



Does circular economy knowledge matter in sustainable service provision? A moderation analysis

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ABSTRACT

Research has shown that achieving sustainable advantage requires building organisational competencies and dynamic capabilities. It has therefore become imperative to extend the understanding of service research by exploring the antecedents of sustainable services. Drawing on organisational-level variables, this study examines the effects of institutional factors (IF), contextual factors (CF), and strategic factors (SF) on the adoption of circular economy (CE) within service organisations and their impact on sustainable service provision. The paper further examines how circular economy knowledge moderates the impact of organisational factors on CE practice adoption. Using Ghana's service sector as a case study, 493 top-management employees from 267 service organisations were surveyed using simple random sampling. The study found that organisational factors lay the foundation for CE practice adoption, and CE knowledge enhances the relationship. Additionally, CE adoption contributes to sustainable service provision via three channels: (1) service longevity, (2) service sharing, and (3) service ownership. The results confirm CE indicators are relevant for predicting sustainable service outcomes and shed light on managerial implications.

1. Introduction

Organisational studies have found that the key to achieving sustainable advantage is building organisational competencies and dynamic capabilities (Kraatz and Zajac, 2001; Wang and Ahmed, 2007; Teece et al., 2016; Rosati and Faria, 2019). Therefore, there is a need to expand the understanding of the service research field by exploring the antecedents of sustainable services. Service is defined as “any act or performance that a party can provide to another that is essentially intangible and does not result in ownership of anything” (Kotler, 1997, p.467). The service sector's constant growth and a shift toward becoming increasingly complex and interdisciplinary are well

documented (Wolfson et al., 2011; Grubel and Walker, 2019). Therefore, it is unsurprising that services now represent the largest share of the global economy. However, there has been little incorporation of sustainability in service design and provision until today (Larrinaga et al., 2020; Field et al., 2021).

The pace of sustainability and the intensity of competition require organisations to renew processes and outcomes (Ozbekler and Ozturkoglu, 2020). New products and services are not the only challenge but also changing the nature of the services offered by organisations (Buhalis et al., 2019; Seetharaman, 2020). For example, service structures, processes, and practices can be adapted to generate competitive advantage (Ozbekler and Ozturkoglu, 2020). In studies such as Baines

Abbreviations: CE, Circular Economy; IF, Institutional Factors; SF, Strategic Factors; CF, Contextual Factors; PSS, Product-Service System; CBM, Circular Business Model; GDP, Gross Domestic Product; GSS, Ghana Statistical Services; EFA, Exploratory Factor Analysis; CFA, Confirmatory Factor Analysis; PCA, Principal Components Analysis; SEM, Structural Equation Modelling.

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et al. (2007) and Tseng et al. (2018), sustainable service has demonstrated how it can affect an organisation, be beneficial to it and redefine an industry by influencing the spread of new ideas. Sustainable service development has become a focus of attention among scholars (Maxwell and Van der Vorst, 2003; Hussain et al., 2016). Shirahada and Fisk (2011) define sustainable services as satisfying the needs of present and future providers and recipients for mutual value co-creation without compromising future value co-creation quality. Elsewhere, in their definition of sustainable service, Letaifa and Reynoso (2015) state that a sustainable service encompasses not only satisfying customer demands and being sustainable without causing harm to the environment but generating basic value to serve customer needs more sustainably as well. In these definitions, developing 'new and alternative values' is, in essence, a concept of sustainable service at large. For example, recycling water and using ecological detergents in the car wash industry are well-known examples of sustainable services (Nidumolu et al., 2009). Similarly, carbon labelling is also well-documented, enabling manufacturers, suppliers, and customers to reduce human-generated greenhouse gas emissions (Wolfson et al., 2011).

Despite the significant progress made in service research, only a few studies have examined antecedents of sustainable service (Harris and Ogbonna, 2002; Elhoushy, 2020). Research on green initiatives has lately focused on technology (Alam et al., 2022; Cohen et al., 2016; Heyes et al., 2018), environmental sustainability initiatives (Todeschini et al., 2017; Ayompe et al., 2021), and consumer pressure and perception (Alvarado-Herrera et al., 2017; Iglesias et al., 2019). Research focusing on organisational-level antecedents is vital for understanding what triggers sustainable service provision. Even though customers recognise organisations as the driving force behind sustainable service decisions (Brinkerhoff and Wetterberg, 2016), it remains unclear what obstacles and triggers influence service organisations to adopt enabling practices toward sustainability outcomes (Heyes et al., 2018; Massoud et al., 2021). Also, no theoretical framework explains how and under what circumstances organisations adopt CE practices for sustainable services (Hidalgo-Carvajal et al., 2021; Atstaja et al., 2022).

CE integrates resources efficiently by reducing waste and retaining value for long periods, reducing the use of primary resources, and providing socio-economic benefits in closed loops (De Jesus and Mendonça, 2018; Hailemariam and Erdiaw-Kwasie, 2022; Kirchherr et al., 2017). In addition to being a potential path to sustainable development, CE decouples economic growth from the adverse effects of resource depletion and environmental degradation (Murray et al., 2017; Babbitt et al., 2018; Hofmann, 2019). Although significant efforts and attention have been given to circularity, the global circularity rate stands at only 8.6% (Haas et al., 2015), and it is widely emphasized that accelerated transitions from linear to circular paradigms are required (Bauwens et al., 2020; Haas et al., 2015). At the organisational level in emerging economies, there is limited knowledge about accelerating the adoption of CE practices (Bauwens et al., 2020; Haas et al., 2015). A recent study by Kirchherr and van Santen (2019) finds that only 5% of articles on circular economies focus on developing and emerging economies.

