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Knowledge, Attitudes, and Practices on Circular Economy among Senior Managers of Ethiopian Textiles and Agro-Food Processing Companies

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Abstract
Companies are increasingly seeking to adopt a Circular Economy (CE) approach when aiming for greater corporate sustainability. In Ethiopia, a country rapidly industrializing, a CE approach in line with Ethiopia's Green Manufacturing Strategy offers businesses a more sustainable and efficient economic approach than linear value chains. This study evaluates approaches towards implementing CE principles into novel business practices, focusing on the crucial role of senior business managers. Drawing on a sample of 145 senior managers of Ethiopian textiles and agro-food processing companies, we analysed their knowledge, attitudes, and practices vis-à-vis CE. The findings show that managers have high levels of knowledge about CE and hold positive attitudes towards it, although their companies' practices did not reflect this. Logistic regression analysis showed that environmental management training, business circularity strategies, and the type of managerial positions are the major determinants of managers' willingness to adopt circular practices. A critical finding was that participation in environmental management training and their managerial status negatively affect the willingness to adopt circular practices. Based on these findings, the study offers key recommendations focused on the potential to build CE models at the corporate level in developing countries, such as Ethiopia, through policy change and improved education and training.

Keywords Circular Economy (CE) · Industrial Parks (IP) · Knowledge-attitude-Practice (KAP) · Textile Industry · Agro-food Processing Industry

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Introduction

In Ethiopia's current 10-year development strategy [29], Ethiopia aspires to achieve an expanded inclusive economic opportunity through transitioning from an agricultural economy to a more industrial one. This transition will be implemented by increasing the involvement of the private sector in the agro-industry and allied sectors in and around the Integrated Agricultural Industrial Parks (IAIPs), generating increased job creation opportunities. At the same time, IAIPs need to operate in a socially inclusive and environmentally sustainable manner to adhere to Ethiopia's Climate Resilient Green Economy Strategy (CRGE) [26]. However, awareness and skills related to social inclusiveness and sustainable development, food safety, quality and traceability, and environmental practice are limited in the private sector. Policy and capacity-building frameworks provide insufficient support for developing such awareness and skills. In particular, the importance of responding to environmental concerns is well-rehearsed in government strategies and is reflected in Ethiopia's aspirations to build a Circular Economy (CE). However, the development of a CE is relatively limited in the private sector, despite government policy aiming to develop CE in Ethiopia. This goal requires an evaluation of the requirements to achieve and implement this shift to CE within developing countries, such as Ethiopia, where there are opportunities to make progress in this regard.

CE has recently gained momentum globally, partly driven by resource risks and supply failures [31]. A CE provides a basis for transitioning away from the current linear economic system, which is becoming unsustainable with its challenges both for the environment and, more generally, for society—a timely question for Ethiopia [46, 61]. A vital aspect of the CE approach lies in its pursuit of long-term value retention to reduce virgin material input and waste and emission output [17, 55, 60]. Unlike a linear 'take-make-waste' economic model, CE seeks to narrow, slow, or close resource flows through resource renewability and recovery, product-life extension, resource efficiency, resource sharing, and clean production [6, 16, 39, 71, 73]. In an ideal CE, materials are retained as stocks in the system for as long as possible, at the highest possible level, while respecting the limits of the planetary boundaries [15, 46, 58]. CE can be applicable at multiple levels—micro-level (products, companies, and consumers), meso-level (eco-industrial parks), and macro-level (subnational, national, regional, and multinational) to achieve sustainable development [4, 32].

Currently, industrial operations in Ethiopia, in common with other countries around the world, largely follow linear economic practices that can have a profound environmental and social impact. However, CE transition can simultaneously improve environmental sustainability and economic growth while supporting job creation, human well-being, and competitiveness [32, 67]. These are important considerations for developing countries. Reflecting this potential, CE is becoming integrated into policies and novel business practices. Key policy frameworks, such as the European Union CE Roadmap [20] and Circular Economy Action Plans of 2015 and 2020 [21, 22], and China's 11th and 12th Year Plans [72] bear testimony to the ambition in the application of CE at supranational and national levels, and in varied contexts.

Many business organisations have started to engage with circularity strategies [31] and are currently adopting CE principles [32]. The integration of CE principles in business performance strategies implies a radical change to business models [54, 65], which is defined as how a business creates and exchanges value with its customers and stakeholders to generate economic and financial returns [8, 77]. Subsequently, a set of managerial practices that aim to improve value creation, value transfer, and value capture are increasingly adopted by businesses [8, 49]. Value creation encompasses changes in design and manufacturing to extend product life through repair, maintenance, reuse, refurbishment,

remanufacturing, and recycling processes; use of renewable energy; and elimination of toxic chemicals [8, 49]. On the other hand, value transfer entails adopting multichannel communication between supply chain partners and customers to allow the transfer of circular initiatives. As Urbinati et al. [77] find, take-back systems, the implementation of product-service systems such as extended warranties and maintenance services, leasing, renting, and pooling are methods that can achieve value capture.

Senior business executives can play a crucial role in shaping and implementing business sustainability strategies and actions that aim to foster the transition to a CE [47]. Understanding their knowledge, attitudes, and practices is of the utmost importance in assessing these efforts towards building circularity in businesses. Most CE transition literature, in contrast, investigates the enablers and barriers of circular business models [13, 42, 45], the benefits of CE business models [77], the role of business managers in the implementation of circular practices [47], awareness of CE practices [14, 51, 53], consumer knowledge and determinants of intentions and practices towards circularity [43, 75], the stock performances (returns and volatility) of companies engaged in innovative and environmentally-friendly disposal practices [62], and the policy frameworks for CE transition [59, 60].

A CE may adopt a variety of strategies and practices as part of the transition, and these strategies need to be made relevant to the context [5, 31]. Such strategies must be supported by clearly articulated and effective government and organisational policies and strategies [56]. As Kirchherr and van Santen [44, 46] state, empirical research is valuable for building evidence on operationalizing and implementing CE in practice. However, as Sehnem et al. [70] and Klein et al. note [46], the extent of CE research is limited in the public administration arena compared to the private sector. Moreover, in the Ethiopian business context specifically, the level of knowledge of CE among senior company managers and details on how that knowledge level affects their willingness to adopt circular practices in the textiles and agro-food processing industries are not clearly understood.

This empirical study aimed to address these gaps to enhance understanding of the existence, scope, and potential for CE in Ethiopia's textiles and agro-processing sectors. It is the first study to examine the KAP of CE for future policy intervention in these emerging Ethiopian industrial sectors. In doing this, it makes a significant contribution to the knowledge base around CE in three important respects. Firstly, our study expands the knowledge base regarding the empirical evidence available to enable a shift to a CE. It does this by exploring what is missing from the skill sets of senior managers which would enable them to make the necessary changes in their business practices. Secondly, our study applies this approach to two key sectors: textiles and agro-processing—areas that are of particular importance in developing countries, particularly in Ethiopia, where the economic base is primarily agronomic. Finally, our study applies this approach in Ethiopia—a country that is rapidly developing, where patterns of doing business are not locked in, and where the time is ripe for making attitudinal changes in the key players in the textiles and agro-processing markets. Our findings are surprising in showing a good level of knowledge of CE among senior management but revealing that attitudes change after training. One would expect to see the opposite effect. This novel insight leads to the recommendations regarding reviewing and revamping training techniques and approaches, which represent an essential and significant contribution to advancing CE principles and techniques.

The approach taken in this study was to apply a Knowledge, Attitude, and Practice (KAP) survey to assess senior managers' perceptions and behaviours relating to CE. This approach aimed to identify, at a granular level, the issues relevant to determining business models and economic patterns and the potential to shift from linear to circular models. The following research questions were explored: (i) What is the level of knowledge

of CE principles among senior managers in Ethiopia's textiles and agro-food processing industries? (ii) What are the current circular economy practices in Ethiopia's textile and agro-food processing industries? (iii) What are the determinants of the willingness to adopt circular practices? These questions were posed in order to help fill the identified gaps in research on CE in the private sector (as opposed to the public sector). The results provided a rich source of data leading to clear findings and recommendations.

