023 informed the design of the survey instrument. The survey data were then analysed to detect statistical patterns in informal CE engagement and CSA membership. These findings helped to structure the thematic codes applied during the second stage of interviews (2024–2025), ensuring that emerging statistical associations were interpreted in light of real-world experiences of CSA actors. Through this iterative process, qualitative insights provided explanatory depth to the quantitative trends, while statistical results allowed us to test the broader relevance of qualitative propositions across a diverse population sample. This combination strengthened the analytical rigour of the study by triangulating evidence from both approaches and enriching our understanding of the mechanisms through which CSAs support informal CE participation and address justice dimensions. Finally, all interview respondents received a draft version of this paper to refine arguments and prevent misinterpretations and factual errors.

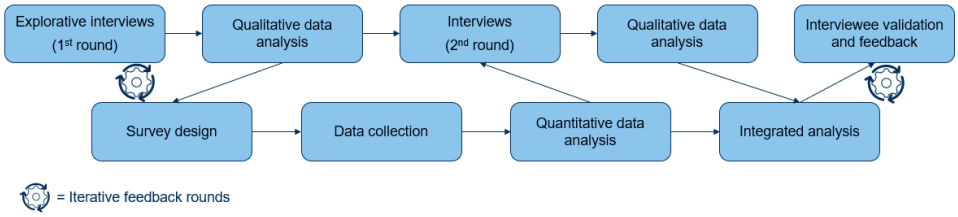


Figure 18 – Empirical strategy

Survey data

While existing literature already offered valuable insights into the prevalence of informal activities (Delanoeije & Bachus, 2022; Korsunova et al., 2023), these studies predominantly focus on transactions or volumes and rarely distinguish clearly between formal and informal channels. An exception is Van Opstal et al. (2025), who make macroeconomic estimations of this informal CE in monetary terms and jobs. Moreover, although some earlier surveys allow to control for socio-demographic characteristics (Encarnación et al., 2024; Fachbach et al., 2022), they do not permit differentiation by CSA membership, which is central to our analysis. Therefore, we opted to collect primary survey data through a mixed-method approach.

To inform the design of our questionnaire and survey methodology, we first conducted 11 exploratory semi-structured interviews in 2023 (see Appendix 8.1). These interviews helped to identify key themes and barriers, which informed the development of an initial survey draft. We then circulated this draft among the interviewees for feedback, allowing us to refine the wording and structure before launch.

Regarding personal characteristics, our survey incorporated commonly used covariates such as age, gender, household size, educational attainment, activity status, and net monthly household income. Additionally, the ZIP code was requested to determine whether respondents lived in one of the 13 central cities in Flanders, in a smaller city, or in a rural area. Furthermore, we included questions on psychosocial traits, such as risk preference, trust, and environmental consciousness, measured using slider bars on a 0 to 100 scale. Slider bars represent a continuous rating scale and are considered engaging for respondents and superior in terms of measurement possibilities compared to discrete rating scales (Maineri et al., 2021). To prevent anchoring biases, the sliders did not show default values, and rounding behaviour was discouraged by only labelling the extreme values of the scale (M. Liu & Conrad, 2019). Finally, we asked respondents about their membership of a CSA.

We collected behavioural data on engagement in informal repair, reuse, and sharing practices in the past 12 months across seven product categories, including fashion, bikes, cars, multimedia, household appliances, baby appliances, and gardening

equipment. Additionally, we asked for barriers and enablers to engage in informal repair, reuse, or sharing activities. For this overview, we based ourselves on recent research by Fachbach et al. (2022), McQueen et al. (2022), and Delanoeije & Bachus (2022). In Appendix 8.2, we provide an overview of summary statistics of this survey.

Our online survey was conducted using SurveyMonkey and distributed through newsletters and communication channels of (1) the research institute of the first author, (2) one of the leading newsletters on building and renovation in Belgium, (3) several prominent CSAs with broad membership. While the newsletter on building and renovation enables us to reach a broad audience that is not related to repair, reuse, or sharing activities, our collaboration with CSAs allowed for an oversampling of CSA members. Controlling for CSA membership in our analyses subsequently to perform robust statistical analyses on a sufficient number of *both* CSA members and non-members. Importantly, we phrased the invitation for this questionnaire in very general terms, with 'product'-related instead of 'sustainability'-related narratives that could have amplified sampling bias towards environmental consciousness population segments. The survey was available online from October 6th, 2023, to January, 8th 2024, resulting in 820 responses. Respondents provided informed consent and were incentivised by a lottery of 20 sets of 6 LED lamps (E27 fitting). The draw was conducted by an independent colleague using a random number generator, selecting from the email addresses collected specifically for this purpose. We consider that this incentive did not influence the response profiles, as nearly every household in Belgium can utilise this type of lamp. Comparing sample characteristics with the population in Belgium, highly educated, female, and older individuals are overrepresented. This underlines the importance of controlling for demographic characteristics in our analysis.

For the statistical analysis, we applied two-sided F-tests to test for differences between proportions. We also performed Poisson regressions to model the number of products categories in which respondents participated in for repair, reuse, and sharing decisions, controlling for socio-demographic characteristics and CSA membership. To control and correct for endogeneity between CSA membership and informal CE activities, we also conducted bivariate probit regressions to ensure reliable coefficients while correcting for any correlation between the error terms.

Interview data

We conducted semi-structured interviews in two stages, applying a purposive sampling strategy designed to ensure both breadth and depth across relevant stakeholder levels. In the first stage (2023), we interviewed 11 experts from region CSAs, academia, and a national public statistical authority. These respondents were selected based on their reported and direct experience with organising, studying, or monitoring informal CE activities, including repair, reuse, and sharing, at organisational or systemic levels. The

interviews focused on motivations to engage (or not) in informal CE practices and the boundary conditions for ensuring a just and sustainable informal CE.

In the second stage (2024-2025), we conducted 14 interviews with staff members and volunteers from CSAs operating at three levels: local, regional (Flanders), and European. The selection of these respondents was based on a broad representation of CSA, aimed at organising activities and promoting rights for groups such as women, youth, families, volunteers, the environment, or rural communities. Sampling stopped when the level of data saturation was reached, meaning that further data collection and coding resulted in minimal or no new insights (Francis et al., 2010). These interviews aimed to gather perspectives on the role of CSAs in an informal CE in general, and more specifically in enabling and embedding a just circular transition. The list of respondents, and a translated version of the interview questionnaires, is included in Appendix 8.1.

During the semi-structured interviews, we asked targeted follow-up questions to make implicit assumptions and tacit knowledge explicit. Therefore, we asked each interview respondent as a last question to perform a premortem analysis explicating why, by 2030, CSAs would play no role anymore in the circular transition. This technique, originating from behavioural economics (Gallop et al., 2016; Thaler & Sunstein, 2008), helps to mitigate cognitive biases among interview respondents such as confirmation bias, hindsight bias, and groupthink.

Interview participants provided informed consent for an online interview conducted via MS Teams, lasting between 45 and 80 minutes. The interview transcripts were subsequently coded using Atlas.ti. Coding involved the circular strategies involved, enablers to foster circular behaviour at the organisational and membership level, challenges and enablers related to a just circular transition, and potential roles of CSA, building on the concepts and theories introduced in Section 2.1. More specifically, this involved market and government failures, the hypotheses formulated by Westerdahl & Westlund (1998), and translocal networks, as defined in Spekking et al. (2022). We then applied a thematic analysis to identify gaps addressed by CSA, their underlying rationales why CSA address these gaps, and the comparative institutional advantage of CSA in doing so. We also coded for 'civil society failures', such as the risk of exclusion, bias, or inefficiency within CSAs themselves. Quotations are reported in an anonymised way.

8.3 Results

8.3.1 Membership and participation in the informal economy

To examine the relationship between CSA membership and participation in the informal CE, we present the results of the Poisson regressions in Table 29. The dependent variables represent the number of product categories in which survey respondents

engaged in demand-side repair, reuse, or sharing transactions during the last 12 months. We differentiate between social repair, reuse, and sharing, which represents activities within households, among relatives, or between friends, and community-related activities, such as repair cafés, organised informal second-hand markets, or community material libraries. Independent variables include socio-demographic variables and CSA membership.

Table 29 – Poisson regression results on the number of product categories involved in repairing, reusing, and sharing in the last 12 months

	Repair (social)	Repair (community)	Reuse (social)	Reuse (community)	Share (social)	Share (community)
n	668	668	668	668	668	668
Prob > chi2	0.0000	0.0000	0.0000	0.0000	0.0000	0.0001
Pseudo R^2	0.0320	0.0946	0.0562	0.0639	0.0531	0.0762
Male	0.1581**	0.1317	-0.1070	-0.0270	-0.0984	-0.0146
	(0.0529)	(0.1900)	(0.0933)	(0.1050)	(0.0652)	(0.2446)
Age	-0.0116**	-0.0018	-0.0213**	-0.0274**	-0.0152**	-0.0359**
	(0.0025)	(0.0091)	(0.0041)	(0.0047)	(0.0029)	(0.0113)
Household size	0.0378	-0.2295**	0.0122	0.1278**	0.0190	0.1645
	(0.0236)	(0.0884)	(0.0388)	(0.0430)	(0.0282)	(0.1015)
Education:	0.0837	0.0698	0.3116*	0.1399	0.3179**	0.2561
bachelor	(0.0701)	(0.2572)	(0.1282)	(0.1387)	(0.0903)	(0.3488)
Education:	0.0941	0.0127	0.2491*	0.0279	0.4411**	0.1036
university	(0.0750)	(0.2740)	(0.1364)	(0.1497)	(0.0949)	(0.3705)
Active	-0.1840*	0.0352	0.1102	-0.0474	-0.2133*	0.0908
	(0.0743)	(0.2621)	(0.1309)	(0.1467)	(0.0897)	(0.3661)
Income	-0.0077	0.1111	-0.0205	-0.0814*	-0.0077	-0.0226
(ordinal)	(0.0184)	(0.0677)	(0.0351)	(0.0353)	(0.0217)	(0.0810)
Rural	0.1100	0.6222*	0.1374	0.1744	0.2362**	-0.0016
	(0.0674)	(0.3039)	(0.1135)	(0.1349)	(0.0824)	(0.2879)
Central city	0.0131	1.0222**	0.0849	0.3709*	-0.0177	-0.0144
	(0.0790)	(0.3201)	(0.1310)	(0.1490)	(0.0975)	(0.3397)
Risk preference	0.0005	0.0152**	0.0013	-0.0005	0.0043**	0.0142**
	(0.0011)	(0.0042)	(0.0019)	(0.0022)	(0.0013)	(0.0052)
Trust	0.0000	-0.0002	0.0020	0.0026	0.0022	-0.0048
	(0.0015)	(0.0055)	(0.0026)	(0.0030)	(0.0018)	(0.0069)
Environmental	0.0085**	0.0282**	0.0098**	0.0048	0.0037	0.0150
consciousness	(0.0018)	(0.0075)	(0.0030)	(0.0033)	(0.0021)	(0.0086)
Member	0.2154**	0.8209**	0.3214**	0.4542**	0.2800**	0.7121*
	(0.0675)	(0.3080)	(0.1154)	(0.1356)	(0.0824)	(0.3514)
Constant	0.5450*	-5.6287**	-0.5560	-0.1996	0.2139	-3.0797**
	(0.2195)	(0.9094)	(0.3728)	(0.4149)	(0.2622)	(1.0205)

Note: * significant at the 5% level, ** significant at the 1% level. Standard errors between parentheses.
VIF statistics: mean value = 1.49, maximum value = 2.04.

For all informal CE activities, we find a significant positive relationship with CSA membership. In addition, male respondents engage in more product categories for social repair, and younger respondents are on general more inclined to engage in informal CE activities, except for community repair. Larger households are more prone to engage in community reuse, but less in community repair. Social reuse and sharing are more popular among highly educated respondents, and social repair and sharing are less popular among the active population. Community reuse is negatively related to income levels. Regarding locality, community repair is more popular both within rural municipalities and central cities, compared to smaller cities. Community reuse is more

popular in central cities, and social sharing within rural areas. In general, sharing and community repair is most popular among risk preferent households, while repair and social reuse are most popular among environmentally conscious respondents.

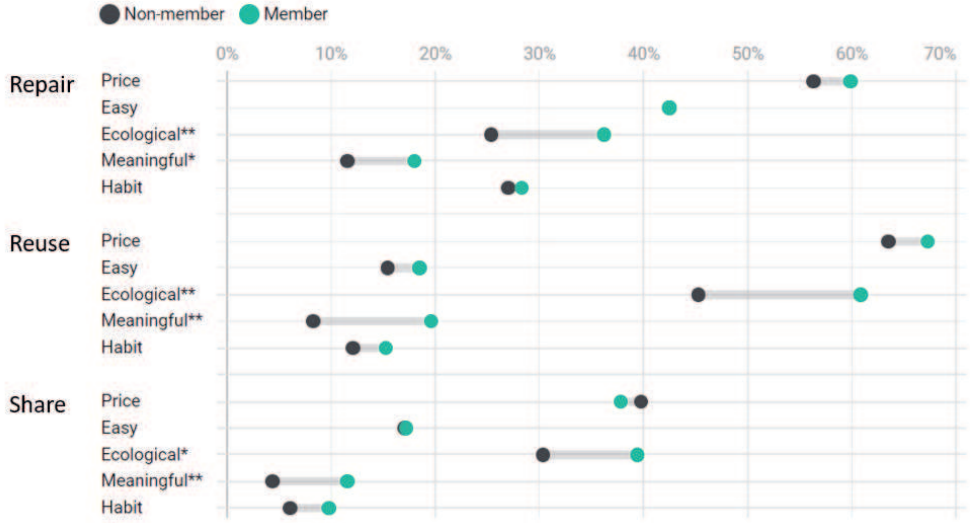
While CSA membership may be defined by similar socio-demographic characteristics as participation in the informal CE, endogeneity may be a concern. Therefore, we ran a bivariate probit regression that simultaneously estimates informal CE activities and CSA membership on the same set of socio-demographic covariates. This procedure corrects standard errors in case of endogeneity. The results, reported in Appendix 8.3, nuance our findings and reflect, as expected, endogeneity, except for social repair. Firstly, CSA membership is related to old households, informal CE activities are on average performed by a younger public. Next, CSA attract individuals with higher trust levels, while informal CE activities are performed by individuals with a higher environmental consciousness. Furthermore, CSA membership is related to higher educational levels, larger households, and a larger female representation. Finally, in our bivariate probit regression, we find a stronger propensity of female respondents engaging in reuse and in social sharing activities.

8.3.2 Barriers and enablers for the informal circular economy

Next, we investigate barriers and enablers to engage in informal CE activities and its relation to CSA membership. We report results from the household perspective and from a broader just transition perspective, building on insights from interviews with CSAs.

Barriers and enablers from the individual perspective

In Figure 19 we report motivations of survey respondents, CSA members and non-members, on why they engage in informal repair, reuse, or sharing activities. Financial motives are most prevalent for these activities. Ecological motives and meaningfulness are reasons that are reported significantly more often by CSA members compared to non-members. Probit regressions on the selection of these motives, controlling for socio-demographic characteristics (reported in Table A.8.5), further reveal that CSA members consider reuse more often as easy compared to non-members.



Note: * significant at the 5% level, ** significant at the 1% level, based on two-sided F-tests for differences in relative frequences

Figure 19 – Motivations to perform informal repair, reuse, and share, for members and non-members of civil society associations (n = 802).

Survey respondents were also asked to select why they would not be motivated to engage in informal repair, reuse, or sharing activities. As reported in Figure 20, we see that perceived risk and a lack of habit formation are the most prevalent barriers. Differences between CSA members and non-members are, apart from financial barriers for repair, not significant. Interestingly, challenges such as a lack of time, financial barriers, or not knowing how to do these activities are not often mentioned. Probit regressions on these barriers, controlling for socio-demographic characteristics (reported in Table A.8.6) only indicate that CSA members report a lack of time more often to engage in reuse activities.



Note: * significant at the 5% level, ** significant at the 1% level, based on two-sided F-tests for differences in relative frequences

Figure 20 – Motivations for not performing informal repair, reuse, and share, for members and non-members of civil society associations (n = 802).

Barriers and enablers from a just transition perspective

As stated by an interview respondent: "*the Green Deal of the EU is great, but it is not just".* This also holds for activities in the informal CE, where interview respondents identified multiple barriers for a just transition, as summarized in Table 30. From a distributive justice perspective, the high costs of quality goods and limited access to affordable tools and spare parts hinder the repairability of items such as textiles and electronics. From a spatial perspective, the unequal distribution of repair, reuse, and sharing initiatives often favours wealthier groups, who are less affected by mobility constraints. Additionally, financial barriers, such as membership fees exclude vulnerable populations from participating in informal CE practices. Procedural justice barriers include the lack of representation for informal repair in policy discussions and the discouragement of informal repair due to legal liability concerns. Furthermore, regulatory obstacles, insufficient support for skill development, and the digital divide impedes the development of the informal CE. Recognitional justice barriers include the lack of acknowledgement and visibility of traditional repair skills, such as those held by refugees or in household work. Additionally, informal CE activities are often taken for granted and are insufficiently acknowledged as contributors to a circular transition. Finally, informal reuse and sharing practices are sometimes misrepresented as unreliable, stemming from societal distrust and reinforcing stigma.

