CIMA Research Executive Summary
Vol. 21 Issue 3

AICPA & CIMA

The Circularity Radar:

A Framework for the Circular Economy in Retailing and Manufacturing

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Key Conclusions

Circular business models and practices in the retail sector

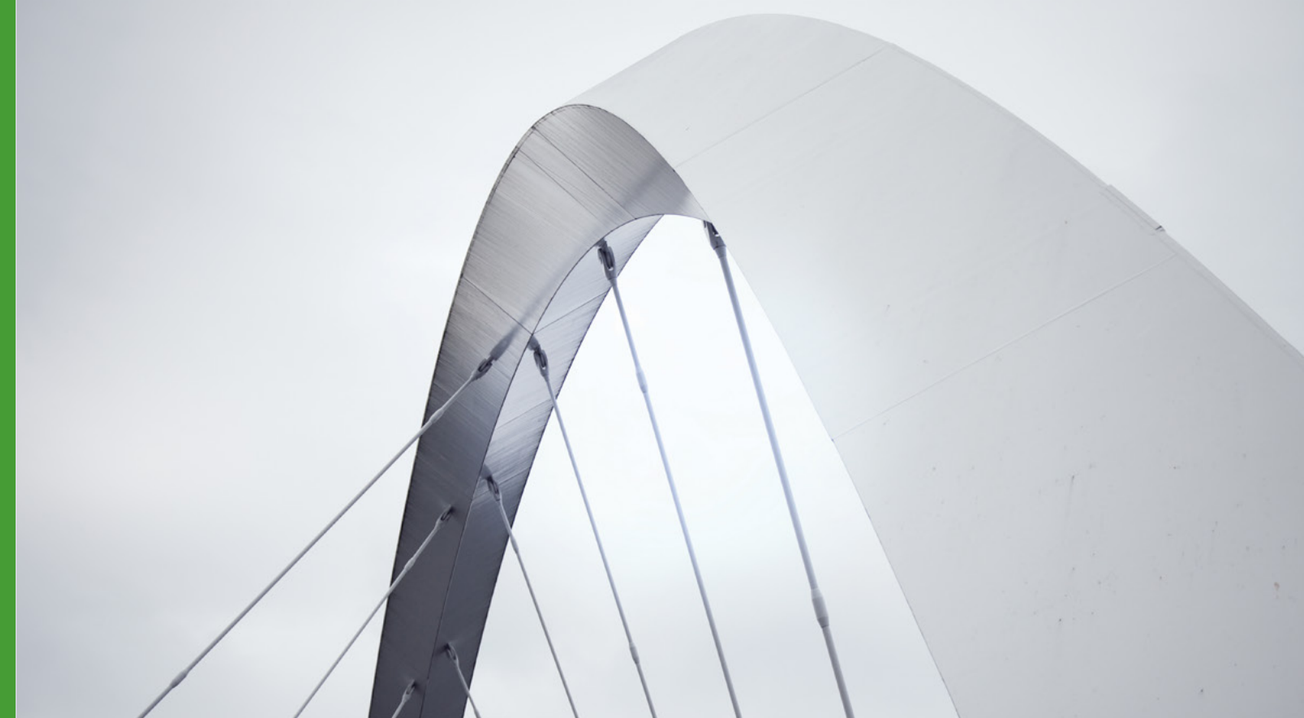
- Most of the world's largest clothing retailers score low in terms of their environmental transparency and commitment when measured against a weighted environmental and sustainability index, with 12% scoring zero out of a hundred.
- The poor environmental performance of many major companies poses a risk of backlash with increasingly environmentally conscious consumers as well as forthcoming sustainability regulations.
- Circular business models (CBMs) provide a means to tackle the environmental problem of product returns and to make retail more sustainable.
- CBMs give companies the opportunity to create value in more sustainable ways. Other drivers for adopting CBMs include regulatory requirements and technological innovation.
- Technological innovation increases sustainability by enabling new pathways for returned items to reach the next consumer and avoiding product returns from happening in the first place. Examples include peer-to-peer shipping, "try whilst the courier waits" and returns ecosystem approaches that optimise the product resale value.
- Despite existing reporting standards, there is also a lack of consensus regarding circularity metrics at the organisational and business levels, with different assessment frameworks leading to discrepancies in the results.

