

Circular economy in post-consumption network: the role of re-commerce groups in Social Media Platforms

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Abstract

The success of the circular economy transition depends on the involvement of all stakeholders. However, research on consumer participation in the circular economy is limited. This study identifies the micro-level dynamics of the circular economy within the post-consumption network, mainly focusing on re-commerce operations. Through exploring re-commerce networks in 20 countries and a statistical analysis of factors influencing sales performances on Facebook, this research aims to identify the primary elements influencing re-commerce activities on Facebook and their role in promoting circular economy. This study uses grounded theory and a mixed-methods approach, combining literature reviews and interviews, to explore the impact of re-commerce on the circular economy. Based on the research findings, this research develops four propositions to promote future research on post-consumption networks in the circular economy context.

Keywords: Circular economy, consumer, econometric model, Facebook, post-consumption, re-commerce.

1. Introduction

1.1. Background of the study

Circular economy (CE) aims to create multiple types of value to accomplish a more resource-effective and efficient economic system (Pieroni, McAloone, and Pigosso, 2019). To achieve this economic system, we must narrow or slow energy and resource loops and close energy and resource flows by transforming how we approach economic value and product interpretation (Bocken et al., 2016). The circular economy is termed as a solution to resolve the negative externalities of a linear economy (Murray et al., 2017; Ünal and Shao, 2019) by decoupling the economic growth caused by the constraints of natural resources and social impact (Merli et al., 2018; Ünal and Shao, 2019). In order to define the concept of CE, the study quoted the definition provided by Kirchherr et al. (2017), who analyzed 114 definitions. According to them, CE is a distinctive economic system that replaces the traditional ‘end-of-life’ concept with extensive applications of reducing, alternatively reusing, recycling, and recovering materials in production, distribution, and consumption processes. The CE system transforms the societal production-consumption systems that maximize the service produced from the linear material and energy throughput flow and create a win-win situation for emphasizing the positive impact on the economic, environmental, and social dimensions (Korhonen et al., 2018; p. 38). The CE transition creates a closed-loop system that minimizes resource input and reduces environmental impact—maintaining and renewing materials and resources with the active involvement of stakeholders (Björklund, Gustafsson, and Skill, 2024; Gonella et al., 2024).

Among all the stakeholders, consumer involvement in implementing CE transition is significant, and they engage in the process through shared use, repair, recycling, upcycling, and others under post-purchase phase of the purchasing process (Herhausen et al., 2019; Vidal-Ayuso, Akhmedova, and Jaca, 2023). In the CE transition, consumers drive demand for sustainable products and behaviors, directly influencing resource management, product design, and service delivery (Soh and Wong, 2021; Vidal-Ayuso, Akhmedova and Jaca, 2023). CE transition points to the importance of understanding consumer motivations and barriers influencing consumption decisions through the interconnectedness of environmental and economic factors (Santos-Corrada et al., 2024). To build an inclusive framework for CE transition, it is essential to investigate consumer motivations and barriers, stimulating active involvement by addressing their needs and aligning

with their values (Henao-Hincapié et al., 2024; Verleye et al., 2024). Engaging consumers in the transition process will change their practices by raising awareness of resource use, promoting responsibility from resource consumption to disposal and encouraging a proactive role in driving system-level change (Conduit, Karpen and Willmott, 2023; Luukkonen, Närvänen and Becker, 2024).

To promote CE, consumers can engage in post-consumption activities through both physical and online marketplaces. Online platforms allow individuals and organizations to market, operate, and co-create products, facilitating transition to a CE (Konietzko et al. 2019). Moreover, online CE-supported marketplaces help maximize technical utility, minimize environmental impact, and generate positive social outcomes to impact environmental awareness toward CE transition (Gonella et al., 2024; Godinho Filho et al., 2024). Re-commerce in online platforms enables product reuse by extending the product life from one consumer to another (Konietzko et al., 2019; Arman and Mark-Herbert, 2021; 2022). Numerous social media platforms facilitate re-commerce trading and influence CE transition, for example, Facebook (Arman and Mark-Herbert, 2021; Godinho Filho et al., 2024), Instagram (Pereira et al., 2024), LinkedIn (Tsironis, Daglis, and Tsagarakis, 2022) and Twitter (De Lima, 2022). This study focused on Facebook for analysis as it is the biggest social media platform, enabling a broad user base to engage in re-commerce activities. Facebook's features, such as local community engagement, easy-to-use interfaces, real-time communication and cost-effective operations, effectively promote the CE by facilitating the reuse, resale and sharing products, thus contributing to resource efficiency and sustainability (Arman and Mark-Herbert, 2021; Konietzko et al., 2019). Moreover, Facebook promotes community concerns related to sustainability and circular business strategies, making it a key platform for raising awareness and fostering dialogue on environmental issues (Bui et al., 2023).

Consumers engaging in re-commerce to extend the lifecycle of products enhance resource efficiency and reduce demand for new production, hence decreasing the environmental impacts across core supply chain activities (Ghisellini, Cialani, and Ulgiati, 2016). Research on consumer re-commerce activities in CE is an emerging field, with many areas remaining unexplored. With these considerations in mind, the research questions of this study are:

- 1) Identifying the primary elements influencing re-commerce activities on Facebook and their role in promoting circular economy.
- 2) Investigating the key characteristics of Facebook recommence groups that drive performances

The above research questions were addressed by exploring re-commerce networks in different countries and conducting a statistical analysis examining the relationships among different factors and the sales performances of re-commerce groups on Facebook.

The novelty of the study can be summarized in three key aspects. Firstly, extensive research was conducted on the post-consumption phase and its role in fostering CE implementation from the consumers' perspective. Secondly, this study identified factors influencing re-commerce practice on Facebook, aiming to accelerate transitions towards CE at the microeconomic level. This was achieved by analyzing re-commerce groups on Facebook, triangulated by consumer responses obtained from the in-depth interviews. Thirdly, the study's theoretical contributions pave the way for further exploration of post-consumption networks, a topic suggested by Vidal-Ayuso, Akhmedova, and Jaca (2023) and Muranko et al. (2018).

Section 2 reviews the literature on CE and its transition. The theoretical framework is presented in Section 3. Section 4 describes the research design, and section 5 presents the research findings. Several research propositions are made in Section 6 based on the research findings. Conclusion and future research are discussed in Section 7.

2. Literature review

2.1 Transition to Circular Economy

The transition from a traditional cradle-to-grave or linear economy to CE emphasizes the wholesome transformation at different levels in the industry, stakeholder, and country perspective (Ghisellini et al., 2016). Using sustainable and environment-friendly digital know-how (Kouhizadeh et al., 2020; Rejeb et al., 2022) to accelerate the transition in the closed loop supply chain networks (Kirchherr et al., 2017) across the production, distribution, and consumption levels to ensure the sustainability for the better future world (Nodehi and Mohamad Taghvaei, 2022; Koide et al., 2022). The following section provides a detailed discussion of the transition components.

2.1.1 Digitalization

Digitalization provides new ways to access, analyze, and use data. Digital technologies, e.g., robotics (Sarc et al., 2019), IoT (Rejeb et al., 2022), blockchain (Kouhizadeh et al., 2020; Upadhyay et al., 2021), artificial intelligence (Akhtar et al., 2024), and predictive analytics (Awan et al., 2021) can boost CE activities. Digital technologies, especially mobile devices, can change customer behavior and reduce the effort required for an action, such as reselling used things (Watling et al., 2018). Embedded data collection and connectivity can help contextualize the environment and respond promptly to user queries and behavior (Toşa et al., 2024). Value can also be delivered to customers via online shops or digital products by reducing prices, enriching product information, extending product life cycles, and reducing environmental impacts (Lewandowski, 2016). Digitalization can potentially reduce resource use and facilitate the transition toward CE (Antikainen et al., 2018). Digitalization can boost the CE by helping to close, slow, narrow, intensify, and dematerialize resource loops (Geissdoerfer et al., 2018). Bressanelli et al. (2018) identify eight digital technologies facilitating the CE transition. These technologies include:

- extending the lifespan of products and improving product design,
- improving marketing activities to attract target customers and increase the adoption of CE offerings,
- monitoring and tracking product activity,
- providing technical support to extend product lifespan,
- offering preventive and predictive maintenance to extend product lifespan,
- optimizing product usage to increase resource efficiency,
- allowing product upgrading to improve resource efficiency and extend product lifespan and
- to close the loop, improving the execution of renovation and end-of-life activities such as refurbishment, remanufacturing, and recycling is essential.

Despite its vast usage, there is still a lack of research on how digitalization will enable the transition towards CE (Burmaoglu et al., 2022; Tseng et al., 2018). Seyyedi et al. (2024) noted that more studies are needed to determine the complex adaptive system of digitalization in consumer perspectives that also influences other stakeholders' involvement.

