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LEARNING-OUTCOMES FACTORS OF CIRCULAR BUSINESS MODEL-TRAINING FOR WASTE-BANK MANAGERS

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Abstract:

Background: Waste banks and reduce-reuse-recycle (3R) waste management sites are critical to addressing growing waste problems, but many face challenges in developing effective business models. Training in circular business models is crucial to empower waste bank managers for sustainable and profitable operations.
Purpose: This study aims to assess the learning outcomes of circular business model training for waste banks and 3R waste management sites, focusing on competencies that can enhance waste management practices.
Design/Methodology/Approach: A two-stage research design was employed. The first stage involved qualitative in-depth interviews with 19 participants, analyzed using content analysis. The second stage applied findings from the qualitative phase to design data collection instruments for a quantitative study, which included a survey of 39 managers. The quantitative data were analyzed through Exploratory Factor Analysis (EFA) using SPSS v26.
Findings/Results: Seven critical learning outcomes were identified: planning, leadership, finance, self-efficacy, entrepreneurship, information sharing, and marketing. These factors represent essential competencies for the successful implementation of circular business models. Notably, self-efficacy emerged as a novel factor, emphasizing the psychological readiness of participants.
Conclusion: The identified factors are key for successful circular business model adoption in waste management. Incorporating them into training programs can enhance waste bank and 3R site operations, leading to greater sustainability and profitability.
Originality/Value: This research contributes new insights into the competencies required for circular business model training in waste management, particularly the role of self-efficacy in fostering successful outcomes.

Keywords: circular business model, exploratory factor analysis, learning outcomes, training, waste banks

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INTRODUCTION

Waste is a global problem and becomes a concern worldwide as the population keeps on increasing (Iglesias, 2022). It pollutes not only land but also water and affects the health of marine ecosystems. It is estimated that between 4.8–12.7 metric tons of plastic accumulate in the oceans every year (Jambeck et al. 2015), where 80% of which is believed to originate from land-based sources while the remaining 20% comes from sea-based sources, such as fisheries and the shipping industry (Ocean Conservancy, 2018). Approximately 75% of leakage from land-based sources is estimated to be from uncollected waste (Ocean Conservancy, 2018). A solution is needed that can reduce the collective impact caused by plastic waste produced by society, which can become a global threat to the earth. Some countries have reacted to this problem by banning the import of plastic waste, banning the use of plastic bags, and allocating more funds to plastic research and innovation (HM Treasury, 2018). Otherwise, without government intervention, ocean plastic will outweigh fish by 2050 (World Economic Forum, 2016).

The circular economy is an alternative solution offered to replace the traditional linear economic system that uses the take-make-dispose model. The circular economy aims to maximize the circular use of materials to minimize waste production by recovering and reusing products and materials as much as possible, systemically, and repeatedly (Barford & Ahmad, 2021; ILO, 2019). In a circular economy, resource use, waste, emissions, and wasted energy are minimized by cycling the production-consumption. This is achieved through extending product life, design innovation, maintenance, reuse, remanufacturing, and recycling original products into other products (Schroeder, 2020). It has the potential of becoming a source of income (Dias, 2016), driving economic growth (McCarthy, Delink & Bibas, 2018), and creating about 9 to 12 million new jobs worldwide (Wilson et al. 2020). Several studies on the circular economy have been done particularly in bringing society into circular economy thinking (Moreau et al. 2017; Murray, Skene & Haynes, 2017; Sauvé, Bernard & Sloan, 2016; Velis, 2017; Webster, 2021).

Bringing circular economy into thinking may also be done through training. Training is an effort formally conducted to help employees gain knowledge, skills, and abilities to improve performance in work (Gomez-Meija, Balkin & Cardy, 2010) not only individual performance but also organizational performance (Garavan et al. 2021), since training links to working people's abilities that contribute to organizational progress (Anwar & Shukur, 2015; Abdullah & Othman, 2015). It also contributes to the community of users (Wang & Wang, 2012; Wang & Remiller, 2009), and may be used to develop thinking capacity. Training becomes even more important due to the dynamic business environment driven by technological advances (Montealegre & Cascio, 2017), talent shortages (Cascio & Graham, 2016), job transitions (Wegman et al. 2018), and changing career expectations (Hirsch-Kreinsen, 2016).

The benefits of training have been well studied. However, the success of training also depends on the selection of appropriate participants. The wrong candidate selected for the training program might affect the success of training despite all the necessary efforts to ensure a successful training program (Laing, 2021). Success or failure may also be influenced by the quality of training content, the application of psychological learning principles (Laing, 2021), and experiential learning processes (McGhee et al. 1996).

Although circular economy studies are growing, research on competency-based training for circular business models remains limited, especially for community-based waste management actors like waste bank managers. Literature highlights that existing training frameworks often lack coherence and fail to adequately address the competencies required for circular implementation (Sumter et al. 2020; Hidayatullah, 2023). While many emphasize community engagement, few offer structured, targeted training content. Rentizelas et al. (2018) stress the need for foundational knowledge but note most efforts focus on supply chain optimization rather than stakeholder empowerment.