The Circularity Framework and Radar

- Creating, implementing and assessing CBMs is challenging and using a framework for circularity will enable companies to gain a strategic overview.
- Many elements, mechanisms and practices can create circularity. The Circularity Framework presented in the report contains seven aspects- eco-design, sustainable operations, sustainable materials, R-strategies (like repair, remanufacturing and recycling), product stewardship, social aspects, and strategic organisational positioning.
- **The Circularity Radar**, a tool developed from the Circularity Framework, allows retailers and manufacturers to conduct a self-assessment and to identify opportunities for increasing their sustainability and circularity. It can serve as a quantitative tool to measure, monitor, and communicate their environmental commitment and sustainability practices, and help overcome barriers faced when composing business cases for sustainability.
- Despite some overlap, the Circularity Framework and Radar have a different focus than sustainability reporting standards like the ESRS E5: Resource use and circular economy; the GRI; and the IFRS Sustainability Disclosure Standards.
- These reporting standards are general, whereas the Circularity Radar was created with the retail industry and related manufacturing industry in mind. Furthermore, the Circularity Radar takes a more active stance in guiding the user to conduct a strategic and conceptual self-assessment in terms of CBM implementation progress and opportunities.

Contents

This report is funded through CIMA's research programme that is designed to promote and develop the science of management accountancy as stipulated in our Royal Charter. The programme encourages leading academic and practitioner researchers to explore issues and provide fresh topics of interest to CIMA® members and CGMA® designation holders.



Introduction

In the traditional linear economy, materials and goods are extracted, consumed, and discarded, without significant attention to the wide range of negative environmental and social externalities that this unsustainable production and consumption model creates.

This has encouraged governments, academics, and practitioners to evaluate whether it is economically feasible and ecologically sensible for retail and associated manufacturing companies to transition towards more circular business models. The digital economy we live in today has also influenced consumption practices that have exacerbated our environmental footprint. For instance, many consumers order things online and have their orders delivered straight to their homes, a practice that the COVID-19 pandemic further encouraged (Frei et al., 2023). Due to the inability of customers to touch and try the product, returns rates are much higher for online shopping than for in-store purchases.

Unfortunately, product returns are wasteful regarding resources, emissions, and monetary value, significantly affecting companies, society, and the environment (Zhang et al., 2023). Many products cannot be resold at all or not through the same channel or at the original price; extra transportation and packaging are often required, and additional products are manufactured to replace those discarded.

The wasteful and costly nature of product returns motivated us to explore and evaluate circular business models, aiming to tackle the environmental problem of product returns and making retail more sustainable (Frei et al., 2020). **This project addressed the need for innovation by creating a foundational framework for circular retail and manufacturing.**

Research objectives and methodology

The overall aim of this study was to examine strategies and mechanisms used to create circular business models in retail and associated manufacturing, and to create a framework for companies to self-assess their implementation progress.

We applied a mixed-method approach to this study to shed light on the problem from different quantitative and qualitative perspectives.

Objective 1

To deepen our knowledge of existing circular business models in retail (excluding food/groceries) and ways to assess their economic, ecologic and social sustainability, ensuring our familiarity with the latest developments across the globe.

To achieve this, we conducted a systematic literature review on the adoption of CBM in retail and associated manufacturing, identifying drivers and barriers to implementation and mechanisms to achieve circularity.

Objective 2

To examine under what conditions and for what products it makes sense for retailers to transition from the common ownership-based business model to a more circular business model, and to determine what the internal and external barriers are and how they can be overcome. It is important to be aware that one solution does not fit all cases, and to understand what factors are critical to ensure an optimal fit.

To achieve this, we conducted 17 interviews with practitioners to gain a deeper understanding of their motivations to implement CBMs, the barriers they need to overcome, and how they create circularity.