2.1.2 Closed Loop Activities in Circular Economy

CE concept is also deeply related to the 10R's activities of materials and products (Potting et al., 2017), including R0: Refuse, R1: Rethink, R2: Reduce, R3: Reuse, R4: Repair, R5: Refurbish, R6: Remanufacture, R7: Repurpose, R8: Recycle, and R9: Recover. The reuse phase of CE in the production chain is used in the consumer phase, with the distribution chain of second-hand items in the form of refills in the manufacturing process (Godinho Filho et al., 2024). The study considered the reuse phase of CE from the

consumer perspective. A circular supply chain is considered an extension of a Closed Loop Supply Chain (CLSC) (MahmoumGonbadi et al., 2021). It encourages all stakeholders in the supply chain and its partners to perform the 10 Rs activities to maximize value recovery across different supply chains in the same industrial sector and other sectors (Fang, Yu, and Zhang, 2024). The activities in a CLSC are shown in Figure 1.

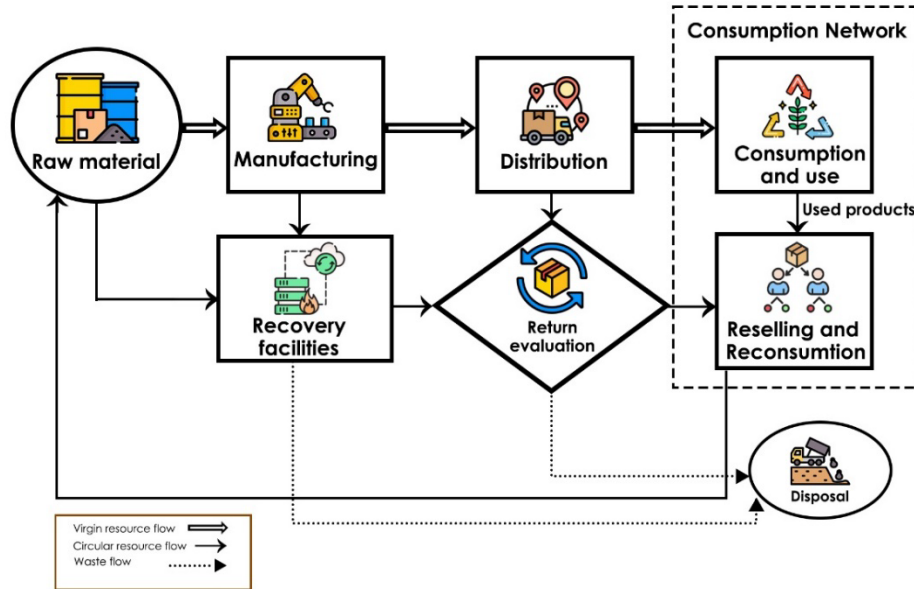


Figure 1. An example of circular supply chain

The literature extensively covers key aspects of CLSC networks, including materials sourcing, product eco-design, manufacturing, distribution, product return, and recovery. Franco (2017) investigated how supplier-buyer collaborative innovation factors were coupled with complexities of product design. Allen, Zhu, and Sarkis (2021) and Tavana et al. (2022) examined how reverse logistics systems can be applied to reduce carbon emissions and dependency on fossil fuels. Techniques like instantaneous pickup, delivery, and cross-docking were identified as enhancing the flexibility, agility, and reliability of distribution systems. However, end-user consumption, reselling, and consumption are rarely addressed in CE. Although consumers and producers can employ these R strategies, the aspects of end-user consumption, reselling, reusing, and re-consumption, as depicted in Figure 1, are often overlooked within the CE context. A consumption network is an essential system in the CE, referring to complex interactions and connections among individuals, businesses, and entities involved in consumption and services. In the CE context, the main activities of a consumption network involve reuse, repair, recycling, and sustainable consumption of products. Sustainable consumption practices aim to reduce the overall ecological footprint and promote long-term sustainability, with exemplary practices such as reducing waste, choosing eco-friendly products, using energy-efficient products, minimizing water usage, and promoting sharing and collaboration (such as tool sharing and car sharing).

2.1.3 Product design in circular economy

According to Bocken et al. (2016), some aspects are crucial to designing products promoting CE. The first aspect is that product design should support durable slowing resources and facilitate extending product life through reusing, conducting product maintenance, repairing, and technical upgrading. Circular product design should include easily recyclable materials, ensure that different materials can be separated easily,

and avoid complex composites and mixed materials that are difficult to recycle (Akhtar et al., 2024). Such product design should practice minimalism, reducing the material used without compromising functionality (Hapuwatte & Jawahir, 2021; Ortner, Tay and Wortmann, 2022). Examples of circular product design are evident across various categories, such as circular furniture at IKEA, circular interiors at Interface, and circular fashion at Levi Strauss & Co. and Patagonia.

2.2 Stakeholder involvement in circular economy transition

Franco (2017) highlighted the importance of applying CE principles at the consumer level due to increasing consumption rates globally. Wang et al. (2020) explored how different types of information about remanufactured products impact consumers' willingness to switch from new to remanufactured items. Soh and Wong (2021) stressed that customer involvement is key to ensuring a sustainable competitive advantage in CE transitions. Re-commerce, or trading products between consumers at lower prices, has gained popularity (Arman and Mark-Herbert, 2021). This customer to customer commerce involves the trading of pre-owned items for reuse, but not for business purposes. Sellers' engagement and competence in post-consumption activities influence consumer decisions (Missen et al., 2021; Nikbin et al., 2022), as sellers' reliability and reputation would gain trust from consumers (Arman & Mark-Herbert, 2021; Hride et al., 2022). Key factors influencing consumers' engagement in re-commerce activities include sellers' responsiveness (Dessart et al., 2015), experience (Missen et al., 2021), positive e-Word of Mouth (Erkan & Evans, 2018), and safeguarding consumer privacy (Hride et al., 2022; Nikbin et al., 2022).

3. Analysis and findings

3.1 Grounded Theory

This research employed grounded theory, as developed by Glaser and Strauss (1967), to construct hypotheses and theories through empirical data collection and analysis on reselling and reconsumption in the CLSC. Grounded theory helps assess consumer purchase decisions, portray human behavior, and identify innovative patterns like mobile consumption (Valvi et al., 2013) and organic food consumption (Dinçer et al., 2022). It has been applied to green consumption (Li et al., 2022; Biswas & Roy, 2015), green logistics (Zhang et al., 2020), and sustainable practices (Jayaram & Avittathur, 2015; Lumsdon & McGrath, 2011). The study followed four steps outlined in the flowchart.

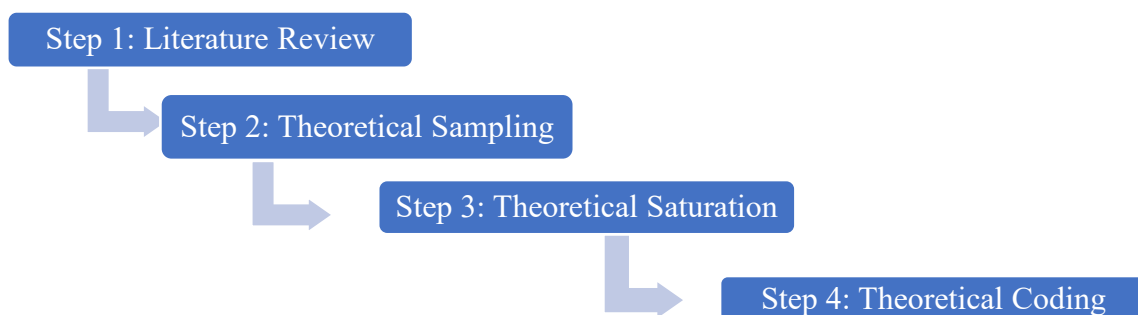


Figure 2. Steps of grounded theory

Step 1: We conducted an initial literature review on the CE concept (Glaser, 1978) and purposively selected respondents (Chun Tie et al., 2019; Denzin & Lincoln, 2011) engaged in re-commerce activities via social media. Facebook, the largest social platform in 2023 (Statista), was chosen for this study.

Step 2: Theoretical sampling involved interviews with Facebook users experienced in exchanging second-hand products. Open codes were developed from the data (Chun Tie et al., 2019; Glaser, 1978; Hoda et al., 2010), and memos documented patterns and themes essential to linking CE and re-commerce concepts (Birks et al., 2008; Christodoulou et al., 2024).