Circular business models emphasize designing out waste, maintaining product and material cycles, and restoring ecosystems (Geissdoerfer et al. 2017). While successful in developed, well-regulated contexts, their implementation in low-resource, decentralized systems like waste banks is still underexplored (Troschinetz & Mihelcic, 2009; Zaman, 2015). Waste banks, in particular, act as micro-level enablers of the circular economy by functioning as community

hubs for recycling and education, yet they suffer from operational inefficiencies without adequate training (Sumter et al. 2020).

Studies also point to the transformative power of training in improving knowledge, behavior, and community practices (Schröder et al. 2019), though its long-term impact and sustainability remain contested. Some argue training alone is insufficient without practical application and continuous support; others suggest capacity-building can enable community-led transformation (Sumter et al. 2020). This disagreement highlights the importance of identifying concrete learning outcomes from training. The specific training titles and their assignments are summarized in Table 1.

Despite their strategic role, waste banks and 3R (Reduce, Reuse, Recycle) sites face challenges in transitioning to sustainable circular business models due to capacity and knowledge limitations. Structured training exists but often lacks a framework tied to essential competencies. Waste bank managers often operate without adequate entrepreneurial, financial, or organizational skills. This gap compromises the long-term sustainability of community-driven waste management models.

Moreover, while general training programs in waste management exist, few focus on circular business model competencies. There remains a lack of clarity in understanding which specific skills or competencies are actually gained through circular training and how they improve operational performance in waste banks and 3R environments. Most training initiatives have not been systematically evaluated for effectiveness or outcomes, especially from the lens of competency development.

Furthermore, waste pickers and collectors who play critical roles in material recovery often lack adequate knowledge and training to contribute effectively to circular systems. Studies by Gutberlet and Carenzo (2020), and Iqbal et al. (2023), emphasize the economic potential of integrating these actors into the circular economy through training. Cooperative and inclusive models (Buch et al. 2021; Gutberlet, 2023) underscore the need for capacity building not just as education but as empowerment.

This study seeks to address the above gap by evaluating the learning outcomes of a circular business model training program designed for waste bank managers and 3R waste site operators. The objective is to identify which key competencies are formed through the training such as leadership, planning, self-efficacy, finance, marketing, and entrepreneurship and how these contribute to sustainable waste management practices. To achieve this, a two-stage mixed-method design was employed. The first stage involved qualitative in-depth interviews with 19 training participants to explore perceived learning outcomes, followed by a quantitative phase using a structured survey involving 39 waste bank managers. The data were analysed using Exploratory Factor Analysis (EFA) to identify critical competency factors.

Table 1. Training title and its assignment

Training Title	Assignment
Circular Business Model	Formulate a circular business model
Entrepreneurial Mindset	Discuss ups and downs of running a business
Product Development	Formulate a value proposition canvas
Supply Chain Management	Formulate a production design
Marketing Plan	Formulate a description of STP, 4P, and 7P
Digital Marketing	Discuss challenges of adopting digital marketing
Work Organization	Formulate a simple organizational chart (STO) and a job description for one position
Teamwork and Leadership	Formulate a Workload Analysis
Digital Bookkeeping	Match activities with account classifications; Open a digital bookkeeping application
Simple Financial Report Analysis	Formulate an Income Statement (Profit and Loss report)

By identifying the key competencies that result from structured training, this research aims to provide an empirical foundation for designing future training programs and for enhancing circular business model adoption in community waste management settings. It also offers insight into how training can contribute to broader goals of environmental sustainability, economic empowerment, and community development. The central research question guiding this investigation focuses on identifying the competency factors that emerge from training on circular business models for waste bank managers.

METHODS

This research employed both qualitative and quantitative data in a two-stage exploratory design. The first stage focused on qualitative data obtained from in-depth interviews with selected participants of the circular business model training program. These data were descriptive, narrative in nature, and centred on participants' perceptions of individual and organizational changes after training. The second stage involved quantitative survey data derived from Likert-scale items, based on themes identified in the qualitative phase.

The sources of data were managers of waste banks and waste management sites in a single region. These individuals shared the following criteria: Held managerial roles for 5–10 years (growth phase); Beneficiaries of a global NGO mentorship program; Attended all 10 sessions of the circular business model training; Faced shared challenges including marketing difficulties, unclear business models, lack of bookkeeping knowledge, and operational focus issues. This approach ensured data richness, contextual consistency, and comparability across the qualitative and quantitative phases.

Data collection in the first stage involved in-depth interviews with 19 purposively selected participants. The interview guide included reflective questions such as:

> "What changes have you experienced after the training and mentoring sessions?"
> "Why do you consider it a change, what was it like before, and how is it now?"
> "Which changes are at the individual level, and which are at the organizational or business level?"

All interviews were recorded and transcribed verbatim to ensure accuracy. The interviews focused on capturing perceived benefits and transformative impacts of the training program, which was structured into five modules (entrepreneurship, product development, marketing, human resource management, and finance) and delivered over three months.

Based on the 51 distinct benefits extracted from the interviews, a questionnaire was developed using Likert-scale items. The items were evaluated by an expert panel for content validity using the Content Validity Index (CVI) method. Following revisions, 2 items were removed due to redundancy, resulting in a final set of 49 items. The survey was then distributed to all 39 training participants (census technique), ensuring complete coverage of the population.