The findings were novel and insightful, revealing misconceptions in the attitudes of senior managers and their companies that hinder the implementation of circular solutions and provide a basis for suggesting possible ways to engage senior business managers in the implementation of a CE in a fast-developing country where the opportunity to prevent social and environmental harm is still available. This article advances the existing CE transition literature through its data analysis on attitudes, which revealed surprising results showing a disconnect between attitude and training on CE, leading to the recommendation for the need for reforms to training and corporate strategies.

Circular Economy Shifts in Sectors: Textiles and Agro-food Processing Industries

Circular Economy and Textiles

Traditionally based on a linear economic paradigm, the textiles and agro-food processing industries are ripe for transformation to a CE. The global textiles industry accounts for four percent of total GHG emissions [57]. It contributes to emissions through material and fabric production, retail-related activities, garment usage, and end-of-use in landfills and incineration. Further, textile mills contribute about one-fifth to the world's industrial water pollution by using toxic chemicals during production, some of which are carcinogenic [66]. Yet, clothing production continues to increase steeply due to the growing middle-class population and increased per capita sales [18]. Similarly, clothing has low rates of use—due to the fast fashion phenomenon, based on a quicker turnaround of new styles—and the sector has low levels of recycling [18]. The potential for reducing emissions and pollution in the textiles industry rests largely on adopting business models that keep textiles at their highest value during use, allowing their re-entry into the economy after use and promoting the use of safe and renewable inputs [18].

Leading apparel brands such as the Phillips-Van Heusen Corporation (PVH Corp) have started to engage with green textiles manufacturing strategies. As a result, various attempts have been made to reduce the use of chemicals to minimise their exposure to workers' health and the environment; manage waste products, including wastewater; reduce energy consumption during the production of fabric; promote the use of recycled fibres; and minimise the carbon footprint of global transportation [40]. While some apparel companies recycle old clothes, the widespread adoption of circular solutions in the textile industry is still lagging [2, 23]. 73% of textiles used for clothing globally are landfilled or incinerated, with 12% destined for cascaded recycling (into lower-value materials and products), and only 1% destined for closed-loop recycling (into similar-quality products) [19]. For a fabric to be recycled, it must first be chopped, which takes longer and produces a lower-quality fabric. As a result, textile wastes, including used clothing, is rarely prioritised for recycling, leading to unsustainable landfill disposal [34]. Extending the useful lifetime of clothing through reuse and sharing approaches could reduce carbon, water, and waste footprints, thereby contributing to a circular economy [1, 79]. However, less sustainable 'quicker' fashion in the clothing sector undermines efforts

to enhance clothing longevity through reuse and clothing rental [18, 34]. In a context where current sustainability practices in the textile sector are inadequate, effective circular-driven solutions should be adopted [69].

Ethiopia has 223 medium- and large-scale textile and garment manufacturing companies, including PVH Corp, Calvin Klein, and Tommy Hilfiger [28]. Most of these companies attract investors from India, Bangladesh, China, and Turkey seeking alternative production bases for export to the EU and North American markets [28]. The growth of the textile industry is attributed to Ethiopia's long tradition in weaving and the African Growth and Opportunity Act (AGOA), which created opportunities for new investments [64]. Further, strategic plans and a roadmap for manufacturing growth prioritised the textiles and garment industry. For example, the second Growth and Transformation Plan (GTP II) was focused on the development of industrial parks and Foreign Direct Investment (FDI) in the textiles industry to generate US$ 30 billion in exports by 2030 [27].

The Government of the Federal Democratic Republic of Ethiopia has prioritised various actions to reduce GHG emissions. The textile and leather sectors comprise 17% of industrial emissions [26]. The volume of GHG emissions from the sector is projected to rise from 0.6 Mt CO2e in 2010 to almost 5 Mt CO2e in 2030, mainly due to the use of furnace oil in the production process and associated effluent discharge [26]. The country nonetheless pledges to abate 2 Mt CO2e by 2030 from the textile and leather sectors [26]. This reduction will be attained mainly through the transformation in the energy sector, including promoting energy efficiency and using alternative fuels [26, 29].

Circular Economy and the Agro-food Processing Industry

The agro-food processing industry can equally be investigated from a CE perspective. Approximately one-third of the global food supply is lost or wasted [20, 24] translating into 1.3 billion tonnes of food waste [25]. The global per capita food loss and waste range are estimated to be between 194 and 389 kgs per person per year [10], implying unnecessary pressure on natural resources and the environment to produce more food. It also implies wasteful use of land and water resources. Thus, innovative policies and technologies to reduce food loss and waste are of paramount importance [48]. This realism is now well-captured in national and global policies that promote sustainable food systems, although there is evidently scope for further progress [30]. The global concern for food loss and waste is firmly reflected in the UN 2030 Agenda for Sustainable Development [76]. Target 12.3 of the UN Sustainable Development Goals (SDGs) seeks to 'halve per capita global food waste at the retail and consumer levels and the reduction of food losses along production and supply chains, including post-harvest losses' by 2030 [76]. Progress towards that target will contribute to addressing a range of SDGs, including eliminating poverty (SDG 1), zero hunger (SDG 2), good health and well-being (SDG 3), gender equality (SDG 5), inclusive and sustainable economic growth (SDG 8), reducing income inequality (SDG 10), climate action (SDG 13), life below water (SDG 14), and life on land (SDG 15). Aligning SDG Target 12.3 with waste prevention priorities will require food waste valorization practices that feature the extraction of high-value compounds from food waste, recovery of nutrients, and production of biomaterials and biofuel. However, shifting to a circular economy approach will be difficult, as that requires a commitment to financing, economic enablers, technical capabilities, and scope for radical changes in consumer behaviours, business models, institutions, and governance [54].

Agro-food processing is among the dominant manufacturing industries in Ethiopia, accounting for more than one-third of the firms and employment in the industrial sector

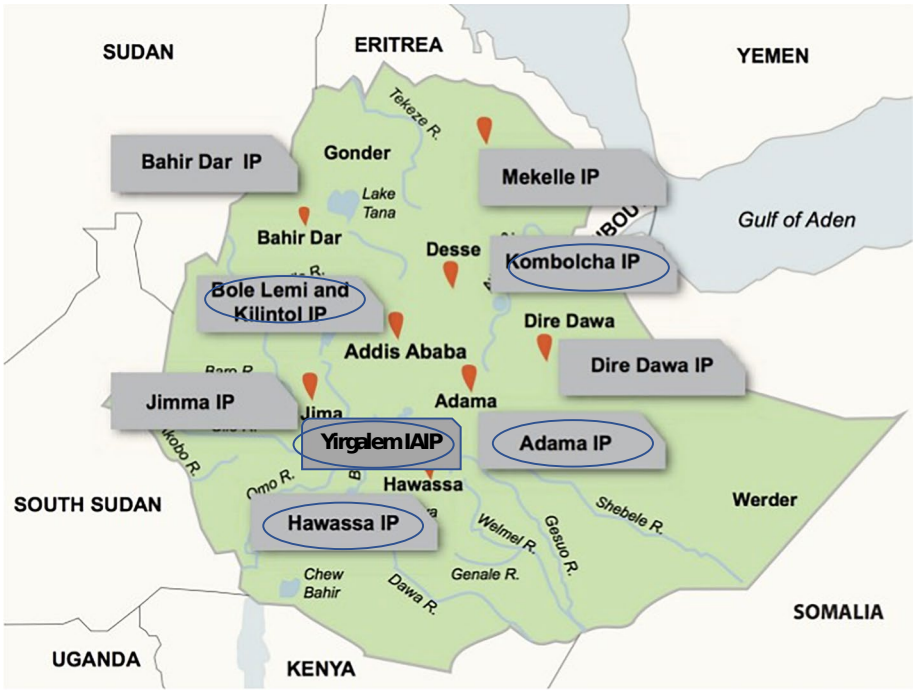

Fig. 1 Locations of industrial parks across Ethiopia

[81]. Despite its relatively small share of GHG emissions, the government has proposed ambitious measures to pursue low-carbon climate-resilient development pathways to achieve lower middle-income status by 2025 [26–28]. These measures focus attention on monitoring and reducing food loss and waste throughout the value chain; reducing natural resources and energy used in agriculture and raw material production, processing, packaging, and distribution; reducing waste and emissions by reducing chemical byproducts; and embedding sustainability criteria in procurement processes and project evaluation [28].