Focusing on organisational-level antecedents to sustainable services as the entry point, this research uses Ghana's largest and fastest-growing sector, the service industry, as the case study. This study investigates the i) effects of organisational factors (contextual factors (CF) and strategic factors (SF) on CE adoption, ii) impacts of CE adoption on sustainable service outcomes, and iii) moderating role of CE knowledge on the relationship between IF, CF, SF and CE adoption.

The study makes four (4) significant contributions to the service research literature. First, the extant literature has focused mostly on the effects of sustainable service with less attention on its antecedents. This study contributes to the least research aspects of sustainable service research by offering a model that opens a new discussion on the topic at the organisational level. In the case of this study, CE adoption is modelled as an antecedent of sustainable service, which presents a different dimension to the sustainable service debate that has not been

studied to date. Second, based on previous research exploring different development paths toward circularity as well as circular futures (Bauwens et al., 2020), this study responds to the demand for theoretical background on accelerating CE practice adoption (Korhonen et al., 2018). The study provides an organisational contribution to the ongoing debate about circular disruption, which aims at refocusing CE research to consider how to achieve CE adoption faster and on a larger scale. Third, to the best of our knowledge, this research is the first to introduce circular economy knowledge across the field of sustainable service research to examine its moderation role. The study's approach helps to better understand how the different relationship between organisational factors and CE adoption impacts sustainable service outcomes. Fourth, existing literature on product-service systems (PSS) based on business models shows that service sustainability supports CE (Reim et al., 2015; da Costa Fernandes et al., 2020). However, there is a lack of empirical studies investigating the reverse relationship regarding how CE enables sustainable service outcomes. The study findings unravel a new direction and perspective on the sustainable service-CE nexus.

This paper is organised as follows. The next section reviews the relevant literature and develops hypotheses for the study. Subsequently, the findings from the empirical analysis using a sample of organisations offering different services. Finally, the paper concludes with a discussion of results, implications, limitations, and issues for further research.

2. Literature and hypotheses development

2.1. Sustainable service

Sustainable production and consumption require changing the traditional model where firms sell products and customers purchase them (Armstrong et al., 2015; Brax, 2005; Gebauer et al., 2005). A company in a traditional product-oriented model has incentives to sell as many products as possible. In contrast, a company with a service-oriented model provides a service, and consumables and products become a cost factor (Tukker, 2015). As a result, businesses are motivated to develop products that can be maintained and repaired at a low cost and a long service life if they also cover the maintenance and repair expenses (Mont, 2002). In addition, by focusing on functionality rather than product sales, the environmental implications of the product offerings will be reduced, and durability will be placed higher on the design priority list (de Jesus Pacheco et al., 2019; Mont, 2002). It has been demonstrated in some studies that product-oriented models are being transformed into service-oriented models (Kamal et al., 2020; Kowalkowski et al., 2017). A typical example of a model illustrating such a transition is the PSS - an integrated system of products, services, infrastructure, and competitive support networks, that satisfy customers' needs and have a lower environmental impact than traditional business models (Michellini et al., 2017; Tukker and Tischner, 2006). By creating PSS incentives, providers can increase resource efficiency, prolong the product's lifetime, optimize its use, and use remanufacturing strategies for their products (Reim et al., 2015; Sassanelli et al., 2019; Tukker, 2015). Despite this, Van Ostaeyen et al. (2013) indicate that not all PSS models are inherently sustainable, emphasising the importance of more sustainable service approaches.

As shared by (Klassen and Whybark, 1999), sustainable service entails setting objectives, plans, and processes that determine operations' position and responsiveness to environmental issues and regulations. According to Shirahada and Fisk (2011), a sustainable service facilitates mutual value creation between current providers and recipients without decreasing the quality of future value creation. However, services do not exist in their own right. They must be able to fit into an active system or function. From a functional and cultural perspective, they exist in systems that take on an identity of their own (Sierra-Pérez et al., 2021; Tseng et al., 2018). The concept of sustainable service is present in all sectors of society, such as sustainable transport services (bike sharing for short periods, electric scooter rentals for short periods), sustainable

health services (paperless patient service, telehealth), and sustainable environmental services (eliminating plastic bags, making use of renewable energy sources). It is imperative to integrate eco-design and service design perspectives when designing sustainable services to foster user adoption and behavioural change (Chen and Chen, 2021; Siera-Pérez et al., 2021). Chart and Tischner (2017) further illustrate the dynamics of sustainability in service provision through the integration of the triple bottom line concept, which extends the biophysical concept of service sustainability to include social and economic dimensions.

There are three streams of research in the field of sustainable service. The first is the literature on the effects of sustainable service. Studies have shown that service sustainability affects public trust, financial performance, customer satisfaction, and organisational reputation (Verma et al., 2013; Baah et al., 2021). The positive effect extends to studies investigating sustainable services as an antecedent variable to various outcomes in developing countries. For example, according to Pakurár et al. (2019), sustainable service improves customer satisfaction in Jordan, while Nguyen and Adomako (2022) report similar results for Vietnam. On the other hand, the impact of sustainable services on socio-economic outcomes is negative in other studies. Specifically, Singjai et al. (2018) find that sustainable service negatively affects cost performance in emerging markets.