Objective 3

To create a framework for circular retail and associated manufacturing, and shape it such that it can be used alongside the Reverse Logistics Toolkit 2.0.

The previously collected data were synthesised in a conceptual framework and practical tool — the Circularity Radar — that can guide researchers and practitioners in understanding how CBM can be implemented, how much progress has been achieved, and to identify opportunities for implementing more circular practices.

We also conducted a quantitative analysis using detailed microdata from the Fashion Transparency Index to study the state of the art of sustainability- and circularity-oriented practices of the world's largest clothing retailers using unsupervised machine learning techniques to identify clusters of fashion retailers based on the similarity of environmental practices. This approach provides a data-driven and direct measure of companies' engagement regarding critical and measurable environmental practices.

To deepen our understanding of how sustainability and circularity can be created in retail, we identified innovative retail technologies currently being employed by companies that address:

- The purchasing and returning processes
- Secondary markets to increase reselling rates

Objective 4

To contribute to building a community of experts on product returns and sharing economy/circular business models.

To achieve objective 4 we conducted two workshops on circularity and sustainability: one for academics and one for practitioners. The goal was to gather feedback on our preliminary results and gain further insights from other perspectives. We also conducted two workshops on sustainable consumption for the general public, with the goal of gathering feedback from consumers.

Main findings and their implications for practice

A framework for sustainability and circularity in retail and manufacturing

We identified a comprehensive set of mechanisms, principles and ways to achieve sustainability and circularity in the context of retail and associated manufacturing, as illustrated in Figure 1 and further detailed in Frei, Litaudon et al. (2024). The core concept at the centre of the framework is the goal of attaining circularity, which aligns with the ultimate aim of businesses adopting more Circular Business Models (CBMs). The framework organises the mechanisms for implementing CBMs into seven interconnected categories, each representing a crucial aspect of circularity. For each category, we indicate the different elements within (a short description of each element is provided in the appendix), followed by a brief discussion of the four elements defining the environment in which CBM are created and exist. It is not possible to generally prioritise one mechanism or strategy above another, as all implementations and their cost-benefit analysis are context-dependent.

Approaches to circular business model for retailers and manufacturers

Figure 1: A framework for sustainability and circularity in retail and manufacturing

The Seven Categories

Strategic organisational positioning:

Intra-organisational collaboration; senior management commitment; inter-organisational collaboration (with suppliers and others); partnership with customers; long-term contracts.

Product stewardship:

Reduce returns, obsolete stock; better returns service models; enable repair, upgrade; renting, leasing, sharing; maintenance; secondary market; product as a service.

R-strategies or R rermt:

Recycle; remanufacture; refurbish; repair; recover; reduce; reuse; rethink; refuse; regift; redesign.

Social aspects:

Supporting communities; equitable employment; equitable sourcing.

Sustainable materials:

Locally sourced; biodegradable; recycled; recyclable; responsibly sourced.

Sustainable operations:

Restorative, regenerative; sustainable logistics; sustainable manufacturing; sustainable energy; avoiding waste.

Eco-design:

Upcyclable; easy dismantling; modular, upgradeable; use less; durable; repairable; extending life cycle.

External and macro influences:

Surrounding these seven categories are external factors that influence the adoption and success of more circular business models: government policies, regulations, laws, taxes; customer demand and attitudes; innovation in technologies and services; shareholders' pressure.

Our framework highlights the multidimensional approach needed for retailers and manufacturers to transition towards CBMs. It emphasizes collaboration, sustainability, innovative design, responsible material sourcing, and the integration of social and operational aspects. The external influences stress the importance of supportive public policies, market conditions, technological innovation, and stakeholder expectations in driving circularity.

More detail on the framework can be found in Appendix 1.

The Circularity Radar

Our research shows that companies in manufacturing and retail systematically declare intentions to reduce their environmental impact in their mission statement yet struggle to implement measurable changes. These challenges are exacerbated in the case of small and medium enterprises (SMEs), which often have limited resources available to assess opportunities for increased sustainability and circularity.