Methods

Study Area

The study was carried out in July 2022 in different industrial parks in Ethiopia (Fig. 1). It targeted Ethiopian textiles and agro-food processing companies. The sample was chosen from six industrial parks (IPs)—Bole Lemi Phases I and II, Hawassa, Kombolcha, Adama, Deber Berihan, and Yirgalem Integrated Agro-Industrial Park (IAIP)—distributed across the country (Fig. 1). The study explores the perceptions and behaviours of senior managers in the Ethiopian textiles and agro-food processing industries. As a country, Ethiopia has set ambitious national targets for advancing circular practices in the manufacturing sector. These efforts can be considered in the context of Ethiopia's GTP II, Climate Resilient Green Economy strategy (CRGE), and Green Manufacturing Strategy [26–28]. These

frameworks demonstrate the country's efforts to foster circularity and consolidate, scale up, and embed green growth initiatives in national development goals.

Specifically, the CRGE provides a framework to facilitate the transition to an economy in which economic goals are reached sustainably [26]. It aims to inform strategic goals by promoting resource efficiency in meeting economic targets. On the other hand, Ethiopia's Green Manufacturing Strategy provides a roadmap towards green industrialization [28], prioritizing the greening of industrial growth through renewable energy and CE principles [40]. Despite such advances in the policy environment, the transition to a circular economy remains slow. The traditional, linear economic paradigm defends its position as the dominant regime.

Data Collection and KAP Survey

We used a combination of multi-stage sampling and simple random sampling design to select industrial parks and companies where a questionnaire survey was administered. In the first stage, a purposive sampling strategy was used to select six industrial parks (IPs) from the list obtained from the Ethiopian Industrial Park Development Corporation (Table 1). In the second stage, a stratified random sampling approach was used to select 29 companies from six selected IPs—Bole Lemi Phases I and II, Hawassa, Kombolcha, Adama, Deber Berihan and Yirgalem Integrated Agro-industry—with consideration of their spatial locations, size, year of establishment, and sector integration (Table 2). The final stage involved selecting 145 respondents from the 29 companies using systematic random sampling (Table 2).

Relatively equal proportions of senior factory managers in charge of sales and marketing, logistics, production and products, and line supervisors were included in the survey, with the assumption that these actors are likely to influence decision-making processes involving their companies' transitions to a CE approach. The survey was conducted through face-to-face interviews using semi-structured questionnaires, including questions about the personal profile of the company's senior managers and their knowledge, attitudes, and practices relative to circular practices (Table 3).

The survey follows the Knowledge-Attitude-Practice (KAP) approach to quantify and analyse perceptions and behaviours regarding CE. The KAP approach to surveying a target population involves three dimensions, assessing first, the extent to which the respondents know about the topic (knowledge); second, their feelings and beliefs about it, including how positively or negatively they regard it (attitudes); and third, their actions relating to it (practices) [3, 52, 63].

Knowledge of CE is one of the necessary factors for adopting circular solutions and can substantially affect attitudes and behaviours [75]. At a time when environmental sustainability has become a key managerial issue [1, 7] and balancing environmental and business needs [9] is an increasing challenge, knowledge is a major asset to companies [78], both in general terms and in the innovative areas of CE and corporate sustainability. Decision-making in these areas is complex, and the attitudes of decision-makers can directly influence corporate strategic actions towards a CE [12, 36, 43]. Attitudes towards a particular behaviour strengthen or weaken one's intention to perform the behaviour in question [35]. The knowledge and attitudes of corporate decision-makers can be instrumental in shaping corporate practices. The diffusion of knowledge and innovations from management to colleagues [68] can enhance the internal credibility of innovative changes [11].

In the context of this study, knowledge of CE refers to an understanding of CE principles, which includes waste and pollution reduction, keeping materials and products in circulation, and regenerating nature [17]. A five-point Likert scale was used to test and rate the responses, where

Table 1 List of industrial parks in Ethiopia

Industrial park	Region/city	Area (ha)	Main sector
Bole Lemi Phases I and II	Addis Ababa	342	Apparel and textile
Addis Industrial Village	Addis Ababa		Apparel and textile
Hawassa	Sidama	400	Textile and garment
Mekele	Tigray	75	Apparel and textile
Kombolcha	Amhara	75	Apparel and textile
Jimma	Oromia	75	Apparel and textile
Adama	Oromia	365	Garment, textile, and machinery
Dire Dawa	Dire Dawa	150	Assembling, garments, and food
Deber Berihan	Amhara		Apparel and textile
Semera	Afar		Apparel and textile
Jimma	Oromia		Apparel and textile
Bahir Dar	Amhara		Garment and apparel
Aysha Industrial Park	Somali		Garment and apparel
Arerti Industrial Park	Amhara		Construction products and home appliance
Kilinto	Addis Ababa		Garment and apparel
Airline and Logistics Park 4	Addis Ababa		Garment and apparel
Modjo Leather City	Addis Ababa		Leather
Bure Integrated Agroindustry	Amhara	342	Agro-industrial
Bulbula Integrated Agroindustry	Oromia		Agro-food processing
Yiregalem Integrated Agroindustry	Sidama	400	Agro-food processing
Baeker Integrated Agroindustry	Tigray	75	Agro-food processing

Source: IPDC (2022)

Table 2 Selected industrial parks and respondents

Industrial park	Sampled companies	Sampled respondents	Proportion of respondents
Bole Lemi Phases I and II	7	46	31.72
Hawassa	8	47	32.41
Kombolcha	4	17	11.72
Adama	4	18	12.41
Deber Berihan	4	11	7.59
Yirgalem Integrated Agroindustry	2	6	4.14
Total	29	145	100

Table 3 Descriptive analysis of variables included in the study

Variable		Type	Description/question
Gender		Binary	Gender of respondents (1, male; 0, female)
Education		Categorical	Educational level attained by the respondent: (1) secondary, (2) college/diploma, (3) university, and (4) other
Environmental management training		Binary	Respondent's participation in environmental management training (1, yes; 0, no)
Company's circularity strategy		Binary	Has the company developed a circular economy performance strategy? (1, yes; 0, no)
Type of managerial positions	a. Factory manager	Binary	Is the respondent a factory manager (1, yes; 0, no)
	b. Production manager	Binary	Is the respondent a production manager? (1, yes; 0, no)
	c. Marketing manager	Binary	Is the respondent a marketing manager? (1, yes; 0, no)
	d. Line supervisor	Binary	Is the respondent a line supervisor? (1, yes; 0, no)
	e. Logistics manager	Binary	Is the respondent a logistics manager? (1, yes; 0, no)

5 is 'very good understanding', and 1 is 'no understanding' (Annex 1). Attitudes towards CE are considered to be a sense of willingness to implement circular solutions. As such, the survey questions were focused on enquiring whether the respondent was inclined to implement CE practices. Respondents were, therefore, required to provide a Yes or No answer (Annex 1). The practice of CE is considered to be current or previous involvement in circular business practices. Nine practices were considered: (i) innovative ways of extending a product's life, e.g., repair, maintenance, and remanufacturing; (ii) using a sharing platform for materials and services; (iii) take back/buy back schemes; (iv) recycling and/or recovery of resources; (v) using recovered material to produce new products; (vi) adoption of efficient resource-use technologies; (vii) safe disposal of toxic wastes; (viii) eco-labelling; and (ix) training employees on circular economy. The practice question asks whether a respondent has implemented or been involved in any of these circularity strategies (with a Yes or No answer). The knowledge, attitude, and practice variables were adapted from previous studies [1, 3, 7, 14, 50, 52].