Literature in the second strand discusses strategies, methodologies, and tools for creating sustainable services, among others (Maxwell and Van der Vorst, 2003; Chou et al., 2012; Liyu and Yan, 2019). For instance, Maxwell and Van der Vorst (2003) drew from Ireland's Environmentally Superior Products initiative to develop a method for effective, sustainable product and service development in the manufacturing and service industry. The third stream of literature focuses on the antecedents of sustainable service. Carneiro (2000) argues that organisations cannot remain competitive if they do not understand the determinants of or constraints to sustainable service initiatives. Most organisations pursue sustainable services to compete effectively in global markets (Amankwah-Amoah, 2016; Laszlo and Zhexembayeva, 2017). However, Nguyen and Adomako (2022) have pointed out that understanding and managing sustainable service concerns is challenging because little is known about its antecedents, particularly at the organisational level. There is evidence that the provision of sustainable services depends on regulatory and legal requirements (Charles, 2019; Olujobi and Olusola-Olujobi, 2019), stakeholder pressures (Wolf, 2014; Erdiaw-Kwasie, 2018; Baah et al., 2020; Nguyen and Adomako, 2022), resource availability (Ajmal et al., 2021; Baah et al., 2021), and COVID-19 adaptability (Chen et al., 2021; Filimonau et al., 2021). There is extensive research in the first and second streams, but fewer studies have been conducted in the third stream, particularly ones that focus on the efficient use of resources and innovation. Taking a circular standpoint, this paper contributes to this strand of literature at the organisational level.

2.2. Organisational factors and CE adoption

In recent years, a growing number of scholars have recognised the importance of organisational factors (Valaei et al., 2017; Alam et al., 2022; Tarillon, 2022). Junni et al. (2015) defined organisational factors as those that affect the business entity's structural, operational, human, and managerial aspects. During the past decade, organisations' technological capability has played a critical role in achieving a competitive advantage within most industries (Gunasekaran et al., 2017). A study by Wang et al. (2015) suggests that companies with superior technological capabilities (strategic factor) are more innovative and, as a result, more responsive to adopting new practices. Using environmental accounting tools, Aranda-Usón et al. (2020) studied the links between IF and CE adoption in Spain's manufacturing industry. The authors conclude that institutional support correlates positively with CE adoption in manufacturing. Similarly, according to Ünal et al. (2019), value propositions and contextual dimensions enable CE business models to reach

their intended goals. Lastly, Van Buren et al. (2016) provide statistical evidence that SF is a critical determinant in CE adoption in Dutch logistics industries.

CE adoption is receiving increasing attention in the scholarly discourse. Despite the widespread application of circular strategies across sectors (Blomsma & Brennan, 2017), recent studies have highlighted the need for speed in systemic transitions (Bauwens et al., 2020; Haas et al., 2015; Mathivathanan et al., 2022; Smol et al., 2021). As a result, CE research now centres on achieving a circular disruption (Droege et al., 2022; Neligan et al., 2022). As a consequence of circular disruption, a socio-technical system undergoes a systemic, widespread, and rapid change from the harmful "take-make-use-dispose" model to a more sustainable and socially desirable model that uses circular strategies to reduce resource consumption and reduce structural waste (Bauwens et al., 2020). As Zink and Geyer (2017) noted, a circular disruption reduces or negates the effects of a circular rebound. However, it has become increasingly clear that barriers preventing CE adoption and disruption have emerged in recent years (De Jesus and Mendonça, 2018; Kirchherr et al., 2017). The slow CE adoption and disruption have been attributed to various barriers, such as regulatory, technical, market, cultural and organisational barriers (de Jesus and Mendonça, 2018; Hartley et al., 2020; Kazancoglu et al., 2021; Kirchherr et al., 2017). In the manufacturing sector in developed economies, the relationship between organisational factors and CE adoption has been largely theorised and discussed as the key driver of eco-innovative practice (Bag et al., 2021; Bossle et al., 2016; Cai and Li, 2018; Yadav et al., 2020), and little empirical evidence exists for the service sector in the developing world. While the previous literature has some key barriers and enablers to CE adoption and implementation, organisational factors appear as key determinants of CE adoption in this study. As a result of these arguments, the study hypothesises that all three organisational factors are positively related to CE adoption:

- H1. IF positively influence CE adoption
- H2. CF positively influence CE adoption
- H3. SF positively impact CE adoption

2.3. Circular economy and sustainable service

Research on CE is emerging and contested despite its visionary and provocative message. Various definitions exist for the concept. For example, Yuan et al. (2008) explain that CE is primarily about circular (closed) flows of materials and using raw materials and energy. According to Webster (2015), a circular economy is intended to be restorative by design while maximising the value and utility of its products, components, and materials. According to Bocken et al. (2016, p.309), a circular economy consists of "design and business models that reduce, close, and narrow resource loops". Elsewhere, a new definition for the circular economy was proposed by Kirchherr et al. (2017) after reviewing 114 definitions. They defined CE as an economic system that is based on business models, which replaces the 'end-of-life' concept with reducing, alternatively reusing, recycling and recovering materials in production/distribution and consumption processes, thus operating at the micro level (products, companies, consumers), meso level (eco-industrial parks) and macro level (city, region, nation and beyond), to accomplish sustainable development, which implies creating environmental quality, economic prosperity and social equity, to the benefit of current and future generations.