Step 3: The open codes are *constantly compared* with other codes derived from the same interviews and other observations of this study to develop *a category* of the codes. In the process of selective coding, these categories generated a core category of the codes (Glaser, 1978; Hoda et al., 2010). Memoing was also conducted to identify preliminary themes of CE within post-consumption networks from a re-commerce perspective, focusing on coding categories, their relationships and insights drawn from the theoretical sample (Christodoulou et al., 2024). Then a particular core category reached the diminishing results, that is, the further data collection and analysis didn't add new aspects of that category and the core category had sufficiently described (Birks and Mills, 2015; Chun Tie et al., 2019). This stage is called *theoretical saturation* (Glaser, 1978; Hoda et al., 2010).

Step 4: After the saturation, we conduct an extensive literature review to portray the emerging theory of the study. We sorted theoretical memos to develop an outline of how different categories related to the core category. As per Glaser (1978) and Hoda et al. (2010), theoretical coding enables us to construct a framework to describe how the categories relate to each other as a hypothesis to be integrated into a theory of re-commerce activities on social media. The theoretical framework serves as a guidance for further empirical data collection and theory testing.

3.2 Empirical study

This study employs both qualitative and quantitative methods. The qualitative research was conducted in two phases: (1) content analysis of literature review and interviews to conceptualize and define the components influencing re-commerce activities in post-consumption network, and (2) econometric modelling to analyse and quantify relationships between characteristics of re-commerce groups and their sales performances. The literature and interviews with Facebook consumers revealed emerging evidence highlighting the impacts of re-commerce on CE. The findings from phase (1), which identified a list of components influencing re-commerce activities, were used to construct the econometric models aimed at assessing the significance of impacts of these components on the sales performance of these groups. Then we manually collected empirical data from re-commerce groups on Facebook (Facebook doesn't allow automatic scrapping using software or computer programming codes). Figure 2 outlines the research design, including the literature review, interviews, and subsequent statistical and content analysis.

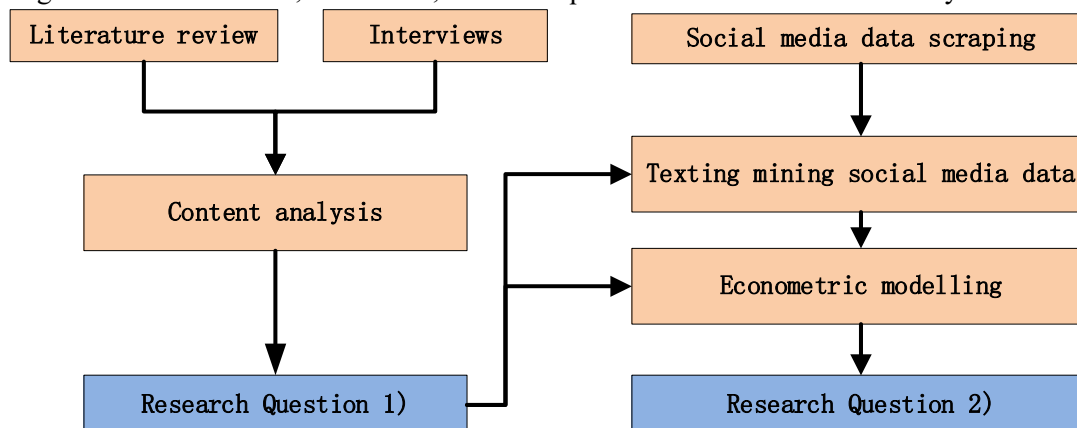


Figure 3. Research Design

To answer the first research question, a list of factors and sub factors influencing re-commerce activities in social media were obtained from the in-depth interviews and content analysis. A theoretical framework was constructed using these factors and subfactors. To answer the second question, guided by the theoretical framework developed from the grounded theory, posts and comments from 100 re-commerce groups from 20 countries registered in Facebook were collected, coded and statically analyzed using econometric models. In the statistical analysis, relationships between influencing factors and business performances of these re-commerce groups were tested. Several research propositions were then made based on the content analysis and economic modelling.

3.2.1 In-depth interviews

We used a naturalistic observation method to see the user behavior when trading second-hand items on a social media platform (Ciesielska et al., 2018). Here, the study considered Facebook as the unit of observation. As per Google Trend analysis in the last five years, we considered different second-hand product exchange groups on Facebook virtually located in the top 20 Facebook-selling countries (See Appendix 1). This observation helped the study to determine suitable candidates for conducting in-depth interviews and second-hand product exchanges among those groups. The purpose of interviews was to gain in-depth information on individuals' second-hand products shopping and selling activities and to identify significant factors in trading second-hand products online (Allmark, 2009; p.48).

In-depth interviews were conducted from March 2023 to September 2023. We aimed to identify Facebook users from the top 20 Facebook-selling countries who had experience exchanging second-hand products as buyers or sellers. According to the Google Trend analysis, the top 20 countries with the most searches of "Facebook Selling" in Google Trend analysis were selected. When choosing respondents from each country, this study considered respondents with a transaction history of at least 12 times on Facebook in the last 12 months (From April 2022 to March 2023). Through convenience sampling, we approached 142 Facebook users; out of them, 82 gave their consent to sit for interviews. Most respondents were from Bangladesh (12), followed by India (8). The interviewees informed the researchers about their transaction history by showing screenshots. Each interviewee was tagged with another interviewee to form a pair (buyer and seller) based on chosen product categories, and the researchers selected these pairs.

We noted that many participants exchanged multiple products, prompting us to request their preference lists. Additionally, a significant number of participants both bought and sold second-hand products, leading us to inquire about their preferred roles as either buyers or sellers. Upon receiving their product preference lists and chosen roles, interviewers assigned them to the corresponding product categories. After confirming, interviewers finalized the product categories and paired the participants accordingly. A total of 41 pairs were formed across 11 product categories. To maintain anonymity, each participant in a pair was identified using the first word of the product category followed by a numerical designation. For example, "A1" represents the first interviewee in the automobile product group, while "C1" represents the first interviewee in the cycle product group. In each pair, the first member served as the buyer, while the second member assumed the role of the seller for that particular product. For instance, in the pair of A1+A2, A1 is the buyer, and A2 represents the seller, as presented in Table 1. Table 1 also shows the product categorical distribution of 41 in-depth interview pairs.

Table 1. In-depth interview pairs of each product category

Product Category	Contents of Product Category	In-depth interview pairs
Automobile (A)	Motor driven vehicles, e.g., private car and motorcycle.	A1+A2, A3+A4, A5+A6

Books (B)	Novels, periodicals, poetry, and textbooks.	B1+B2,B3+B4, B5+B6
Cycles (C)	All kinds of adult and infant cycles, e.g., electric, mountain, and scooter.	C1+C2, C3+C4, C5+C6
Female Items (FI)	Female outfits (excluding undergarments), e.g., shirts, pants, jackets; and ethnic female dresses. Female accessories, e.g., belts, handbag, scarves, and watches.	FI1+FI2,FI3+FI4, FI5+FI6,FI7+FI8, FI9+FI10, FI11+FI12, FI13+FI14,FI15+FI16
Furniture (F)	Personal furniture (bed, chair, sofa, shelf, cabinet, and table) and office furniture (chair, cabinet, and table).	F1+F2,F3+F4, F5+F6, F7+F8,F9+F10
Jewelry (J)	Casual and ethnic jewelries (e.g., anklets, bangles, earrings, finger rings, and necklace).	J1+J2,J3+J4, J5+J6
Kitchen utensils (K)	Cooking equipment, food preparation equipment, and serving equipment	K1+K2,K3+K4,K5+K6
Male Items (MI)	Male outfits (excluding undergarments), e.g., shirts, pants, jackets; and male ethnic dresses (punjabi). Male accessories, e.g., belts, wallets, and watches.	MI1+MI2,MI3+MI4, MI5+MI6,MI7+MI8
Mobile phone (M)	All kind of cellphones, e.g., button phones and smartphones.	M1+M2,M3+M4, M5+M6
Personal computer (P)	Desktop and laptop computer.	P1+P2, P3+P4, P5+P6
Toddler items (T)	Toddler toys, outfits, accessories (e.g., headbands, baby carrier, strollers, walker)	T1+T2, T3+T4,T5+T6
		n= 82

The socio-demographic information of the respondents who engaged in re-commerce activities is presented in Table 2.