Table 30 – Barriers towards a just informal circular economy: repair, reuse, and sharing

Informal repair	Informal reuse	Informal sharing
Distributive justice		
High costs of quality goods, limiting the repairability of textiles, electronics, etc. Unequal distribution of repair skills Limited access to affordable tools and spare parts for informal repair activities (including risk of dependence on large manufacturers)	Unequal distribution of reuse initiatives, resulting in unequal access to reusable items between urban and rural areas Rebound effects of reuse initiatives, not replacing but complementing virgin-material consumption by high-income groups	Financial barriers to participate in sharing networks or platforms Exclusion of low-income groups due to platform membership fees or deposits Limited sharing infrastructure in underserved areas (e.g., rural communities)
Procedural justice		
Lack of representation for informal repair practitioner in policy discussions Legal liability concerns, discouraging informal repair Insufficient support for skill development in repair for underrepresented groups	Regulatory barriers limiting formalisation or scaling of reuse initiatives	Digitalisation excluding individuals unfamiliar with online sharing platforms
Recognitional justice		
Lack of acknowledgement of traditional repair skills (e.g., household work, skills of refugees) Lack of visibility and recognition of the contribution of informal repair to a circular transition	Lack of societal trust and misrepresentation of reuse as unreliable Potential stigma associated with using second-hand goods Lack of visibility and recognition of the contribution of informal reuse practices to a circular transition	Lack of societal trust and misrepresentation of informal sharing as unreliable, limiting participation of diverse groups Lack of visibility and recognition of the contribution of informal sharing practices to a circular transition

To address distributive injustices, interview respondents emphasise the importance of establishing or scaling informal CE initiatives to better reach underserved populations. They also highlight the need for policies that redistribute time and financial burdens, enabling vulnerable groups to engage in time- and resource-intensive practices, such as repair. To address procedural injustices, respondents highlight the need for inclusivity in decision-making processes and ensuring access for all groups by simplifying procedures and reducing digital barriers. This also requires active monitoring to guarantee a meaningful inclusion and empowerment of marginalised groups. Finally, concerning recognitional justice, enablers involve acknowledging and valuing the contributions of all groups to a circular transition. Recognising grassroots and informal networks allows traditional practices and community-based approaches to be integrated into CE policy initiatives. As stated by one respondent, "*the great added value*

of civil society is that it stands among people and can make the circular economy tangible while ensuring access for everyone".

8.3.3 The role of CSAs towards a just circular transition

What gaps do CSAs address?

The vacuum hypothesis suggests that CSAs step in to address gaps left by market and government failures. Market failures render repair, sharing, and reuse activities economically unviable within a profit-driven model, while government interventions are sometimes incompletely implemented due to budget constraints and a lack of market information. CSAs engage in creating positive externalities and mitigating negative externalities. For example, repair initiatives reduce waste and extend the lifespan of goods while fostering skills development and community engagement. Similarly, CSAs facilitate sharing and reuse schemes, such as toy libraries and clothing depots, helping to reduce overproduction and alleviate household expenses. CSAs address collective action problems by coordinating community efforts, building trust, and creating spaces for collaboration. They act as intermediaries to ensure the quality of reused goods, organise repair cafés to fill gaps in formal repair markets, and establish systems that utilise local knowledge and social capital. Through these activities, CSAs provide practical solutions to sustainability challenges, enabling communities to take collective action where traditional market and government mechanisms fall short. This goes beyond environmental goals, as stated by one respondent: "*Our reuse activities originally emerged after World War I in response to the needs of families who had lost their husbands. Also today, our second-hand fairs continue to support families to participate in society.*" Another example, *"When people organise garage sales, it is because they want to bring life to their neighbourhood."*

CSAs achieve economies of scale through collaboration and shared infrastructure. By operating through decentralised yet coordinated networks, regionally active CSAs replicate successful initiatives – such as tool libraries and second-hand markets – across local chapters. This bottom-up structure allows for flexibility and innovation at the grassroots level while enabling cost-sharing and expertise dissemination at the organisational level. For example, some CSAs support local initiatives with educational resources to alleviate asymmetric information on the quality of goods offered on their reuse markets. These economies of scale reduce costs and enhance the overall impact of circular initiatives.

Why do CSAs address these gaps?

Exploring motivations of CSAs to engage in informal CE activities, we find reasons closely tied to the local-global hypothesis and the political voice hypothesis. Locally, CSAs operate as trusted intermediaries, addressing immediate community needs and

fostering connections through proximity. They mobilise individuals, build networks, and provide tailored solutions that larger, top-down institutions often struggle to deliver. For instance, one CSAs board member illustrates how their second-hand fairs build local trust by relying on peer familiarity: "*When people buy second-hand items locally, they know who they're dealing with. You can chat and assess whether the item's reliable – you can't do that online*." Similarly, another CSA organising reuse shops for mothers fosters not only reuse but dignity in access, with its coordinator noting: "*We aim to create a boutique feel – people are offered a drink and feel welcome, not stigmatised*." These examples illustrate how CSAs convert abstract trust mechanisms into tangible practices of recognition, interaction, and self-worth.

By creating accessible spaces for collective learning and experimentation, they enable individuals to engage in initiatives, such as repair cafés and informal sharing initiatives, that encompass trust and collaboration. These local actions serve as platforms that provide a sense of ownership and purpose to their members while also fostering behavioural change and strengthening community resilience. A concrete example is put forward by a CSA staff member: "*Many refugees and asylum seekers arrive with mechanical or textile repair skills. They volunteer in our cafés – we provide tools; they bring knowledge.*" This shows how CSAs integrate marginalised skills into community repair ecosystems, advancing both inclusion and circular literacy. One respondent exemplifies it as "*CSAs are closer to the population – they better understand the needs and how they can be met. They can mobilize people. It is a matter of proximity.*"

At the regional, national, or global level, CSAs leverage these local engagements to advocate for systemic change, acting as a counterbalance to corporate and governmental power. Therefore, next to their connecting and laboratory role, CSAs play a critical role, raising awareness and maintaining dialogue on pressing societal issues. As member-based organisations, they are connected to issues faced by the households they represent, complementing governance gaps and challenging dominant economic and policy paradigms that may fail to sufficiently account for social and environmental considerations. In their efforts to promote a CE or a just transition they challenge existing systems and propose alternative solutions. One respondent explains this as follows: "*Civil society has a role in staying alert to ongoing transitions and societal evolutions. Transitions will unfold – inevitably – so CSAs, guided by their values framework, must decide where to build connections, where to adopt an experimental role, and how to link societal creativity and ideas to these challenges. At the same time, a critical stance is necessary.*"

Why would CSAs be effective and efficient?

Interview respondents confirm how the organisational design of CSAs renders them particularly effective in addressing informational asymmetries. The non-distribution constraint creates an environment of trust and credibility, fostering assortative

matching where motivated staff and volunteers align with the mission. CSAs can organise repair, reuse, or sharing initiatives where participants feel confident about product quality due to the personal interaction. Additionally, CSAs are perceived as independent intermediaries, providing nuanced advice that neither businesses – focused on promoting their products – nor governments – perceived as detached or overly generic – can offer. This makes them valuable as trusted sources in contexts where asymmetric information impedes the uptake of circular solutions, as illustrated by the following respondent: "*Connecting people and fostering collaboration—this is where civil society excels, as it is not driven by sales."*

The effectiveness of CSAs is further enhanced by social psychological mechanisms that overcome collective action problems. By fostering identity, trust, reciprocity, and reputation, CSAs create networks of mutual support that encourage participation and long-term engagement. This is exemplified by the following quote: "*Often, families want to buy second-life products but lack trust. We bridge that gap by organising these initiatives, creating a sense of familiarity by knowing the background of the people involved, which fosters a sense of security."* These organisations operate in a peer-to-peer framework, enabling non-monetary incentives to collaborate compared to market-interactions with businesses or hierarchical interactions with government entities. Accessibility is also enhanced through hyper-local presence and flexible governance. The reuse shops for mothers, for example, operate in villages with poor transport links and use donated public buildings. "*In our rural area, having something local is essential,*" noted one organiser. Access for low-income groups is quietly facilitated through referral cards provided by social welfare centres, ensuring discretion: "*People come in with a discount card, no spotlight on them.*" This low-threshold, decentralised setup makes circular practices feasible for groups otherwise excluded from market-based or centralised models. Lastly, CSAs have comparative advantages to build economies of scale and influence through their grassroots connections and collaborative networks. Operating in networks at local and global levels, they mobilise voluntary and mission-driven resources and expertise to amplify their impact.

Civil Society failures

Civil society organisations in general, and CSAs in particular, are not immune to failures or the challenges stemming from organisational design flaws.

Firstly, CSAs may face challenges in recognising when an activity or initiative becomes less relevant or effective. Discontinuing an activity can be a difficult decision, given the organisational inertia caused by path dependencies. Activities that were once vital may no longer align with shifting societal needs or priorities, yet they persist due to entrenched organisational habits while not operating in a performance based market system. As one respondent notes, there is a tendency to "*keep doing what we have always done*," even when it is no longer impactful. This status-quo bias can lead to resources

being misallocated and a failure to adapt to societal transitions and remaining relevant for new generations of potential members. CSA respondents are aware of this challenge, as our pre-mortem questions most frequently resulted in answers such as "*if we fail, it is because we are no longer relevant to our members*". Conversely, there is also a risk of premature abandonment if results are not instantly visible, particularly as volunteers and stakeholders often seek tangible outcomes to justify their commitment.

A *second* challenge is the tension between the critical role of CSAs as movements, and the grassroot roles of connecting and experimenting at the local level. This tension can be illustrated by accusations of paternalism, where staff at regional headquarters are sometimes perceived as imposing solutions, attempting to "educate" communities, or trying to "direct" bottom-up initiatives. As one interviewee suggests, associations should "*educate people to come to conclusions by themselves*," but achieving this without ending up with paternalism is a delicate balancing act. This tension can create a sense of disconnection. To mitigate this, CSA are challenged once more to stay connected to their foundational values while fostering a culture of innovation and inclusivity.

Thirdly, assortative matching around missions of CSAs may result in them operating as club goods, where access revolves around those who meet certain criteria, such as shared values, resources, or cultural familiarity. While enabling cohesion and trust within the group, this can unintentionally hinder inclusivity and limit effectiveness towards a just transition. As pointed out by most interview respondents, many CSAs struggle to diversify their membership demographics, as they are dominated by highly educated staff members and volunteers, lacking representation from marginalised groups. Language barriers, cultural differences, and structural factors, such as strict formal membership requirements, further reinforce this exclusivity. Moreover, the concept of the "good cause" of a CSA may not be universally agreed upon. What one group views as a noble mission may be critiqued by others as paternalistic or misaligned with broader societal priorities. Therefore, CSAs face an ongoing challenge to reinvent themselves as inclusive platforms for collective action.

8.4 Discussion

8.4.1 Empirical contributions

According to our findings, CSAs can play a significant role in fostering a just informal CE by addressing market and policy failures, reducing barriers to participation, and ensuring inclusivity in the circular transition. In this section, we outline the implications of our findings for both civil society organisations and policymakers, while also acknowledging the limitations of our study. We begin by situating our main empirical contributions in relation to existing literature, as summarised in Table 31, highlighting how our work advances current debates.

Table 31 – Contribution highlights and comparison with extant literature

Key studies	Key findings	What this study adds
Informal CE in industrialised contexts		
Delanoeije & Bachus (2022); Korsunova et al. (2023); Van Opstal et al. (2025); Siderius & Zink (2023); EEA (2024a,b)	Focus on quantifying repair and reuse volumes Motivations to participate in specific circular strategies Macro-level estimations Informal CE framed a residual or marginal	Micro-level evidence on informal CE practices based on household survey and interviews. Distinguishes informal practices and links informal circularity to CSA membership. Challenging residualist views on the informal CE, calling for its reconceptualisation as community-anchored and institutionally nurtured. Responds to EEA (2024a,b) calls to map diverse actors and contexts.
Role of CSA in a CE		
Bradley & Persson (2022); Quintelier et al. (2023); Eiselein & Langenus (2025); Vetters et al. (2025); Hansmann (2021); Ben-Ner (2006); Lebrón (2025)	Emphasis on niche experimentation (e.g. repair cafés) Limited integration of CSAs in mainstream CE debates Civil society often treated hypothetically in transition literature.	Responds to Vetters et al.'s (2025) call for empirical grounding. Provides empirical analysis of how CSAs foster circular engagement by addressing barriers related to trust, skills, and accessibility. Identifies governance functions (e.g., redistribution, knowledge transfer, non-stigmatising access). Demonstrates how CSAs mediate market failures, validate alternative value systems, and operate under constraints, thereby enriching understanding of the comparative institutional advantages of CSA and risks for civil society failure.
Justice dimensions in CE transitions		
Kirchherr (2021) Deutz et al. (2024) Leclerc & Badami (2023) Malcolm et al. (2024) McCauley (2025) Gözet et al. (2025)	Distributive, procedural, and recognitional justice is often underexplored in CE research on industrialised countries Absence of granular data beyond case studies on how justice outcomes are shaped at grassroots level.	We empirically examine how CSAs address barriers to distributive, procedural, and recognitional justice in informal CE practices. Provides empirical foundation for just transition frameworks.

This study adds critical new evidence to the literature on the informal CE in industrialised regions. Prior research has largely concentrated on mapping and understanding specific circular strategies such as repair (Korsunova et al., 2023) or reuse (Delanoeije & Bachus, 2022) without having a clear distinction between formal and informal activities. A recent broader study encompassing multiple CE strategies in the informal economy only focuses on macro-level estimations (Van Opstal, Pals, et al., 2025). Our mixed-methods approach contributes to this literature with micro-level insights by quantifying individual engagement in informal CE practices such as repair, reuse, and sharing, while distinguishing how these practices are shaped by civil society association (CSA) membership. Our findings provide empirical grounding to recent

conceptual debates about blurred formal/informal boundaries (Siderius & Zink, 2023) by demonstrating that informal CE practices are not residual or marginal but are embedded in organised, trust-based systems of collective provision. This challenges prevalent dichotomies and calls for a reconceptualisation of informal circularity as an institutionalised and community-nurtured phenomenon. In doing so, the study responds to calls from the European Environment Agency (EEA, 2024b, 2024c) to better understand the diversity of actors, practices, and socio-spatial contexts in which informal CE activities emerge in high-income countries.

Secondly, our study makes a novel contribution to the growing literature on the role of civil society in enabling circularity transitions (Bradley & Persson, 2022; Eiselein & Langenus, 2025; Quintelier et al., 2023). While existing research has tended to focus on niche experimentation, repair cafés, or grassroots circular initiatives in isolation, our results systematically map the relationship between CSA membership and CE behaviours and explore how CSAs address systemic participation barriers. In doing so, we respond to the gap identified by Vetters et al. (2025) by providing empirical insight into the role of CSAs in the CE, an aspect that has largely remained speculative and underexplored in empirical research on sustainability transitions. We empirically validate theoretical propositions about the enabling role of CSAs in mediating market failures (Ben-Ner, 2006; Hansmann, 2021), demonstrating their comparative advantage in cultivating trust, skills, and accessible services and infrastructures. We identify multiple governance functions carried out by CSAs, such as redistribution via voucher systems, knowledge transfer and skill circulation, and the construction of non-stigmatising spaces for reuse. Moreover, we show how these functions are carried out under real-world constraints such as funding scarcity, professionalisation pressures, and organisational mission drift, enriching current understandings of civil society agency and vulnerability within circular transitions (Lebrón, 2025; Pansera et al., 2024).

Finally, the study significantly advances the empirical literature on just circular transitions. Building on the distributive, procedural, and recognitional justice dimensions outlined by Kirchherr (2021), we show how CSAs actively mitigate justice deficits that arise in informal circularity contexts. Our data reveal that CSA involvement enhances procedural justice by fostering proximity-based governance, offering participation channels in reuse and repair, and advocating for inclusive decision-making – providing solutions for key circular justice concerns identified in literature (Deutz et al., 2024; Leclerc & Badami, 2023). We also identify recognitional justice mechanisms, such as non-stigmatised access models and cultural validation of reuse practices, that are otherwise absent in mainstream CE policy frameworks (Hur, 2020). In distributive terms, our regression findings suggest that CSAs serve to democratise engagement in CE practices across income groups, particularly through relational and trust-based models of exchange. Importantly, we identify novel risks of civil society failure, such as exclusionary norms, gatekeeping, or overreliance on unpaid labour, that

echo broader critiques in the literature about elite-driven transitions and epistemic injustice (K. Liu, 2025; Malcolm et al., 2024; McCauley, 2025).