The questionnaire survey was complemented by key informant interviews (KIIs) and focus group discussions (FGDs). FGDs were undertaken with selected individuals comprising company and industrial park managers. The discussion points were focused on existing CE practices and related challenges. KIIs were conducted with stakeholders drawn from the textiles and agro-food processing sectors. Interviews, which followed a semi-structured approach, were focused on existing circularity strategies. Additionally, illustrative case stories from two selected companies were used to demonstrate actions taken to embed green growth initiatives. This integration of qualitative methods (interviews, focus groups) aimed to enhance the viability and reliability of the survey [50, 52].

Data Analysis

Qualitative data was analysed using SPSS software (IBM, Portsmouth, UK), and it entailed descriptive statistics for the socio-economic characteristics of the respondents. The Relative Importance Index (RII) was used to determine the relative importance of knowledge, attitude, and practice variables. Qualitative data from KIIs and FGDs were coded and analysed by themes to generate categories [33].

The study used a regression analysis to assess the determinants of willingness to adopt CE. Respondents were classified as either willing or not willing to adopt circular practices. Here, the dependent variable is binary, which assumes a value of '1', if the respondent is willing to adopt CE, and '0', if otherwise. Thus, the appropriate econometric method analysis was notably logit/probit. The two standard binary outcome models, the logit and the probit models, specify different functional forms for this probability as a function of regressors [35]. For its mathematical simplicity, the study used the logit model [35, 37]. The binary logit model is presented below [37].

$$\mathrm{Li} = \ln\left(\frac{\mathrm{Pi}}{1-\mathrm{Pi}}\right) = \mathrm{Zi} = \beta 1 + \beta 2Xi$$

According to Gujarati [37], the logit model can be presented as follows:

$$P_{\mathrm{i}} = E(Y = 1|X_{\mathrm{i}}) = \frac{1}{1 + e^{-(\beta_0 + \beta_{\mathrm{i}} X_{\mathrm{i}})}}$$

where P_{i} is the probability of the respondent being willing to adopt CE, and Xi represents the institutional and individual characteristics. Table 2 shows the variables used in the regression analysis.

Let $Z_i = \beta_0 + \beta_i X_i$; the above equation could be written in the following way:

$$P_i = E(Y = 1|X_i) = \frac{1}{1+e^{-z}} = \frac{e^z}{1+e^z} \quad P_i = E(Y = 1|X_i) = \frac{1}{1+e^{-z}} = \frac{e^z}{1+e^z}$$

1- P_i then, the possibility of not willing to adopt CE can be explained as follows:

$$1 - \mathrm{Pi} = \frac{1}{1 + e^{\mathrm{Zi}}}$$

Dividing Pi by $1 - \mathrm{Pi}$ and taking the logarithm of both sides of the equation gives

$$\mathrm{Li} = \ln\left(\frac{\mathrm{Pi}}{1 - \mathrm{Pi}}\right) = \mathrm{Zi} = \beta 1 + \beta 2 Xi$$

The parameter values are calculated using maximum likelihood techniques [80].

Results

Socio-demographic Characteristics of the Study Population

One hundred and forty-five respondents were interviewed, and 122 responded to the questionnaires. Ninety percent (90%) of the respondents were drawn from textiles companies and 10% from agro-food processing firms. The mean age of the respondents was 33 years, with the youngest aged 22 and the oldest aged 60 (Table 4 below). Most respondents were male (65%), with an average of 9 years of work experience. All the respondents had attained tertiary education—79% had a bachelor's degree, 14% had a master's degree, and 7% had a diploma. The high levels of education among company managers imply a strong awareness and understanding of circularity principles.

Knowledge of Circular Economy

The respondents reported a good understanding of circularity principles (Table 5). The relative index of the entire sample is 0.8, suggesting a better knowledge of circular economy among the senior managers of textiles and agro-food processing companies. Thirty-eight percent (37.8%) rated their recycling knowledge as good, and 50.3% rated their knowledge as very good. Similarly, the respondents had diverse ratings on their knowledge of innovative ways for extending product life, such as maintenance, repair, and remanufacturing, with 36.6% rating their knowledge as good and 40.7% as very good. Most respondents (70.4%) rated their understanding of clean energy and efficient energy options as good or very good, compared to seven percent (7%) who had a poor understanding. Notably, 52.4% of respondents reported a good and very good understanding of policy and legal framework on waste and emissions reduction. However, foreign-owned textile companies have a limited awareness of environmental management systems.

Respondents' Attitudes Towards Circular Economy (Based on Their Preference)

Most of the respondents had positive attitudes towards circularity (Table 6). Notably, there is a high willingness among senior managers to safely dispose of waste chemicals

Table 4 Demographic characteristics of respondents

Statistics	Gender		Level of education				Age	Work experience
	Female	Male	Diploma	Degree	Masters	Statistics	$n = 122$	$n = 122$
Percent	35.17	64.83	6.9	78.62	14.48	Mean	32.76	9.3
Cum.	35.17	100	6.9	85.52	100	Min	22	0
						Max	60	38

Table 5 Respondents' levels of knowledge about circular economy

Components of knowledge on circular economy	No understanding (%)	Poor (%)	Average (%)	Good (%)	Very good (%)
Recycling of resources	0.7	4.14	7	37.9	50.3
Innovative ways for extending a product's life, e.g., maintenance/repair/remanufacturing	0.7	4.14	17.9	36.6	40.7
Clean energy and efficient energy options	0.7	7	22.1	35.2	35.2
Government policies on waste and emission reduction	6.2	11	30.3	35.9	16.6
Safe disposal of wastes	3.5	4.8	17.2	40.0	34.5
Cost-effectiveness of resource sharing	1.4	5.5	20	40.7	32.4

(84.8%), recycle resources (80%), embrace environmental purchasing criteria for selecting suppliers (73.8%), share resources with other organisations (72.4%), design products that can easily be recycled or recovered (67.6%), and recover resources (67.6%). The overall index of attitude is 0.74, indicating a significant positive attitude towards circular practices.

Practices Relating to Circular Economy

In relation to engagement with circular economy practices (Table 7), 61.4% of the respondents were already innovating ways for extending a product's life, 52.4% were engaging in platforms for sharing materials and services, and 37.9% had established take-back/buy-back schemes. Similarly, 44.8% of the respondents were recycling resources, 71.7% had adopted efficient resource use technologies, and 59.3% had embraced eco-labelling. Notably, 66.2% of the companies were implementing circular economy training programmes.

The overall index is estimated at 0.58, which is low compared to knowledge and attitudes. This result suggests that businesses in these sectors in IPs engage with circular practices to a limited extent, with much of the attention focused on waste collection and segregation, waste treatment, and the reuse and sale of fabric off-cuts. However, some textile companies were using fabric off-cuts to produce their energy, leading to increased greenhouse gas emissions.

Agro-food processing companies in the IPs are mainly processing avocado oil for the local and export markets. Their main challenge relates to the disposal and reuse of secondary raw materials such as peel, seed, pomace, and water. While these discarded materials have important value quantified in molecular and functional compounds, they were being disposed of in the nearby landfill. The alternative uses of avocado wastes as mulch, fertilizer, stockfeed, and energy were not considered.

Factors Influencing Willingness to Adopt Circular Economy Practices

The logistic regression model was estimated for the determinants of willingness to adopt circular practices. The marginal effects of a unit change in the explanatory variables on willingness to adopt are shown in Table 8. The results show that environmental management training, the organisation's circularity strategy, and the type of managerial positions are the major determinants of the willingness to adopt circular practices. The coefficients for education and business circularity strategy are positive, suggesting that better-educated, more knowledgeable managers and companies with circular economy performance strategy are more likely to adopt circular solutions. Additionally, positive attitudes towards the principles of CE positively influence individual willingness to adopt circular practices.

However, the coefficients for gender, environmental management training, and type of managerial positions are negative. Female managers are more likely to influence the adoption of circular practices than their male counterparts. Moreover, managerial positions such as those related to production and logistics led to a decline in willingness to adopt circular practices.