Table 2. Demographic profile of 82 interviewees

Socio-demographic variables	Categories of the variables	Percentage
Age	21-30	80%
	31-40	20%
Gender	Female	60%
	Male	40%
Religiosity	Religious	88%
	Not religious	12%
Area of residence	Urban	74%
	Sub-urban	17%
	Rural	9%
Country of residence of 82 respondents	United Kingdom	7.31%
	Australia	7.31%
	United States of America	7.31%
	Canada	7.31%
	New Zealand	4.87%
	Nigeria	2.43%
	Ireland	2.43%
	South Africa	2.43%
	Philippines	2.43%
	Pakistan	4.87%

	Singapore	2.43%
	Malaysia	4.87%
	Bangladesh	14.63%
	United Arab Emirates	4.87%
	India	9.76%
	Vietnam	2.43%
	Thailand	2.43%
	Indonesia	2.43%
	Germany	4.87%
	Brazil	2.43%
Marital status	Relationship	81%
	Not in a relationship	19%
Minimum level of education	Secondary	26%
	Tertiary	74%
Occupation	Student	56%
	Professional	24%
	Self employed	20%
Average net personal income per month (US \$)	Less than \$500	45%
	\$501-\$1000	25%
	\$1001 and above	9%
	No answer	21%

The study conducted in-depth interviews through Zoom. Each paired interview lasted for in between 40 minutes to 60 minutes. Most of the respondent responded in English. Some respondents requested to express their thoughts in their mother tongue for better interpretation and in those cases, we used translators to convert their speech in English. The full transcripts were written in English at Microsoft Word files.

3.3 Content Analysis

The purpose of content analysis is to systematically and objectively convert interview responses into concise summaries of key themes. Developing themes involves a step-by-step process of abstracting data from the clear, literal content to deeper, underlying meanings.

3.3.1 Coding process

In conjunction with literature review, the interview results were analyzed using text mining-techniques and then coded by two authors using a hierarchical coding method, in accordance with the grounded theory processes detailed in Section 3. To ensure the validity and reliability of content analysis, two key steps were followed: 1) data sources from interviews and literature review are used to cross check findings and increase credibility. Table 3 shows the core components and sub-components of CE, identified from the literature and triangulated by evidences from the interviews. In Table 4, these components and sub-components were assigned codes and subcodes, and corresponding labels, supported by interview results. 2) Two authors independently analyzed the interview results and classified into them corresponding categories of components or sub-components. Iterative steps were undertaken to concisely describe and categorize the meaning in each response, and to identify connections between responses. Ambiguous responses were not coded. All the interview responses were iteratively coded by two co-authors to establish coding agreement based on their outcomes and engaging in dialogue to reconcile differences.

At level 1, the key elements that underpin the re-commerce in post-consumption network and enable transition to CE were coded into four groups, namely Facilities (FAC), Product Availability (AVA), Services (SER), and Sellers' competence and engagement (COM), as shown in Table 3.

Table 3. Core elements of re-commerce in post-consumption network

Core components	Sub-components	Explanation	References	Interviews
Digitalization	Facilities (FAC): Platform availability; Platform security and privacy, and Third-party services (3PS) (logistics and payment).	Digitalization offers re-commerce platforms on Facebook with proper security and privacy. Also, digitalization enables third party services in logistics for real time tracking and payment that are convenient to the re-commerce users.	Arman and Mark-Herbert, 2021; Gagnon et al., 2022; Rentizelas et al., 2022; Mihai et al., 2023	A1 and A2: Automobile products were widely sold in digital platforms. FI7 and FI8: Female attire were sold to the reliable client with trusted logistics services. J3 and J4: Jewelry exchange was reliable with trusted seller.
Product design and Closed loop activities	Product Availability (AVA): Availability of used products, refurbished products, and upcycled products.	Ensuring closed loop activities involves exchanging used products among consumer re-commerce groups. Producing and selling refurbished and upcycled products increases the value of the original items, improving their usefulness and market appeal. These goods foster customer participation in circular economy practices.	Cao et al., 2022; Coppola et al., 2021; Gaur et al., 2022; Heiges and O'Neill, 2022; Kouhizadeh et al., 2022; Wallner et al., 2022; Zan and Zhang, 2022;	C5 and C6: Second-hand cycle with slightly refurbished is desirable. M1 and M2: Cellphones with partly refurbished prohibits purchasing a new phone. MI3 and MI4: Used male attire available for low budget consumers.
Digitlization and Closed loop activities	Services (SER): Service from sellers and service from platform	In Facebook re-commerce groups, sellers and purchasers, who are consumers, typically choose to engage with each other using digital communication methods. These actions promote circularity among consumers.	Bhattacharyya and Bose, 2020; Gkikas et al., 2022; Mondal and Giri, 2022; Kraus et al., 2022; Saidani, 2022	FI3 and FI4: Furniture sellers provide detailed videos of the product. T1 and T2: toddler items were properly tested before selling.

Sellers competence and engagement	Sellers' competence and engagement (COM): Sellers' speed and quality of responses, Sellers' reliability	Sellers on re-commerce groups build a reputation by answering buyer questions. Their group activities and excellent customer feedback help future shoppers decide. Thus, sellers' contributions are vital to circular economy positivity.	Agostini et al., 2021; Arman and Mark-Herbert, 2021; Lim et al., 2022; Missen et al., 2021; Shou and Domenech, 2022; Sohal and De Vass, 2022; Zhou et al., 2022	B1 and B2: Buyers preferred sellers who promptly responded about the query of books. K3 and K4: Reputation from selling history is highly recommended in selling kitchen utensils. P5 and P6: Personal computers can be exchanged on the basis of reliability.
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At level 2, we identified and coded several sub-components for each group of elements. For example, we identified three facility sub-components (FAC1-FAC3) for Facilities (FAC) and coded three sub-components (AVA1-AVA3) for the availability of recycled products and sellers in Product Availability (AVA). Additionally, we coded five service sub-components (SER1-SER5) for Services (SER) and five sub-components (COM1-COM5) for sellers' competence and engagement. These sub-components and codes are listed in Table 4.

Table 4. Coding of interview results and literature review.

Level 1 code	Level 2 code	Label	Interview results	Quantified measures of coded data
Facilities (FAC)	Digital Platform availability (Arman and Mark-Herbert, 2021; Lee et al., 2015)	FAC1	C1: I can access the Facebook group anywhere even in slow internet connection. T4: The group is not blocked by the Facebook authority and it is completely fine.	1: The re-commerce groups is accessible in Facebook 0: The re-commerce group is not accessible in Facebook can be accessed from these channels.
	Platform security and privacy (Arman and Mark-Herbert, 2022; Rychwalska et al., 2022)	FAC2	A4: I had to answer questions set by the moderators before being a member. FI3: I feel secured in monetary transaction through this group. MI8: Public groups are not safe. K1: Private re-commerce groups are safe.	1: Members have to send request for membership that is required and to join there, and the contents are not visible to the non-members. 0: Membership is not required, and the contents are visible to the public.

	<p>Payment options</p> <p>(Arman and Mark-Herbert, 2021; Kerber and Zolna, 2022)</p>	FAC3	<p>C3: COD is desirable when I get my cycle from the seller.</p> <p>F2: I instantly pay by cash after receiving the product from the courier.</p> <p>P6: As my product is costly, so I requested the buyer to send money via bank transfer.</p>	<p>The percentages of three payment options, including FAC3_1=Mobile finance services (MFS), FAC3_2= are the most preferable options in paying the product price (COD), and FAC3_3= Other services, e.g., card payment or cheque payment. are also being availed by the traders.</p>
Product Availability (AVA)	<p>Availability of used products</p> <p>(Kraus et al., 2022; Samsioe and Fuentes, 2022)</p>	AVA1	<p>B4: I got a rare piece of books from this group.</p> <p>C1: Numerous bicycle options are there.</p> <p>F11: I am a bit choosy. But this group facilitates me from lots of options.</p> <p>T2: I selected my desired stroller for my toddler from lots of selling posts.</p>	<p>The estimated total number of products available in the platform.</p>
	<p>Refurbished products</p> <p>(Gaur et al., 2022; Wallner et al., 2022)</p>	AVA2	<p>J4: I was being informed by the seller that the jewelry was washed about a year ago.</p> <p>M5: The sound system was replaced.</p> <p>P5: The hard disk drive was changed to the new one.</p>	<p>Sellers mentioned in their sell posts about which part(s) of the product is being refurbished.</p>
	<p>Upcycled products</p> <p>(Kim et al., 2022; Shi et al., 2022)</p>	AVA3	<p>C1: I purchased an old cycle and then upgraded the gears and sold it to another person for a higher price.</p> <p>J6: The metal jewelry was being added with some rubies.</p>	<p>Upon buyer(s)' query, seller may reveal on how they upcycled the product.</p>
Services (SER)	<p>Communication channels</p> <p>(Kraus et al., 2022; Kerber and Zolna, 2022)</p>	SER1	<p>A5: I prefer selling posts where seller responded quickly.</p> <p>T6: I prefer voice messaging services.</p>	<p>The percentage of sellers' posts responding to buyers' queries.</p>
	<p>Product images and video</p> <p>(Khoa et al., 2022; Nikbin et al., 2022)</p>	SER2	<p>A6: I provide pictures with detailed product description.</p> <p>B5: Sometimes I want videos of the inner pages of the book.</p>	<p>The percentage of sellers' posts containing images and videos.</p>