While our analysis concentrates on the social dimensions of circularity and the role of CSAs in advancing a just transition, it is essential to acknowledge the broader strategic significance of CE strategies as highlighted in recent literature. Scholars and policymakers increasingly frame circularity as a pathway to reduce dependence on imported fossil fuels and critical raw materials, thereby enhancing energy and material autonomy, economic competitiveness, and resilience to geopolitical shocks (Ashraf et al., 2024; Cerchione et al., 2025; Wolters & Brusselaers, 2024). This macro-level vision complements local and informal circular initiatives by reinforcing the need to close loops, relocalise production, and diversify supply chains. In this regard, CSAs, through their embeddedness in local communities and their ability to mobilise trust and participation, may not only address socio-environmental justice concerns but also contribute to strategic autonomy by enabling decentralised, circular resource practices.

8.4.2 Implications for civil society associations

A *first* implication for CSAs is that they need to safeguard and strengthen their role as trusted intermediaries, bridging the gap between formal CE initiatives and grassroots informal activities. By offering transparent, community-driven platforms for repair, reuse, and sharing, CSAs can reduce perceived risks associated with second-life products and mitigate social stigma, as pointed out earlier by Hur (2020). This involves investing in initiatives that enhance trust, such as quality assurance mechanisms, skill-sharing networks, and community-building activities. Furthermore, by addressing recognitional justice, CSAs can work to shift the dominant narratives around reuse and repair. CSAs can counteract this by publicly celebrating community repair practices and ensuring that the contributions of volunteers, migrants, or women in feminised labour roles are made visible and valued.

Second, CSAs should ensure inclusivity by lowering participation thresholds for vulnerable groups, including low-income households, migrants, and individuals with limited digital access. This requires co-developing activities that align with the daily lives and realities of diverse communities, such as language-neutral repair cafés, hybrid membership structures, and alternative engagement models. This needs to be balanced, however, with the need within CSAs to share a joint identity, taking into account the inseparability of social interactions and (circular) activities within the association, as pointed out by van der Velden (2021) and Quintelier et al. (2023). All in all, CSAs ultimately depend on the voluntary contribution of their members. CSAs should also advocate for more accommodating legal and regulatory frameworks, such as simplified insurance and liability models, to legitimise and protect informal repair and sharing initiatives. Distributive justice can be operationalised here by ensuring that circular opportunities, such as access to shared goods or repair services, are not concentrated

in affluent areas or among digitally literate members. Procedural justice is also relevant: CSAs should include vulnerable groups in the co-design of initiatives, ensuring that activities reflect their experiences, fostering agency and inclusion.

Third, CSAs must maintain a critical yet constructive role in CE policymaking by ensuring that informal CE activities receive normative and cognitive legitimacy. Many informal circular practices remain invisible in policy debates and are even taken for granted by citizens themselves. CSAs should work to integrate these practices into local, regional, and national CE strategies, advocating for enabling policies and financial support mechanisms that do not only rely on short-term project-based funding but ensure long-term viability. This is not always straightforward as CSAs are sometimes reduced by policymakers and members themselves to providers of community services and social activities, neglecting their role as opinion-makers (Vanhuyse et al., 2022).

Fourth, CSA leaders and coordinators should invest in capacity-building and organisational continuity, professionalising where appropriate without eroding grassroots engagement. CSAs should embrace adaptive governance and innovation to remain relevant in an evolving circular economy and society. Internally, this requires balancing grassroots engagement with broader strategic influence, allowing members to take ownership of new initiatives, while avoiding stagnation in outdated practices – a risk identified earlier by Hansmann (2021). It is important for CSAs to balance their social missions while avoiding a paternalistic stance that could undermine intrinsic member motivations. Likewise, they should recognise diverse member motivations, including those unrelated to environmental goals. Leadership teams should also reflect on their own representativeness, ensuring that inclusivity goals are institutionally embedded. Externally, CSAs can align resource circularity with social inclusion by engaging broader communities in decision-making, supporting external initiatives, and collaborating with policymakers to remove barriers.

Fifth, cross-sector alliances with circular businesses, social enterprises, or municipal repair and waste infrastructures can help CSAs expand their reach. Collaborations that blend informal initiatives with formal actors (e.g., co-hosted repair spaces or shared logistics for reuse) can enhance both visibility and operational capacity, while still preserving core values of community-based circularity (Amend et al., 2022; Van Opstal & Borms, 2025). Such partnerships can help to improve the scalability, replicability, and accessibility of their initiatives.

Finally, digital tools can serve as levers for scale but must be implemented with care. CSA management can explore apps for sharing, coordination, or digital repair literacy, provided they are accompanied by offline alternatives and accessible design (Ozturkcan, 2024). This prevents the exclusion of digitally less confident members and ensures that digitalisation supports rather than replaces collective participation (Meinhold et al., 2025).

8.4.3 Implications for policymakers

To advance a just CE that includes informal and community-based actors, policymakers at all levels must move beyond declarative support and establish concrete, durable mechanisms for enabling inclusive circular practices. While informal circular activities often emerge locally, their flourishing depends on multilevel support that addresses structural constraints. Given the reliance of many informal circular activities on volunteers and the high transaction costs associated with long-term participation (Williams, 2022), public authorities should help lower barriers, facilitate collaboration, and provide structural support as these activities generate positive externalities and resolve collective action problems. Policymakers should embed justice concerns into programme design from the outset, to ensure that circular initiatives do not replicate existing social inequalities. This means considering distributive justice (who benefits), procedural justice (who participates in decision-making), and recognitional justice (whose knowledge and values are reflected). Below, we provide operationalised recommendations for local, regional, and EU-level policymakers, based on the findings of this study in connection to recent literature.

Municipalities can help to establish and support local ecosystems that enable informal CE activities by providing accessible, well-equipped spaces such as repair cafés, community sharing hubs, and skills exchange initiatives. Facilitating access to local facilities, such as libraries and maker spaces, can ensure that circular practices remain inclusive and affordable (Eiselein & Langenus, 2025). Cooperation and coordination between municipalities, e.g., by intermunicipal associations, can further help to foster knowledge-sharing, replicate impactful initiatives, and scale successful CE initiatives. Meanwhile, municipalities must avoid over-relying on unpaid civil society actors, particularly in socio-economically disadvantaged areas and among vulnerable groups, where more structured support may be necessary, as pointed out earlier in research on repair cafés (Bradley & Persson, 2022). At the operational level, municipalities and intermunicipal associations can appoint dedicated CE liaison officers to support informal actors with permits, safety protocols, and basic regulatory guidance. Furthermore, municipal procurement can be opened to CSAs via socially responsible public procurement frameworks, giving informal repair or reuse groups access to discarded municipal goods, from ICT equipment to office furniture (Purvis et al., 2025).

At the *regional* level, governments should provide stable financial mechanisms that go beyond short-term project-based funding to ensure the long-term viability CSAs. Many CSAs operate through project-based models, often leading to myopic decision-making and an inability to retain staff (Ebrahim, 2005). To address this, regional authorities should develop, safeguard, or enhance structural funding streams that support core operations and capabilities oriented at social innovation. Additionally, financial incentives such as subsidies for repair, reuse, and sharing activities can help make informal circular practices more economically viable and attractive. Likewise, they can

support CSAs by simplifying regulatory frameworks, particularly regarding liability and insurance, enabling community repair and reuse initiatives to operate legally and securely. Finally, regional governments should also integrate informal CE activities into broader environmental strategies, ensuring they are recognised as legitimate components of a circular economy and society. This should be operationalised in an improved eligibility for CE infrastructure grants, strategic consultation, and monitoring. Aligning regional CE roadmaps with just transition plans, including metrics for social inclusion and labour quality in organised informal settings, would prevent the exclusion of marginalised actors from CE transitions (Circle Economy, 2024b).

At the *European* level, policymakers should develop harmonised legal frameworks that facilitate the expansion of informal CE initiatives while ensuring social protections for participants. Dedicated EU legislation on liability and insurance for informal CE actors would help mitigate risks. In addition, funding mechanisms such as Horizon Europe and LIFE should include specific allocations for informal CE innovation. CSAs at the EU level can play a crucial role in just transitions policymaking, bridging the gap between EU policymakers and community voices at the member-state level, as identified earlier in research on the energy transition (Ullman & Kittner, 2024). Furthermore, the EU should ensure that informal CE activities are integrated into broader policy frameworks such as the European Green Deal. Benchmarking informal CE contributions, including social impact indicators, would further institutionalise their role. Finally, cross-border learning and peer exchange should be supported through Erasmus+ and Interreg programmes for circular social enterprises, informal circular networks, and community organisers. Transnational mobility schemes for circular skills can support capacity-building and diffusion of successful local practices, addressing one of the core barriers in informal CE scale-up identified by recent studies (Lebrón, 2025; Malcolm et al., 2024).

Across all levels, policymakers must explicitly address the risk that CE initiatives become socially and spatially exclusionary, benefiting wealthier or better-connected communities while failing to serve vulnerable populations (Deutz et al., 2024; Premyanov et al., 2024). Without proactive inclusivity measures, circular initiatives by CSAs risk reinforcing existing inequalities rather than reducing them. By strategically supporting informal CE actors at multiple governance levels, policymakers can help create a resilient, inclusive CE that aligns with broader just transition goals.

8.4.4 Limitations and recommendations for future research

This study provides novel insights into the role of CSAs in the informal CE but also has some limitations.

First, our analysis captures a static perspective of CSA engagement, whereas the roles of CSAs are inherently dynamic. The interactions between public policies, market developments, and technological advancements define the informal CE over time,

influencing the scope and relevance of CSA activities. Future research should therefore adopt a longitudinal perspective to assess how CSAs evolve in response to shifting systemic conditions.

Second, our study focuses primarily on repair, reuse, and sharing activities within a European context, overlooking other informal CE strategies such as informal waste management, which has received more attention in Global South contexts. Further research is needed to explore the role of CSAs in different informal CE settings, including their involvement in waste picking, upcycling, and material recovery. Comparative studies between the Global North and Global South could help identify commonalities and divergences in how CSAs operate under distinct socio-economic and institutional conditions. Moreover, expanding the geographic scope of research within industrialised economies could reveal regional variations in how CSAs engage in informal CE activities.

Third, a methodological limitation of our study lies in the potential influence of cognitive biases on survey responses regarding barriers to informal CE participation. The low reported percentages for reasons not to engage in informal circular practices may be affected by social desirability bias, with respondents underreporting negative attitudes towards repair, reuse, or sharing. Additionally, self-serving bias and cognitive dissonance could lead respondents to rationalise their non-participation in ways that align with their self-perceptions as environmentally responsible individuals. Future studies should incorporate experimental or qualitative techniques to better uncover these cognitive mechanisms and provide a more nuanced understanding of participation barriers.

Fourthly, this study focuses on CSAs as defined by their non-distribution constraint and membership-based governance, thereby excluding cooperatives and foundations. While this approach ensures conceptual clarity, future research should explore interdependencies between different organisational forms within civil society and the extent to which CSAs collaborate or compete with other actors in shaping the informal CE.

Finally, while research on the formal CE has explored interactions between civil society, businesses, and governments (Ho et al., 2022), little is known about these dynamics within the informal CE. Our study contributes to this gap but does not fully capture the co-evolution of civil society knowledge with indigenous, local, and private-sector expertise, as highlighted by Ullman & Kittner (2024). Future research should therefore map the dynamics and coordination mechanisms that influence how informal CE initiatives are embedded within broader socio-economic systems.

8.5 Conclusions

This work provides new empirical evidence on how CSA membership shapes engagement in informal CE practices and addresses structural barriers to a just transition. It investigated the roles of CSAs in organising the informal CE in an industrialised context, answering three key research questions. First, our analysis of household survey data in Flanders revealed that CSA membership is positively associated with participation in informal CE activities such as repair, reuse, and sharing. This relationship holds across multiple product categories and remains significant when controlling for demographic characteristics. Second, we identified a range of barriers and enablers from both household and justice perspectives. While financial and ecological motivations drive participation, CSA members report fewer perceived barriers, suggesting that CSAs enhance accessibility and trust. Third, we found that CSAs play critical roles in enabling a just informal CE by filling institutional gaps, empowering citizens, and addressing distributive, procedural, and recognitional justice concerns through their grassroots engagement and policy advocacy.

These findings have important implications for policymakers and civil society actors. CSAs serve as effective intermediaries that foster behavioural change, create inclusive participation channels, and strengthen social capital in the CE. Policymakers should provide long-term, structural support and create enabling frameworks that recognise and integrate informal CE activities into formal CE strategies. For CSAs, safeguarding trust, avoiding exclusion, and building adaptive, mission-driven organisations will be crucial to maintain relevance and impact. Cross-sector collaboration and inclusive governance mechanisms can further enhance the scale and effectiveness of informal CE practices, ensuring that circular transitions benefit a wider range of social groups.

Future research should explore how CSA roles evolve over time, particularly in response to policy shifts and systemic transitions in a challenging geopolitical era. Comparative studies between regions and between the Global North and South could enrich understanding of CSA contributions across diverse informal CE contexts. Additionally, greater attention is needed to uncover cognitive, institutional, and organisational factors that influence both participation and exclusion in informal CE practices. Expanding the scope of research to include other forms of civil society organisations, such as cooperatives and foundations, and mapping their interactions with state and market actors, can deepen our understanding of the transformative potential of civil society organisations in circular transitions.

9. Discussion and conclusion

The following sections summarise the main scientific advances, practical contributions, and policy recommendations arising from this work. This discussion then considers the key limitations of the research and avenues for future study, before closing with concluding reflections.

9.1 Main contributions and impact of this thesis

9.1.1 Scientific contributions

Beyond the individual contributions of each paper, this thesis advances circular economy scholarship through an applied institutional perspective on organisational forms. It examines how regulative arrangements (ownership structures, control rights, and formal decision rules), normative orientations (mission commitments and value-based objectives), and cultural-cognitive elements (shared beliefs, trust, and legitimacy) influence the capacity of different organisations to enable and embed circular strategies.

First, this thesis clarifies the organisational foundations of CE governance by introducing a *comparative organisational perspective* that analyses how ownership, control, and benefit-distribution structures affect the capacity to enable and embed circular objectives. Much of the CE governance literature focuses on firms and state actors, leaving limited insight into the institutional features of non-profit-distributing organisations. By applying and extending comparative organisational advantage theory (Ben-Ner, 2006; Besley & Ghatak, 2005; Hansmann, 1979, 1999, 2021) to the CE, this research conceptualises how third sector organisational forms mobilise resources, coordinate stakeholders, and design value propositions that integrate environmental, social, and economic objectives. It shows that mission-oriented corporate governance and member ownership can align incentives towards long-term stewardship, that democratic decision-making can foster trust and transparency, and that the non-distribution constraint can credibly channel surpluses into social or environmental reinvestment. These features also influence system-level coordination in emerging circular ecosystems. Third sector organisations often act as intermediaries in multi-actor arrangements and strengthen legitimacy through embedded, value-based decision-rules. In the empirical context of this thesis – democratic, high-income welfare states – these institutional features equip third sector organisations with distinctive capacities to contribute to a circular economy and society, while their relevance in other political systems remains an open question for future research.

Second, this thesis contributes to understanding *market and coordination failures* by theorising how third sector organisational forms address – or fail to address – barriers

to a circular economy and society. Existing CE research identifies market failures such as environmental externalities, public goods, and information asymmetries (Austin & Rahman, 2022; Grafström & Aasma, 2021; Jaffe et al., 2005), but rarely examines the organisational mechanisms that mitigate them. The empirical work here demonstrates that social enterprises, cooperatives, and civil society associations can internalise externalities, provide quasi-public goods, reduce transaction and coordination costs, and improve information quality through mission orientation, stakeholder accountability, and shared ownership. At the same time, the findings highlight secondary failures of these organisational forms. Governance features that protect mission integrity can generate rigid membership rules and slow decision making, which limits scalability and strategic agility. Reliance on restricted funding can create project lock-in that diverts attention from system-level CE outcomes. Professional and regulatory isomorphism can induce mimicry of corporate practices that erodes participatory strengths, while capability gaps create path dependence on activities with limited impacts.

Third, this thesis contributes to debates on a *circular society* and *justice in circular transitions* by integrating distributive, procedural, and recognitional justice dimensions into organisational analysis (Jaeger-Erben et al., 2021; Kirchherr, 2021; Schlosberg, 2007). The just transition literature rarely examines how organisational forms relate to justice outcomes in a circular transition. This research shows that access to CE benefits, participation in decision-making, and recognition of diverse needs are mediated by governance arrangements embedded in the ownership and decision structures. Third sector organisations can widen participation in CE initiatives, create inclusive employment pathways, and strengthen recognition through proximity, trust, and shared values. Their embeddedness in local networks enables them to link environmental goals with social welfare provision, while their governance arrangements ensure that those affected by circular strategies can also influence them. WISEs illustrate this through the reintegration of workers in reuse and repair activities; cooperatives through participatory ownership of energy and housing infrastructures; and associations through civic engagement and behavioural change initiatives. In other words, organisational diversity represents a structural and normative dimension of a circular economy and society, shaping how fairness, inclusion, and resilience can be realised. However, collaborative and multi-actor governance arrangements are not inherently inclusive. They may reproduce power asymmetries when participation is dominated by well-resourced actors, and consensus-oriented processes can weaken democratic accountability. The findings suggest that organisational diversity can mitigate such risks only where governance arrangements secure meaningful participation, transparency, and clear responsibility.