With this in mind, we developed a digital tool to allow companies to explore and assess sustainability and circularity opportunities: The Circularity Radar (Merlano et al., 2024). It is available at: https://bit.ly/3SwdCE8. Businesses can use this tool alongside the Reverse Logistics Toolkit 2.0.

The Circularity Radar is a free and open-source interactive application that guides practitioners in exploring and assessing their transition to more sustainable and circular business models. The tool constitutes an early stage and guided self-assessment exercise that can help businesses evaluate their current situation and potential for improvement through a simple and user-friendly interface. Once an initial self-assessment is completed, companies can use the information available in the tool to explore additional ways to measure and monitor circularity opportunities through more specific instruments at different levels beyond the organisational one, like products, departments or their supply chain.

The Circularity Radar ensures the privacy and confidentiality of the information by allowing companies to deploy the application locally using the open-source and free software R (R Core Team, 2022). This approach prevents the need for data sharing with third parties. Moreover, the open-source nature of the application enables companies to tailor the circularity tool to their own needs, especially if the pre-defined interface or parameters do not correspond to the company's nature, business model, or needs.

As detailed in Appendix 2, we have made available the source code of the application along with a user-friendly parametrisation that supports organisations in either retail or manufacturing in adapting our tool to their specific needs. The application is also flexible enough that users can exclude features that are not applicable or relevant to their specific needs. SMEs can leverage this tool to run various "what-if" scenarios, providing sustainable solutions and insights. This capability supports the evaluation of uncertain strategies and facilitates more informed decision-making. Finally, the platform is also designed to inform and orient businesses regarding state-of-the-art circular business models and metrics.

Overall, the tool aims to inform and guide practitioners in exploring the drivers of their sustainability transition, to assess their present situation and the obstacles they need to overcome, and ultimately to help them explore the mechanisms that can be used to create sustainability and circularity at the company level.

The Circularity Radar incorporates the seven elements of circularity in Figure 1: sustainable materials, sustainable operations, eco-design, strategic organisational positioning, product stewardship, R-strategies (such as reduce, reuse, repair, refurbish, remanufacture, etc.), and social aspects. Additionally, the Circularity Radar presents alternative instruments and metrics businesses can use to quantitatively assess their current progress regarding circular business models and opportunities.

A current limitation of the Circularity Radar is that it provides guidance on which circularity and sustainability dimensions the user should assess, but it does not yet define standards for how each dimension should be scored; for instance, what constitutes a poor / average / good / outstanding implementation of refurbishing? Our ongoing work examines how to define systematic scoring scales.

More details of the Circularity Radar can be found in Appendix 2.

Drivers and barriers to CBM implementation

Businesses in the retail industry typically implement CBMs due to a number of reasons, further detailed in Frei, Litaudon et al. (2024). These were identified through our systematic literature review and confirmed through interviews. They include:

- Value creation (environmental, social, and financial benefits)
- Collaborations and partnerships
- Policies, laws, and regulatory frameworks
- Technology and innovation
- Certification and standards

Barriers that need to be overcome can be:

- Consumer-related
- Economic or financial
- Technical or operational
- Related to knowledge and skills
- Organisational or strategic
- Social or reputational
- Related to policies, laws, and regulatory frameworks

Several practitioners mentioned a general feeling of being overwhelmed with the complexity of the transition to circularity and sustainability, in combination with difficulties relating to several of the above listed barrier categories. They expressed that simple and straight-forward guidance would help; for instance, from a tool like the Circularity Radar.

Considering various routes to increase circularity, and fundamentally rethinking how things are done, can lead to more efficient solutions that consume less resources. Competitive advantages can also emerge gradually, with increasing numbers of consumers favouring more sustainable products and services.