Data from the interviews were analysed using content analysis, with open coding conducted independently by two coders. To assess the reliability of coding, Cohen's Kappa was calculated, yielding a value of 0.71, which indicates substantial agreement and acceptable inter-rater reliability.

This approach enabled the researchers to derive clear and consistent themes that served as the foundation for the quantitative instrument development. In the second stage, Exploratory Factor Analysis (EFA) was conducted using SPSS version 26, applying Varimax rotation to achieve a simplified and interpretable factor structure. The following criteria were used for factor retention: Kaiser criterion (eigenvalues > 1); Scree plot inspection.

Prior to EFA, a validity test resulted in the removal of 24 items, leaving 25 valid items. A reliability test using Cronbach's Alpha produced a value of 0.93, indicating high internal consistency.

Although the total number of respondents was limited (n = 39), the use of a census method ensured full representation of the population, enhancing the statistical validity of the results and mitigating generalizability concerns (Bacchetti, 2013; Oh, 2022).

Based on the literature and qualitative findings, the study is guided by the following hypothesis:
H_1: Circular business model training significantly enhances multiple competency factors including leadership, planning, marketing, entrepreneurship, finance, and self-efficacy among waste bank and 3R site managers.

This hypothesis reflects the assumption that targeted training interventions can measurably improve the skillsets required for sustainable, community-based circular business model implementation.

Figure 1 illustrates the research framework guiding this study, which adopts a two-stage sequential approach to evaluate the impact of Circular Business Model Training on waste bank and 3R site managers. The framework begins with structured training modules covering entrepreneurship, product development, marketing, HRM and leadership, and finance. These modules are designed to address common challenges faced by waste managers. The qualitative phase captures participants' perceived changes post-training, which are then translated into measurable competency constructs in the quantitative phase. These constructs leadership, planning, marketing, finance, self-efficacy, entrepreneurship, and information sharing represent the key learning outcomes of the training. Ultimately, the framework demonstrates how targeted training can improve the capability of waste bank managers to implement circular business models effectively.

RESULTS

Variable to be Included

The 25 variables constructed from the qualitative study were adequate for further analysis (KMO = 0.71; (acceptable > 0.60), Bartlett's test of sphericity $p < 0.05$), as shown in Table 2. From the Anti-Image Correlation matrices, it was found that no diagonal score is lower than 0.5, indicating that all of the variables may be used for further analysis.

Variables included in the study are variable 21- able to do planning, 11- able to plan production targets, 40- able to map business potential, 20- able to translate business ideas into product development plans, 12- able to make marketing plans, 41- dare to develop business, 25- understand how to lead efficiently, 24- understand how to lead effectively, 23-understand the characteristics of an entrepreneur, 26-understand how to prepare a business plan, 15-understand the importance of financial bookkeeping, 14-understand the importance of business financial management, 39-understand the sequence of steps in preparing marketing plan, 37-eager to learn new things in business, 10- motivated to develop a business model that was initially linear to become circular, 01- feel like a communicative leader, 31-confident, 46-dare to stand in front of people a lot to talk about, 04- able to draw up a business model canvas, 42-know the flow of product marketing, 19-have business ideas for development n my business, 06- able to share the knowledge I gain with the management of the business I foster, 13- motivated to do marketing through social media, 38- know who the target buyers of my business are, 30- confident in marketing my business products.

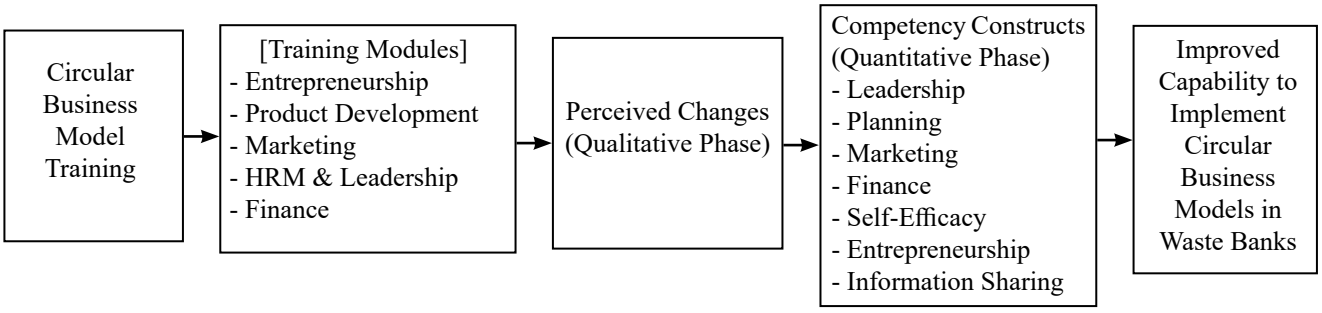

Figure 1. Flow of Research

Number of Factors

Looking at the initial eigenvalues and the scree plot, seven factors can be used to explain the benefit of a circular economy training program on waste. In Table 3 on Total Variance Explained, the total initial eigenvalue is higher in the first factor and starts to diminish in the subsequent factors. At factor number seven, the total initial eigenvalue is still greater than 1.00. However, at factor number eight the total initial eigenvalue starts to be lower than 1.00. Therefore, seven factors that have a total initial eigenvalue greater than one are selected. The accumulated variance that can be explained by the seven factors is 76.15 percent

Looking at the scree plot in Figure 2, there is a sharp drop in eigenvalue from factor number one to factor number two. Forty-one-point seventy-seven percent of the variance in factor one can explain the benefit of taking the circular economy of waste training. The variance explanations of factor two to factor seven ranged between 4.043 to 7.959 percent which is closely related to each other unlike factor one.