Developing and implementing circular economy systems requires designing and implementing business models that maximize value while using as few resources as possible (Atasu et al., 2021; Hailemariam and Erdiaw-Kwasie, 2022). As part of adopting the circular economy model, organisations must create new business models by rethinking value propositions and developing value chains that are cost-effective, production effective, and competitive (Atasu et al., 2021; Lüdeke-Freund

et al., 2019). As Rosa et al. (2019a) and Tukker (2015) describe, circular business models (CBM) are new types that use the economic value stored in products for new types of market offerings. Adopting CBMs is one way to move toward an increasingly regenerative economy (Bocken et al., 2016; Urbinati et al., 2020; Rosa et al., 2019b). The PSS-based CBM is one of several CBMs available in the literature (Tukker and Tischner, 2006; Tukker, 2015) considered simple innovation strategies. However, there are challenges associated with creating a CBM, and taking the wrong approach can be extremely costly. It has been demonstrated that barriers to CBM exist at every level, including socio-technical, organizational, value chain, employee, and market and institutional levels (Bianchini et al., 2019; Guldmann and Huulgaard, 2020; Vermunt et al., 2019; Galvão et al., 2022). As Urbinati et al. (2017) describe, identified barriers to CBM result in a lack of operational frameworks and knowledge about CBM processes, delaying CBM uptake (Linder and Willander, 2017) and the transition to sustainability (Boons et al., 2013).

The CE has been touted for the past decade as having many sustainability benefits (Dantas et al., 2021; Geissdoerfer et al., 2017). CE encourages consumers to share services among themselves (Daunorienė et al., 2015; Ertz et al., 2018). In addition to providing value to users, service sharing enables them to access a more comprehensive set of resources, such as pre-owned products and informal peer-to-peer services (Ertz et al., 2018). Some empirical studies have supported the assertion that CE adoption can change basic services to more shared and cost-saving ones (Demirel and Danisman, 2019; Ormazabal et al., 2018). Researchers have recently examined service-sharing examples, including peer-to-peer online exchanges, bike and home-sharing, and ridesharing (Ryu et al., 2019; Yang et al., 2021). CE has also often been praised from an economic perspective for facilitating the effective, timely, and efficient allocation of resources between an owner and a user (Hobson and Lynch, 2016). Based on these findings, the study hypothesises that CE positively impacts sustainable service provision through ‘service ‘sharing’.

In terms of a CE level of analysis, the most obvious but largely overlooked implication is the level of service longevity, which is typically measured by how much extra functionality the service contains (Bocken et al., 2016; Ellsworth-Krebs et al., 2022). That could be reused in the future, and how much of the service’s functionality will likely go beyond what is currently required. CE emphasises activities that preserve energy, labour, and materials, implying that organisations should pursue durable services. Several scholars have made similar arguments in the context of developed economies (Ghisellini and Ulgiati, 2020;

Tukker and Tischner, 2017). According to Ghisellini and Ulgiati’s (2020) Italian study, organisations with CE culture promote repurposing customer services. Furthermore, other research has indicated that CE adoption can promote service capabilities based on possible future service use scenarios (Kalmykova et al., 2018; Tischner and Tukker, 2017). However, in the developing country context, there is no evidence that CE practices relate to the longevity of services other than the well-documented tendency for CE to be a core component of sustainable service design. Based on the above arguments, this study hypothesises that CE improves service quality and positively impacts service longevity.

CE has a third effect, which is illustrated in Fig. 1. In other words, just as PSS-based CBM focuses on service sharing, it also argues that ownership structures are crucial in determining the circulation of services. A traditional CBM is based on the product-as-a-service model, which ensures that providers retain ownership of materials while end-users purchase a service on a limited basis (Konietzko et al., 2020; Lüdeke-Freund et al., 2019). The focus is on product functionality rather than product sales by applying concepts from PSS-based CBM literature and transitioning from product-oriented to service-oriented models. For example, in pay-per-use services, the product function (service) ownership remains with the provider, increasing both the product’s longevity and reducing consumer ownership burdens (Cherry and Pidgeon, 2018). Differently, instead of assuming that all products must be purchased, owned, and disposed of by their users, products with valuable technical elements, such as cars, televisions, carpets, computers, and refrigerators, could be reconceived as services users want to enjoy (Nansubuga and Kowalkowski, 2021). The users would, in this scenario, buy the product’s service rather than own it. In such cases, service providers are incentivised to maintain upgrades and the quality of their service during its lifetime. In addition, PSS-based CE actions increase service ‘providers’ control and ownership of products and materials by focusing on performance rather than volume. Through such practices, material costs can be reduced, protected against material price shocks, and hedged against material scarcity issues, which can underscore efforts to provide sustainable services. Drawing from the above discussion, the study proposes the following hypotheses:

- H4a. CE adoption positively influences service longevity
- H4b. CE adoption positively impacts service sharing
- H4c. CE adoption positively influences service ownership

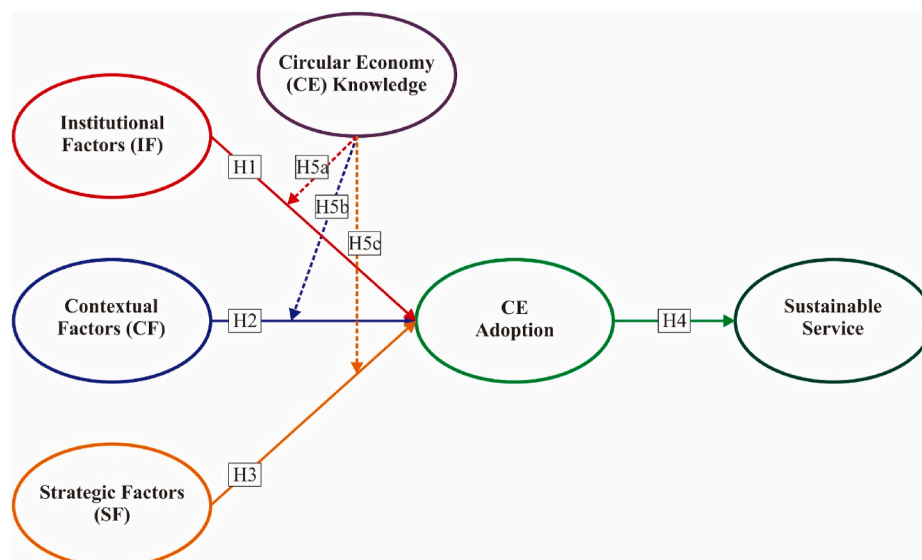


Fig. 1. Conceptual model.