Our workshops with consumers revealed that many are concerned about the climate emergency, and aware of the need to consume less resources and adopt more sustainable practices. Many of those who can afford are willing to spend more on more sustainable products and services, but sometimes concerned about additional payment amounts accumulating. Consumers wish for sustainable products that are affordable, reinforcing the need to find viable solutions that are viable in all three sustainability dimensions: environmental, social, and financial.

Analysis of circularity metrics

As part of our ongoing work on how to define systematic scoring scales, we examined several existing metrics and sustainability reporting standards, such as the ESRS E5: Resource use and circular economy; the GRI; the IFRS Sustainability Disclosure Standards; and the sustainability ratings used by GoodOnYou. We decided to focus on the Fashion Transparency Index (FTI) due to its specific focus on the fashion industry and the publicly available detailed FTI data, which assesses 250 of the world's largest clothing retailers (based on annual turnover) in terms of their sustainability- and circularity-oriented practices.

We performed a statistical analysis using detailed microdata from the FTI identify clusters of fashion retailers based on the similarity of environmental practices. This allowed us to identify global environmental trends that are representative of the overall fashion sector as measured by market size.

We selected a sample of 258 environmental and human rights indicators from the FTI that represent performance in four categories: Policies (P), Governance (G), Sustainability (S), and Circularity (C). With the selected indicators, we produced a weighted environmental and sustainability index with scores normalised between 0 and 100. Higher values in the scale imply more environmental compliance.

We found three main results: First, there is a lack of consensus regarding circularity metrics at the organisational and business levels, despite the availability of several sustainability assessment systems and reporting standards. Second, companies score significantly low on our weighted environmental and sustainability index, and around 12% of brands score zero out of 100. Finally, our cluster analysis identified that apart from three clusters of firms with relatively low scores, only one small group of clothing retailers (8% of the sample) scored above 60 and showed signs of substantial environmental transparency or commitment.

These findings confirm that most of the largest fashion companies fail to deliver on their sustainability promises, with only few performing reasonably well. Our analysis also illustrates the complexity of dealing with a very large number of performance indicators, which vary from one assessment framework to another.

Innovative retail product returns pathways

Zooming in on one specific area of retail sustainability, we explored how recent retail technology and service innovation can improve circularity and sustainability (Frei, Zhang et al., 2024). Product returns systems often suffer from low efficiency and effectiveness. Innovative solutions are proposed by an increasing number of start-ups, with many enabling new and more circular pathways for returned products. Our research explored the implications of adopting these innovations and the outcomes for retailers and suppliers, employees, and consumers.

We adopted an engaged research approach involving close dialogue with retailers as well as technology and returns service providers to identify innovative retail technologies and services addressing the purchasing and returning processes as well as the access to secondary markets for resale.

Purchasing and returns

- "Trying whilst the courier waits" is a service proposition potentially best suited for the higher-price sector, whereby products are provided for the customer to try at home and hand unwanted ones back to the waiting courier. This eliminates delays, simplifies the process, and significantly reduces the risks of returns fraud.
- Peer-to-peer returns shipping (Zhang et al., 2024) increases the probability and speed of a resale via the primary sales channel by cutting out the return to the warehouse. Instead, the returning customer sends the item directly to the next customer, who receives a small discount as an incentive to participate in the scheme.

Secondary markets

An increasing number of retailers, manufacturers and brands are starting to engage in secondary markets to increase the reselling rates or returned and otherwise unwanted items whilst creating financial benefits for the company. This includes online as well as brick-and-mortar outlet channels for open-box, repaired, refurbished, or remanufactured items. Some companies are collaborating with third-party resellers to form strategic partnerships.