Table 2. KMO and Bartlet's Test of Sphericity

Test	Value
Kaiser-Meyer-Olkin Measure of Sampling Adequacy	0.716
Bartlett's Test of Sphericity - Approx. Chi-Square	694.56
Bartlett's Test of Sphericity - df	300
Bartlett's Test of Sphericity - Sig.	0

Table 3. Total variance explained

Component	Initial Eigenvalues			Extraction Sums of Squared Loadings			Rotation Sums of Squared Loadings		
	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %
1	10.443	41.771	41.771	10.443	41.771	41.771	4.217	16.866	16.866
2	1.99	7.959	49.73	1.99	7.959	49.73	3.021	12.083	28.949
3	1.607	6.427	56.157	1.607	6.427	56.157	2.799	11.197	40.146
4	1.52	6.081	62.238	1.52	6.081	62.238	2.758	11.032	51.178
5	1.421	5.684	67.922	1.421	5.684	67.922	2.449	9.797	60.976
6	1.048	4.194	72.116	1.048	4.194	72.116	2.01	8.042	69.018
7	1.011	4.043	76.158	1.011	4.043	76.158	1.785	7.14	76.158
8	0.979	3.915	80.073						
9	0.791	3.166	83.239						

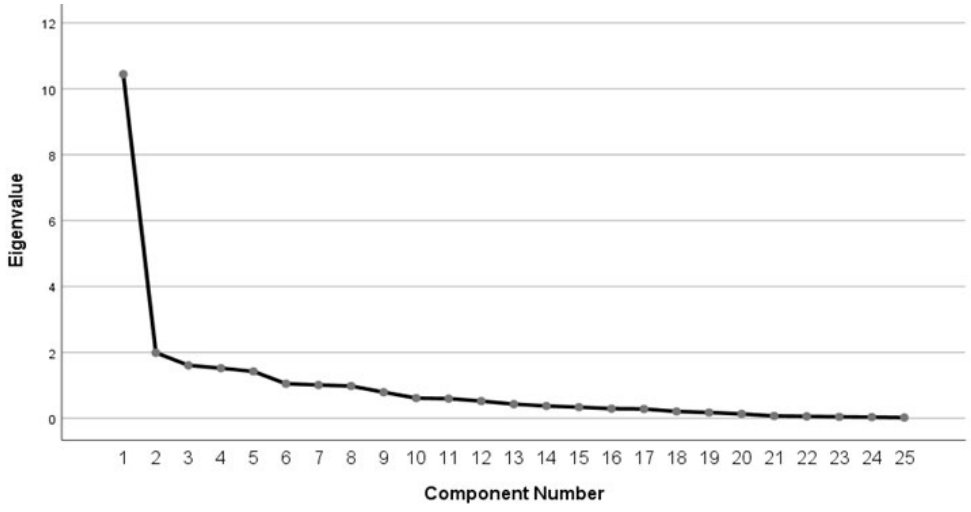

Figure 2. The Scree Plot

As shown in Table 4, Variables 41, 21, 20, 12, 11, and 40 belong to factor one. It has a rotation sum of square loading range from 0.608 to 0.829. Factor two compose of variables 23, 24, 25, and 26 with a rotation sum of square loading range from 0.471 to 0.872. Factor three compose of variables 39, 15, and 14 with a rotation sum of square loading range from 0.745 to 0.779. Factor four compose of variables 01, 10, 31, and 37 with a rotation sum of square loading range from 0.542 to 0.824. Factor five compose of variables 19, 04, 46, and 42 with a rotation sum of square loading range from 0.488 to 0.836. Factor six compose of variables 13 and 6 with a rotation sum of square loading 0.746 and 0.761. Factor seven compose of variables 38 and 30 with a rotation sum of square loading 0.639 and 0.682.

Name of Factors

As shown in Table 4, factor one that has the highest loading is variables 21 and 11. Variable 21- can do planning (r = 0.829), and variable 11- can plan production targets (r = 0.797). Both of the highest factor loadings indicate planning. Therefore, the name of factor one is PLANNING.

Factor two that have the highest loading is variable 25 and 24. Variable 25- understand how to lead efficiently (r = 0.872), and variable 24- understand how to lead effectively (r = 0.815). Both indicate leadership. Thus, the name of factor two is LEADERSHIP.