2.4. CE knowledge, organisational factors and CE adoption

This study proposes that a high level of CE knowledge will enhance the positive influence of organisational factors (IF, CF, and SF) on CE adoption. As a fundamental driver of eco-innovative processes, CE knowledge promotes reuse, sharing, repair, refurbishment, remanufacturing and recycling to create a closed system to reduce resources input and waste, pollution and emissions (Geissdoerfer et al., 2017; Ghisellini and Ulgiati, 2020). When CE knowledge among employees and across an organisation is high, the coordination and communication about new approaches like circular techniques are more effective (Bag et al., 2020; de Abreu and Ceglia, 2018; Flores et al., 2018; Potting et al., 2017). Several studies have found that an organisation's ability to coordinate, create, and disseminate knowledge is vital in developing the green economy and opening new opportunities (Al-Omouh et al., 2020; Lin and Chen, 2017). According to Tsai and Liao (2017), an organisation's adoption of eco-innovation relies heavily on its strategic knowledge base. With a high level of CE knowledge, employees are more likely to see the organisation's commitment to sustainable outcomes. In the CE knowledge process, employees are encouraged to engage in open and dynamic discussions and information exchanges about circular actions and their impacts across organisations (Flores et al., 2018). Accordingly, the link between organisational factors and CE adoption is stronger in high CE knowledge than in low CE knowledge. It is highly likely that when there is a high CE knowledge process, the organisation can experiment with new practices and business models to solve problems and improve performance. Thus, this study proposes and tests three hypotheses:

H5a. CE knowledge moderates the relationship between IF and CE adoption

H5b. CE knowledge moderates the relationship between CF and CE adoption

H5c. CE knowledge moderates the relationship between SF and CE adoption

3. Research methods

Like other quantitative studies, a literature review was conducted to map and assess the CE and sustainable service literature to justify the research questions and hypotheses. In addition, the review was also used to identify items that appropriately define the latent variables adopted for the study. Tranfield et al. (2003) notes that the traditional literature review approach lacks thoroughness and rigour due to its ad hoc process rather than a specified methodology. To ensure the literature for the study is valid and provides a good summary of the body of research on CE and sustainable services, search strings were carefully designed with appropriate synonyms and a combination of search terms (e.g., 'circular economy* AND 'sustainable service*', '*circularity AND 'sustainable service*'). Outcomes from the search were assessed using the following criteria. The papers considered for this review were all peer-reviewed papers written in English and publication types irrespective of geographic location and study design. Articles that satisfied the selection criteria were then analysed and summarised in descriptive information such as authors, year published, topic, study type and key findings. Finally, the summarised results were combined to form the basis of the study's literature.

3.1. Survey design and data collection

The study adopted a cross-sectional design to address the research question. A cross-sectional design has an inherent strength of linking data, hypothesis, model development and generalised results (Barratt and Kirwan, 2009) and comparing study outcomes across different population groups at a single time (Levin, 2006). The survey instrument

consisted of a series of statements (manifest variables) measuring the eight (8) latent variables (CF, IF, SF, circular knowledge, CE adoption, service sharing, service longevity, and service ownership) employed in the study as depicted in Table 1. The latent constructs employed in this study were developed through an in-depth literature review. A 2-stage process recommended by Abunywah et al. (2020) and Fatemi et al. (2020) was used to ensure the validity and reliability of the constructs. The variables used in the study were measured on a 5-point Likert scale where 1 represents 'strongly disagree', and 5 means 'strongly agree'. Overall, 493 top management employees (representing a response rate of 45.35%) from the service industry voluntarily participated in the study through a face-to-face method. The detail of how participants have recruited, and the guiding criteria are captured in Appendix 1.

3.2. Data analysis

Before the analysis, the questionnaire surveys administered were carefully vetted to check for errors and inconsistencies. Follow-ups were made on questionnaires with errors and inconsistencies. In addition, data were carefully screened to identify missing variables, outliers, and multicollinearity to ensure that the factors generated applied to the statistical procedures. Further analysis including EFA was run to determine the factors that effectively define each construct, followed by CFA to assess the validity of the measurement model using construct validity. Construct validity was tested using standardised factor loadings, average variance extracted, and construct reliability. Following the validation of the measurement model, the structural model was estimated to ascertain the relationship between the latent and manifest variables, path coefficients and the model fit using the Goodness-of-fit. Appendix 2 captures additional details on the data analysis.

3.3. Ghana's service sector

The service sector is Ghana's largest and fastest-growing sector and has the highest labour productivity. The sector's contribution to gross domestic product (GDP) has fluctuated since the 1990s. For instance, the services sector's share of the GDP rose from 43.5% in 1991 to 49.1% in 2012 and subsequently to 56.8% in 2016. However, the sector's share of the GDP decreased to 56.2% in 2017 (Ghana Statistical Services (GSS), 2018a). The GSS categorises the services industry into the following sub-sectors: i) wholesale and retail trade, ii) transport and storage, iii) information, communication and technology, iv) health and social work, v) education, vi) financial and insurance activities, vii) hotels and restaurants, viii) trade, repair of vehicles and household goods, ix) business, real estate, and other activities, x) public administration and defence, and xi) other community, social and personal activities. Categorising the Ghanaian economy into three main industries (Agriculture, Industry and Services), the services sector's share of employment is 80% (GSS, 2018b).