Fourth, it strengthens methodological approaches to the study of organisational forms in a CE by combining quantitative and qualitative evidence across multiple studies. This thesis integrates econometric analysis based on survey and administrative data with

semi-structured interviews and scenario-based simulations across organisational forms and sectors. This methodological pluralism enhances both internal and external validity, supports cross-case theorisation, and provides transferable frameworks for analysing organisational diversity in sustainability transitions. The mixed-method allows for triangulation between behavioural and institutional explanations, capturing both measurable outcomes and underlying mechanisms.

Finally, this thesis contributes to debates on circular effectiveness by demonstrating how organisational forms condition the enabling and embedding of circular strategies and thereby affect material flow outcomes. Circularity ultimately concerns changes in material throughput – narrowing, slowing, closing, and regenerating resource flows. While this research primarily analyses governance, incentives, and justice dimensions, these institutional features shape whether circular strategies translate into measurable reductions in virgin input, waste generation, and premature obsolescence. Organisational forms influence asset ownership, investment horizons, maintenance incentives, and coordination across value chains, all of which determine whether loops are effectively closed or merely rhetorically adopted. For example, cooperative ownership can extend asset lifetimes through shared stewardship, WISEs can operationalise repair and reuse activities that slow material flows, and civil society associations can normalise sufficiency-oriented practices that narrow demand. Future research should therefore combine organisational analysis with material flow assessments in order to examine how specific organisational arrangements relate to closing, slowing, narrowing, or regenerating loops.

9.1.2 Practical contributions

This dissertation provides actionable insights for practitioners working in social enterprises, cooperatives, non-profit associations, and other third sector organisations engaged in CE activities. The findings highlight concrete recommendations for designing, implementing, and scaling circular business models contributing to a circular society.

From the studies on *social enterprises* – WISEs in particular – we learn:

- *WISEs* should not take their role in a CE for granted and must therefore invest in collaboration, innovation, and adaptive capabilities to strengthen their competitive position in circular value chains. ESG measurement should be treated as a strategic tool for demonstrating their environmental, social, and economic value, supporting their claims and enhancing their legitimacy. At the same time, WISEs need to actively create awareness of their strongest assets and distinctive characteristics, since potential partners are not always fully aware of their contributions and capacities. By making their value proposition more visible, they can reduce ignorance among stakeholders, build trust, and

position themselves as credible partners in circular initiatives. They should also connect with broader innovation networks and entrepreneurial ecosystems to identify opportunities beyond their current activities and diversify their operations accordingly.

- *Businesses* working with WISEs should build partnerships that directly address operational needs, such as filling skill shortages in logistics, production, or repair. They can benefit from targeted matchmaking and better information flows to identify WISEs with relevant expertise. Integrating work integration into core CE strategies will enable supply chains to generate and capture social, environmental, and economic value in a mutually reinforcing way.
- *Circular hubs* that involve WISEs and other companies should align governance, funding models, and engagement strategies with their defined scope and purpose. Capacity-building activities should be used to improve the circular literacy and operational readiness of WISEs and other partners. Integrating social inclusion objectives into hub activities will further strengthen legitimacy and public support.

From the studies on *cooperatives*, we can draw the following recommendations:

- *Citizen energy cooperatives* should diversify into circular solutions by leveraging experiences from early adopters to demonstrate feasibility and initiate internal governance discussions. Balancing innovation with inclusive membership strategies will help avoid homogeneity and ensure that benefits are extended to underrepresented groups.
- *Cooperatives managing complex socio-technical systems*, such as smart grids or industrial parks, should integrate CE principles into technical design, governance, and member engagement from the earliest stages. This includes ensuring interoperability and upgradeability of components, embedding repairability and reuse into procurement standards, and establishing clear governance processes for member participation in strategic decisions. This can in turn lower operational costs, increase system resilience, and strengthen long-term member trust and engagement.
- *Housing cooperatives* should embed CE principles into governance and business models from the outset to make lifecycle thinking the default approach. Collaborating across cooperatives can achieve economies of scale in procurement and process design, but measures should be in place to prevent rebound effects.

From the study on non-profit associations, we identify the following recommendations:

- *Leaders* within non-profit associations should lower participation thresholds for vulnerable groups by adapting activities to different cultural, linguistic, and

digital access needs. They should also recognise and make visible circular strategies in the informal economy – such as repair, reuse, and sharing – that might otherwise be taken for granted. This fosters access of these opportunities to a broad range of community members.

- *Partner organisations*, including municipalities, social enterprises, and private companies, should work with non-profit associations to build operational capacity without undermining grassroots engagement. Partnerships can provide access to shared infrastructure, funding, and technical expertise, enabling successful community-based models to be expanded or replicated in other locations while maintaining the association's community-driven character.
- *Partner organisations*, including municipalities, social enterprises, and private companies, should work with non-profit associations to build operational capacity because these associations often provide trusted, community-embedded channels that formal actors cannot replicate on their own. Non-profits can reach groups that are otherwise difficult to involve in circular initiatives, lower the social risks of introducing new practices, and mobilise volunteer networks to extend the lifespan and reach of projects. This enables the further replication of successful community-based models in other locations and fosters their local legitimacy.
- At the *European-level*, civil society organisations should build internal knowledge and capacity on CE issues to ensure that these topics are addressed alongside their existing agendas. This includes investing in training for staff and members, incorporating CE considerations into position papers and advocacy strategies, and establishing links with specialist networks to avoid superficial or outdated understandings of the CE.

9.1.3 Policy contributions

The policy recommendations in this thesis follow from a law and economics perspective that treats ownership rights, control structures, and legal form as levers for incentive design in a circular economy and society. They respond to the evolving regulatory, normative, and cultural-cognitive pillars that shape CE policies in Europe and are intended to inform and support the design and refinement of policies across municipal, regional, national, and European levels.

Firstly, as demonstrated in this thesis, third sector organisational forms can help resolve persistent barriers to circular transitions by addressing market failures, building trust in complex multi-actor arrangements, and embedding distributive, procedural, and recognitional justice principles. Policies should *create conditions that leverage these organisational comparative advantages*. Specific policy recommendations are:

- Provide direct funding and procurement to projects that generate a "double dividend" by delivering both environmental and social returns. In this dissertation we show how third sector organisations have a comparative advantage in internalising both social and environmental externalities. Targeted public funding and procurement can leverage this advantage to expand their impact and avoid the underprovision of these public goods. This strengthens the regulative pillar of EU policy and can inform the forthcoming Circular Economy Act announced under the Clean Industrial Deal.
- Support matchmaking platforms and knowledge-sharing initiatives to reduce information asymmetries between CE actors, both among and between businesses and third sector organisations. Such asymmetries can lead to adverse selection and missed opportunities for collaboration. By improving information flows, these initiatives lower transaction costs, enhance trust, and better align supply with demand in circular value chains, unlocking the latent capacity of underused organisational assets. This aligns with the cultural-cognitive pillar by fostering shared understanding and trust across actors and complements initiatives under the Circular Cities and Regions Initiative (CCRI).
- Design funding schemes that value justice outcomes in a circular transition – such as equitable access to its benefits, and inclusive decision-making. From a welfare economics perspective, market mechanisms alone will not ensure equitable distribution of benefits or inclusive governance, as these are not priced into market exchanges. This responds to the normative pillar of European circular policy. This dissertation demonstrates that organisational governance structures shape access and participation: cooperatives, social enterprises, and CSAs have comparative organisational advantages to embed procedural and recognitional justice in their operations, but these features are undervalued in existing funding criteria that mostly focus on return on investment.

Secondly, third sector organisations often face structural undercapitalisation, capability gaps, and dependency on short-term funding, which limit their ability to scale circular strategies. At the same time, they benefit from high trust, local legitimacy, and flexible governance, which can be amplified through targeted policy support. Policies should focus on *removing systemic constraints* while reinforcing these enabling features. Specific policy recommendations are:

- Move from short-term project grants to structural financing mechanisms that support ongoing CE-related operations and organisational capacity-building. Short-term grants often create stop-start dynamics that waste resources, inflict transaction costs, and undermine long-term investment in people and infrastructure. This measure corresponds to the regulative pillar of CE policy, complementing EU funding instruments such as Horizon Europe and the

European Social Fund Plus (ESF+), which increasingly aim to strengthen institutional capacity for sustainability transitions.

- Offer targeted subsidies and innovation funding for upgrading infrastructure to ensure repairability, interoperability, and reuse potential across value chains. Infrastructure investment in CE often suffers from coordination failures. Individual actors hesitate to invest in interoperable systems because benefits accrue across the whole value chain – leading to split incentives. Targeted subsidies address this by reducing first-mover risk and enabling shared infrastructure that benefits multiple stakeholders.
- Support skills development programmes that combine technical CE competences with governance and collaboration capabilities specific to third sector contexts. Firms often underinvest in transferable skills because they cannot fully capture the returns, while employees may underinvest in organisation-specific skills for fear of labour market lock-in. Third-sector organisations, particularly WISEs and cooperatives, face both problems as they operate in hybrid markets that demand not only technical CE expertise but also collaborative governance and partnership skills. Training that integrates both domains enables these organisations to govern complex multi-actor projects more effectively and reinforce their position as trusted intermediaries in circular value chains. This reinforces the European Skills Agenda and the Pact for Skills, both of which emphasise sustainability and social inclusion.
- Create blended finance instruments that de-risk investment in CE projects led by social enterprises, cooperatives, or civil society associations. Many investors prioritise liquidity and growth, while third sector organisations optimise for mission stability and member value. Capital markets also tend to assign high risk, given limited or illiquid collateral and legal constraints to attract equity capital. Blended finance that combines public funds, patient capital, and private investment, can absorb part of the risk and mobilise capital for socially and environmentally beneficial projects. Mandates for public and impact investors can target mission outcomes and member control, and community capital instruments can mobilise locally anchored savings. In this way, private capital can complement rather than compromise organisational aims.
- Using CSRD reporting pathways and the EU Taxonomy can make performance legible to lenders by translating environmental and social results into verifiable metrics. Standardised templates for third sector organisations can reduce information asymmetries, lower due-diligence costs, and crowd in private finance alongside limited public funds.

Thirdly, diversity in organisational forms offers a broader set of governance models, trust relations, and resource mobilisation strategies than any single form alone. *Harnessing this diversity* in a circular economy and society can strengthen resilience, increase legitimacy, and address multiple objectives simultaneously. Policymakers

should create frameworks that recognise and connect these forms for systemic effect. Specific policy recommendations are:

- Integrate third sector actors into formal CE roadmaps and governance bodies at local, regional, and national levels to ensure diverse organisational perspectives shape transition strategies. Excluding certain organisational forms from formal decision-making can lead to coordination failures and policy lock-in, as dominant actors over-prioritise their own constraints and objectives. The formal integration of third sector organisations into CE governance bodies reduces information asymmetries between policymakers and community-level implementers, improves policy legitimacy, and ensures that transition strategies account for a broader range of incentives, resource constraints, and justice outcomes.
- Fund consortia that bring together different organisational forms to tackle shared bottlenecks, such as infrastructure costs, skills shortages, or access to secondary markets. Such consortia can pool complementary assets, achieve economies of scale, and resolve split incentive problems along value chains.
- Develop legal and regulatory frameworks that safeguard the distinctive governance features of each organisational form while enabling them to collaborate effectively. Third sector organisations derive part of their comparative advantage from specific governance constraints, such as non-profit distribution rules, member control, or mission-locked statutes. Poorly designed accreditation rules and public-private partnerships may lead to diluting these features, creating mission drift or undermining trust among stakeholders. Conversely, regulatory clarity can lower transaction costs in cross-organisational projects, reduce the risk of opportunism, and maintain the incentive structures that underpin each form's unique contribution to the CE. This is particularly important for partnerships involving long-lived assets and shared infrastructure, where governance integrity is essential for sustained cooperation.
- Support umbrella and second-tier organisations at national and EU level to build CE literacy among members. Many sector-level federations and civil society alliances currently lack sufficient knowledge of CE concepts, market dynamics, and policy tools, leading to superficial engagement or missed funding opportunities. Building this literacy strengthens advocacy capacity, improves the alignment of sectoral agendas with CE goals, and ensures that justice considerations are embedded in cross-sector policy dialogues.

9.2 Limitations and future research avenues

Although this thesis is based on an extensive body of empirical and conceptual work, several overarching limitations must be acknowledged.

First, a recurrent limitation across the studies is their geographical focus on Belgium, particularly the region of Flanders. While this region offers a fertile context, due to its industrialised setting, policy support for circularity, vibrant civil society, and longstanding traditions in the social and cooperative economy, these characteristics may limit the transferability of findings. Several papers explicitly recognise that the institutional, cultural, and economic embedding of WISEs, cooperatives, and civil society associations may vary considerably across other European regions and are even more distinct when considering the Global South. The thesis has thus generated rich context-sensitive insights, but future research is required to test and refine these insights in more diverse geographical settings, particularly in regions with weaker institutional infrastructures or alternative path dependencies. Further research could also examine how contextual differences determine the adaptive capacity of organisational forms towards a CE.

Second, some methodological limitations apply. Except for one study using a longitudinal case study design - most of the studies employed cross-sectional research designs, limiting the ability to capture dynamic processes and evolving motivations. For example, several contributions note the need for longitudinal data to better understand how value propositions, organisational models, and collaborative dynamics change over time. Furthermore, the use of surveys and interviews introduces potential cognitive biases such as social desirability or retrospective rationalisation, particularly when investigating socially desirable behaviours in a circular transition. Some contributions also rely on theoretical proxies (e.g., professional stakeholder or trade union views) rather than directly capturing the perspectives of citizens, workers, or members themselves. Pathways for further research should involve the design of longitudinal panel datasets and repeated qualitative empirical data collection (e.g., follow-up interviews) to trace organisational and behavioural changes over time. At the same time, also more empirical work based on cross-sectional observations would strengthen the external validity of these outcomes. Iterative and structured survey approaches, ideally organised or supported by statistical authorities, could further enhance the robustness and comparability of evidence. Experimental designs may also help mitigate cognitive biases, while participatory and citizen-science methodologies could better capture the voices of end-users, workers, and non-professional stakeholders in circular initiatives.

Third, another recurring limitation is the selective focus on specific organisational forms. While the papers presented concentrate on accredited WISEs, formal cooperatives, and civil society associations, this work does not study the potential role

of foundations or more hybrid organisational models. This choice, often motivated by conceptual clarity or data availability, may obscure important interdependencies and grey zones between organisational forms. Similarly, some contributions restrict their sample to frontrunner firms or niche initiatives, limiting broader insights into mainstream or laggard segments. Further work is needed to map how diverse organisational forms interact, compete, or collaborate in developing the CE. Pathways for further research should include explorations of hybrid legal forms, organisational ecologies in regional CE systems, and how organisational forms change when evolving towards or away from circularity. Future work may also map relational dynamics between organisations, further illuminating systemic enablers or constraints.

Fourth, while the thesis draws on a rich array of theoretical frameworks, it also acknowledges the blind spots inherent to these lenses. For example, market failure theory may struggle to fully account for non-market values or the normative tensions embedded in circular transitions. Similarly, ideal-typical representations of cooperative principles may not align with their practical implementation, revealing a gap between normative theory and governance realities. These tensions invite further theoretical refinement, potentially through the integration of behavioural, institutional, and justice-oriented perspectives. Moreover, further conceptual development is needed to theorise trade-offs and normative tensions within CE transitions in different organisational forms.

Finally, some findings are susceptible to endogeneity risks and selection biases. Participants in these initiatives often self-select based on pro-environmental values, higher education levels, or social capital. As a result, it remains challenging to disentangle whether observed circular behaviours and governance advantages stem from the organisational model itself or from the characteristics of its members. While the thesis makes contributions in theorising these mechanisms while trying to control for this risk, it also recognises the need for more robust empirical strategies to mitigate such biases. Pathways for further research therefore involve the development of quasi-experimental research designs (e.g., propensity score matching, instrumental variable techniques), as well as more comprehensive data collection on baseline attitudes and beliefs that go beyond traditional socio-demographic characteristics.

9.3 Concluding remarks

The findings in this thesis confirm that the organisation of a circular economy and society is as critical as the technologies and business models that drive it. The examples explored across the chapters reveal that when governments, firms, and third sector organisations work to their strengths, the combined effect is greater than the sum of individual contributions. This requires governance arrangements that do more than align interests; they must enable complementary roles, mutual accountability,

safeguard democratic participation, and prevent elite capture while supporting the scaling of circular strategies and business models.