Table 4. Rotated Component Matrix

Variable	Component 1	Component 2	Component 3	Component 4	Component 5	Component 6	Component 7
VAR00001	0.376	0.092	0.323	0.566	0.234	0.289	0.007
VAR00004	0.314	0.011	0.457	0.063	0.513	0.232	-0.156
VAR00006	0.155	0.206	0.281	0.281	-0.087	0.761	0.229
VAR00010	0.241	0.201	-0.024	0.758	0.206	0.041	-0.033
VAR00011	0.797	0.268	0.172	0.203	0.159	0.088	-0.049
VAR00012	0.673	-0.016	-0.038	0.395	0.037	0.332	-0.036
VAR00013	0.153	0.196	0.134	0.047	0.353	0.746	0.076
VAR00014	0.029	0.34	0.726	-0.039	0.395	0.224	0.066
VAR00015	0.102	0.374	0.762	0.255	0.19	0.049	0.033
VAR00019	-0.002	0.205	0.135	0.278	0.488	0.232	0.195
VAR00020	0.695	0.101	0.309	0.257	0.29	0.151	0.056
VAR00021	0.829	0.21	0.17	0.085	-0.11	-0.054	0.258
VAR00023	0.419	0.572	0.463	0.159	-0.117	-0.22	-0.051
VAR00024	0.193	0.815	0.229	0.259	0.124	0.175	0.104
VAR00025	0.203	0.872	0.071	0.143	0.149	0.062	0.054
VAR00026	0.229	0.471	0.038	0.166	0.064	0.247	0.324
VAR00030	0.163	0.088	0.258	0.039	0.479	0.17	0.639
VAR00031	0.177	0.227	0.049	0.542	0.087	0.335	0.244
VAR00037	0.093	0.169	0.283	0.824	0.006	0.024	0.228
VAR00038	0.314	0.157	0.143	0.376	0.217	0.17	0.682
VAR00039	0.189	-0.124	0.762	0.161	-0.035	0.088	0.308
VAR00040	0.774	0.238	0.004	0.012	0.017	0.12	0.447
VAR00041	0.608	0.407	0.026	0.153	0.334	0.146	0.35
VAR00042	0.229	0.407	-0.256	0.218	0.503	0.351	0.137
VAR00046	0.205	0.044	0.135	0.112	0.836	-0.054	0.205

Extraction Method: Principal Component Analysis.
Rotation Method: Varimax with Kaiser Normalization.

Factor three that have the highest loading is variable 15 and 14. Variable 15- understand the importance of financial bookkeeping (r = 0.779), and variable 14- understand the importance of business financial management (r = 0.755). Both indicate financially. Thus, the name of factor three is FINANCE.

Factor four that has the highest loading is variables 37 and 10. Variable 37- eager to learn new things in business (r = 0.824), and variable 10- motivated to develop a business model that was initially linear to become circular (r = 0.758). Both indicate internal influence. Thus, the name of factor four is SELF EFFICACY.

Factor five that has the highest loading is variables 46 and 04. Variable 46- dare to stand in front of people a lot to talk about (r = 0.824), and variable 04- able to draw up a business model canvas (r = 0.510). Both indicate self-ability to do business. Thus, the name of factor five is ENTREPRENEURSHIP.

Factor six has two variables, 06 and 13. Variable 06- able to share the knowledge I gain with the management of the business I foster (r = 0.761), and variable 13- motivated to do marketing through social media (r = 0.746). Both indicate information sharing. Thus, the name of factor six is INFORMATION SHARING.

Factor seven has two variables too, 30 and 38. Variable 30- confident in marketing my business products (r = 0.639), and variable 38- know who the target buyers of my business are (r = 0.682). Both indicate marketing. Thus, the name of factor seven is MARKETING.

Planning as a Core Competency in Circular Business Models

To address the research question regarding the core competencies developed through the training program for implementing Circular Business Models (CBMs) in waste management, the findings strongly indicate that planning emerged as the most significant competency acquired by participants.

The training effectively strengthened participants' capacity to structure their waste management practices by embedding circular principles such as waste minimization, resource efficiency, and recovery strategies. This supports the hypothesis that planning plays a pivotal role in enabling organizations to transition toward sustainable CBMs.

Participants consistently reported that post-training, they were better able to formulate goals, anticipate challenges, and allocate resources strategically confirming the centrality of planning. This outcome aligns with prior studies (Talen, 1997; Berke et al. 2006; Lyles & Stevens, 2014) emphasizing the role of planning in achieving coherence between organizational objectives and operational actions, particularly in complex and evolving sectors like waste management. Furthermore, this finding echoes Bocken et al. (2018), who highlighted planning and experimentation as critical enablers in the implementation of circular strategies. In this study, planning functioned not only as a competency but as an integrating mechanism that allowed waste bank managers to shift from reactive to proactive waste handling approaches demonstrating a tangible impact of the training program on strategic capability building.

Leadership as a Catalyst for Organizational Change

Leadership emerged as another critical factor, reinforcing the idea that effective leadership is essential for driving organizational change and fostering team alignment. The training program's emphasis on leadership skills aligns with the broader literature that positions human capital as a key driver of value creation (Chen & Huang, 2009). Shalley et al. (2004) further emphasize the importance of leadership in mobilizing resources and motivating teams to adopt innovative practices. In the context of CBMs, leaders must navigate the complexities of stakeholder collaboration and regulatory challenges, as discussed by Fatmawati et al. (2022), who highlights the role of empowered leadership in community-based waste management initiatives.