Table 6 Respondents' attitudes towards circular practices

Attitude components of circular economy	No (%)	Yes (%)
Design products to be easily recycled or recovered	32.4	67.6
Environmental purchasing criteria for selecting suppliers	26.2	73.8
Safe disposal of chemicals	15.2	84.8
Use renewable energy	17.9	82.1
Use new technologies for recycling	15.2	84.8
Use organic raw materials	23.5	76.8
Recycling of resources	20.0	80.0
Recovery of resources	32.4	67.6
Use of third-party logistics	34.5	65.5
Resource sharing	25.6	72.4

Table 7 Responses on practices on Circular Economy among senior managers

Components of practices in circular economy	No (%)	Yes (%)
Innovative ways for extending a product's life, e.g., repair, maintenance, and remanufacturing	38.6	61.4
Sharing platform for materials and services	47.6	52.4
Take back/buy back schemes	62.1	37.9
Recycle/recover resources	55.2	44.8
Use recovered material to produce new products	62.8	37.2
Adopt efficient resource-use technologies	28.3	71.7
Safe disposal of toxic chemicals	17.2	82.8
Eco-labelling	40.7	59.3
Training employees on circular economy	33.8	66.2

Discussion

Our study builds on existing CE literature by analysing knowledge, attitudes, and practices towards circular practices among senior managers of Ethiopian textiles and agro-food processing companies. The findings show that managers have a high level of understanding about CE and hold positive attitudes towards circularity. However, a relatively low proportion of the managers reported circular practices in their companies.

The managers of textiles and agro-food processing companies demonstrated a broad understanding of the basic concept of CE (Table 5). This finding resonates with a previous study [51], indicating that firms are becoming increasingly aware of CE principles following their integration into policies at regional and national levels. However, the proportion of respondents who related CE to the recycling of resources was greater than the proportion who connected it to a more diverse range of environmental, social, and economic benefits, such as the use of renewable energy and the potential of CE to extend the lifecycle of products through maintenance, repair, and remanufacturing. This finding resonates with a previous study [32, 45, 53]. It shows that knowledge of CE continues to be generally limited and narrow in scope among many managers, particularly those who relate the concept of CE to

recycling resources. CE focuses not only on recycling and recovery of resources, but also on innovative ways of extending product life, using clean energy, and cost-effectiveness of resource sharing [73]. Understandably, the uptake of CE requires a diversification of the CE practices, and the achievement of scale, volume, and infrastructure issues of the entire circular economic system [45].

The company managers held favourable attitudes towards circular economy principles (Table 8) and circular practices (Table 6). However, attitudes towards some circular practices were more favourable than others. Among the identified circular practices, a willingness to safely dispose of toxic chemicals, use renewable energy, and adopt new recycling technology was viewed markedly more favourably than redesigning the products for recycling and recovery, recovery of resources, and use of third-party logistics (Table 6). These findings align with both theoretical arguments and empirical findings [43, 53]. Business organisations are primarily driven by profitability and will be averse to higher-cost innovations [39]. The finding indicates a moderately favourable attitude to essential elements needed to successfully transition to CE, arguably some—such as sustainable design—which depend on the engagement of other actors in the value chain [74].

The most significant practices identified in CE engagement are the safe disposal of toxic chemicals, efficient resource-use technologies, and training employees on circular practices (Table 7). Notably, using recovered material to produce new products—a classic feature of CE—was the least reported practice. However, the relative importance index for practice in CE was relatively low (0.58)—compared to knowledge (0.8) and attitude (0.74)—suggesting limited circular practices in the textiles and agro-food processing companies overall. This finding is aligned with a previous study [43]. It shows that despite positive intentions, most business organisations are reluctant to implement best practices in CE in the context of textiles and agro-food processing companies in Ethiopia. It is worth mentioning that respondents in our study are senior factory managers with less control over companies' operations than the board of directors.

Many medium- and large-scale textile manufacturing companies in Ethiopia are foreign-owned. Our study shows that these firms have limited awareness of environmental management systems, suggesting a low understanding of waste and emission-reduction policies. This finding highlights the importance of environmental management training in enhancing awareness and cultivating trust and support for circular practices. This finding resonates with research in other contexts [e.g., 38, 41, 77] and indicates that environmental awareness on the part of management can trigger the transition of companies from linear to circular business models. However, the findings indicate that the nature of this training is important. Notably, participation in environmental training had a negative impact on the adoption of circular practices. Interviews with key informants showed that existing training targeted locally owned companies to enforce compliance with environmental standards. This perceived bias led to suspicion and resistance regarding circular practices, particularly among managers who had participated in such training. This finding implies that environmental management training aimed at fostering circular practices should be appropriately structured and delivered in a way that builds trust rather than alienating stakeholders. However, more investigations are required to offer concrete evidence about the negative association between participation in environmental training and the adoption of business circular models.

Other results from the regression analysis highlight the importance of environmental management training, educational attainment, business circularity strategy, type of managerial positions, and positive attitudes towards circular economy principles (Table 8) in influencing the willingness to adopt circular practices. However, educational attainment

Table 8 Results of logistic regression for the determinants of willingness to adopt circular practices

Attributes	Logit result		Marginal effects	
	Coefficient	Standard error	Coefficient	Standard error
Gender	−0.4930109	0.4597804	−0.0870788	0.7828
Education (degree holder)	0.1192938	0.6533615	0.0222961	0.12425
Education (diploma holder)	0.870117	1.025773	0.1290465	0.118277
Environmental management training	−1.262965***	0.49475	−0.22981***	0.08638
Business circularity strategy	2.197107***	0.5612167	0.364254***	0.07551
Factory manager	−0.8363771	0.7837005	−0.1765796	0.18214
Production manager	−1.321743**	0.6476157	−0.2887408*	0.15147
Marketing manager	−0.9144367	0.7347392	−0.1948914	0.17242
Line supervisor	−0.7815885	0.6600781	−0.1624955	0.14956
Logistics manager	−1.320458*	0.7137722	−0.2892016	0.1679
Knowledge index	−0.2530613	1.867823	−0.0464864	0.34315
Attitude index	1.85574**	0.8876263	0.3408922**	0.1624
Constant	0.4878035	1.446606		
Log-likelihood	−70.901722			
Number of observations	145			
LR chi^2 (12) = 36.19				
Prob > chi^2 = 0.0003				
Pseudo R^2 = 2033				

Except for knowledge and attitude index, the other variables are categorical

*Significant at 10% level; **significant at 5% level; ***significant at 1% level

has no significant effect on willingness to adopt circular solutions. Managerial positions, such as those relating to production and logistics, significantly negatively influence willingness to adopt circular practices. This finding implies that despite the perceived influence of senior managers, their role in restructuring business practices to achieve a circular regime is often limited by structural and other constraints. This finding resonates with a previous study [47] and indicates that existing power arrangements in the linear economic regime in the contexts we analysed curb senior managers' role in pursuing CE transition. The company's board of directors often exercises real power regarding the transition to CE [47]. Thus, management and decision-making are pivotal in achieving circular business solutions in textile and agro-food processing companies.

Business circularity strategies are key to the willingness to adopt circular practices. It can provide an enabling environment for implementing circular business models through appropriate support and initiatives, such as technology deployment and skills development. The development of green strategies should therefore be prioritised to scale up the adoption of CE business models. However, concerns about ensuring their companies' economic success affect the managers' roles in shaping and implementing business circularity strategies.

Following these findings and to improve the sustainability and circularity of the textiles and agro-processing industries, one logical step would be to encourage recycler manufacturers to enter the IP or establish links with recycling factories. In this way, micro- and small-scale enterprises would be able to avail themselves of technological and financial support to assist them in implementing a CE. Additionally, policy changes such as consistency and standardisation of definitions, classifications, standards, and tools would assist in the implementation of circular approaches. Such harmonisations would provide a greater enabling environment for the development and monitoring of a CE. Moreover, international buyers for big brands have a role to act as advocates for a CE approach. This advocacy would increase the circularity of textiles through the enhanced eco-design of products, recycled content requirements, and adaptations to business models. Examples of these include takeback programmes for product repair, resale, and rental. Finally, targeted capacity building and outreach to (i) advance sustainable consumption, (ii) extend the life of products (e.g., through repair, donation or thrift) and (iii) develop consumer awareness of repair, reuse and recycling of textiles, would be another important step in the roadmap towards circular solutions.