At the same time, the comparative advantages of organisational diversity do not emerge by default. They rely on institutional environments that recognise the distinctive capacities of each organisational form, provide room for experimentation, and address structural barriers that hold back social and environmental innovation. Yet across the world, third sector organisations are able to foster progress where these conditions are only partly in place. They often act prospectively and correctively by initiating, testing, and legitimising new practices, and by helping to shape standards, markets, and policy debates. The scale and durability of these efforts depend on the wider institutional framework, but the capacity to create and nurture niches extends well beyond EU policy settings.

Looking ahead, the challenge is to view organisational choice, design, and governance as integral elements of circular transition strategies, not as accidental by-products. Doing so will require policy frameworks that create space for mission-driven organisations to work alongside market-driven and state-led actors, without eroding their governance integrity. It will also demand a shift in how contributions are measured and valued so that the environmental and social dividends of collaboration are visible and rewarded.

In this way, the work in this thesis connects back to its starting point: recognising that a circular economy and society is built not only on closing, slowing, narrowing, and regenerating material loops, but also on designing institutions and relationships capable of enabling and embedding change. The aspiration is that these insights support future efforts to realise the full potential of diverse organisational forms in creating a CE that is not only more resource-efficient, but also fairer and more resilient.

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Appendices

APPENDIX 2.1 – Partner organisations from the circular startup ecosystem in Flanders

Circular Flanders (Vlaanderen Circulair): Circular Flanders is a partnership of governments, companies, civil society, and the knowledge community and act as the central hub and inspiration source for the circular economy in Flanders. The Government of Flanders has set the circular economy as one of the seven transition priorities and appointed the OVAM (the Public Waste Agency of Flanders) as the initiator of Circular Flanders. The operational team, which is responsible for the day-today operation, is embedded in the OVAM.

Start it @KBC: Start it @KBC is startup accelerator and is considered to be the largest startup ecosystem in Belgium. Its mission is to support startups in their entrepreneurship. Start it @KBC aims to attract startups with an innovative and scalable product or business model. Selected startups pay no money or equity and follow an acceleration program during the first three months, followed by a growth path. For a year, they can count on mentorship, expertise, custom workshops, and funding advice. The program focuses on market validation, business development, and sales as a basis for later fund-raising. Start it @KBC is part of the Global Accelerator Network (GAN), a network of more than 100 accelerators worldwide.

Social Innovation Factory (Sociale Innovatiefabriek): The Social Innovation Factory has been founded in 2013 as a joint initiative of the Flemish Government, civil society actors and companies. Its mission is to mainstream social innovation and social entrepreneurship as means to support societal change. As a network organisation, they collaborate with actors from the quintuple helix. The Social Innovation Factory acts as a knowledge hub, a community, and offers activities and trajectories, including an Impact Startup Club.

Dyzo: Dyzo is a non-profit association, established to assist entrepreneurs in difficulty, trying to prevent bankruptcy. Its support encompasses economic, legal and psychological aspects, offered by a combination of professionals and volunteers. The Flemish Government provides financial support, rendering this offer free for enterprises in difficulty.

Others: Hefboom (social and circular credit organisation), Microstart (credit provider focusing at micro-enterprises), and Voka (employer federation whose services include trajectories for startups).

APPENDIX 2.2 – The Survey (translated from Dutch)

To start, we would like to ask you some questions about the startup for which you are completing in this survey.

1. In which phase is the startup?
    a. I don't have a startup yet, but I have a business idea (ideation) [go to pathway 2]
    b. I already sold to some early adopters (build-validation)
    c. I sell enough to generate profit and growth (go-to-market)
    d. I have a proven scalable or repeatable business model (mature business)
    e. The startup has stopped [go to pathway 3]

2. Have you ever participated at a Start it @KBC trajectory?
    a. Yes, I am a participant
    b. Yes, I participated in the past
    c. No, I have never participated (yet)

3. What type of startup do you have?
    a. Production (product, hardware,…)
    b. Services
    c. IT / Software
    d. Commerce and retail
    e. Other: describe

4. Which sector does your startup belong to?
    a. Agriculture and fishing
    b. Food and beverages
    c. Textiles and clothing
    d. Wood and furniture
    e. Plastics and chemicals
    f. Automotive and (e-)bikes
    g. Waste collection, treatment, and recycling
    h. Energy
    i. Construction
    j. Transport and logistics
    k. Warehousing, postal, and courier activities
    l. Accomodation and food service activities
    m. Information and communication
    n. Rental and leasing activities
    o. Advertising and market research
    p. Wholesale, retail and e-commerce in household appliances

   q. Wholesale, retail, and e-commerce of other goods
   r. Financial and insurance activities I
   s. Real estate activities
   t. Education and research
   u. Human health and social work activities
   v. Arts, entertainment, and recreation
   w. Repair of household appliances
   x. Repair of other goods
   y. Other: describe

5. Which markets does the startup target? (multiple answers are possible)
   a. Business-to-business (BtB)
   b. Business-to-consumer (BtC)
   c. Business-to-government (BtG)
   d. Business-to-business-to-consumer (BtBtC)
   e. PeerToPeer
   f. Other: describe

6. Which legal form does your startup have?
   a. Sole proprietorship in main or secondary occupation
   b. Private company with limited liability
   c. Limited company
   d. Cooperative
   e. Non-profit association
   f. Other: describe

7. How much turnover did your startup have in 2020?
   a. No turnover
   b. 1 – 10 000 EUR
   c. 10 000 – 50 000 EUR
   d. 50 000 – 100 000 EUR
   e. 100 000 – 250 000 EUR
   f. 250 000 – 500 000 EUR
   g. 500 000 – 1 000 000 EUR
   h. > 1 000 000 EUR

8. What was the suspected impact of COVID-19 on your turnover?
   a. Not applicable (e.g. not yet started in 2020)
   b. A strong negative impact
   c. A limited negative impact
   d. Little or no impact

e. A limited positive impact
f. A strong positive impact

9. What do you consider to be the comparative advantages of your startup? (max. 3)
    a. Skills, experience, and knowledge
    b. Access to information
    c. Investments in human capital
    a. Capacity to innovate
    b. Entrepreneurship and leadership
    c. Sustainability and/or circularity
    d. Relational skills and network
    e. Value creation and quality

In a circular economy we try to (re)use materials as long and efficiently as possible. The Flemish Government also targets the circular economy in its relance strategy. We are interested to which extent your startup implements several circular strategies.

10. To what extent does you startup implement the following strategies?
    [not – limited – extensive – not applicable]
    a. Product design to use less materials
    b. Product design for lifetime extension
    c. Product design with modular parts (in function of repair, recycle,…)
    d. Using renewable materials
    e. Sharing production means
    f. Circular business models (e.g. as-a-service models)
    g. Offering maintenance and repair
    h. Recuperation of waste, residuals and/or by-products
    i. Take-back system for refurbishment and recycling
    j. Support services which reinforce circularity (e.g. software)

11. According to you, is it more or less difficult to build a profitable business for startups with a circular strategy compared to other startups?
    [much easier – easier – the same – more difficult – much more difficult – no opinion]
    Why? (empty text box)

12. Which barrriers do you see to implement circular strategies in your startup? (Max. 5)
    a. Little or no personal interest
    b. The customer is not interested

c. There is a lack of cooperation in the value chain (producers, wholesale,…)
d. Our sector mainly works linear (design-make-use-dispose)
e. The current regulations create important barriers
f. There is a lack of international cooperation concerning regulations
g. Virgin materials are (less) expensive
h. There is a lack of standardization (labels, certificates, guarantees,…)
i. High initial investment costs
j. Technological barriers to deliver a satisfying quality
k. Limited circular design of products
l. Limited examples of frontrunners
m. There is a lack of information on the environmental impact of products
n. Other (describe)

13. Which support measures could be offered by the government to encourage you to implement (more) circular strategies? (Max 5)
    a. Measures to limit international competition
    b. Bank quarantees for investments
    c. Eliminating regulatory barriers
    d. Support for innovation and cooperation (subsidies)
    e. More education and training for new and more polyvalent skills
    f. More access to information and expertise
    g. Liquidity support for subordinate loans
    h. Chances to reinforce export and international knowledge exchange for Flemish frontrunners
    i. Fiscal measures that stimulate circular goods and services
    j. Public procurement for circular goods and services
    k. Other (describe)

14. Are the elements below considered as enablers or barriers in your company? (A barrier, rather a barrier, neutral, rather an enabler, an enabler)
    a. Financial means
    b. Experience of the entrepreneur(s)
    c. Scale
    d. Team dynamics
    e. Feasibility of the product
    f. Quality of the product
    g. Market developments
    h. Marketing
    i. Growth path of the company
    j. Loyal clients
    k. Competition

l. Stable supply chain of materials
m. Administrative and legal environment
n. Skills

Startups need the right skills and talents. Therefore, we would like to ask some questions on the need for competent employees.

15. How many full time equivalent employees does your startup have? (payroll, e.g. no interns)

16. To what extent do you expect to need the following skills in a future, more circular economy? Skills related to…
[certainly not – probably not – probably – certainly – don't know]
    a. Trade, sales, and marketing
    b. Crafts
    c. Wood and construction
    d. IT and digital communication
    e. Environment and green technology
    f. Research and development
    g. Production
    h. Technical skills
    i. Transport and logistics
17. Do you plan to employ disadvantaged groups?
    a. I already collaborate with Work Integration Social Enterprises (WISEs)
    b. Ik already employ disadvantaged groups
    c. I am considering to collaborate with WISEs
    d. I am considering to employ disadvantaged groups
    e. I don't see any immediate added value for my company
    f. I don't know

The results of this survey are processed anonymously. We would like to ask you some questions about your profile as entrepreneur.

18. What is your gender?
    a. M
    b. F
    c. X

19. What is your age?

20. What is your highest educational degree?
    a. I don't have a high school degree

b. High school (focused on practical experiences)
c. High school (focused on technical skills)
d. High school (focused on arts, architecture,…)
e. High school (focused on general skills)
f. Higher education: bachelor (or similar)
g. University: master (or similar)
h. University: PhD

21. Is at least one of your grandparents originating from outside the European Union?
    a. Yes
    b. No
    c. Don't know

22. To what extend do you have the following professional experience:
    a. Number of years work experience (total):
    b. Number of years experience in the sector of your startup:
    c. Number of years experience in management or a leadership position:
    d. Number of years experience as entrepreneur of your own business:

Specific question for enterpreneurs that stopped their business [pathway 3]

23. What was the reason the enterprise stopped?
    a. The enterprise actually never started
    b. The enterprise was sold / I sold my shares
    c. The enterprise was liquidated (or the procedure is ongoing)
    d. The enterprise went bankrupt (or the procedure is ongoing)
    e. Other (describe)

APPENDIX 2.3 – Interview questions, questionnaire, and list of respondents

List of respondents

Number	Date	Role	Organisation
1	22/08/2022	Policy advisor social and circular economy	Provincial administration A
2	23/08/2022	Policy advisor social and circular economy	Provincial administration B
3	25/08/2022	Head of Unit	Flemish government administration
4		Policy expert sustainable development	Flemish government administration
5		Policy expert circular hub development	Flemish government administration
6	26/08/2022	Policy advisor social policy	Sectoral federation of WISEs
7		Policy advisor circular economy	Sectoral federation of WISEs
8	30/08/2022	Project Manager	Social circular Hub
9	08/09/2022	Facilitator	Circular Economy Hub

Interview questions (translated from Dutch)

1. What is the main value WISEs can provide to startups in general and circular startups in particular?
2. What is the main value startups in general and circular startups in particular can provide to WISEs?
3. What do you consider as the main barriers for (circular) start-ups and WISEs to cooperate?
4. What do you consider as the main enablers to foster cooperation between (circular) start-ups and WISEs?

Questionnaire (translated from Dutch)

Respondents were asked to evaluate the following statements, on the one hand asking to what extent they recognize these statements from their experience and expertise. On the other hand, asking to what extent these statements make sense according to them. Respondents were given the choice to answer on a 5-point Likert scale, complemented with the option 'no idea'. We used SurveyMonkey to collect responses.

Statement	In line with own experience	In line with logic (makes sense)
1. Startups in the ideation phase show a stronger interest in working with target groups than startups who in the go-to-market phase. We notice idealism at the drawing board, but this interest fades away when the start-up enters the market.	(Rather) No: 2 (Rather) Yes: 1	(Rather) No: 4 (Rather) Yes: 2
2. Target groups are mainly regarded as interesting by startups when they are still too small to recruit staff themselves. Once a certain turnover has been reached, the interest in target groups fades away. Target groups are especially interesting as cheap labour during the initial phase.	(Rather) No: 2 (Rather) Yes: 1	(Rather) No: 6 (Rather) Yes: 1
3. Startups that want to work with target groups mainly need skills in production and transport & logistics. In addition, startups that want to collaborate with WISEs have a stronger need for research and development skills, because they need to streamline and optimize complex(er) production processes.	(Rather) No: 1 (Rather) Yes: 3	(Rather) No: 1 (Rather) Yes: 4
4. Startups that recruit target groups themselves (or wish to do so) need different skills than those that want to collaborate with WISEs.	(Rather) No: 0 (Rather) Yes: 5	(Rather) No: 0 (Rather) Yes: 9
5. Entrepreneurs with more than 5 years of management experience show less interest in working with target groups or WISEs than others. They go back to traditional models that they know from the normal economic circuit.	(Rather) No: 3 (Rather) Yes: 0	(Rather) No: 5 (Rather) Yes: 4
6. Circular startups show more interest than other startups in collaborating with target groups and WISEs.	(Rather) No: 0 (Rather) Yes: 4	(Rather) No: 0 (Rather) Yes: 7
7. Working with WISEs is not only considered by startups that focus on circular strategies in the outer circles (recycling or refurbishment), but also by startups that focus on circular strategies in the inner circles (design, use of renewable materials).	(Rather) No: 2 (Rather) Yes: 4	(Rather) No: 0 (Rather) Yes: 6
8. WISEs have a comparative advantage within the circular economy because they are already strongly embedded in value chains and have experience of strong collaboration within value chains.	(Rather) No: 0 (Rather) Yes: 9	(Rather) No: 0 (Rather) Yes: 6
9. Circular startups that collaborate with WISEs are more likely to find their way to subsidies and public procurement.	(Rather) No: 1 (Rather) Yes: 2	(Rather) No: 0 (Rather) Yes: 4
10. Circular startups that collaborate with WISEs are often active in business-to-consumer markets. Price competition plays a strong role in these markets, causing these companies to look for cheap labour.	(Rather) No: 2 (Rather) Yes: 2	(Rather) No: 6 (Rather) Yes: 1

APPENDIX 2.4 – Probit regressions on profile differences

Table A.2.1 – Profile differences of circular social enterprises – probit regressions

	No CE No WISEs	CE WISEs
N	121	121
Prob > Chi-2	0.0003	0.0097
Pseudo R^2	0.3131	0.2398
Constant term	-1.5397 (0.8938)	0.1873 (0.9529)
Female	0.6741 (0.3927)*	-0.5535 (0.3583)
Age	0.0288 (0.0189)	-0.0123 (0.0197)
Education: bachelor	0.1466 (0.5579)	-1.1517 (0.5432)**
Education: master	0.0220 (0.5350)	-0.2305 (0.4639)
Education: PhD	0.2216 (0.6744)	-0.8161 (0.6997)
Migrant	-0.6596 (0.4793)	-0.0981 (0.4521)
≥ 5 years industry experience	0.4446 (0.3838)	-0.3865 (0.3410)
≥ 5 years management experience	0.1356 (0.5172)	-0.5529 (0.4360)
≥ 5 years entrepreneurial experience	-0.2066 (0.4764)	0.1591 (0.4068)
Manufacturing	-0.5979 (0.5110)	0.1077 (0.3655)
Secondary sector	-1.6649 (0.4881)***	0.1912 (0.3863)
BtB market	-0.2621 (0.3912)	0.2270 (0.3552))
BtC market	-0.2748 (0.3447)	0.6910 (0.3238)**
BtG market	-0.6227 (0.4145)	0.0140 (0.4048)
BtBtC market	-0.2412 (0.3499)	0.4238 (0.3182)
Limited liability	0.3811 (0.4684)	0.4796 (0.4115)
Return (ordinal)	0.0019 (0.1011)	-0.1579 (0.0988)
FTE employed	0.0008 (0.0388)	0.0721 (0.0387)*

"CE" indicates the startup implements at least one circular strategy in full.
"WISEs" indicates that the startup is willing to collaborate with WISEs (or already does).
Note: Significance levels: * at the 10% level, ** at the 5% level, *** at the 1% level. The same VIF-statistics apply as in Table 3, suggesting only a limited degree of multicollinearity.

APPENDIX 3.1 – The CGE model

The CGE model applied is calibrated for the Belgian economy, with 13 sectors and 13 goods for 2018, one household, a government, and trade (Borms, Pals, Dams, et al., 2023; Brusselaers et al., 2022).