This collaborative framework is essential for developing effective waste management policies, as it brings together diverse perspectives and resources, thereby enhancing the overall effectiveness of the initiatives (Latanna, 2023). Furthermore, Mukherji et al. point out that social and psychological factors, including a sense of empowerment and self-efficacy, significantly influence public participation in waste management (Mukherji et al. 2016). Leaders who empower community members can foster a sense of ownership and responsibility, which is vital for the sustainability of waste management practices. Moreover, empowered leadership is instrumental in promoting community participation, which is critical for the success of waste

management programs. Sinthumule and Mkumbuzi discuss the importance of participatory approaches in solid waste management, asserting that community involvement is essential for addressing the limitations of conventional waste management systems (Sinthumule & Mkumbuzi, 2019). Similarly, Herdiansyah et al. argue that community participation is a prerequisite for effective waste management, particularly in coastal areas where waste density poses significant challenges (Herdiansyah et al. 2021). By empowering community members to take an active role in waste management, leaders can enhance the effectiveness of these initiatives and ensure that they are tailored to the specific needs of the community.

Additionally, empowered leadership contributes to the education and capacity building of community members regarding waste management practices. The importance of knowledge dissemination in promoting effective waste management, noting that residents' understanding of proper waste disposal methods is crucial for successful implementation (Jongsuksomsakul, 2024). Leaders who prioritize education and training can significantly improve community members' knowledge and skills, leading to better waste management outcomes. This is further supported by the findings of Dlamini et al. who emphasize that community residents' perceptions of waste management effectiveness are closely linked to their understanding of recycling and waste minimization practices (Dlamini et al. 2017).

Financial Literacy and Economic Competencies

Finance is another significant outcome of the training, addressing the participants' need for robust financial skills. Many waste managers face challenges in basic bookkeeping and cost management, hindering their ability to make informed decisions about investments in circular practices. The training program bridged this gap by providing participants with essential financial tools, such as digital bookkeeping and financial statement analysis. This finding aligns with Silva et al. (2023) emphasize that the transition to a circular economy necessitates new business models that are attractive to investors, highlighting the critical role of financial acumen in identifying and securing these investments.

Furthermore, the financial viability of CBMs can be quantitatively assessed through comprehensive analyses of key financial indicators, as demonstrated in the wine industry, where circular models have shown superior profitability compared to linear models under similar investment conditions (Chkareuli, 2024). Moreover, financial acumen is essential for understanding the broader implications of adopting CBMs on a company's overall performance. Feng discusses how circular economy practices enhance business performance by fostering sustainability and resource efficiency, which are crucial metrics for evaluating a company's financial success (Feng, 2023). This perspective is reinforced by the findings of Gonçalves et al. who identify barriers to financial performance in circular economy adoption, including initial investment costs and the complexity of transitioning from linear to circular models (Gonçalves et al. 2022). Such insights illustrate that financial acumen not only aids in assessing current viability but also in navigating the challenges associated with the transition.

In addition to direct financial assessments, the integration of financial acumen with strategic planning is vital for the successful implementation of CBMs. The literature suggests that organizations must consider the entire lifecycle of resources and the potential for value creation beyond mere economic performance (Donner & Vries, 2023). This holistic approach requires a deep understanding of financial metrics and their interplay with sustainability goals, as companies seek to close material loops and enhance resource efficiency (Reim et al. 2019). Furthermore, the development of innovative business models that leverage financial resources effectively can lead to long-term viability and competitive advantage in the marketplace (Baldassarre et al. 2019).

Self-Efficacy: A Novel Perspective

The inclusion of self-efficacy as a critical learning outcome in the context of adopting Circular Business Models (CBMs) underscores the significance of psychological readiness among individuals and organizations. Self-efficacy, defined as an individual's belief in their ability to execute behaviors necessary to produce specific performance attainments, plays a pivotal role in facilitating the transition to more sustainable practices. This psychological readiness is essential for employees and managers alike, as it influences their willingness to embrace innovative practices and navigate the complexities associated with circular economy initiatives. Research indicates that positive work characteristics can enhance self-efficacy,

thereby improving organizational members' attitudes and behaviors towards task completion (Kao et al. 2021). In the context of CBMs, fostering self-efficacy can empower employees to engage with new sustainability practices, as they feel more competent and confident in their abilities to contribute to the organization's goals. Furthermore, the transition from linear to circular economic models often requires a shift in mindset and behaviors, which is facilitated by individuals' self-efficacy beliefs (Wang et al. 2022). This is particularly relevant in the context of the circular economy, where individuals must often navigate complex systems and make choices that impact resource use and waste generation (Millard et al. 2018).

This psychological readiness can mitigate the barriers faced by small and medium-sized enterprises (SMEs) in adopting circular practices, such as financial constraints and lack of technical skills (Rizos et al. 2016). Moreover, the successful implementation of CBMs is contingent upon the collective self-efficacy of teams within organizations. When employees believe in their capacity to effect change, they are more likely to collaborate effectively and innovate, which is critical for overcoming the challenges associated with transitioning to circular practices (Susur & Engwall, 2022). The interplay between self-efficacy and organizational culture further emphasizes the need for supportive environments that nurture confidence and competence in sustainability efforts (Brendzel-Skowera, 2021). This is particularly relevant in SMEs, where resource limitations can exacerbate feelings of inadequacy and hinder the adoption of circular strategies (Rizos et al. 2016). In addition to individual and team self-efficacy, the broader organizational context also influences the successful adoption of CBMs. Factors such as leadership support, training, and access to resources can enhance self-efficacy at the organizational level, thereby facilitating a more robust transition to circular practices (Geissdoerfer et al. 2017). The integration of self-efficacy into the learning outcomes of organizations pursuing CBMs can thus serve as a strategic approach to foster a culture of sustainability and innovation, ultimately leading to more effective implementation of circular economy principles.