	Return and refund service (Khoa et al., 2022; Nikbin et al., 2022)	SER3	MI7: Though I never returned any product, but I consider this option as reliable. M4: I gave refund to the buyer in full.	The percentage of sellers' agreeing to refund.
	Specific Re-commerce policy (Kraus et al., 2022; Kerber and Zolna, 2022)	SER4	FI9: I prefer exchange policies written on the group information. J2: Such policies help to conduct exchange with ease. MI8: Such policies clear many confusion while trading.	Rating of the re-commerce policy in terms of clarity and transparency, 1- very poor, 2-poor, 3-average, 4-good, 5-excellent.
	Third party logistics services (3PS) (Arman and Mark-Herbert, 2021; Kerber and Zolna, 2022)	SER5	FI10: I avail the logistics services available in the area. J5: Sometimes, I avail logistics services provided by the re-commerce group. MI4: I prefer such supports to make my trading easier.	The percentage of sellers using 3PLs.
Sellers' competence and engagement (COM)	Speed in responding to buyers' queries (Missen et al., 2021; Nikbin et al., 2022)	COM1	C4: Usually it takes about 10 minutes to respond queries during pick time. F4: I respond quickly when it is not an odd hour, e.g., after 12am. K1: I like those sellers who doesn't keep me waiting in the comment section.	The average speed in which sellers respond to buyers' queries. The speed is measured in minutes.
	Seller rating (Leong et al., 2022; Nikbin et al., 2022; Wang et al., 2023; Zhou et al., 2022)	COM2	F5: Before selecting, I search on positive feedback about the seller in previous posts. FI1: Positive responses made me confident in trading with the seller.	Ratings of sellers as given in Facebook, based on the number of positive reviews posted about the sellers
	Seller's length of time being a member (Agostini et al., 2021; Hride et al., 2022)	COM3	K3: I prefer sellers who is a member of at least for a year of this group. FI6: After becoming a member, I get good responses from buyers. M3: The longer the membership duration, the better.	The average length of period of being group members. This is measured in days. .

	Number of friends and followers (Hride et al., 2022; Nikbin et al., 2022)	COM4	B3: The visibility of number of friends and followers determines the authenticity of the profile. M4: I keep the profile visible so that my friend and follower number is visible to the prospective buyer.	The average number of friends and followers of group members.
	Privacy of the profile (Hride et al., 2022; Nikbin et al., 2022)	COM5	A4: I deny buying request from them whose profile is locked and is suspicious. MI1: I prefer sellers whose friend list is visible. P3: A locked profile is not trustworthy.	The number of sellers with private profiles.

3.4 Text mining of posts and comments published by re-commerce groups on Facebook

After defining the components influencing online re-commerce success, the coding procedure was repeated to analyze posts and comments published by 100 re-commerce groups in Facebook (Appendix 2). To ensure the insights were comparable with those from the interviews, purposive sampling was used, and the sampling pool was kept consistent with the interviewees' countries of residence. We chose 100 re-commerce groups from the same 20 countries, with five groups from each country. Choosing re-commerce groups from the same geographical context helps reduce response variability due to differing national contexts, while the wide geographical spread provides sufficient diversity for generalising the findings. We classified these posts, comments, and product listing descriptions using the codes defined in Table 4.

The following keywords were used to search re-commerce groups from the 20 countries on Facebook: "Second-hand Buy and Sell," "Preloved items," "Yard sell," "Yard sale," "Used items," "Declutter," "Garage Sells," along with specific country or city names (e.g., Australia, Sydney). We concluded searches within Facebook's group tab to locate relevant re-commerce groups in each of the 20 countries. When the list of groups appeared, we preliminarily selected a group that traded solely in second-hand products without being confined to a specific product category. The sample explicitly targets groups engaged in buying and selling second-hand goods on Facebook without aiming to provide a comprehensive representation of all re-commerce groups on Facebook or other online platforms. The exhaustive information regarding each re-commerce group is listed in Appendix 1. We utilized a German translation for Germany and a Portuguese language translator for Brazil due to the limited availability of re-commerce groups in those countries. We assessed the groups' popularity in selling on Facebook by analyzing the five-year Google trend data (see Appendix 1).

Daily data was collected from these re-commerce groups in Facebook from Nov 2022 to Oct 2023. The Facebook data include posts and users' comments published in each group, and the characteristics of each group. The variables of interest and corresponding notations are presented in Table 5.

Table 5 Variables of interest and descriptions

Variable	Description
i	Facebook group ID, $i \in [1, 2, \dots, 100]$
Group's characteristics	
Page	Vector of Facebook group's characteristics: Posts, Comments and Likes

Posts	Total number of posts on a group on its Page
Comments	Total number of comments on a group on its Page
Likes	Total number of likes on a group on its Page
Control for public attention	
GT	Google Trend Index, indicating public attention on the country where the group is located.
Facilities in online platform	
Facilities (FAC)	Vector of platform facilities, including availability of digital platform, platform security and privacy, and payment options.
Product availability	
Availability (AVA)	Vector of product availability, including availability of used products, refurbished products and upcycled products.
Services provided by sellers	
Services (SER)	Vector of services, including communication channels, product images and videos, return and refund service, recommence policy and logistics services.
Seller's competence and engagement	
Competence and engagement (COM)	Vector of seller's competence and engagement, measured as speed in response, seller rating, membership duration, number of friends, and privacy profile.
Dependent variable	
Performance Indicator (PI)	Sales performance of a re-commerce group

We examined how the recommence groups' characteristics affect groups' performances using econometric modelling. External factors, such as awareness on environmental protection and sustainability, as presented in Table 4 are applicable to all the re commerce groups in Facebook, hence, they are not considered in the econometric models.

3.5 Quantifying coded Facebook data

Beyond coding textual content on Facebook, we consider quantifying the coded data using appropriate measures. It is common to represent the availability of facilities or services in a binary manner (yes or no); hence, some coded Facebook data, including FAC1, FAC2, and SER5, are quantified in a binary manner.

If the number of users registered in a re-commerce exceeds a threshold, for example, 1000, it would be challenging to count the number of products or the range of services offered by all the sellers in a re-commerce group. A simple random sampling was used to select a subset from the population of sellers registered in each re-commerce group while minimizing bias and ensuring the sample represents the population as accurately as possible. This approach enables us to draw inferences about the entire population of sellers based on the characteristics observed within the sample. We calculated the percentages of various types of Facilities (FAC), Product Availability (AVA), and Services (SER) provided by the re-commerce group using formula (1) on random samples drawn from seller populations. For example, FAC3 represents the proportion of payment options used by buyers. At the same time, AVA2-3 is the percentage of refurbished and recycled products.

$$\text{Percentage} = \frac{\text{the number of sample sellers offering the facility, product, or service}}{\text{the total number of sample sellers}} \quad (1)$$

We selected a sample of 100 sellers, of which 40 sold refurbished products, resulting in AVA2 being 40%. To analyze the services, we reviewed the posts published by the sample sellers. Among the 1,000 posts from the 100 randomly chosen sellers, 60 responded to buyers' queries, and 500 contained product images or videos, yielding percentages of SER1 at 6% and SER2 at 50%, respectively.

We used a Likert scale rating of 1-5 to assess specific policies and sellers' competence and engagement. For example, we evaluated the transparency and clarity of the re-commerce policy (SER4). We calculated basic metrics for the sample sellers in each re-commerce group: COM1 measures the average response speed to buyers' queries, COM2 assesses seller ratings based on positive reviews, COM3 tracks the average duration of group membership, COM4 counts friends and followers, and COM5 monitors the number of sellers with private profiles.

We defined the sales performance of a re-commerce group, noted as PI in formula (3), using parameters that reflect group age, popularity, and sales activities. We measured popularity by group size, recent member increments since September 2023, and Facebook page activities, adjusting weights to account for diminishing interest in earlier sales data.

$$PI = \frac{\text{Group size}}{\text{Age of group}} + \text{increment of memeber since Sept 2023} + \sum_{\text{year}=2023} (\text{number of posts, number of comments, number of likes}) + \sum_{\text{year}=2022} \frac{1}{2} \times (\text{number of posts, number of comments, number of likes}) + \sum_{\text{year}=2022,2023} \text{Annual sales} \quad (2)$$

3.6 Econometric models

We focus on how the different characteristics of a re-commerce group, as represented by the variables in Table 4, impact the group's sales performance. We model the group's performance, denoted as PI, by incorporating variables across four key areas: (i) product availability, (ii) services provided by sellers, (iii) management mechanisms, and (iv) sellers' competence and engagement.

$$PI = c + \alpha \times \text{FAC} + \beta \times \text{AVA} + \theta \times \text{SER} + \gamma \times \text{COM} + \delta \times \text{GT} + \varepsilon \quad (3)$$

In Equation (3), c is the constant, and the term $\alpha \times \text{FAC}$ represents the services and facilities offered by the recommerce group, for example, the accessibility to the group from social media platforms, and the membership requirement for making transactions in the group. The component $\beta \times \text{AVA}$ captures the effect of product availability has on the sales performance. A higher variety of used products listed in Facebook could boost sales volume. The element $\theta \times \text{SER}$ models the relationships between service level and the sales performance. The intuition is that a better service level would increase sales level. The item $\gamma \times \text{COM}$ models the effect of sellers' competence and engagement on sales volume. This suggests that more competent and engaged sellers might attract more buyers, adapt their services to cater to buyers' preferences, and consequently, promote sales. The element $\delta \times \text{GT}$ represents a vector of Google Trends (GT) data for the years 2022 and 2023. GT, in this context, is an index that reflects the frequency with which a corresponding re-commerce group is searched for in comparison with the total number of Google searches over a specific time frame. The GT index is displayed in a range of [0, 100]. For instance, the 2023 GT index for *UK second-hand alternative buy/sell/swap* is 90, indicating a substantial level of public interest in searches related to this group.