The model

The main assumptions of this model, as summarised by (Lahcen et al., 2020), include the following:

- Each sector is modelled as a representative company, with constant elasticity of transformation production functions that are embedded in a nested production function. The production functions are calibrated according to (Van der Mensbrugghe & Peters, 2016);
- Firms maximise profits, subject to labour and capital availability, technology, and input of intermediate products and services;
- Labour is traded on the labour market, wages are dependent upon the household's desire for leisure time. Hence, the CGE model only accounts for voluntary unemployment;
- Consumer decisions are functions of constant elasticity of substitution functions and are nested in consumption structures following (Pollak & Wales, 1978);
- Government spending is subject to the available budget and is determined by consumption prices and distribution parameters of the government's utility function;
- Investment demand depends on investment prices and distribution parameters of investment utility functions;
- National income is used for aggregate household consumption, public consumption, and savings;
- The exported volume depends on export prices while imported volumes depend on Armington elasticities as they are not perfect substitutes;
- All elasticities are retrieved from the GEM-E3 model description by (Capros et al., 2013) except for the substitution elasticities for transport modes which are based upon (Mayeres, 1999).

Furthermore, the model is comparative static by nature and thus does not contain time-dynamics.

The labour market

In terms of the labour market, the model determines that demand for labour in efficiency equivalent hours is equal to the supply of labour in efficiency equivalent hours. Therefore, any unemployment is voluntary unemployment and is included in the consumption of leisure. In the following, we briefly describe the main modelling parameters to capture the effects of a tax shift from labour to resources and servitisation and discuss some future pathways to model social employment in a CGE model.

A tax shift from labour to resources

In the model, the product tax parameter (for Belgium) was increased for agriculture, forestry, and fishing (G1) and mining (G2) in all sectors. The product tax is calculated as the share of product taxes and product subsidies in the total production cost of activities excluding Value Added Taxes (VAT) on inputs. Table A.3.1 shows the product tax parameter as a percentage of the total production cost of activities excluding VAT in the baseline (SC0) and the stepwise increase between the first scenario (SC1) and the most extreme scenario (SC9). Subsequently, the increased revenue from product taxes is used to decrease labour income tax while keeping government utility levels constant. The income tax rate is set to 100% in the baseline and is compared to this baseline in the other scenarios. That way, we can compare the increase in the product tax rate to the decrease in the income tax rate. We see that the increase in the product tax rate is higher than the decrease in the income tax rate because there are relatively few agricultural and mining activities in Belgium. Therefore, to generate a tax revenue high enough to compensate only a very small decrease of income taxes, product taxes must increase significantly.

Table A.3.1: Adaptation of the product tax parameter for agricultural and mining goods

	SC0	SC1	SC2	SC3	SC4	SC5	SC6	SC7	SC8	SC9
Agriculture, forestry, and fishing (G1)	0.1%	2%	5%	10%	15%	20%	30%	40%	50%	60%
Mining (G2)	0.0%	2%	5%	10%	15%	20%	30%	40%	50%	60%
Income tax rate	100%	99%	98%	96%	95%	93%	90%	88%	86%	84%

Note: the product tax is the sum of product taxes and product subsidies (negative number) as a share of the total production cost of activities excluding VAT. The income tax rate is compared to the baseline, which is set to 100%

Servitisation

We model servitisation as a decrease in household consumption of manufacturing goods which includes electronics, furniture, transport equipment, textiles, etc., compensated by an increase in household consumption of market services which includes renting and leasing, advertisements and market research, travel agencies, employment mediation, telecommunication, and software services, among others. The CGE's calibration and equilibrium conditions apply and rely upon a minimum level of consumption for each good, which is a percentage of the consumption in the base year. In the baseline scenario (SC0), households have a minimum consumption of manufacturing goods (G3) and market services (G11) of 30% of the base year consumption. In other scenarios (SC1-9) we opt for a stepwise decrease of this 30% base year minimum consumption of manufacturing goods. This will simultaneously be

compensated by a stepwise increase in the consumption of market services which is set so to be equal to the decreased consumption of manufacturing goods. These parameters are reported in Table A.3.2.

Table A.3.2: Adaptation of the minimum consumption of manufacturing goods

Good	SC0	SC1	SC2	SC3	SC4	SC5	SC6	SC7	SC8	SC9
Manufacturing (G3)	30 %	27 %	24 %	18 %	15 %	12 %	9%	6%	3%	0%

We note here that we forced consumers to shift their consumption from manufacturing goods to market services instead of increasing the consumers' perceived substitutability between manufacturing and market services. This choice was made because it allows for a disruptive shock on consumer behaviour with control on consumer actions simulating an actual 'shift in preferences' while the approach of substitutability might still require external incentives to move away from the current equilibrium and stimulate the uptake of market services. Note that the minimum level of consumption controls for heterogeneous price and income elasticities of demand, given constant elasticity of substitution across all goods. Hence, adjustment of these minimum levels results in a structurally different and irreversible consumption pattern in which the consumers cannot return to the original situation. This study, however, does not intend to consider the gradual transition from the baseline scenario into the new situation but instead, for analytical reasons, opts for the comparative analysis of these two considerably distinct situations.

Future pathways to model social employment in a CGE model

Several options were considered to analyse the effect of CE measures on WISEs. One approach to link the CGE model with economic information of WISEs, is to integrate activities and produced goods in an additional sector and good, as conducted earlier on case studies of repair (Brusselaers et al., 2022), and of waste and recycling (Borms, Pals, Dams, et al., 2023). A second approach is introducing a second type of labour and a second type of household in the calibration of the model. This would allow us to analyse differences in labour productivity, wages, and income elasticities. However, CGE models are typically very aggregated models to stimulate economy-wide policy measures. Introducing a WISE sector or a WISE type of labour would only reflect figures that are way too small to have the CGE model calibrated in a meaningful way. Moreover, indicators that are measured with CGE models are production per sector, GDP, labour supply and demand on sectoral level, household consumption and household utility, import and export to the EU and the Rest of World (RoW). We do not expect any policy measure targeted at WISEs to have significant results on these indicators.

APPENDIX 3.2 – List of interview respondents and questionnaire

In this Appendix, we provide an anonymized list of interview respondents (Table A.3.3) and an overview of translated interview questions.

Table A.3.3 List of interview respondents

ID	Function	Organisation	Date
1	Sector Manager Social Economy	Trade Union	19/06/2023
2	CEO	WISE	19/06/2023
3	Division Manager	Regional public administration	19/06/2023
4	Advisor	Trade Union	20/06/2023
5	Advisor	Trade Union	20/06/2023
6	Researcher	Advisory body of the regional government	20/06/2023
7	Expert	Advisory body of the regional government	20/06/2023
8	Staff member	Regional Employment Office	26/06/2023
9	Advisor	Regional public administration	27/06/2023
10	Advisor	Regional public administration	27/06/2023
11	Advisor	Federation of WISEs	28/06/2023
12	Expert	Regional Employment Office	28/06/2023
13	CEO	Federation of WISEs	29/06/2023
14	CEO	WISE	29/06/2023
15	Commercial Director	WISE	29/06/2023
16	Division Manager	Local or Provincial public administration	12/07/2023
17	Policy Officer	Local or Provincial public administration	12/07/2023
18	Coordinator	Local or Provincial public administration	12/07/2023
19	Advisor	Federation of WISEs	13/07/2023
20	Circular Economy Expert	WISE	19/07/2023

The semi-structured interview encompassed the following questions:

1. What would be impact of a CE transition on skills required within WISEs?
2. What would be the challenges of a growth path of WISEs towards circularity?
3. How should social sustainability, including job quality and upskilling opportunities, be safeguarded within a growth path of WISEs towards a CE?
4. How should environmental sustainability be safeguarded within a growth path of WISEs towards a CE?
5. How should economic sustainability be safeguarded within a growth path of WISEs towards a CE?
6. Open comments on early modelling results
7. What costs and benefits are important to take into account when envisioning a sustainable growth path for WISEs towards a CE?

APPENDIX 4.1 – Cobb Douglas production function estimates

In this appendix, we report Cobb Douglas production function estimates of WISEs and major industries WISEs are serving in Belgium. A Cobb Douglas production function allows to estimate the technological relationship between the amount output that can be produced by capital goods and labour. This function can be represented as follows:

$$Y = AK^{\propto}L^{\beta}$$

With Y = output, A = total factor productivity, K = capital input, L = labour input. a and b are output elasticities of capital and labour. This functional form is straightforward to estimate using linear regression (OLS), by taking logarithms of both sides of the equation, resulting in:

$$lnY = lnA + \alpha lnK + \beta lnL$$

In Table A.4.1 we report Cobb Douglas production function estimates for WISEs and several industries in Belgium, based on financial records data retrieved from the Belfirst database. These estimates result in high to very high R^2 values. For WISEs, we notice a lower total factor productivity than in other industries and a high labour intensity.

Table A.4.1 – Cobb Douglas production function estimates for WISEs and industries in Belgium (year: 2022)

	Regression (OLS)			Ln(Capital)		Ln(Labour)		Constant	
	n	Prob > F	R^2	coefficient (se)	p-value	coefficient (se)	p-value	coefficient (se)	p-value
WISEs	121	0.000	0.80	0.174 (0.046)	0.000	0.728 (0.070)	0.000	3.121 (0.230)	0.000
Food and beverages	579	0.000	0.70	0.311 (0.043)	0.000	0.667 (0.059)	0.000	4.945 (0.222)	0.000
Textiles and clothing	134	0.000	0.62	0.218 (0.075)	0.004	0.787 (0.133)	0.000	4.884 (0.288)	0.000
Paper and printing	152	0.000	0.85	0.233 (0.067)	0.001	0.808 (0.116)	0.000	4.531 (0.200)	0.000
Wood and furniture	154	0.000	0.76	0.141 (0.049)	0.004	0.887 (0.073)	0.000	5.230 (0.244)	0.000
Chemistry and plastics	402	0.000	0.68	0.264 (0.052)	0.000	0.720 (0.091)	0.000	5.045 (0.320)	0.000
Electrical and electronic equipment	143	0.000	0.75	0.075 (0.046)	0.104	0.857 (0.092)	0.000	5.809 (0.262)	0.000
Machine construction and automotive	262	0.000	0.79	0.085 (0.031)	0.006	0.869 (0.055)	0.000	5.734 (0.192)	0.000
Metals and metal products	428	0.000	0.75	0.243 (0.036)	0.000	0.800 (0.051)	0.000	4.714 (0.189)	0.000
Mineral products	203	0.000	0.71	0.177 (0.047)	0.000	0.808 (0.103)	0.000	5.236 (0.280)	0.000
Waste management	176	0.000	0.46	0.330 (0.054)	0.000	0.294 (0.067)	0.000	5.846 (0.367)	0.000
Repair and maintenance	110	0.000	0.63	0.099 (0.061)	0.105	0.840 (0.113)	0.000	5.388 (0.332)	0.000

To enable a comparison of labour intensities between industries, we need to apply a constant returns to scale variant of the Cobb Douglas production function, assuming that $a + b = 1$ for all industries, resulting in the following functional form to estimate:

$$lnY = lnA + \alpha lnK + (1 - \alpha)lnL$$

Which we can rearrange as follows:

$$ln\frac{Y}{L} = lnA + \alpha ln\frac{K}{L}$$

Estimates of (1-a) are reported in Figure 3 in the main text.

APPENDIX 4.2 – Descriptive statistics

In this appendix, we report the descriptive statistics of personal and company characteristics of our survey respondents. Descriptive statistics of the other survey questions are reported in the main text.

Descriptive statistics of personal characteristics

Table A.4.2 - Gender of respondents (n = 115) (nominal variable)

	Frequency	%
Sex		
Male	80	70%
Female	32	28%
I prefer not to disclose	3	3%

Table A.4.3 - Age and risk preference of respondents (n = 115) (ratio variables)

	Average (standard deviation)	Minimum	P25	Median	P75	Maximum
Age	46.90 (10.82)	20	38	48	55	69
Risk preference	65.92 (20.04)	0	58	66	80	100

Table A.4.4 – Role positions of respondents (n = 117) (dummy variables)

	Frequency	%
(Co-)owner	43	37%
Director	25	21%
CEO	30	26%
Management	25	21%
Staff	24	21%

Descriptive statistics of company characteristics

Table A.4.5 – Industry (nominal variable)

	Frequency	%
Agriculture	1	1%
Manufacturing industry	37	32%
Construction	20	17%
Waste management	11	9%
Work Integration Social Enterprise	11	9%
Tertiary sector	26	22%
Quaternary sector	9	8%
Public sector	2	2%
Total	117	100%

Table A.4.6 – Company age (ordinal variable)

	Frequency	%
Not started officially (yet)	2	2%
< 5 years	23	20%
5 – 10 years	24	21%
> 10 years	68	58%
Total	117	100%

Table A.4.7 – Turnover (ordinal variable)

	Frequency	%
No turnover	9	8%
1 – 10 000 EUR	6	5%
10 000 – 100 000 EUR	16	14%
100 000 – 1 000 000 EUR	16	14%
1 000 000 – 10 000 000 EUR	33	28%
10 000 000 – 100 000 000 EUR	20	17%
> 100 000 000 EUR	17	15%
Total	117	100%

Table A.4.8 – Employment (ordinal variable)

	Frequency	%
No employees	21	18%
1 – 10 employees	30	26%
11 – 49 employees	16	14%
50 – 249 employees	20	17%
250 – 999 employees	22	19%
> 1 000 employees	8	7%
Total	117	100%

Table A.4.9 – Markets (n = 117) (dummy variable)

	Frequency	%
Business-to-business	97	83%
Business-to-consumer	56	48%
Business-to-government	38	32%
Peer-to-peer	5	4%

APPENDIX 4.3 – Interview questionnaire

In this appendix, we provide an overview of the interviewed organisations and the interview questionnaire.

Table A.4.10 – Overview of interviewed organisations, the countries they are embedded in, and interview dates

ID	Organisation	Country	Date
1	Holland Circular Hotspot	The Netherlands	December 18, 2024
2	Circular Valley	Germany	December 19, 2024
3	Circular Flanders	Belgium	December 19, 2024
4	Helsinki-Uusima Circular Valley	Finland	December 20, 2024
5	Circular Berlin	Germany	January 7, 2025
6	Circular Economy Forum Austria	Austria	January 7, 2025
7a	Social Circular Hub Smart Loops	Belgium	January 9, 2025
7b	Social Circular Hub Smart Loops	Belgium	January 9, 2025
8a	ICESP	Italy	January 13, 2025
8b	ICESP	Italy	January 13, 2025
9	Social Circular Hub Kempen	Belgium	January 13, 2025
10	Re-Use Austria	Austria	January 15, 2025
11	Circular Black Forest	Germany	January 15, 2025
12	ENSIE	Europe	January 17, 2025
13	Circular Hub Montenegro	Montenegro	January 21, 2025
14	Mixi Helsinki	Finland	January 22, 2025

Questionnaire:

1. What are the activities of your circular hub?
    a. How can these activities support the shift from a linear economy to a CE (e.g., symbiotic dependencies)?
    b. What are the main needs/difficulties you observe among enterprises willing to shift to a CE?
    c. How do you identify and engage relevant actors?
    d. What activities do you deliberately not perform (and why)?
    e. What activities do you organise oriented at involving vulnerable groups at the labour market (why/not)?
2. What is the business model of the circular hub? (incl. its ecosystem value proposition)
3. What is the governance framework of the hub? (multilevel perspective)
    a. At the level of the circular hub (not at the level of individual projects)
    b. At the level of networks of circular hubs
4. How can the hub support cocreation and ensure a fair distribution of value (captured) between parties involved?
5. How can the hub keep track of the economic, environmental, and social impact of its activities?
6. What are conditions to succeed in the long term / in a sustainable way?
    a. Cultural, strategic, operational barriers and drivers
    b. Optimal size/scope of the hubs?
7. Premortem question: why will the hub be a failed case within 5 years?

APPENDIX 4.4 – Attributes of WISES and respondent characteristics

In this appendix, we provide more details on the statistically significant relationships between attributes of WISEs and respondent characteristics, as summarized in Table 14.

- Proximity is considered least an asset among respondents active in the construction industry (42% versus 67%, $p < 0.05$), and most as a disqualifier among those who consider customised banking and insurance for a circular economy as an enabler (1% versus 12%, $p < 0.05$). Conversely, it is considered more an asset among respondents considering subsidies and network support on innovation and entrepreneurship as an enabler (71% versus 51%, $p < 0.05$).

- Quality is considered least as an asset among companies without experience with target group employees (31% versus 52%, $p < 0.05$) and most as a disqualifier among risk preferent respondents ($p < 0.05$) and respondents stating customers are not interested in circularity (33% versus 14%, $p < 0.05$).

- Flexibility is considered more often an asset by companies in the manufacturing industry (58% versus 32%, $p < 0.05$) but less among companies in the service industry (23% versus 47%, $p < 0.05$). Moreover, it is considered most an asset among respondents who see subsidies and networking support as an enabler (54% versus 24%, $p < 0.01$) and least as a disqualifier by those who see improved access to information and expertise (6% versus 27%, $p < 0.05$), training (4% versus 25%, $p < 0.05$), or research and development (5% versus 25%, $p < 0.05$) as enablers for a circular economy.