Limitations of the Study

Despite the promising findings, our study exhibits several limitations, mainly deriving from the methodology employed. First, the coding of KAP into binary variables is insufficient to demonstrate the variance in attitudes and practices in a circular economy. Some respondents may have mixed feelings towards specific circular practices but would find it difficult to reflect such nuances. Secondly, the study has not comprehensively examined the complexity behind respondents' decisions to engage with specific circularity strategies. In future research, it would be promising to examine how interrelated factors are shaping company managers' perceptions and attitudes towards specific circularity strategies. Possible consideration of the Multivariate Multiple Regression model could have extended this study by examining the specific determinants of knowledge, attitudes, and practices in CE. Finally, the KAP survey relied on respondents'

self-reported knowledge, attitudes, and practices. However, this did not affect the validity of the research because data collection methods were triangulated to verify the authenticity of the responses. Moreover, our study is cross-sectional and limited to the sample size of 145 senior managers of textile and agro-food processing companies in Ethiopia.

Conclusions and Recommendations

This study has analysed how senior managers of textiles and agro-food processing companies in Ethiopia are engaged in circular practices, specifically what they know about CE, how positively or negatively they regard it, and what they are doing about it. The study used logistic regression analysis to estimate the determinants of the willingness to adopt circular practices. Our results show senior managers have high levels of foundational knowledge about CE and hold positive attitudes towards circularity. However, there was more limited evidence that managers understand the technical aspects of CE, including the effects of waste, renewable energy, green raw materials, and resource-sharing, which are basic requirements for transforming businesses to adopt CE approaches. While there is evidence of innovation, there was a low tendency to implement some classic elements of CE, such as using recovered material to produce new products. Overall, a relatively low proportion of the managers reported implementing circular practices in their companies. With the caveat that our study has size limitations, findings from our sample show that female managers were more likely to influence the adoption of circular practices in companies.

Environmental management training, the presence of business circularity strategies, and the type of managerial positions are the major determinants of the willingness to adopt circular practices. Managers are more willing to adopt circular practices if the companies have implemented sustainability or green strategies. Notably, participation in environmental management training was linked to a lower willingness to adopt CE. This finding suggests that there is a need to re-examine the content and structure of existing environmental management training programmes. The study has shown that business circularity strategies are a critical element in adopting circular practices. Circularity strategies can provide a conducive environment for implementing circular solutions through appropriate support and initiatives. Business organisations should, therefore, prioritise the development of green strategies to scale up the adoption of circular business models.

Managerial positions, such as roles in managing production and logistics, negatively influence willingness to adopt CE. Despite their influence, the role of managers in restructuring a circular regime is limited. This aligns with research showing that the factory owners make high-level decisions regarding CE transition. For this reason, senior managers must identify ways to push the sustainability agenda for CE while promoting their economic competitiveness. Further research is needed to test the hypothesis that there is differentiation according to seniority of position on willingness to adapt to CE approaches.

The two industrial sectors of textiles and agro-processing were chosen for their preeminence in the domestic economy of Ethiopia, which is a fast-developing country in terms of economic growth. The key recommendations of policy development at the corporate level and technical training for key managers would be highly transferable to other sectors in the future, such as construction—an area where high growth is likely to take place and where such policy changes, if implemented early on, could be instrumental in driving the shift to a CE at the earliest possible stage.

Annex 1 Questionnaire format

Variables
Knowledge of circular economy principles (rating on a scale of 1(strongly disagree) to 5 (strongly agree))
Recycling of resources
Innovative ways for extending a product's life, e.g., maintenance/repair/remanufacturing
Clean energy and efficient energy options
Government policies on waste and emission reduction
Safe disposal of wastes
Cost-effectiveness of resource sharing
Attitude towards circular economy practices (yes/no answer)
Design products to be easily recycled or recovered
Environmental purchasing criteria for selecting suppliers
Safe disposal of chemicals
Use renewable energy
Use new technologies for recycling
Use organic raw materials
Recycling of resources
Recovery of resources
Use of third-party logistics
Resource sharing
Practices in the circular economy (yes/no answer)
Innovative ways for extending a product's life, e.g., repair, maintenance, and remanufacturing
Sharing platform for materials and services
Take back/buy back schemes
Recycle/recover resources
Use recovered material to produce new products
Adopt efficient resource-use technologies
Safe disposal of toxic chemicals
Eco-labelling
Training employees on circular economy

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Data Availability The data is available on request from Belay Simane.

Declarations

Ethics Approval and Consent to Participate Ethics approval for field interviews was obtained at the College of Development Studies, Addis Ababa University, Ethiopia. The procedures used in this study adhere to the tenets of the Declaration of Helsinki.

Competing Interests The authors declare no competing interests.

References

1. Ahmad A, Madi Y, Abuhashesh M, Nusairat NM, Masa'deh R (2020) The Knowledge, attitude, and practice of the adoption of green fashion innovation. JOItmC 6(4):107. https://doi.org/10.3390/joitmc6040107
2. Alamerew YA, Kambanou ML, Sakao T, Brissaud DA (2020) Multi-criteria evaluation method of product-level circularity strategies. Sustainability 12(12):5129. https://doi.org/10.3390/su12125129
3. Andrade C, Menon V, Asmeen S et al (2020) Designing and conducting knowledge, attitude and practice surveys in psychiatry: practical guidance. Indian J Psychol Med 42(5):478. https://doi.org/10.1177/0253717620946111
4. Atanasovska I, Choudhary S, Koh L, Ketikidis PH, Solomon A (2020) Research gaps and future directions on social value stemming from circular economy practices in agri-food industrial parks: insights from a systematic literature review. J Clean Prod 354:131753. https://doi.org/10.1016/j.jclepro.2022.131753
5. Blomsma F, Brennan G (2017) The emergence of circular economy: a new framing around prolonging resource productivity. J Ind Ecol 21(3):603. https://doi.org/10.1111/jiec.12603
6. Bocken NMP, de Pauw I, Bakker C, van der Grinten B (2016) Product design and business model strategies for a circular economy. J Ind Prod Eng 33(5):308–320. https://doi.org/10.1080/21681015.2016.1172124
7. Caniato F, Caridi M, Crippa L, Moretto A (2012) Environmental sustainability in fashion supply chains: an exploratory case based research. Int J Prod Econ 135:659. https://doi.org/10.1016/j.ijpe.2011.06.001
8. Centobelli P, Cerchione R, Chiaroni D, Del Vecchio P, Urbinati A (2020) Designing business models in circular economy: a systematic literature review and research agenda. Bus Strategy Environ 29(4):1734–1749. https://doi.org/10.1002/bse.2466
9. Clarke T, Clegg S (2000) Changing paradigms: the transformation of management knowledge for the 21st century. Profile Books, London
10. Corrado S, Sala S (2018) Food waste accounting along global and European food supply chains: state of the art and outlook. Waste Manage 79:120–131. https://doi.org/10.1016/j.wasman.2018.07.032
11. Cruz LB, Boehe D (2008) CSR in the global marketplace. Manag Decis 46:1187
12. Daddi T, Ceglia D, Bianchi G, de Barcellos MD (2019) Paradoxical tensions and corporate sustainability: a focus on circular economy business cases. Corp Soc Responsib Environ Manag 1–11. https://doi.org/10.1002/csr.1719
13. D'Agostin A, de Medeiros JF, Vidor G, Zulpo M, Moretto CF (2019) Drivers and barriers for the adoption of use-oriented product-service systems: a study with young consumers in medium and small cities. Sustain Prod Consum 21:92–103. https://doi.org/10.1016/j.spc.2019.11.002
14. Dhir A, Sadiq M, Talwar S, Sakashita M, Kaur P (2020) Why do retail consumers buy green apparel? A knowledge-attitude-behaviour-context perspective. J Retail Consum Serv 59:102398. https://doi.org/10.1016/j.jretconser.2020.102
15. Desing H, Brunner D, Takacs F, Nahrath S, Frankenberger K, Hischier R (2020) A circular economy within the planetary boundaries: towards a resource-based, systemic approach Resour. Conserv Recycl 155:104673
16. Ellen MacArthur Foundation (2013) Towards the circular economy vol 1: an economic and business rationale for an accelerated transition. pp 21–34. https://ellenmacarthurfoundation.org/towards-the-circular-economy-vol-1-an-economic-and-business-rationale-for-an. Accessed: 29 September 2023