4 Results of econometric models

Constant factors that have one value for all the re-commerce groups, such as FAC1, FAC2, do not provide any information to the target variable PI, so it is good to remove them from the dataset. A pooled Ordinary Least Square (OLS) approach was used to estimate the coefficients for the rest factors in Equation (2). Pooled OLS regression assumes that the relationship between the dependent variable and the independent variables is the same for all individuals or entities in the panel. Pooled OLS regression combines the data across individual groups from different countries, and time-series variations in the data, and runs a single OLS regression to estimate the parameters of the regression model. This model specification allows us to examine the significance of the coefficients of interest on the re-commerce groups' performances.

The sales performance coefficients β_3 [AVA3]=-1.0346, and γ_2 [COM2]=0.094 are significant at 0.1 level, while δ_1 [GT2021]=0.4606 and γ_3 [COM3]=0.1809 are significant at 0.05 level and β_1 [AVA1]=0.0002 and δ_2 [GT2022]=0.5676 are significant at 0.001 level. The γ_2 values for COM2 suggest positive rating of sellers is a driver of sales performance. The β_3 values indicate that an increased promotion in upcycled product discourages sales, which might be not be intuitive since products being sold in recommerce group are alleged to be used and recycled products. However, it is understandable that the more details revealed about how the products were upcycled, the less interests received on the products. The positive and significant coefficient estimates of γ_3 for COM3 imply that the sellers with a longer history of membership are regarded more reliable and attract more sales opportunities. The positive and significant coefficients δ_1 and δ_2 imply that higher GT index of a recommerce group drives sales volume.

Table 6 Estimation results on re-commerce group sales performances in 2022-23

	Coefficients	standard error	p values
GT2022	0.4606	0.206	0.028**
GT2023	0.5676	0.186	0.003***
FAC31	0.0663	0.114	0.563
FAC32	0.1345	0.127	0.292
FAC33	0.4107	0.496	0.411
AVA1	0.0002	1.80E-05	0***
AVA2	-0.2043	0.51	0.69
AVA3	-1.2107	0.637	0.061*
SER1	0.001	0.051	0.984
SER2	0.0061	0.164	0.971
SER3	0.0071	0.323	0.982
SER4	1.6097	1.345	0.235
SER5	0.0592	0.216	0.784
COM1	-0.0491	0.083	0.557
COM2	0.516	0.314	0.094*
COM3	0.1809	0.084	0.034**
COM4	-0.0013	0.006	0.823
COM5	-0.301	0.349	0.391

5. Research propositions

In this session, a number research propositions are made from the research outcomes, linking with existing literature.

The *public image* of a re-commerce group establishes a reliable and professional digital presence for consumers engaging in the trade of second-hand products on Facebook (Chi, 2022; Kim and Jang, 2021). A positive public image is crucial for fostering user trust and enhancing the perceived authenticity of product verification within re-commerce groups (Arman and Mark-Herbert, 2021; Dinçer et al., 2022). The favorable index associated with a re-commerce group signifies both the protection of member privacy and the credibility of information pertaining to product transactions (White and Boatwright, 2020). Moreover, a robust GT index within a particular re-commerce group signals reliability among its members, facilitating transactions akin to those on professional platforms (Chi, 2022; Kim and Jang, 2021; Li et al., 2022). The positive GT indices for re-commerce groups, with $\delta_1[\text{GT2022}] = 0.4606$ and $\delta_2[\text{GT2023}] = 0.5676$, indicate an affirmative image that drives sales volume within the group (Chi, 2022; Li et al., 2022). Sales volume is contingent upon the active participation of existing group members, which includes commenting on posts, reacting to content, and inviting new members to expand the re-commerce community (Arman and Mark-Herbert, 2021; Katika et al., 2022; Kutaula et al., 2022). A positive public image also cultivates favorable electronic word-of-mouth among Facebook users regarding a specific re-commerce group, thereby ensuring a competitive advantage through the development of unique selling propositions relative to similar groups on the platform (Rezaei and Ho, 2021; Sharma et al., 2024). Members experience a heightened sense of security in trading their second-hand products, significantly mitigating the risks associated with digital piracy (Kim and Jang, 2021; Sousa and Bates, 2021). Such risks can be alleviated through enhanced content credibility and an intention to engage with traders (Li and Suh, 2015; Sousa and Bates, 2021). Re-commerce groups on Facebook that boast a strong reputation are better equipped to navigate crises or negative incidents, with members more inclined to extend the benefit of the doubt to groups that have consistently upheld a positive brand image (Mosley, Schweidel, and Zhang, 2024). Concurrently, a positive index also influences the perceived credibility of the content disseminated by such groups, thereby augmenting visibility to prospective Facebook users considering membership (Chi, 2022; Sousa and Bates, 2021).

Proposition 1: Public image of re-commerce groups drives sales volumes.

The availability of second-hand products is pivotal for enhancing the popularity of re-commerce groups, effectively attracting a broader audience of Facebook users. The diversity in product offerings, regional representation, and varying tastes and preferences within these groups facilitates engagement from a more heterogeneous user base compared to geographically constrained re-commerce groups (Boudjemaa and Mouhadjer, 2022; Heiges and O'Neill, 2022; Laor, 2022). The listing of refurbished products in Facebook re-commerce groups serves as a significant mechanism for promoting the circular economy (CE) philosophy (Ackermann et al., 2018; Cao et al., 2022; Gaur et al., 2022; Wallner et al., 2022). Refurbished products can be categorized based on demand and specific product attributes (Ackermann et al., 2018; Cao et al., 2022).

The perceived value and associated risks regarding seller reputation and the distribution of refurbished products significantly influence consumer attitudes and intentions toward purchasing these items (Agostini et al., 2021; Gaur et al., 2022). Furthermore, the re-commerce platform facilitates the trading of upcycled products, thereby promoting positive eco-branding initiatives (Phau et al., 2022), encouraging alternative uses for existing products (Oliveira et al., 2022), and motivating end-users to generate innovative ideas that align with ethical consumption practices to advance CE (Coppola et al., 2021; Shi et al., 2022).

Seller reputation is intrinsically linked to the positive impressions garnered within Facebook re-commerce groups (Leong et al., 2022; Missen et al., 2021; Samoggia et al., 2020). However, the β_3 value of AVA3 (-1.0346), which pertains to the process of upcycling, suggests that this aspect may deter buyers from purchasing such products. This finding aligns with the research of Aschemann-Witzel et al. (2022), Peschel and Aschemann-Witzel (2020), and Yu and Lee (2019), who assert that the costs associated with upcycled products can lead consumers to be reluctant to pay premium prices. Shi, Huang, and Sarigöllü (2022)

advocate for a shift in consumer behavior toward accepting higher prices for upcycled products, emphasizing the ethical value addition, improved product quality and durability, perceived environmental benefits, and support for eco-entrepreneurs. To facilitate this transition, sellers must effectively communicate the merits of upcycled and refurbished products to consumers, ensuring that they understand the rationale behind premium pricing associated with their ethical consumption behaviors that contribute to the CE transition (Wu et al., 2024).

Proposition 2: Sellers are advised to accurately specify the refurbished components of a product, or if applicable, its entirety, to ensure that prospective consumers are informed accordingly.

Proposition 3: Sellers should advocate for price transparency on Facebook to enhance consumer acceptance.

Sellers' competence and engagement play a pivotal role in attracting potential customers to re-commerce Facebook groups (Arman and Mark-Herbert, 2021; Johnson, 2022; Shou and Domenech, 2022; Sohal and De Vass, 2022). Unlike established e-commerce platforms such as Amazon and eBay, Facebook does not offer a seller rating system. However, the overall performance of sellers significantly influences prospective buyers' perceptions of the re-commerce group's efficacy, encouraging active participation from these individuals (Wongkitrungrueng, Dehouche, and Assarut, 2020).