- The resale of both used and returned items require an assessment of the product (whether it is genuine and as expected) and its condition, to decide whether it can be sold as new with tags / original packaging, new with slight cosmetic damage, used — good condition, used — fair condition, or similar. Digital solutions to conduct this assessment are becoming more common, enabling solutions such as peer-to-peer returns shipping as well as optimised decision-making for resale, increasing the speed of resale and the retained product value.
- Digital size-finders have existed for over a decade, but recent innovation is based on more sophisticated algorithms and machine learning. Some tools include 3D scanning of customer body shapes to optimise the fitting process of apparel, shoes and accessories. Virtual try-on systems can be as simplistic as superposing a product image with a customer image, for instance, to visualise what a watch might look like on a customer's arm. More advanced systems aim to provide a more realistic impression of what the garment would look like if draped around the customer's body, indicating where it might be loose or tight fitting. Challenges include consumer acceptance, data privacy concerns, and large data quantities and processing power required to render realistic-looking images.
- Startups are also working on innovative alternative ideas, such as a platform for price-negotiating with retailers, typically towards the end of an item's full-price shelf life and before it is put on sales. By engaging in such deals, retailers may obtain a higher price than the sales price, and consumers may feel additional satisfaction through the discount, potentially valuing the item more, and being less inclined to return it.

We found that many recent retail technology and service innovations offer added value to consumers, while also allowing retailers to increase the retained value of returned products, reduce waste, and increase circularity. These new pathways enable retailers to address the challenges of high returns rates, financial pressure, and the need to reduce their environmental impact.

Conclusions

Businesses, consumers, and governments are increasingly embracing the need for sustainability and circularity in response to the increasing environmental crisis. Evaluating the expected environmental impact of more sustainable business practices becomes challenging without effective ways to measure the adoption and evolution of Circular Business Models (CBMs) in the economy. Adopting the framework proposed in this study — the Circularity Radar — will enable retailers and manufacturers to gain an overview, assess their progress, identify further opportunities to increase sustainability, and communicate their findings to stakeholders. Disseminating strong sustainability performance may increase success with environmentally conscious consumers and stakeholders, lead to further collaborations and improve brand image.

The tool guides users through self-assessments in seven categories of mechanisms and practices that enable sustainability and circularity: eco-design, sustainable operations, sustainable materials, R-strategies (like repair, remanufacturing and recycling), product stewardship, social aspects, and strategic organisational positioning. Each category contains several elements, and these can be adapted to suit individual business needs. Through its visualisation feature, the Circularity Radar provides businesses and organisations with a way to measure, monitor, and communicate their environmental commitment and sustainability practices.

Our quantitative assessment of the state of the art of sustainability- and circularity-oriented practices of the world's largest clothing retailers found that most companies score very low on our weighted environmental and sustainability index, and only very few showed signs of substantial environmental transparency or commitment. Whilst not surprising, this is concerning.

A sector-wide transition to more sustainability will likely occur only when changes bring financial advantages or if structural legislation prescribes it. Regulators can support startups developing new sustainable CE solutions by providing financial incentives such as grants. They can facilitate collaboration by creating platforms for startups and large companies to work together on pilot projects, showcasing successful implementations. Additionally, promoting certifications can validate the reliability and effectiveness of sustainable technologies.

The transition to more sustainable and circular practices requires collaboration and coordination between policymakers, entrepreneurs and consumers. Researchers and practitioners agree that regulators should implement specific actions and policies to promote circular practices in the retail sector.

Technological innovation can increase sustainability, for instance, by enabling new pathways for returned items to reach the next consumer and avoiding product returns from happening in the first place. Examples include peer-to-peer shipping, platforms where customers can negotiate prices with retailers for instance on end-of-season items, and digital consumer portals that both encourage consumers to purchase responsibly and return items in more sustainable ways.

Efforts to design, source, make, use and reuse things in more sustainable ways are being made by a growing number of researchers, practitioners and consumers, but they often act in silos. Connecting them would have a catalysing effect by creating synergies and fostering creativity in finding viable and profitable solutions.