Entrepreneurship: Driving Innovation and Adaptability

Entrepreneurship is another vital skill developed through the training, enabling participants to explore innovative solutions and adapt to market demands. This aligns with the findings of Bocken et al. (2018), who highlight the need for organizations to experiment with CBMs as a pathway to sustainability. Participants gained the ability to design business models that prioritize resource recovery and value creation, a competency that resonates with the insights of Ting et al (2023). This transition is not merely a response to environmental pressures but also a strategic move that can lead to improved operational efficiencies and competitive advantages.

Information Sharing: Bridging Knowledge Gaps

The successful implementation of Circular Business Models (CBMs) is heavily reliant on effective information sharing and marketing strategies. Information sharing facilitates the seamless exchange of data regarding product lifecycle, maintenance, and repair, which is essential for prolonging product life and enhancing resource efficiency. Jørgensen emphasizes that the integration of information flow with physical products significantly improves the efficiency and effectiveness of CBMs, although empirical evidence linking information flow to life-prolonging activities remains sparse (Jørgensen, 2023). This lack of empirical data highlights the need for robust information systems that can support the circular economy by enabling stakeholders to access and share critical information about product reuse and recycling.

Moreover, Bruyne and Verleye argue that consumer engagement is crucial for realizing the economic and circular potential of sharing business models. They suggest that aligning sharing business model choices with the sustainability orientation of consumers can significantly enhance consumer engagement with CBMs (Bruyne & Verleye, 2022). This indicates that effective marketing strategies must not only promote the benefits of circularity but also resonate with consumer values and behaviors to foster participation in circular initiatives.

In addition, the role of data management in facilitating circular economy practices cannot be overstated. Bellini and Bang highlight that the exchange of data regarding

reusable materials throughout the building lifecycle is critical for developing effective CBMs, particularly in the construction industry (Bellini & Bang, 2022). This underscores the importance of establishing collaborative networks among stakeholders to ensure that information flows efficiently, thereby enabling better decision-making and resource allocation.

The textile sector also illustrates the complexities involved in implementing CBMs. Barros et al. discuss the challenges faced by the textile industry in adopting circular practices, emphasizing that effective information sharing and marketing strategies are vital for overcoming these hurdles and promoting sustainable practices (Barros et al. 2022). This is further supported by the findings of Stål and Corvellec, who note that CBMs involve various activities such as repair, reuse, and recycling, which require comprehensive information systems to track and manage resources effectively (Stål & Corvellec, 2018).

Innovative Marketing: Promoting Sustainable Practice

Furthermore, the integration of digital technologies plays a pivotal role in enhancing information sharing and marketing efforts within CBMs. Neligan et al. argue that digitalization can drive the implementation of circular business models by facilitating better communication and coordination among stakeholders (Neligan et al. 2022). This is particularly relevant in sectors like the olive oil industry, where innovative marketing strategies are necessary to raise consumer awareness and promote sustainable practices (Donner & Radić, 2021). Effective information sharing and strategic marketing are fundamental to the successful implementation of Circular Business Models. By fostering consumer engagement, enhancing data management, and leveraging digital technologies, businesses can create a more sustainable and efficient circular economy.

Broader Implications for Circular Business Models

The adoption of CBMs in waste management requires a holistic approach that integrates these seven competencies into organizational practices. This research contributes to the existing literature by providing empirical evidence on the importance of these competencies, particularly in the context of training programs designed for waste bank managers. The findings resonate with the broader discourse on CBMs, which emphasizes the need for technological (Burykina et al. 2023; Elghaish et al. 2022), managerial, (Rios & Charnley, 2017; Supanut, 2024; and collaborative skills (Ting et al. 2023; Sumter et al. 2020).

For instance, the ability to plan and lead aligns with the strategic requirements of waste valorisation, as discussed by Leder et al. (2020). Similarly, financial literacy supports organizations in evaluating the economic implications of transitioning to CBMs, ensuring that sustainability initiatives are aligned with profitability goals (Lahti et al, 2018; Romero-Hernández & Romero, 2018; Ozili, 2021). Geissdoerfer et al. (2017) emphasize that the actual impacts of circular economy initiatives need to be analysed in terms of their contributions to the triple bottom line—economic, environmental, and social performance. Self-efficacy and entrepreneurship further enable organizations to navigate uncertainties and experiment with innovative practices, addressing the complexities of circular transitions (Schmitt et al. (2017; Паниħ & Milic, 2022; Ahmed et al. 2020).

Stakeholder Collaboration and Policy Engagement

Beyond individual competencies, the findings underscore the importance of stakeholder collaboration and policy engagement. Effective CBMs require organizations to foster partnerships with governments (Camilleri, 2020; Tapaninaho & Heikkinen, 2022), NGOs (Ceesay, 2020), and local communities (Nainggolan et al. 2020). By cultivating these relationships, waste managers can leverage diverse expertise and resources, facilitating the implementation of circular strategies. Additionally, engaging with policymakers to advocate for supportive regulations, such as extended producer responsibility and sustainable product design, is essential for creating an enabling environment for CBMs (Salvioni & Almici, 2020).