SMEs characterise the sector as male-dominated, with limited indigenous ownership and controls and low application of technology (Ayandibu and Houghton, 2017; Donbesuur et al., 2020; Mamman et al., 2019). Adding to this, the service sector constitutes a significant portion of the country's informal sector, characterised by underemployment, bad working conditions, unregulated activities and low wages (Osei-Boateng and Ampratwum, 2011; Ibrahim et al., 2018). According to the GSS (2018b), the wholesale and retail sub-sector constitutes the largest sub-sector with most businesses. The sector's share of GDP and employment has relatively grown compared to other industries, yet sustainability outcomes have not kept pace with the sector's share of the GDP. Thus, there are various initiatives, including the green Ghana program to drive the sustainability actions of organisations within the sector. Therefore, examining the relationship between CE and sustainable service is important by focusing on the Ghanaian service sector. While empirical evidence is for Ghana, the growing importance of the service sector globally suggests that the study's findings have relevance

Table 1
Constructs for the study.

Latent Construct	Code	Item	Literature references
Institutional Factors	IF1	Our organisation values diversity and inclusion	Bianchini et al. (2019); Guldmann and Huulgaard (2020); Galvão et al., 2022
	IF2	Our organisational norm promotes information sharing among employees	
	IF3	Our organisation processes are dynamic and adaptable	
	IF4	Our organisational culture respect shared values that promote employee engagement	
	IF5	Our 'organisation's performance is underpinned by ethical behaviour	
	IF6	Our organisational rules and regulation promote efficient and fair allocation of resources	
	IF7	Our organisation upholds openness that enhances employee participation	
	IF8	Our organisation emphasises collaborative decision-making processes	
	IF9	Our organisation has experience in implementing innovative ideas	
Contextual Factors	CF1	Our organisation has less bureaucratic processes	Ghisellini and Ulgiati, 2020; Ünal et al., 2019; Tukker and Tischner, 2017
	CF2	Our organisation accepts innovative ideas that are economically viable	
	CF3	Our organisation adopts business approaches that have high consumer confidence	
	CF4	Our organisation employs technological innovations that promote consumer choices and demand trends	
	CF5	Our 'organisation's rules and regulations adhere to national and international sustainability standards	
	CF6	Our organisation upholds environmental stewardship	
Strategic Factors	SF1	Our organisation prioritises views of customers	Van Buren et al. (2016); Wang et al. (2015)
	SF2	Our organisation has a healthy relationship with our stakeholders	
	SF3	Our organisation leaders adopt transformation approaches that are adaptable to new ideas	
	SF4	Our organisation adopts a unique management function that promotes meaningful engagement	
	SF5	Our organisational structure embraces new ideas that offer a competitive advantage	
	SF6	Our organisational board encourages regular review of policies to align with modern trends	

Table 1 (continued)

Latent Construct	Code	Item	Literature references
Circular Economy Adoption	SF7	Our organisation priorities key performance indicators that are strategy-driven	Aranda-Usón et al. (2020); Haas et al. (2015); Mathivathanan et al. (2022)
	CEA1	Our organisations have increased the use of green materials	
	CEA2	Our organisation adopts an effective information management system	
	CEA3	Our organisation adopts effective facility layout out decision	
	CEA4	Our organisation prioritises strategies against resource scarcity	
Circular Economy Knowledge	CEA5	Our organisation pursues new opportunities that are environmentally sound	Ghisellini and Ulgiati, 2020; Urbinati et al. (2017)
	CEK1	Our organisation has access to current and emerging circular economy information	
	CEK2	Our organisation has experienced circular economy issues	
	CEK3	Our organisation has an adequate understanding of the circular economy	
	CEK4	Our organisation has reliable sources for circular economy information	
Service Sharing	CEK5	Our organisation practices are aligned with circular economy information	Atstaja et al. (2022); Tsou et al. (2019)
	SS1	Our organisation prioritises service-sharing orientation	
	SS2	Our organisation rewards service sharing attitude	
	SS3	Our 'organisation's intention to share services is high	
	SS4	Our 'organisation's willingness to collaborate and share services with others is recommendable	
	SS5	Our organisation recognises service-sharing reward incentives	
Service longevity	SS6	Our organisation is publicly recognised for its service-sharing initiative and performance	Bocken et al. (2016); Ellsworth-Krebs et al., 2022
	SL1	Our organisation values error-free service delivery for its customers	
	SL2	Our organisation outcomes instil confidence in customers	
	SL3	Our 'organisation's service outcomes have high readiness to respond to changing environment	
	SL4	Our 'organisation's service outcome supports the reusability of services	
	SL5	Our organisation maintains a high standard of services to customers	
	SL6	Our organisation adopts modern technologies in service delivery	
SL7			

(continued on next page)

Table 1 (continued)

Latent Construct	Code	Item	Literature references
Service Ownership	SL8	Our organisation ensures dependable handling of services	
	SL9	Our organisation has efficient customer engagement systems	
	SL10	Our organisations provide ongoing services that align with the needs of our customers	
	SO1	Our organisation prioritises investments in ongoing services	Bocken et al. (2018); Cherry and Pidgeon (2018); Konietzko et al. (2020); Lüdeke-Freund et al. (2019)
	SO2	Our organisation is committed to the control and care of service delivery	
	SO3	Our organisation takes ownership of problems or improvements to the 'service's overall life cycle	
	SO4	Our organisation recreates service basics for continuous delivery	
	SO5	Our organisation is protective of our service rights	
	SO6	Our organisation takes responsibility for the contents of all service provision	

Table 2 Socio-demographic characteristics of respondents.