17. Ellen McArthur Foundation (2015) Delivering the circular economy, a toolkit for policymakers. https://ellenmacarthurfoundation.org/a-toolkit-for-policymakers. Accessed: 29 September 2023
18. Ellen MacArthur Foundation (2017) Fashion and the circular economy. https://archive.ellenmacarthurfoundation.org/explore/fashion-and-the-circular-economy. Accessed: 29 September 2023
19. Ellen MacArthur Foundation (2017) A new textiles economy: redesigning fashion's future. https://emf.thirdlight.com/file/24/uiwtaHvud8YIG_uiSTauTlJH74/A%20New%20Textiles%20Economy%3A%20Redesigning%20fashion%E2%80%99s%20future.pdf. Accessed: 22 December 2023
20. European Commission (2011) Roadmap to a resource efficient Europe. COM(2011) 571 https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=CELEX:52011DC0571. Accessed: 22 December 2023
21. European Commission (2015) 'Closing the loop - an EU action plan for the circular economy'. COM(2015) 614 final. 2.12.2015. https://eur-lex.europa.eu/resource.html?uri=cellar:8a8ef5e8-99a0-11e5-b3b7-01aa75ed71a1.0012.02/DOC_1&format=PDF. Accessed: 22 December 2023
22. European Commission (2020) 'A new circular economy action plan - for a cleaner and more competitive Europe'. COM(2020) 98 final. https://eur-lex.europa.eu/legal-content/EN/TXT/?qid=1583933814386&uri=COM:2020:98:FIN. Accessed: 22 December 2023
23. European Commission (2022) 'EU strategy for sustainable and circular textiles COM(2022) 141 final. https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=CELEX%3A52022DC0141. Accessed: 22 December 2023
24. Food and Agriculture Organization of the United Nations (FAO) (2014) Save food: global initiative on food loss and waste reduction. 'Definitional Framework of Food Loss'. Working Paper, Rome, Italy
25. FAO (2019) The state of food and agriculture, moving forward on food loss and waste reduction. Italy, Rome
26. Federal Democratic Republic of Ethiopia (2011) Ethiopia's climate-resilient green economy: Green economy strategy. FDRE, Addis Ababa
27. Federal Democratic Republic of Ethiopia (2016) Growth and Transformation Plan II (GTP II) (2015/16-2019/20). FDRE, National Planning Commission, Addis Ababa
28. Federal Democratic Republic of Ethiopia (2019) Green Manufacturing Strategy - 2019. Growing Industry Sustainably. FDRE, Industrial Parks Development Corporation (IPDC), Addis Ababa
29. Federal Democratic Republic of Ethiopia, Planning and Development Commission (2021) 'Ten years development plan – a pathway to prosperity (2021–2030)'. https://www.ircwash.org/sites/default/files/ten_year_development_plan_a_pathway_to_prosperity.2021-2030_version.pdf. Accessed: 22 December 2023
30. Federal Democratic Republic of Ethiopia (2021) Vision 2030: transforming Ethiopian food systems. Federal Democratic Republic of Ethiopia: Food Systems Pathway Commitment and Vision Statement. Addis Ababa
31. Geissdoerfer M, Savaget P, Bocken N, Hultink E (2017) The circular economy – a new sustainability paradigm? J Clean Prod 143:757–768. https://doi.org/10.1016/j.jclepro.2016.12.048
32. Ghisellini P, Cialani C, Ulgiati S (2016) A review on circular economy: the expected transition to a balanced interplay of environmental and economic systems. J Clean Prod 114:11–32. https://doi.org/10.1016/j.jclepro.2015.09.007
33. Gioia DA, Corley KG, Hamilton AL (2013) Seeking qualitative rigor in inductive research: notes on the Gioia methodology. Organ Res Methods 16(1):15–31. https://doi.org/10.1177/1094428112452151
34. Goworek H, Oxborrow L, Claxton S, McLaren A, Cooper T, Hill H (2018) Managing sustainability in the fashion business: challenges in product development for clothing longevity in the UK. J Bus Res 117:629–641. https://doi.org/10.1016/j.jbusres.2018.07.021
35. Greene WH (2003) Econometric analysis, 5th edn. Prentice Hall, Upper Saddle River
36. Gusmerotti NM, Testa F, Corsini F, Pretner G, Iraldo F (2019) Drivers and approaches to the circular economy in manufacturing firms. J Clean Prod 230:314–327. https://doi.org/10.1016/J.JCLEPRO.2019.05.044
37. Gujarati DN (2004) Basic econometrics. McGraw−Hill, New York
38. Hossain MdB, Nassar S, Rahman MU, Dunay A, Illes CB (2022) Exploring the mediating role of knowledge management practices to corporate sustainability. J Clean Prod 374:133869. https://doi.org/10.1016/j.jclepro.2022.133869
39. Jensen JP, Prendeville SM, Bocken NMP, Peck D (2019) Creating sustainable value through remanufacturing: three industry cases. J Clean Prod 218:304–314. https://doi.org/10.1016/j.jclepro.2019.01.301
40. Jensen F, Whitfield L (2022) Leveraging participation in apparel global supply chains through green industrialization strategies: implications for low-income countries. Ecol Econ 194:107331. https://doi.org/10.1016/j.ecolecon.2021.107331
41. Jia F, Yin S, Chen L, Chen X (2020) The circular economy in the textile and apparel industry: a systematic literature review. J Clean Prod 259:120728. https://doi.org/10.1016/j.jclepro.2020.120728