Education and Training: The Pathway to Competency Development

The role of education and training in developing these competencies cannot be overstated. As this study demonstrates, a well-structured training program can significantly enhance the skills, knowledge, and behaviors required for successful CBM adoption. This aligns with the work of Owojori et al. (2022) and Burykena et al (2023). who emphasize the need for

targeted educational programs that prepare individuals for the complexities of circular economy transitions. By investing in human capital, organizations can build a workforce that is both technically proficient and strategically innovative.

This study highlights the transformative potential of training programs designed to equip waste management practitioners with the competencies necessary for adopting circular business models (CBMs). Seven critical traits planning, leadership, financial literacy, self-efficacy, entrepreneurship, information sharing, and marketing emerged as key learning outcomes from the training program. These competencies collectively account for 76.15% of the variance, a significant figure that underscores the training program's effectiveness in fostering managerial skills essential for the circular economy.

The significance of the 76.15% variance lies in its indication that a substantial portion of the observed improvements in participants' competencies can be directly attributed to the standardized training program. Such high variance highlights the comprehensive impact of the training on addressing the challenges faced by waste managers, including unclear business models, financial management issues, and marketing challenges. This finding aligns with previous research emphasizing the critical role of education and training in promoting sustainability and resource efficiency (Filho et al. 2019; Burykina et al. 2023; Muriithi & Ngare, 2023).

In conclusion, the high variance of 76.15% underscores the transformative potential of the training program in fostering essential competencies for managing the circular economy of waste materials. By integrating planning, leadership, financial literacy, self-efficacy, entrepreneurship, information sharing, and marketing into the training, the program provides a robust framework for empowering participants to implement circular business models effectively. Supported by a broad body of literature, this research highlights the critical role of education and training in driving sustainable practices within the circular economy framework, offering valuable insights for practitioners, policymakers, and educators.

Managerial Implication

The findings emphasize the importance of incorporating planning, leadership, financial management, and marketing competencies into training programs. Waste bank managers can leverage these competencies to improve operational efficiency, enhance sustainability practices, and achieve greater profitability in waste management systems. Investing in targeted training fosters strategic alignment and organizational success.

This study extends the theoretical foundations of Circular Business Models (CBMs) by proposing a refined competency model that identifies seven key learning outcomes, including planning, collaboration, innovation, and self-efficacy. While existing circular economy theories predominantly emphasize technical and structural capabilities such as resource efficiency, system redesign, and closed loop processes this research highlights the psychological and behavioral dimensions, particularly self-efficacy, as critical enablers of CBM adoption.

By integrating self-efficacy into the competency framework, this study challenges the prevailing techno-centric narratives of circular economy theory. It suggests that successful implementation of CBMs not only depends on technical knowledge and systems thinking but also on individuals' confidence and motivation to act within uncertain, evolving sustainability contexts. This enriches the current understanding by positioning competency development especially through targeted training as a central pathway to behavioral change and organizational transformation in circular initiatives.

Furthermore, the model presented here broadens the competency-based training perspective by demonstrating how holistic learning (combining cognitive, social, and psychological elements) can better prepare waste management actors to transition toward circularity. These insights offer theoretical leverage for future research to further investigate the role of human-centred capacities in sustaining circular economy transitions, thereby bridging the gap between system-level design and ground-level implementation.

CONCLUSIONS AND RECOMMENDATIONS

Conclusions

This study identified seven core competencies planning, leadership, finance, self-efficacy, entrepreneurship, information sharing, and marketing as key learning outcomes from circular business model training, all of which contribute significantly to the successful adoption of circular business models in waste banks and 3R (reduce-reuse-recycle) waste management sites.

The most novel contribution of this study lies in introducing self-efficacy as a critical psychological competency within the circular economy framework, highlighting the importance of individual belief and readiness in driving sustainable behavioral change. This finding expands the scope of circular economy theory beyond technical and organizational factors by integrating a human-centered perspective.

By incorporating these competencies into training programs, waste management practitioners can improve the operational effectiveness and sustainability impact of circular initiatives, ultimately supporting a more holistic transition toward a circular economy. Government and educators should consider these traits as their training's learning outcomes.

Recommendations

This research is without limitations. To build on the findings of this study, future research should focus on empirically validating the seven identified competency factors through confirmatory factor analysis (CFA) on a larger and more diverse sample of circular business model (CBM) training participants. This would strengthen the generalizability and structural robustness of the proposed competency framework. Additionally, researchers are encouraged to explore whether the acquired competencies align with higher-order thinking skills (HOTS) such as analysis, evaluation, and creation or remain within the domain of lower-order thinking skills (LOTS) like remembering and understanding. A taxonomy-based assessment of cognitive depth would provide insights into the effectiveness of current training approaches.

Finally, experimental or quasi-experimental studies could be conducted to test tailored training modules specifically designed to foster HOTS-level competencies. Such studies would inform evidence-based improvements in the design and delivery of CBM training programs, ensuring they not only transfer knowledge but also cultivate transformative capabilities necessary for leading circular economy transitions.

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