References and /or further reading

References

Merlano F, Frei R, and Zhang D (2024). *The Circularity Radar: A digital tool for SMEs to assess circular opportunities. In Proceedings of the Low-Cost Digital Solutions for Industrial Automation Conference, Cambridge UK, October 2-24. (to appear)*

Frei R, Litaudon V, Zhang D, Kimaro J, Merlano F, and Wood S (*2024). Circular Business Models in Retail: Mechanisms, Drivers, and Barriers. Journal of Cleaner Production. (under review)*

Frei R, Jack L and Krzyzaniak SA (2020). *Sustainable reverse supply chains and circular economy in* multichannel retail returns. Business Strategies and the Environment (B*SE), 29(5), p.1925-1940. https://doi.org/10.1002/bse.2479*

Frei R, Zhang D, Bayer S, Senyo PK, Gerding E, Wills G, and Beck A (2023). T*he Impact of COVID-19 on Product Returns Management in Multichannel Retail. Available at SSRN: http://dx.doi.org/10.2139/ssrn.4503184*

Frei R, Zhang D, Parry G, and Wood S (2024). *Scoping Innovative Retail Product Returns Pathways. Strategic Change. (under review)*

Zhang D, Frei R, Wills G, Gerding E and Senyo PK (2023). *Strategies and practices to reduce the ecological impact of product returns: an environmental sustainability framework for multichannel retail. Business Strategy and the Environment, 32(7), 4636-4661. https://doi.org/10.1002/bse.3385*

R Core Team (2022). R: *A Language and Environment for Statistical Computing. Vienna, Austria. [Online]. Available: https://www.R-project.org/*

Zhang D, Dawson I, Frei R and Merlano F (2024). *Navigating the Green Path: exploring the dynamics and impact of Peer-to-Peer Retail Returns. In Proceedings of the EuROMA Conference, July 2024, Barcelona. Available online.*

Further reading

Advancing the circular economy in Sri Lankas manufacturing sector. CIMA Executive Summary Volume 20 Issue 2 (2024) https://www.aicpa-cima.com/professional-insights/download/advancing-the-circular-economy-in-sri-lankas-manufacturing-sector-the-role

Making the circular economy a reality for SME's. CIMA Executive Summary Volume 19. Issue 2. (2023): https://www.aicpa-cima.com/resources/download/making-the-circular-economy-a-reality-for-smes

https://www.aicpa-cima.com/resources/article/managing-reverse-logistics#search. Sheffield University, (2018) *Registration required to access.*

Appendices

Appendix 1 — Circularity Framework in Detail

Elements and sub-component of the framework for sustainability and circularity in retail and manufacturing:

Strategic organisational positioning:

- **Intra-organisational collaboration:** Coordinated efforts and communication within different departments to promote circular practices.
- **Senior management commitment:** Active involvement and support from top management is crucial for implementing and sustaining circular business strategies.
- **Inter-organisational collaboration (with suppliers and others):** Collaborating with external stakeholders, including deep-tier suppliers, to promote a more circular economy.
- **Partnership with customers:** Engaging with customers to understand their needs and encouraging them to participate in circular initiatives.
- **Long-term contracts:** Establishing lasting agreements with partners to ensure stability and long-term cooperation in circular practices.

Product stewardship:

- **Reduce returns and obsolete stock:** Minimizing wasteful product returns and optimising excess inventory effectively to reduce waste. It also involves better returns service models, e.g., implementing efficient systems for handling product returns to maximise value recovery, enabling new pathways for returned items, and preventing product returns from happening in the first place.
- **Enable repair and upgrade:** Providing options for repairing or upgrading products to extend their lifespan.
- **Renting, leasing, and sharing:** Offering products as rentals, leases, or through sharing models to optimise resource use (e.g., Facilitating the resale of used, unwanted or unfit for purpose products to extend their lifecycle through secondary markets).
- **Maintenance:** Providing services to enhance durability and functionality of products.
- **Product as a service:** Shifting from selling products to providing them as services, focusing on usage rather than solely ownership.