42. Kazancoglu I, Kazancoglu Y, Yarimoglu E, Kahraman A (2020) A conceptual framework for barriers of circular supply chains for sustainability in the textile industry. Sustain Dev 28(5):1477–1492. https://doi.org/10.1002/sd.2100
43. Khan O, Daddi T, Slabbinck H, Kleinhans K, Vazquez-Brust D, De Meester S (2020) Assessing the determinants of intentions and behaviors of organizations towards a circular economy for plastics. Resour Conserv Recy 163:105069. https://doi.org/10.1016/j.resconrec.2020.105069
44. Kirchherr J, van Santen R (2019) Research on the circular economy: a critique of the field Resour. Conserv Recy 151:104480. https://doi.org/10.1016/j.resconrec.2019.104480
45. Kirchherr J, Yang N-HN, Schulze-Spüntrup F, Heerink MJ, Hartley K (2023) Conceptualizing the circular economy (revisited): an analysis of 221 definitions. Resour Conserv Recy 194:107001. https://doi.org/10.1016/j.resconrec.2023.107001
46. Klein N, Deutz P, Ramos TB (2022) A survey of circular economy initiatives in Portuguese central public sector organisations: National outlook for implementation. J Environ Manage 314:114982. https://doi.org/10.1016/j.jenvman.2022.114982
47. Koistinen K, Onkila T, Teerikangas S, Mäkelä M, Sarja M, Valkjärvi M (2022) Bold ambition, blunted agency? Examining top management perspectives on a circular economy transition in Finland. Energy Res Soc Sci 86:103451. https://doi.org/10.1016/j.erss.2021.102451
48. Kör B, Krawczyk A, Wakkee I (2022) Addressing food loss and waste prevention. Br Food J 124(8):2434–2460. https://doi.org/10.1108/BFJ-05-2021-0571
49. Kowalski Z, Makara A (2020) The circular economy model used in the polish agro-food consortium: a case study. J Clean Prod 284:124751. https://doi.org/10.1016/j.jclepro.2020.124751
50. Launiala A (2009) How much can a KAP survey tell us about people's knowledge, attitudes and practices? Some observations from medical anthropology research on malaria in pregnancy in Malawi. Anthropol Matters 11(1):1. https://doi.org/10.22582/am.v11i1.31
51. Liakos N, Kumar V, Pongsakornrungsilp S, Garza-Reyes JA, Gupta B, Pongsakornrungsilp P (2019) Understanding circular economy awareness and practices in manufacturing firms. J Enterp Inf Manage. https://doi.org/10.1108/jeim-02-2019-0058
52. Liao X, Nguyen TPL, Sasaki N (2022) Use of the knowledge, attitude, and practice (KAP) model to examine sustainable agriculture in Thailand. Reg Sustain 3(1):41
53. Liu Q, Li H, Zuo X, Zhang F, Wang L (2009) A survey and analysis on public awareness and performance for promoting circular economy in China: a case study from Tianjin. J Clean Prod 17(2):265–270. https://doi.org/10.1016/j.jclepro.2008.06.003
54 Maaß O, Grundmann P (2018) Governing transactions and interdependences between linked value chains in a circular economy: the case of wastewater reuse in Braunschweig (Germany). Sustainability 10(4):1125. https://doi.org/10.3390/su10041125
55. Maitre-Ekern E (2021) Re-thinking producer responsibility for a sustainable circular economy from extended producer responsibility to pre-market producer responsibility. J Clean Prod 286:125454. https://doi.org/10.1016/j.jclepro.2020.125454
56. Masi D, Kumar V, Garza-Reyes JA, Godsell J (2018) Towards a more circular economy: exploring the awareness, practices and barriers from a focal firm perspective. Prod Plan Control 29(6):539–550. https://doi.org/10.1080/09537287.2018.1449246
57. McKinsey & Company and Global Fashion Agenda. Fashion on climate: how the fashion industry can urgently act to reduce its greenhouse gas emissions (2020) Available at: https://www.mckinsey.com/~/media/mckinsey/industries/retail/our%20insights/fashion%20on%20climate/fashion-on-climate-full-report.pdf. Accessed: 29 September 2023
58. Merli R, Preziosi M, Acampora A (2018) How do scholars approach the circular economy? A systematic literature review. J Clean Prod 178:703–722. https://doi.org/10.1016/j.jclepro.2017.12.112
59. Milios L (2018) Advancing to a circular economy: three essential ingredients for a comprehensive policy mix. Sustain Sci 13:861–878. https://doi.org/10.1007/s11625-017-0502-9
60. Monciardini D, Dalhammar C, Malcolm R (2022) Introduction to the special issue on regulating the circular economy: gaps, insights and an emerging research agenda. J Clean Prod 350:131341. https://doi.org/10.1016/j.jclepro.2022.131341
61. Moreau V, Sahakian M, Griethuysen P, Vuille F (2017) Coming full circle: why social and institutional dimensions matter for the circular economy. J Ind Ecol 21(3):497–506. https://doi.org/10.1111/jiec.12598
62. Murali M, Kayal P, Maiti M (2023) Should you invest in the companies that promote the circular economy idea? Manag Environ Q ahead-of-print no. ahead-of-print. https://doi.org/10.1108/MEQ-07-2022-0193
63. Nguyen TPL, Seddaiu G, Roggero PP (2019) Declarative or procedural knowledge? Knowledge for enhancing farmers' mitigation and adaptation behaviour to climate change. J Rural Stud 67:46. https://doi.org/10.1016/jrurstud.2019.02.005

64. Pathak R, Endayilalu A (2019) Circular economy: a perspective of Ethiopian textile sector. IJCIRAS 11(1):2581
65. Ranta V, Aarikka-Stenroos L, Väisänen J-M (2021) Digital technologies catalyzing business model innovation for circular economy – multiple case study. Resour Conserv Recy 164:105155. https://doi.org/10.1016/j.resconrec.2020.1051
66. Ravelo JL (2018) Mapping the environmental impacts of China's textile industry', Devex. https://www.devex.com/news/mapping-the-environmental-impacts-of-china-s-textile-industry-91905. Accessed 22 Dec 2023
67. Rejeb A, Rejeb K, Zailani S, Kayikci Y, Keogh JG (2022) Examining knowledge diffusion in the circular economy domain: a main path analysis. Circ Econ Sust 3:125–166. https://doi.org/10.1007/s43615-022-00189-3
68. Rogers EM (2003) 2003, 5th edn. Diffusions of innovations. Free Press, New York
69. Sahimaa O, Miller EM, Halme M, et al (2023) From simplistic to systemic sustainability in the textile and fashion industry. Circ Econ Sust (2023). https://doi.org/10.1007/s43615-023-00322-w
70. Sehnem S, Kuzma E, Julkovsky DJ, Frare MB, Vazquez-Brust D (2021) Megatrends in circular economy: avenues for relevant advancements in organizations. Circ Econ Sust 1:173–208. https://doi.org/10.1007/s43615-021-00036x
71. Stahel WR, Clift R (2016) Stocks and flows in the performance economy. In: Clift R, Druckman A (eds) Taking stock of industrial ecology. Springer, Cham, p 137
72. Su B, Heshmati A, Geng Y, Yu X (2013) A review of the circular economy in China: moving from rhetoric to implementation. J Clean Prod 42:215–227. https://doi.org/10.1016/j.jclepro.2012.11.020
73. Suikkanen J, Saarinen I, Näyhä A (2022) Practices and perceptions on ecolabels of Finnish companies with circular economy business models. In Albrecht S, Fischer M, Scagnetti C, Barkmeyer M, Braune A (Eds.), LCM 2021: 10th International conference on life cycle management (article 01005). EDP Sciences. E3S Web of Conferences, pp 349. https://doi.org/10.1051/e3sconf/202234901005
74. Teixeira TGB, Fleith de Medeiros J, Kolling C, Duarte Ribeiro JL, Morea D (2023) J Clean Prod 397:136588. https://doi.org/10.1016/j.jclepro.2023.136588
75. Trần TV, Phan TH, Lê ATT, Trần TM (2022) Evaluation of factors affecting the transition to a circular economy (CE) in Vietnam by structural equation modeling (SEM). Sustainability (Switzerland) 14(2):613. https://doi.org/10.3390/su14020613
76. United Nations General Assembly, Resolution 70/1, 'Transforming our world: the 2030 agenda for Sustainable Development', A/RES/70/1, 25 September 2015. https://www.un.org/en/development/desa/population/migration/generalassembly/docs/globalcompact/A_RES_70_1_E.pdf. Accessed 22 Dec 2023
77. Urbinati A, Franzò S, Chiaroni D (2021) Enablers and barriers for circular business models: an empirical analysis in the Italian automotive industry. Sustain Prod Consum 27:551–566. https://doi.org/10.1016/j.spc.2021.01.022
78. Usai A, Scuotto V, Murray A, Fiano F, Dezi L (2018) Do entrepreneurial knowledge and innovative attitude overcome 'imperfections' in the innovation process? Insights from SMEs in the UK and Italy. J Knowl Manag 22(8):1637. https://doi.org/10.1108/JKM-01-2018-0035
79. Waste and Resources Action Programme (WRAP) (2017) Sustainable clothing: a practical guide to enhancing clothing durability and quality. Available at: https://wrap.org.uk/sites/default/files/2020-08/WRAP-Sustainable-Clothing-Guide-2017.pdf. Accessed: 29 September 2023
80. Wooldridge JM (2002) Econometric analysis of cross section and panel data. The MIT Press, Cambridge, Massachusetts
81. Worneh S, Tesafa F, Fanta A, Mengistnew M (2017) Study of agro-food processing industries in Ethopia: policy and strategy options for its development (2015–2025). FDRE Policy Study and Research Center (PSRC) and Bahirdar University Institute of Technology (BiT), Research Report

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