The γ_2 value of COM2, calculated at 0.094, indicates a positive correlation between seller competence—exemplified by timely responses, flexible options, reliability, and effective remarketing strategies—and favorable electronic word-of-mouth directed toward the sellers (Arman and Mark-Herbert, 2021; Lim et al., 2022; Samoggia et al., 2020). Furthermore, the significant positive coefficient estimate of γ_3 for COM3, at 0.1809, highlights that the duration of a seller's membership within a group is indicative of their competence (Arman and Mark-Herbert, 2021; 2022; Blomsma et al., 2019; Johnson, 2022; Lim et al., 2022).

A seller's tenure in a re-commerce group reflects their experience in managing the nuances of second-hand product transactions (Arman and Mark-Herbert, 2021). This experience encompasses effectively addressing consumer inquiries (Lim et al., 2022; Nyagadza et al., 2023), formulating posts that resonate with consumer purchase intentions (Blevins and Ragozzino, 2019; Lim et al., 2022; Nyagadza et al., 2023), and promoting ethical consumption values within the community by encouraging re-commerce activities across the post-consumption network (Arman and Mark-Herbert, 2022; Johnson, 2022; Sohal and De Vass, 2022).

Moreover, the competence of sellers is crucial in mitigating the intention-behavior gap that often affects consumers' decisions to engage in re-commerce activities. By providing ethically sound product options, sellers can bridge this gap, fostering a sense of trust and encouraging consumers to make sustainable choices (Carrington, Neville, and Whitwell, 2014). This emphasis on competence and engagement ultimately cultivates a vibrant and interactive community within re-commerce Facebook groups, reinforcing the circular economy's principles and enhancing overall consumer participation.

Proposition 4: Competencies from the seller side are a great enabler to circular economy to engage the prospective customers with more confidence and awareness (Johnson, 2022; Sohal and De Vass, 2022) and positively triggers the consumer intention (Carrington, Neville and Whitwell, 2014; Izogo et al., 2022).

6. Conclusions

6.1 Contributions of the study

This study significantly advances the contributions of Arman and Mark-Herbert (2021), who explored the role of Facebook as an enabler of re-commerce activities within the context of the circular economy (CE). Furthermore, it expands upon the consumer phase articulated by Herhausen et al. (2019), Muranko et al. (2018), Vidal-Ayuso, Akhmedova, and Jaca (2023), and Zhang and Benyoucef (2016) concerning post-consumption networks. By incorporating multi-country contexts, this research encompasses a spectrum of nations, ranging from highly developed countries to those at various stages of development, thereby facilitating a comparative analysis of re-commerce practices and their contributions to the CE transition within the post-consumption network.

This multi-country examination also builds upon existing literature in the domain, particularly the works of Bocken et al. (2016) and Carrington, Neville, and Whitwell (2014). Through content analysis, as outlined by Glaser (1978) and Hoda et al. (2010), the study generates codes that provide valuable insights for future research. These insights will focus on the specific aspects and best practices of Facebook-based re-commerce groups in promoting the transition to a circular economy (Konietzko et al., 2019). The findings of this content analysis elucidate the performance of re-commerce groups and their contributions to the CE transition, offering guidance for enhancing trading performance on Facebook.

The econometric models employed and the subsequent results of this research lay the groundwork for future research initiatives, particularly in examining how consumers can play pivotal roles in facilitating the CE transition. The implications of this research are particularly salient for business enterprises seeking to redesign their supply chains to support re-commerce activities. This includes the adoption of reverse logistics approaches, as discussed by Agrawal et al. (2022), Franco (2017), and Shadkam (2022).

Moreover, the research propositions derived from this study can inform future business development plans aimed at constructing targeted marketing strategies that align with consumption patterns supporting the transition to a circular economy. By leveraging insights from this study, businesses can better navigate the complexities of consumer behavior in the context of re-commerce, ultimately fostering more sustainable practices and contributing to the overarching goal of a circular economy.

6.2 Theoretical, managerial, and social implications of the study

This study used a mixed-method approach, incorporating content analysis and an econometric model to analyze re-commerce activities on Facebook within the context of the CE transition. This study considered 100 re-commerce groups from 20 countries. This analysis triangulated the outcome from 100 re-commerce groups by conducting in-depth interviews of 82 respondents who regularly engaged with second-hand product transactions. These analyses paved the way for assessing re-commerce activities on CE transition in complex adaptive systems and considering stakeholders' engagement in the process. Moreover, the econometric model assesses the influences of critical drivers on re-commerce group performances, helping existing and new groups plan future activities. The research propositions offer re-commerce impact on CE transition about the influences of product availability, (national) public interest in re-commerce, and the competency of re-commerce sellers. Post-consumption networks in the CE business model (Agrawal et al., 2022) should draw more attention from the academic community. This study has added implications to Muranko et al. (2018) post-consumption network to investigate the influential factors on consumer decision-making in CE transition.

The managerial implications of the study highlight the importance of business entrepreneurs integrating the post-consumption network into their business model. Entrepreneurs who seek to develop a closed-loop supply chain network can utilize the identified influential factors as a framework to design their own CE models. This research outcome could also inspire future entrepreneurs interested in developing sustainable business ideas in the second-hand product market, offering guidance on designing a sustainable business plan. In addition, entrepreneurs develop their strategies on upcycled products that the study addressed,

especially on pricing strategy, so consumers should understand the value of paying the premium price. Investors may view post-consumption network, focusing on re-commerce activities, as lucrative opportunities for green funding initiatives. Policymakers of different countries can consider the research propositions when implementing and updating CE action plans.

The study's social implications portray how individual consumers can contribute to the CE transition in developing a sustainable society. The econometric model also depicted the re-commerce practitioners developing a sustainable post-consumption network successfully in practicing an effective and engaging second-hand product trading in social media, like Facebook in this study, in creating a positive ethical image in society. At the same time, re-commerce on Facebook develops a green brand image among users to engage in the CE community acceptance in a country. Such involvement could help to implement CE transition in society.

6.3 Limitations of the study and direction for the future research

The study has limitations that inherit future research directions in the area of how the post-consumption network is significant in CE transition. The study considered 82 re-commerce users from 20 countries. The study considered ten product categories customers use the most in their re-commerce activities. Future research will consider how re-commerce activities may differ from a cross-country perspective. In-depth interviews were also conducted via videoconferencing tools. Although such video conferencing facilities allow convenience from both ends, they miss the opportunity to assess the interviewees' environment and whole-body language (Irani, 2019). Future research would consider a mix of both physical and virtual interviews. Some groups were unavailable during the study or had no sell posts mentioning "sold", so the researchers had to select another group. This study also faced limitations on extracting data from Facebook due to the privacy policy, which may not be on other social media platforms like LinkedIn.

Empirical and conceptual/theoretical works on CE transition in the post-consumption phase are seriously underrepresented. There is an apparent disconnect between academic research and practice, as evidenced in under-presented empirical works (Zhang et al., 2021). Additional research is called to refer to the specific industry contexts or real-life applications and to validate the relevance of conceptual/theoretical and mathematical models, which is what this research attempts to do. The factors derived from the econometric models can further be extended in cross-country perspectives. The research propositions can be implemented on other social media platforms to investigate re-commerce activities and ensure CE transition from consumer perspectives.

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Appendix 1

5 year Google trend analysis (December 17, 2019 – December 17, 2023)

Country	Sell on Facebook (2019)	Sell on Facebook (2021)	Sell on Facebook (2023)	Sell on Facebook: (5 year average)*
United Kingdom	90	91	90	100
Australia	100	96	92	97
United States	76	100	100	95
Canada	77	92	87	82
New Zealand	88	71	71	81
Nigeria	65	77	87	79
Ireland	77	58	56	61
South Africa	51	65	52	58
Philippines	37	43	35	42
Pakistan	33	42	61	41
Singapore	27	33	29	32
Malaysia	23	28	11	22
Bangladesh	20	28	18	22
United Arab Emirates	15	14	15	16
India	13	10	6	10
Vietnam	5	6	3	8
Thailand	5	6	5	7
Indonesia	2	2	1	3
Germany	1	3	1	1
Brazil	1	1	1	1

* worldwide interest ranking on Google Trend (2019-2023)