Socio-demographic factors	Components	Percentage (%)
Genders	Male	69.0
	Female	31.0
Service typology	Local government	6.1
	Telecommunication	4.5
	Utilities (electricity and water)	4.9
	Retail	62.7
	Hospitality and Tourism	19.3
Organisation size	Banking	2.6
	1–5	27.6
	6–29	61.9
	30–99	8.3
	100+	2.2
Age	18–26	15.2
	27–35	31.6
	36–44	21.5
	45–53	25.8
	54–62	5.3
	63+	0.6
Education Level	No Formal Education	16.4
	Primary/Middle/JHS	20.9
	Senior High School	37.3
	Polytechnic	13.3
	Undergraduate	10.5
	Postgraduate	1.6
Experience of Respondents	1–5	9.9
	6–10	50.3
	11–15	30.4
	16+	9.3

for other developing countries.

4. Results

Table 2 provides a summary of the demographic composition of the respondents. Regarding gender, 31% were female, and 69% were male. Most of the respondents were within the age cohort 27–35. According to the results, 73% did not hold any management role. On average, most respondents had attained high school and tertiary education.

4.1. Exploratory factor analysis

An EFA was conducted to reduce the data to a manageable size and determine factors that effectively define each construct. The EFA used the Principal Components Analysis (PCA) as the extraction method and the Promax Rotation method to identify the underlying factor structure of the constructs used in this study. Adopting the 'Kaiser's criterion of Eigenvalues greater than 1 and scree plot as the guide, eight (8) components were extracted as shown in Table 3, confirming the same number of variables a priori. The eight (8) components explained 81.77% of the total variance in the data, higher than the recommended threshold of 60% (Hair et al., 2012). In addition, the EFA was guided by Howard's (2016) approach, where factors that loaded above 0.4 were retained. As a result, the EFA reduced the number of items from 54 to 48. This dataset's Kaiser–Meyer–Olkin coefficient was 0.92 and a statistically significant Bartlett test of Sphericity ($\chi^2 = 29,385.33$, $df = 1128$, $p = 0.000$). This indicates that the properties of the correlation matrix justified the factor analysis carried out.

Using 'Harman's One-Factor Test, the result showed an absence of common method bias because the first factor extracted did not account for over 50% of the total variance (Podsakoff and Organ, 1986; Podsakoff et al., 2003). Also, multicollinearity was assessed employing the determinant score approach by Samuels (2017), and the result showed a determinant score greater than the recommended cut-off of 0.00001 (Field, 2013).

4.2. Confirmatory factor analysis (CFA)

This study employed the approach Sethi and King (1994) recommended to test the measurement model beforehand, followed by the structural model. A CFA was run to evaluate the relationship between the observed variables and the underlying latent construct. The result from the CFA was satisfactory with a significant chi-square ($\chi^2/df = 2.60$, $p = 0.000$) and a fit statistic showed a well-fit model [GFI = 0.84; AGFI = 0.81; CFI = 0.94; IFI = 0.94; NFI = 0.91; TLI = 0.94, RMSEA = 0.06]. This result indicates that the manifest variables represented the latent constructs well. The reliability and validity measures were employed to test the adequacy of the manifest variable and associated latent variable. The reliability of the constructs was tested using 'Cronbach's Alpha. The reliability of each construct was computed to ascertain the internal consistency in scale items employed in the study. Results showed a Cronbach's alpha that meets Hair et al. (2012) recommended cut-off of equal to or greater than 0.7 (CF = 0.94, IF = 0.98, SF = 0.96, CEA = 0.97, CEK = 0.71, SS = 0.97, SL = 0.97, SO = 0.96).

A convergent validity test evaluated the proportion of variance explained by the latent constructs and their respective manifest variables. Convergent validity of the measurement model was assessed using Hair et al. (2012) recommended criteria-i) statistically significant factor loadings of the indicators with values higher than 0.6, ii) composite reliability (CR) greater than 0.7 and iii) average variance extracted (AVE) greater than 0.5. The result from the CFA showed that factor loadings were statistically significant, ranging from 0.67 to 0.97, CR between 0.78 and 0.97, and AVE of all constructs were higher than 0.5, as depicted in Table 4. The discriminant validity demonstrates the measure to which items of the factors are not theoretically connected was also assessed using two approaches. The first is the method

Table 3
Correlation matrix and square root of AVE.

Components	1	2	3	4	5	6	7	8
Institutional Factors	0.93							
Service Longevity	0.51	0.88						
Strategic Factors	0.08	0.15	0.90					
Contextual Factors	0.10	0.24	0.35	0.86				
Service sharing	-0.12	0.17	0.15	0.20	0.93			
Circular Economy Adoption	-0.04	-0.30	-0.18	0.13	-0.11	0.93		
Service Ownership	0.02	-0.16	0.12	0.08	0.263	0.32	0.91	
Circular Economy Knowledge	0.05	-0.11	0.04	0.03	0.01	0.01	-0.14	0.79

Table 4
CFA factor loadings, reliability and validity of Constructs.