R terms or strategies:

- **Reuse (Design Phase):** Using products or materials more than once.
- **Rethink (Design Phase):** Re-evaluating current productive practices to integrate circular principles, including both product designs and business models (e.g., through an access-based model or economy).
- **Reduce (Design Phase):** Minimizing resource use and waste generation.
- **Reuse (Consumption Phase):** reusing products when conditions are adequate (e.g., second-hand markets).
- **Repair (Consumption Phase):** Fixing products to extend their usability.
- **Refurbish (Consumption Phase):** Renovating and restoring used products for resale or secondary markets.
- **Remanufacture (Consumption Phase):** Rebuilding products to like-new condition.
- **Repurpose (Consumption Phase):** the use of discarded products or parts in alternative products.
- **Recycle (End of life):** Converting waste into reusable materials.
- **Recover (End of life):** Extracting valuable materials or components from waste.
- **Refuse (Additional — Design Phase):** Avoiding products or practices that are unsustainable, like excessive and fraudulent product returns.
- **Redesign (Alternative - Design Phase):** Creating products with circularity in mind, emphasising sustainability and resource efficiency.
- **Regift (Additional - End of life):** Allowing social platforms to facilitate passing on unwanted items to others who can use them.

Social aspects:

- **Supporting communities:** Engaging in activities that benefit local communities and promote environmental awareness.
- **Equitable employment:** Ensuring fair labour practices that incorporate the highest standard in terms of labour and human rights conventions.
- **Equitable sourcing:** Procuring materials and services in a manner that supports fair trade and ethical practices.

Sustainable materials:

- **Locally sourced:** Using materials from local suppliers to reduce transportation emissions and support local economies.
- **Biodegradable:** Choosing materials that can break down naturally without minimal environmental harm.
- **Recycled:** Using materials that have been used to create new products.
- **Recyclable:** Selecting materials that can be reprocessed and reused in the new and circular production cycle.
- **Responsibly sourced:** Ensuring materials are obtained in an environmentally and socially responsible manner.

Sustainable operations:

- **Restorative, regenerative:** Adopting practices that restore and regenerate natural systems.
- **Sustainable logistics:** Transportation and distribution to minimise environmental impact.
- **Sustainable manufacturing:** Implementing production processes that reduce waste and conserve resources.
- **Sustainable energy:** Utilizing renewable energy sources and improving energy efficiency.
- **Avoiding waste:** Implementing strategies to minimise waste generation across companies' operations and supply chains.

Eco-design:

- **Upcyclable:** Designing products that can be creatively reused or repurposed.
- **Easy dismantling:** Creating products that can be easily taken apart for reuse, repair, recycling, etc.
- **Modular, upgradeable:** Designing products with interchangeable parts that can be upgraded or replaced for upgrading.
- **Repairable:** Designing products that can be easily repaired to extend their life.
- **Extending life cycle (durability):** Ensuring products are long-lasting and have a prolonged functional lifespan through various strategies.

Appendices

Appendix 2 — Technical details of the Circularity Radar

We provide a more detailed and technical description of the application's structure below:

Libraries and packages:

- The core package to run the application is "shiny." We also use the following packages: "shiny themes" (appearance), "tidyverse" (data manipulation and plots), and "Cairo" (graph quality), which provide the necessary tools to support the UI, radar chart, and data manipulation.
- User-driven customisation and extensions: The code allows the user to define or rename the dimension and sub-components, allowing different organisations to tailor the application if necessary.

UI structure:

- Navbar Layout: The app uses a "navbarPage" layout, which organises the interface into multiple tabs.
- Tabs include a combination of Shiny's "titlePanel," "fluidPage," and "sidebarLayout" that describe the app content, explaining the page's purpose and providing user guidance regarding the tool.

Server logic:

- The server function contains reactive expressions and observers to process user inputs, calculate dimension-specific scores, generate radar charts, and update the UI based on dynamic interactions.
- The app uses reactive values to manage state, store inputs, calculate scores based on sub-components and update visualisations dynamically.
- The application also allows dynamic sliders if the user wants to manually adjust or update the dimensions' values.

Customisation:

- The source code includes detailed comments explaining various sections, particularly around the customisation of input names, variable lists, and visual components. These comments help users understand how to modify the app to suit specific needs.

Acknowledgements

The Researchers would like to thank CIMA's General Charitable Trust for funding this project.

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January 2025
ISBN 978-1-85971-932-9

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