Appendix 2

A comparison of performances of the 100 re-commerce groups

Group*	Increment of members in last week 2023	Number of posts in Oct 2023	Number of likes in Oct 2023	Number of comments in Oct 2023	Number of posts in Nov 2022	Number of likes in Nov 2022	Number of comments in Nov 2022	Number of items sold and recorded in 2023	Number of items sold and recorded in 2022	Performance Index of reselling group
United Kingdom										
1.UK second-hand alternative buy/sell/swap	183	437	248	489	617	345	708	27	59	3701
2.Swindon buy sell n swap	236	3578	91	301	2897	74	205	38	63	9014
3. Sell Or Exchange Items In Cambridge	10	120	25	34	67	27	30	12	8	478
4. Glasgow UK_sell-buy-swap-free items-wanted items	58	1854	245	301	1234	188	201	10	5	3712
5. Durham Uni students - buy, sell and swap items	22	29	74	189	35	85	201	20	16	1672
Australia										
6. Buy Sell Swap - Australia (Brisbane, Sydney, Adelaide, Melbourne etc)	96	7390	1528	2798	6568	1148	1325	59	78	18899
7.Trash and treasure canberra, Queanbeyan	442	6135	67	219	7894	78	398	21	46	12868
8. GARAGE SALES - SYDNEY	69	4193	845	974	2456	941	989	63	27	12733

21.Garage Sales - Canterbury, New Zealand	46	78	213	56	54	110	127	21	13	2273
22.AUCKLAND Buy Sell and Free – SECOND-HAND	31	26	57	34	22	69	41	23	28	2331
23.South Auckland Garage Sale and Community Group	16	1534	57	11	1125	378	8	87	75	6733
24.Second-Hand Christchurch	24	100	515	219	86	637	188	63	27	3727
25.Second hand for Wellington	18	105	135	71	75	81	51	1	0	1256
Nigeria										
26.Second hand Market in Abuja	705	2576	2952	2007	2151	2304	1687	112	67	41360
27.ABUJA FAIRLY USED ITEMS FOR SALE	1684	7567	4052	6327	2378	3315	4025	133	85	57236
28. Fairly Used Items for Sale in Lagos	1885	7802	879	5445	6486	954	4135	178	14	32586
29. FAIRLY USED ITEM'S....LAGOS/ OGUN STATE ONLY	278	437	1249	3402	237	978	2456	104	83	28145
30. ABUJA FAIRLY USED ITEMS HUB	448	1285	1645	2354	645	897	1035	78	64	24715
Ireland										
31. Galway Online Garage Sale.	50	1030	346	287	546	145	87	41	25	2636
32. Sell your stuff Dublin	113	314	56	97	484	41	78	17	13	1419

33.Second-Hand Ireland	454	4589	2185	2136	2478	71	29	31	40	14459
34. Swap Shop Ireland Zero Waste	11	43	18	34	74	24	19	12	18	483
35.Things for sale in and around the Vienne	21	931	45	297	1023	56	305	56	39	2899
South Africa										
36.second hand goods for sale in capetown	322	1588	1312	2685	1256	875	1987	78	59	17975
37.Pretoria Second Hand Stuff For Sale	424	4885	257	1450	3465	129	1278	35	32	10513
38. second hand in and around Johannesburg	58	65	235	459	74	314	556	24	0	1888
39. DURBAN BLUFF BUY AND SELL SECOND HAND HOUSEHOLD GOODS	13	128	235	311	131	245	326	6	4	2134
40. Durban Garage Sales	2375	25	45	231	64	125	345	14	8	5298
Philippines										
41.Antipolo "Preloved Stuffs, Second hand" buy n sell	123	7460	181	47	4312	55	34	39	25	15552
42.OFFICIAL PRELOVED CLOTHES/ITEMS CAVITE PH	230	9832	907	3055	6509	754	2387	98	82	31639
43. Preloved Manila	152	6443	157	296	5147	142	258	56	51	11918

44. MANILA ONLINE GARAGE SALE GROUP (MOGS Est 2015)	230	4396	2330	5103	3456	2287	4879	53	37	25326
45. DECLUTTERING MANILA	63	24	564	1034	31	245	604	5	1	9304
Pakistan										
46. Branded preloved	1189	9745	17564	18304	9645	16426	17459	379	231	101497
47. Branded and Preloved- Pakistan	293	5321	2745	6489	3989	2013	5978	84	71	24617
48. Branded Preloved Items For Resale	100	1588	2878	1134	1026	1102	896	72	43	8388
49. Preloved not Unloved	39	85	546	978	26	213	301	51	32	10671
50. islamabad second hand market	123	5440	1264	1879	4123	1301	1789	41	34	24211
Singapore										
51.SG Second-hand Sales	986	10000	135	240	8756	120	231	65	41	19601
52.2ND Hand Items in Singapore	30	217	15	53	102	11	31	25	37	2959
53. Singapore Buy, Sell and Used Deals Group	272	8647	2412	1456	8246	1243	815	36	27	21583
54. Singapore preloved clothes /things and other new items for sale	90	3762	1100	1464	2543	1230	1600	56	49	12878
55. SG Unused/Second hand Furniture, Phones, TV,...	81	33	87	76	38	91	71	27	23	3024

66. Dubai Sharjah Buy Sell Second Hand Marketplace	975	8459	3784	1975	6885	2458	1638	39	79	52344
67.Ajman Buy and Sell Used Items Only	350	9325	213	89	4710	37	67	31	53	15360
68. UAE Preloved New Items Buy Sale Free Giveaway	192	9304	868	789	5879	745	978	41	56	25279
69. second hand stuff for sale in buy abu Dhabi	832	5123	1647	2842	4156	1704	2869	56	46	23002
70. Second hand Ajman	172	268	835	1645	668	785	1058	74	59	7557
India										
71. Preloved(Sell Anything and Everything)India	106	3098	1045	3648	4015	1256	4689	64	78	20905
72.Second To None – Bangalore	108	1307	250	770	1102	241	736	121	101	24116
73 .second hand kerala	397	8546	1400	1735	8965	1125	1698	53	35	36669
74. Garage Sale Second hand Used Stuff MUMBAI INDIA Market	19	447	354	415	589	400	715	47	71	3073
75. Garage Sale Bangalore	19	238	254	478	486	789	875	44	24	8455
Vietnam										
76. Saigon Second-hand and Vintage	103	1066	412	623	878	357	621	43	37	5644
77. Buy and Sell/wanted In Vung Tau	12	38	57	47	27	51	42	5	21	437

78. Danang Garage Sale For Expats	23	22	31	51	29	37	60	6	31	607
79. HANOI BUY, SALE, SWAP AND SHARE	53	436	289	281	504	234	297	14	22	4097
80. Da Nang expats Sell, Buy and Auction, Service	14	119	53	67	85	56	70	3	1	800
Thailand										
81. Bangkok Second-hand	37	89	41	66	102	56	91	21	14	3377
82. Phuket - Second hand - For Sale	146	2069	414	592	1478	314	401	54	29	6685
83. Bangkok Good Second Hand Stuff	90	2101	342	485	1523	348	501	69	44	8501
84. SECOND-HAND ITEMS BANGKOK THAILAND	349	1429	648	845	1356	508	753	54	39	12587
85. Chiang Mai Second Hand Deals,Sell Buy Trade	92	726	418	424	645	321	256	67	39	5960
Indonesia										
86.JAKARTA seconds sale	43	12	8	2	10	6	3	3	2	452
87.INDONESIA SECOND-HAND	5	112	34	63	56	8	5	4	0	614
88. Jual Beli Barang Preloved Second Indonesia	26	26	24	51	34	42	52	0	7	2245
89. Barang PRELOVED	230	8796	3398	5215	7896	3145	4566	102	0	40211

90. JUAL BELI BARANG PRELOVED INDONESIA	80	2225	1890	2563	1256	1578	2156	54	31	9941
Germany										
91. Sell Your Stuff Berlin	58	3134	4540	3105	2578	3123	4298	75	40	33071
92. Things for sale or Wanted in Munich and HF-Angebote	3	109	46	56	68	31	40	28	16	643
93. Trade, Swap and Share Your Stuff Berlin	12	15	25	31	18	29	39	0	0	716
94. Second Hand München (Verkaufen, Kaufen, Verschenken, Schnäppchen)	88	670	71	89	478	49	68	37**	54**	2474
95. Munich Kleinanzeigen - English Buy/Sell/Trade	343	4265	348	501	3581	298	434	41**	38**	11677
Brazil										
96. Segunda Mão...	225	6548	869	1456	5349	945	1652	15***	10***	14613
97. Segunda mão Araraquara	14	567	256	301	412	274	298	24***	21***	2008
98. Segunda Mão Salvador	25	35	57	69	42	60	89	15***	18***	674
99. Bazar Novos/Usados NatalRN	313	6941	1418	2424	5646	1542	2987	36***	31***	23626

100. Venda de garagem - Divinópolis	177	8456	2897	3426	6478	2456	3214	75***	62***	25762
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* From January 1 to November 30, 2022. For assessing the number of sold post, we considered such posts where the users marked “sold” in their posts.

**verkauft (GERMAN) = Sold

***VENDIDO (BRAZILIAN PORTUGUESE) = Sold