- Incumbent firms, being respondents with companies aged 10 years or more, value price less as an asset of WISEs (30% versus 50%, $p < 0.05$). Price is also considered most disqualifier by those considering high initial investment costs as a barrier (38% versus 18%, $p < 0.05$).

- Capacity is considered more often an asset among those considering subsidies and networking support as an enabler (50% versus 23%, $p < 0.01$).

- The ability of WISEs to perform complex tasks is considered most an asset among those considering a lack of knowledge as a barrier (41% versus 16%, $p < 0.01$).

APPENDIX 5.1 – Descriptive statistics

Table A.5.1 – Descriptive statistics of descriptive characteristics of RESCOOP-members and other respondents.

	RESCOOP members	Non-members
N =	2808	1143
Personal characteristics		
Male	83.12%	81.45%
Age*	56,42 (0.2384)	57,16 (0.4055)
Activity status: independent	7.55%	8.14%
Activity status: white collar worker	31.37%	30.62%
Activity status: blue collar worker*	3.24%	4.99%
Activity status: civil servant or education**	17.31%	11.46%
Activity status: other (inactive)*	40.53%	44.79%
Education level: no higher education**	25.07%	33.51%
Education level: higher education	36.47%	33.60%
Education level: university**	38.46%	32.90%
Migrant	5.91%	7.17%
Household size	2.68 (0.0384)	2.70 (0.0233)
Median income (in EUR)*	3500-4500	3500-4500
Risk aversion	67.47	65.54
Experience: car lease*	29.84%	33.68%
Experience: Netflix	37.04%	39.98%
Experience: Spotify	29.97%	28.52%
Housing characteristics		
Ownership status: homeowner**	96.15%	93.88%
Area: urban**	27.62%	18.94%
Area: semi-urban	46.61%	45.33%
Area: rural**	25.78%	35.73%
Living in a city**	45.04%	38.84%
Housing type: open**	50.85%	64.06%
Housing type: semi-open**	25.68%	20.75%
Housing type: closed**	18.85%	12.04%
Housing type: apartment*	4.62%	3.14%
Number of building layers**	2.33 (0.0139)	2.19 (0.0210)
Roof type: slope	84.51%	86.00%
Roof type: flat	13.54%	12.57%
Construction year (median)	1980-1989	1980-1989
Installation parameters		
Meter type: digital	27.69%	28.37%
Meter type: analog	70.90%	68.94%
Functions on electricity: none**	48.92%	38.60%
Functions on electricity: heating**	14.12%	21.63%
Functions on electricity: boiler**	29.89%	38.06%
Functions on electricity: air-conditioning**	17.44%	22.98%
Functions on electricity: EV charging	12.09%	10.95%
Functions on electricity: heath pump	15.74%	17.77%
Year of PV installation (median)*	2012	2011
PV status: no PV	21.72%	22.92%
PV status: PV (as an owner)**	75.64%	70.52%
PV status: PV (in a PSS contract)**	1.28%	4.02%
Institutional trust		
Trust in governments**	2.45 (0.0222)	2.13 (0.0336)
Trust in service suppliers**	2.71 (0.0187)	2.40 (0.0305)
Trust in nuclear energy**	2.83 (0.0259)	3.46 (0.0378)
Trust in technology	3.94 (0.0139)	3.90 (0.0245)
Trust in the green political party**	2.73 (0.0246)	2.08 (0.0361)

Note: Differences are reported as * significant at the 5% level and ** significant at the 1% level. We applied a two-sided F test for differences in ratios and a Mann-Whitney U test for differences between distributions. Standard errors of means are reported between brackets.

APPENDIX 5.2 – Probit regression estimates

Table A.5.2 – Probit regression estimates on profile differences of upfront costs as a barrier for solar PV uptake, among homeowners without solar PV.

	High upfront costs as a barrier for solar PV uptake
n =	651
Prob > chi^2	0.0000
Pseudo R^2	0.1001
Constant term	1.0564 (0.6236)
RESCOOP member	-0.0914 (0.1323)
Male	-0.3902 (0.1292)**
Age	-0.0132 (0.0060)*
Activity status: white collar worker (omitted)	
Activity status: independent	-0.3306 (0.2361)
Activity status: blue collar worker	-0.3493 (0.3342)
Activity status: civil servant	-0.0220 (0.1620)
Activity status: inactive	-0.0446 (0.1904)
Education: no higher education (omitted)	
Education: higher education	-0.2860 (0.1594)
Education: university	-0.3203 (0.1589)*
Migrant background	-0.6024 (0.2689)*
Household size	0.1162 (0.0542)*
Income (ordinal)	-0.1458 (0.0520)**
Risk aversion	0.0039 (0.0019)*
City	-0.1344 (0.1195)
Type: closed and apartment (omitted)	
Type: semi-open	0.0490 (0.1536)
Type: open	-0.0195 (0.1694)
Building layers	-0.1418 (0.0896)
Flat roof	0.1287 (0.1498)
Roof quality	0.0026 (0.0024)
Construction year (ordinal)	-0.0636 (0.0246)**
Trust: government	0.0364 (0.0682)
Trust: service suppliers	-0.0813 (0.0724)
Trust: nuclear energy	0.0510 (0.0519)
Trust: technology	0.0213 (0.0811)
Trust: green political party	-0.0625 (0.0619)
Experience: car lease	-0.0106 (0.1333)
Experience: Netflix	0.3859 (0.1305)**
Experience: Spotify	0.0478 (0.1294)

Note: * significant at the 5% level, ** significant at the 1% level. Standard errors between brackets.

APPENDIX 6.1 – List of interview respondents

In Table A.6.1 we report an overview of the 33 anonymized interview respondents that have been interviewed during 30 online MS Teams interviews after providing formal informed consent. Note that project partners are also project beneficiaries, while respondents indicated as project beneficiary were not formally involved in the UIA project as described in Section 6.3.2.

Table A.6.1 – List of interview respondents (anonymised)

ID	Function	Stakeholder type	Case study relation	Date
1	Staff member	Founding public authority	Project partner	March 11, 2024
2	CEO	Service provider	External expert	March 11, 2024
3	Freelance consultant	Founding public authority	Project partner	March 12, 2024
4	Project coordinator	Founding public authority	Project partner	March 13, 2024
5	Staff member	Founding public authority	Project partner	March 13, 2024
6a	Staff member	Founding public authority	Project partner	March 13, 2024
6b	Staff member	Founding public authority	Project partner	March 13, 2024
7	Project manager	Supplier	Supplier	March 14, 2024
8	CEO	Project partner	Project partner	March 14, 2024
9	Project manager	Founding public authority	Project partner	March 14, 2024
10	Founder	Cohousing community	External expert	March 15, 2024
11	Staff member	Public sector federation	External expert	March 15, 2024
12	Founder	On-site company	Project beneficiary	March 18, 2024
13	CEO	RESCOOP	External expert	March 18, 2024
14a	Researcher	Project partner	Project partner	March 20, 2024
14b	Researcher	Project partner	Project partner	March 20, 2024
15	Policy officer	Public authority	External expert	March 20, 2024
16	Project manager	Project partner	Project partner	March 21, 2024
17	CEO	On-site company	Project beneficiary	March 21, 2024
18	CEO	Purchasing cooperative	External expert	March 22, 2024
19	Site manager	Founding public authority	Project beneficiary	March 22, 2024
20	Policy officer	Public authority	Project partner	March 22, 2024
21	Sales manager	Supplier	Supplier	March 26, 2024
22	Staff member	Founding public authority	Project partner	March 26, 2024
23a	Board member	RESCOOP	External expert	March 26, 2024
23b	Board member	RESCOOP	External expert	March 26, 2024
24	Design Engineer	Supplier	Supplier	March 27, 2024
25	Coordinator	Supplier	Supplier	March 27, 2024
26	Founder	Supplier	Supplier	March 27, 2024
27	Staff member	RESCOOP	External expert	March 28, 2024
28	Founder	RESCOOP	Project partner	March 29, 2024
29	CEO	Founding public authority	Project partner	April 3, 2024
30	Director	Consultant	External expert	April 5, 2024

After introducing the smart grid project (Figure 14) and potential circular economy (CE) strategies involved, the following interview questionnaire was used during the interviews:

1. What value would these CE strategies generate (for whom) in a smart grid and how could this value be captured (e.g., extra income, lower costs)?
2. What would be barriers and enablers to foster CE strategies in a smart grid?
3. Who should be the members of the cooperative, and why (would they want to)?

4. What would be the transaction relation of these members with their cooperative?
5. How could a smart grid cooperative enable the application of circular strategies?
6. How could a smart grid cooperative embed circularity goals in its governance?
7. How could a smart grid cooperative enhance social sustainability in its governance?
8. What capabilities are required to govern a circular smart grid cooperative?
9. What is necessary to scale and replicate a circular smart grid cooperative?
10. Why will this model fail within the next 5 years (major binding barriers)?

APPENDIX 6.2 – Overview of project documents

In Table A.6.2 we report an overview of project documents related to the case study involving the participation of the first author. Meeting notes and materials include PowerPoint presentations, agenda's, technical documents, and attachments discussed during these meetings.

Table A.6.2 – List of project documents

ID	Date	Description	Document
1	06/10/2020	Consortium meeting	Meeting notes and materials
2	20/10/2020	Meeting on DC Backbone	Meeting notes and materials
3	23/10/2020	Meeting on sustainability trade-offs	Meeting notes and materials
4	23/10/2020	Meeting on cooperative governance	Meeting notes and materials
5	03/11/2020	Meeting on certification and labelling	Meeting notes and materials
6	12/11/2020	Meeting on measuring circularity	Meeting notes and materials
7	20/11/2020	Meeting on circular design	Meeting notes and materials
8	27/11/2020	Meeting on circular design	Meeting notes and materials
9	02/12/2020	Meeting on circular design	Meeting notes and materials
10	03/12/2020	Cooperative governance	Meeting notes and materials
11	05/01/2021	Consortium meeting	Meeting notes and materials
12	08/02/2021	Circular impact	Meeting notes and materials
13	24/02/2021	Energy communities	Meeting notes and materials
14	13/04/2021	Consortium meeting	Meeting notes and materials
15	04/05/2021	Meeting on circular design	Meeting notes and materials
16	07/05/2021	Meeting on energy community	Meeting notes and materials
17	16/06/2021	Meeting on cooperative governance	Meeting notes and materials
18	06/07/2021	Consortium meeting	Meeting notes and materials
19	02/09/2021	Meeting on regulatory barriers	Meeting notes and materials
20	09/02/2021	Meeting on cooperative governance	Meeting notes and materials
21	24/08/2021	Project management team	Meeting notes and materials
22	22/09/2021	Workshop preparation	Meeting notes and materials
23	24/09/2021	Meeting on cooperative governance	Meeting notes and materials
24	27/09/2021	Meeting on use phase of the smart grid	Meeting notes and materials
25	28/09/2021	Stakeholder site visit	Meeting notes and materials
26	29/09/2021	Stakeholder site visit	Meeting notes and materials
27	29/09/2021	Consortium meeting	Meeting notes and materials
28	29/09/2021	Stakeholder workshop	Meeting notes and materials
29	09/11/2021	Project management team	Meeting notes and materials
30	22/10/2021	Meeting on circular procurement	Meeting notes and materials
31	29/10/2021	Meeting on smart grid governance	Meeting notes and materials
32	09/11/2021	Project management team	Meeting notes and materials
33	01/02/2022	Meeting on governance and business model	Meeting notes and materials
34	14/02/2022	Meeting on business plan and stakeholder map	Meeting notes and materials
35	15/02/2022	Meeting on governance and business model	Meeting notes and materials
36	02/05/2022	Status update	Meeting notes and materials
37	23/08/2022	Project management team	Meeting notes and materials
38	18/10/2022	Meeting on energy management system	Meeting notes and materials
39	19/10/2022	Meeting on circular procurement	Meeting notes and materials
40	08/11/2022	Consortium meeting	Meeting notes and materials
41	30/11/2022	Status update	Meeting notes and materials
42	05/12/2022	Status update	Meeting notes and materials
43	07/12/2022	Project management team	Meeting notes and materials
44	10/01/2023	Meeting on procurement EMS	Meeting notes and materials
45	10/01/2023	Meeting on lessons learned	Meeting notes and materials
46	11/01/2023	Meeting on governance and EMS	Meeting notes and materials
47	20/01/2023	Meeting on EMS procurement	Meeting notes and materials
48	23/01/2023	Status update	Meeting notes and materials
49	25/01/2023	Meeting on EMS procurement	Meeting notes and materials
50	15/02/2023	Lessons learned	Meeting notes and materials
51	16/05/2023	Meeting on wind turbine	Meeting notes and materials
52	18/07/2023	Project management team	Meeting notes and materials
53	17/10/2023	Consortium meeting	Meeting notes and materials
54	12/12/2023	Project management team	Meeting notes and materials
55	06/02/2024	Consortium meeting	Meeting notes and materials
56	12/02/2024	Meeting on interview preparation	Meeting notes and materials
57	20/02/2024	Lessons learned	Meeting notes and materials
58	02/04/2024	Lessons learned	Meeting notes and materials
59	2021	Conceptual blueprint for the energy cooperative at Transfo	RESCOOP (2021)
60	2024	Blueprint for a circular smartgrid	Rommens et al. (2024)
61	2024	Final project report	Leiedal (2024)

APPENDIX 6.3 – Coding details

In this appendix, we provide an overview of the retained codes.

Table A.6.3 – List of retained codes: smart grid components

Codes (number of codings)
1. Batteries (51)
2. CHP (37)
3. DC grid (86)
4. EMS (30)
5. EV charger (28)
6. Flywheel storage (2)
7. Pumped water storage (4)
8. Site repurposing (11)
9. Solar PV (103)
10. Wind turbine (8)

Table A.6.4 – List of retained codes: market failures

Codes (number of codings)	Illustrative quote [respondent number]
1. Externalities (54)	*"Applying circularity principles to a smart grid is more expensive than buying everything new. The value is not in direct financial benefit but in significant environmental benefits that are not priced into current accounting or economic models. […] The value lies in socioeconomic impacts, reducing reliance on politically unstable countries for rare earth metals, reducing landfill waste, and associated costs."* [30]
2. Asymmetric information (54)	
2.1 Adverse selection (3)	*"If you do not involve citizens from the beginning, it becomes difficult to engage them later."* [29]
2.2 Moral Hazard (2)	*"The property management association must include requirements for its users in the lease agreement to ensure that circular economy principles are properly applied (maintenance, recycling, etc.)."* [3]
2.3 Principal agent problems (28)	*"In the context of good governance, it is important to clearly articulate who you do and do not want as a member (especially when conflicts of interest arise)."* [2]
2.4 Screening (19)	*"In the case of the CHP, the supplier of the installation knows it well, having built and maintained it. However, if they decide they no longer wish to handle its maintenance over a longer period, the choice is to involve a third party, which increases costs. This is because the third party is unfamiliar with the installation and will want to mitigate risks."* [27]
2.5 Signalling (2)	*"Mandatory regulations on material passports: the question is, who will enforce them? It's challenging. With this project, we can demonstrate pioneering efforts in this area, but it is clear that no framework exists yet. We cannot act as a lever in the market."* [5]
3. Market power (7)	*"Reuse makes us less dependent on big market players in foreign countries."* [23b]
4. Incomplete markets (47)	*"If you want of reused batteries, you really have to search for them. The market is still weak, as is the case with refurbished products."* [15]

Table A.6.5 – List of retained codes: ICA principles

Codes (number of codings)	Illustrating quote [respondent number]
1. Voluntary and Open Membership (47)	*"All stakeholders involved in any way, whether as consumers or as interested parties with a vested interest, should have the opportunity to participate (or at least be able to become members)."* [6b]
2. Democratic Member Control (58)	*"Given its democratic nature, a cooperative doesn't focus on the next quarterly results. What's typical of all cooperatives is that they also think across generations, showing concern for those who will be part of the cooperative in the future. This creates fertile ground for circularity."* [28]
3. Member Economic Participation (53)	*"Circularity also lies in the financial aspect—you benefit both through a modest dividend and on your energy bill, as members of a cooperative have a dual connection to their cooperative: they are both owners and users of its services."* [27]
4. Autonomy and Independence (45)	*"The founders may, over time, want to discard certain aspects to keep the organisation afloat, while the citizens insist: no, don't do that, we don't need a dividend right now—stick to the goals."* [13]
5. Education, Training, and Information (41)	*"We tell the story, and that circular aspect is part of it. That's also one of the reasons we want to be involved—to ensure the story is told correctly. We want people to be able to say: wow, it's impressive how well circularity and energy are handled here. We want people to remember this and translate it to their own region. To do that, the story must be communicated clearly. You need to know what's happening, where things are, and ensure everyone is united behind it."* [12]
6. Cooperation among Cooperatives (20)	*"When people are aligned on sustainability and circular economy, it creates a unifying factor in a cooperative, where members are more or less on the same page. If you have several cooperatives that align, you can bring together these small networks and create a greater impact."* [6a]
7. Concern for Community (35)	*"The money we invest and the added value we generate are redistributed back into the community—primarily to the members and, secondly, to the local community by allocating a portion of the profits to initiatives with social and societal value."* [27]

APPENDIX 7.1 – Interview respondents and questionnaire

In this appendix, we present an anonymised overview of interview respondents (Table A.7.1) and a translated (from Dutch) version of the interview questionnaires.

Table A.7.1 - Interview respondents

ID	Position	Stakeholder type	Date
1	Founder	Housing cooperative	May 14, 2024
2	Staff member	Finance provider	May 14, 2024
3	Staff member	Intermunicipal organisation	May 15, 2024
4	Staff member	Municipality	May 16, 2024
5	Staff member	Housing cooperative	May 17, 2024
6	Founder	Housing cooperative	May 21, 2024
7	Founder	Housing cooperative	May 21, 2024
8	Founder / CEO	PSS provider	May 22, 2024
9	CEO	Finance provider	May 24, 2024
10	Staff member	Commercial real estate	June 5, 2024
11	Staff member	Commercial real estate	June 6, 2024
12	Founder / CEO	PSS provider	December 9, 2024
13	Expert	University	December 13, 2024
14	CEO	Housing cooperative	December 13, 2024
15	Founder	PSS provider	December 17, 2024
16	Founder	PSS provider	January 7, 2025
17	Founder / CEO	PSS provider	January 8, 2025
18	Founder / CEO	PSS provider	January 8, 2025
19	Staff member	Intermunicipal organisation	January 14, 2025
20	Independent expert	Consultancy	January 16, 2025
21	Founder	Housing cooperative	January 20, 2025
22	Staff member	Consultancy	January 28, 2025
23	Staff member	Municipality	February 11, 2025

Interview questionnaire respondents 1 – 11 (translated from Dutch):

1. What are your experiences with (combinations) of legal persons to organise cooperative housing, while aiming for affordable and sustainable housing?
2. What are, according to you, the critical traits of legal persons (including cooperatives) to ensure affordable and environmentally sustainable housing?
3. What is needed to support housing cooperatives to enable affordability and environmentally sustainability?
4. If there would be a legal status for housing cooperatives, what would be critical design and implementation conditions?
5. What are cases of housing cooperatives we should look at, and why?
6. How can we enable and embed circularity goals in cooperative housing solutions?
7. What are crucial legal, organisational, and financial design considerations for PSS models in housing, from the perspective of users/residents, the cooperative, service providers
8. Regarding funding, what are crucial legal, organisational, and financial design considerations from users/residents, the cooperative, capital providers

9. By 2030, it is clear that the combination of housing cooperatives with affordable housing and the implementation of circular strategies turns out to be a complete failure. How did that happen? (premortem question).

Interview questionnaire respondents 12 – 23 (translated from Dutch):

1. What are your experiences with housing cooperatives and circular strategies?
    a. What was your role in this experience?
    b. What were reasons (not) to implement circular strategies?
2. What are key governance parameters for housing cooperatives to be economically, environmentally, and socially sustainable?
3. What are key organisational drivers to enable/embed circular strategies in housing?
4. What are key barriers and drivers to combine affordability and environmental sustainability?
    a. Depending on housing type (individual, collective, cohousing)?
    b. Depending on the organisational identity of the initiator (housing cooperatives, real estate developers, social housing associations, etc.)?
    c. Depending on the stakeholder position (residents, landlords, external investors, social housing associations, public administrations)?
5. What are key barriers and drivers for sustainable housing cooperatives?
    a. Scaling and replication
    b. Funding
    c. Legal/policy
    d. Other boundary conditions
6. By 2030, it is clear that the combination of housing cooperatives with affordable housing and the implementation of circular strategies turns out to be a complete failure. How did that happen? (premortem question).

APPENDIX 8.1 – Interview respondents and questionnaires

In this Appendix we provide an overview of interview respondents (Table A.8.1) and a translated version of the questionnaires for the semi-structured interviews.

Table A.8.1 – Interview respondents

Interview ID	Respondent ID	Respondent role	Stakeholder type	Date
1	1	Director	Regional CSA	07 July 2023
2	2	Researcher	Academic	12 July 2023
3	3	Director	Regional CSA	13 July 2023
4	4	Director	Regional CSA	14 July 2023
5	5	Staff member	Regional CSA	24 July 2023
6	6	Staff member	Regional CSA	09 August 2023
7	7	Team Leader	Statistical authority	24 August 2023
8	8	Staff member	Regional CSA	01 September 2023
9	9	Staff member	Regional CSA	05 September 2023
10	10	Management	Regional CSA	11 September 2023
11	11	Staff member	Regional CSA	13 September 2023
12	9	Staff member	Regional CSA	17 December 2024
13	1	Director	Regional CSA	19 December 2024
14	13	Director	European CSA	19 December 2024
15	10	Management	Regional CSA	08 January 2025
16	14	Volunteer	Local CSA	14 January 2025
16	15	Volunteer	Local CSA	14 January 2025
17	16	Social worker	Local CSA	17 January 2025
18	17	Staff member	European CSA	20 January 2025
19	12	Staff member	Regional CSA	20 January 2025
20	18	Staff member	Municipality	21 January 2025
21	19	Director	Local CSA	22 January 2025
22	20	Social worker	Local CSA	24 January 2025
23	21	Staff member	European CSA	27 January 2025
24	22	Director	Regional CSA	29 January 2025

Questionnaire first stage (2023):

1. What data sources should we take into consideration when mapping the informal circular economy in Flanders?
2. What survey questions should be included when we organise a household survey to map the informal circular economy in Flanders?
3. What are, according to you, the main motives of households to engage in informal circular economy activities (either on the demand side or the supply side) in Flanders?
4. What are, according to you, boundary conditions to ensure a just and sustainable informal circular economy in Flanders?

Questionnaire second stage (2024-2025):

1. What activities does the CSA you represent organise in the sphere of the informal CE (including repair, reuse, or sharing)? How are they organised (top-down vs bottom up)? Which activities are discontinued, and why?
2. Why should CSAs play a role in a circular transition? What are the roles CSA perform in this transition?
3. What are, according to you, challenges and enablers for a just circular transition?
4. How can CSA enable or embed activities and actions towards a just circular transition?
    a. Aimed at the level of CSAs itself
    b. Aimed at the level of its members (influencing membership behaviour)
5. Imagine in 2030, CSAs appear to play no role anymore in the circular transition. What could have happened? (Premortem question)

APPENDIX 8.2 – Descriptive statistics

In this Appendix we report descriptive statistics of our survey (Table A.8.2 and A.8.3).

Table A.8.2 – Survey descriptive statistics on socio-demographic characteristics and CSA membership

Variable	Value	Statistic
Personal characteristic		
Age	51.28 (13.80)	Average (standard deviation)
Male	32.68%	Relative frequency
Living in a city	41.79%	Relative frequency
Living in a central city (subset of living in a city)	23.78%	Relative frequency
Risk preference (0-100)	42.72 (22.97)	Average (standard deviation)
Trust (0-100)	62.81 (18.98)	Average (standard deviation)
Environmental consciousness (0-100)	72.69 (15.94)	Average (standard deviation)
Household size	2.93 (1.28)	Average (standard deviation)
Monthly net household income	2500-3499 EUR	Mode
University degree	38.78%	Relative frequency
Active activity status (worker or independent)	66.59%	Relative frequency
CSA Membership	77.57%	Relative frequency

Table A.8.3 – Survey descriptive statistics on informal CE activities

	Repair (social)	Repair (community)	Reuse (social)	Reuse (community)	Share (social)	Share (community)
Fashion	70%	4%	36%	27%	28%	1%
Car	11%	0.1%	2%	0.5%	32%	0%
Bike	45%	2%	9%	3%	21%	3%
Household						
EEE	35%	8%	8%	3%	21%	0.4%
Multimedia	27%	3%	4%	1%	10%	1%
Baby	26%	1%	19%	21%	23%	4%
Garden	36%	1%	11%	6%	41%	1%

APPENDIX 8.3 – Probit regression estimates

Table A.8.4 – Bivariate probit regression results on the informal repair, reuse, or share, and CSA membership

	Repair (social)	Repair (community)	Reuse (social)	Reuse (community)	Share (social)	Share (commun)
n	668	668	668	668	668	668
Prob > chi2	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Male	-0.1092	-0.1697	-0.3122**	-0.2814*	-0.3122**	-0.1025
	(0.1317)	(0.1420)	(0.1103)	(0.1132)	(0.1103)	(0.1644)
Age	-0.0234**	-0.0004	-0.0229**	-0.0236**	-0.0229**	-0.0182*
	(0.0069)	(0.0065)	(0.0052)	(0.0053)	(0.0052)	(0.0078)
Household size	0.0648	-0.1180	0.0740	0.1149*	0.0740	0.1149
	(0.0611)	(0.0640)	(0.0484)	(0.0492)	(0.0484)	(0.0696)
Education:	0.2074	0.0800	0.2868*	0.2417	0.2868*	0.2999
bachelor	(0.1591)	(0.1799)	(0.1401)	(0.1446)	(0.1401)	(0.2320)
Education:	0.3360	0.0638	0.3103*	0.1662	0.3103*	0.1665
university	(0.1841)	(0.1934)	(0.1526)	(0.1568)	(0.1526)	(0.2467)
Active	-0.2968	-0.1842	-0.0201	-0.0635	-0.0201	-0.0666
	(0.1886)	(0.1927)	(0.1528)	(0.1561)	(0.1528)	(0.2428)
Income (ordinal)	0.0020	0.0364	-0.0720	-0.0746	-0.0720	0.0284
	(0.0462)	(0.0489)	(0.0382)	(0.0389)	(0.0382)	(0.0536)
Rural	0.2372	0.2755	0.2000	0.2506	0.2000	-0.0222
	(0.1646)	(0.1934)	(0.1389)	(0.1432)	(0.1389)	(0.1913)
Central city	0.1895	0.5295*	0.1601	0.4663**	0.1601	-0.1217
	(0.1941)	(0.2115)	(0.1613)	(0.1650)	(0.1613)	(0.2267)
Risk preference	-0.0005	0.0076*	0.0004	0.0014	0.0004	0.0067*
	(0.0028)	(0.0030)	(0.0023)	(0.0024)	(0.0023)	(0.0034)
Trust	0.003	0.0044	0.0043	0.0038	0.0043	0.0010
	(0.0036)	(0.0039)	(0.0030)	(0.0031)	(0.0030)	(0.0046)
Environmental	0.0153**	0.0128**	0.0099**	0.0081*	0.0099**	0.0129*
consciousness	(0.0040)	(0.0049)	(0.0035)	(0.0036)	(0.0035)	(0.0057)
Constant	0.8341	-2.6773**	-0.0117	-0.3176	-0.0117	-2.3507**
	(0.5474)	(0.6180)	(0.4468)	(0.4514)	(0.4468)	(0.6903)
	Membership	Membership	Membership	Membership	Membership	Membership
Male	-0.2650*	-0.2689*	-0.2619*	-0.2650*	-0.2619*	-0.2682*
	(0.1259)	(0.1261)	(0.1259)	(0.1261)	(0.1259)	(0.1260)
Age	0.0123*	0.0124*	0.0124*	0.0125*	0.0124*	0.0123*
	(0.0058)	(0.0058)	(0.0058)	(0.0058)	(0.0058)	(0.0058)
Household size	0.2448**	0.2427**	0.2417**	0.2409**	0.2417**	0.2415**
	(0.0566)	(0.0565)	(0.0563)	(0.0564)	(0.0563)	(0.0565)
Education:	0.4311**	0.4331**	0.4291**	0.4410**	0.4291**	0.4311**
bachelor	(0.1610)	(0.1617)	(0.1611)	(0.1617)	(0.1611)	(0.1613)
Education:	0.3748*	0.3759*	0.3794*	0.3828*	0.3793*	0.3806*
university	(0.1769)	(0.1772)	(0.1768)	(0.1770)	(0.1768)	(0.1770à
Active	-0.5665**	-0.5697**	-0.5607**	-0.5606**	-0.5607**	-0.5658**
	(0.1801)	(0.1799)	(0.1795)	(0.1797)	(0.1795)	(0.1798)
Income (ordinal)	-0.1056*	-0.1066*	-0.1072*	-0.1101*	-0.1072*	-0.1065*
	(0.0434)	(0.0436)	(0.0435)	(0.0434)	(0.0435)	(0.0435)
Rural	0.2697	0.2674	0.2672	0.2721	0.2672	0.2610
	(0.1558)	(0.1561)	(0.1557)	(0.1558)	(0.1557)	(0.1564)
Central city	-0.0908	-0.0986	-0.0944	-0.0899	-0.0943	-0.1006
	(0.1782)	(0.1784)	(0.1781)	(0.1780)	(0.1781)	(0.1786)
Risk preference	0.0038	0.0042	0.0037	0.0040	0.0037	0.0041
	(0.0027)	(0.0027)	(0.0027)	(0.0027)	(0.0027)	(0.0027)
Trust	0.0133**	0.0134**	0.0134**	0.0135**	0.0134**	0.0132**
	(0.0034)	(0.0034)	(0.0034)	(0.0034)	(0.0034)	(0.0034)
Environmental	0.0069	0.0068	0.0068	0.0066	0.0068	0.0068
consciousness	(0.0038)	(0.0038)	(0.0038)	(0.0038)	(0.0038)	(0.0038)
Constant	-1.5618**	-1.5605**	-1.5499**	-1.5515**	-1.5499**	1.5349**
	(0.5018)	(0.5010)	(0.499)	(0.4994)	(0.4999)	(0.5006)
Rho	0.1211	0.2839**	0.2147**	0.1774*	0.2147**	0.2224*
	(0.0910)	(0.0995)	(0.0741)	(0.0766)	(0.0741)	(0.1111)

Note: * significant at the 5% level, ** significant at the 1% level. Standard errors between parentheses.
VIF statistics: mean value = 1.49, maximum value = 2.04.

APPENDIX 8.4 – Probit regression estimates on (not) engaging in the informal circular economy

Table A.8.5 – Summary of probit regressions on motives for engaging in the informal circular economy

	Prob > F	Male	Age	Bachelor	University	Risk preference	Trust	Env. Conscious	Member
Why repair?									
Price	0.1408								
Easy	0.0000		(-)**	(+)*	(+)*			(+)*	
Ecological	0.0000		(-)*					(+)**	
Meaningful	0.0126	(+)*						(+)**	
Habit	0.0002		(-)**			(+)*			
Why reuse?									
Price	0.0000	(-)*	(-)**						
Easy	0.0000		(-)**						(+)*
Ecological	0.0000	(-)**	(-)**	(+)*	(+)**			(+)**	
Meaningful	0.0006		(-)**					(+)*	(+)**
Habit	0.0090		(-)**			(+)**			
Why share?									
Price	0.0413	(-)**							
Easy	0.0339	(-)**							
Ecological	0.0000	(-)**			(+)**		(+)**	(+)**	
Meaningful	0.0122	(-)**							(+)**
Habit	0.1353								

Note: * significant at the 5% level, ** significant at the 1% level. Standard errors between parentheses. Covariates with no significant results: household size, activity status, income level, and geography (dummy variable for rural or central city).

Table A.8.6 – Summary of probit regressions on motives for not engaging in the informal circular economy

	Prob > F	Male	Age	Central city	Risk preference	Env. Conscious	Member
Why no repair?							
No time	0.0444						
Financial	0.1082						
Risk	0.3875						
Don't know how	0.4120						
No habit	0.1549						
Why no reuse?							
No time	0.0201				(-)*		(+)*
Financial	0.1193						
Risk	0.0151					(-)*	
Don't know how	0.2291						
No habit	0.0000	(+)**	(+)**	(-)*	(-)*		
Why no share?							
No time	0.1471						
Financial	0.3795						
Risk	0.0943						
Don't know how	0.2119						
No habit	0.0015		(+)*		(-)**		

Note: * significant at the 5% level, ** significant at the 1% level. Standard errors between parentheses. Covariates with no significant results: household size, educational attainment (dummy variable for bachelor or university degree), activity status, income level, dummy-variable for rural geography, and trust level.

About the author

Wim Van Opstal is a senior researcher at VITO (Flemish Institute for Technological Research), where he leads the *Circular Business & Society* research team. His work focuses on the governance, business models, and social dimensions of the circular economy, with a particular interest in how different organisational forms shape and implement circular strategies.

He has published in peer-reviewed journals on just circular transitions, circular business model innovation, the informal circular economy, and the role of social enterprises, cooperatives, and civil society associations in enabling and embedding circular strategies. His research combines conceptual and empirical approaches, drawing on interdisciplinary perspectives from economics, governance studies, and social innovation.

Wim holds degrees in economics and commercial sciences and has over 25 years of experience working at the intersection of research, policy, and practice. He frequently collaborates with policymakers, industry actors, and civil society organisations to translate research findings into actionable strategies that support both environmental and social goals while ensuring economic viability.