Items	Contextual Factors	Institutional Factors	Strategic Factors	Circular Economy Adoption	Circular Economy Knowledge	Service Longevity	Service Sharing	Service Ownership
CF1	0.75							
CF2	0.79							
CF3	0.84							
CF4	0.90							
CF5	0.93							
CF6	0.91							
IF2		0.92						
IF3		0.94						
IF4		0.91						
IF5		0.94						
IF7		0.95						
IF8		0.92						
IF9		0.90						
SF1			0.87					
SF2			0.91					
SF3			0.92					
SF4			0.91					
SF5			0.90					
SF6			0.92					
CEA1				0.97				
CEA2				0.95				
CEA3				0.93				
CEA4				0.86				
CEA5				0.94				
CEK1					0.70			
CEK2					0.66			
CEK3					0.78			
CEK4					0.72			
CEK5					0.75			
SL1						0.89		
SL2						0.96		
SL3						0.95		
SL4						0.95		
SL5						0.90		
SL6						0.88		
SL7						0.76		
SL8						0.72		
SS1							0.94	
SS2							0.90	
SS3							0.89	
SS4							0.98	
SS5							0.94	
SO2								0.89
SO3								0.93
SO4								0.92
SO5								0.88
SO6								0.90
AVE	0.73	0.86	0.82	0.86	0.53	0.77	0.87	0.82
CR	0.94	0.97	0.96	0.97	0.78	0.96	0.97	0.96
IR	0.94	0.98	0.96	0.97	0.71	0.97	0.97	0.96

recommended by Hair et al. (2012), which states that cross-loading indicators should be greater than any other opposing constructs. In addition, Fornell and Larcker's (1981) criteria of the square root of AVE of each construct are more significant than the inter-correlation with other constructs in the model employed as displayed in Table 3. Discriminant validity for the measurement model was confirmed because of the

cross-loadings of indicators. Results shown in Table 4 reveal that institutional factors, service sharing and circular economy adoption exhibited the highest discriminant validity among all the constructs, with a square root of AVE being 0.93. Also, circular knowledge had the least discriminant validity, with a square root of AVE (diagonal values in bold in Table 3) being 0.79 and correlation ranging from -0.01 and 0.05..

This suggests an excellent degree of unidimensionality for each construct is achieved.

4.3. Structural equation model

Following a satisfactory result of adequate convergence and reliability of the measurement model, the structural model was estimated to test the relationships between the latent variables. Results from the structural model estimation showed a good fit ($\chi^2/df = 3.05, p = 0.000, GFI = 0.75; AGFI = 0.72; CFI = 0.94; IFI = 0.94; NFI = 0.91, TLI = 0.94$ and $RMSEA = 0.06$). This indicates that the structural model meets all the recommended thresholds, indicating that the data analysis validates all the hypotheses tested in the study. Fig. 2 shows the statistically significant estimates of indicators and corresponding latent variables, including the casual paths (hypotheses).

4.4. Moderation effects of circular knowledge

This study tested the moderation effect of circular economy knowledge on the relationship between organisational factors and CE adoption. To do this, the study employed the approach by Aiken and West (1991) and Dawson (2014). This approach was used because of its intrinsic ability to centre data and mitigate the collinearity of the main effect variables with the interaction terms (Aiken and West, 1991). This approach involved three stages. First, the standardised scores (z-scores) were computed for the independent, moderator, and dependent variables. Secondly, an interaction term was created by multiplying the standardised z scores of the independent variables (institutional, contextual and strategic factors) with the moderator (circular knowledge). Thirdly, the resultant output from the model estimation was plotted on a two-way interaction excel sheet, as depicted in Fig. 3.

The results showed a significant correlation between CF ($\beta = 0.7, p = 0.00$), IF ($\beta = 0.28, p = 0.00$), SF ($\beta = 0.34, p = 0.00$) and CE adoption. In addition, there was a statistically significant relationship between the interaction terms [β (CF) = 0.19, $p = 0.00, \beta$ (IF) = 0.05, $p = 0.00$] and β (SF) = 0.05, $p = 0.000$] and CE adoption. The GOF and other parameters also proved that the model is good ($\chi^2/df = 3.53, GFI = 1.00, NFI =$

1.00, IFI = 1.00, CFI = 1.00, RMSEA = 0.06). This means that the relationship between organisational factors and CE adoption is moderated by circular knowledge.

5. Discussion and implications

This research is one of the first empirical studies to explicitly test the relationship between CE and sustainable service in a developing country. In addition to investigating the association between organisational factors and CE adoption, this research assessed the role of circular economy knowledge as a moderator. This study develops a novel model that provides new insights regarding the relative influence of organisational factors (IF, CF, and SF) and CE adoption on sustainable service. Further, the study shows that circular economy knowledge is vital in strengthening organisational 'factors' relationship with CE adoption. Thus, as proposed by Zheng et al. (2010) and Shujahat et al. (2019), knowledge can be an external agent of change that impacts the implementation of new practices, processes, and structures. Finally, this paper provides evidence of a direct association between CE adoption and sustainable service, including the moderating effect of circular economy knowledge. Zhou et al. (2019) demonstrated that dynamic capabilities influence service quality and organisational innovation.

The first set of hypotheses (H1, H2, H3) suggested that organisational factors could facilitate CE practice adoption, which is critical for accessing an organisation's dynamic capabilities. The findings of this study support the argument that organisations' improvements in circular and environmental performance gain competitive advantage (Jakhar et al., 2019; Pieroni et al., 2019; Prieto-Sandoval et al., 2019). These hypotheses suggest that IF, CF and SF can assist service organisations in integrating, building, and reconfiguring organisational competencies to better respond to changing business conditions. According to the evidence for H1, H2 and H3, organisational factors, though socially complex, can still help service organisations achieve superior circular performance. In support of empirical studies, this research found that top management within service organisations that aspire to lead in the race toward sustainable service must embrace a strategic orientation toward circular approaches (Eccles et al., 2014; Cezarino et al., 2019;

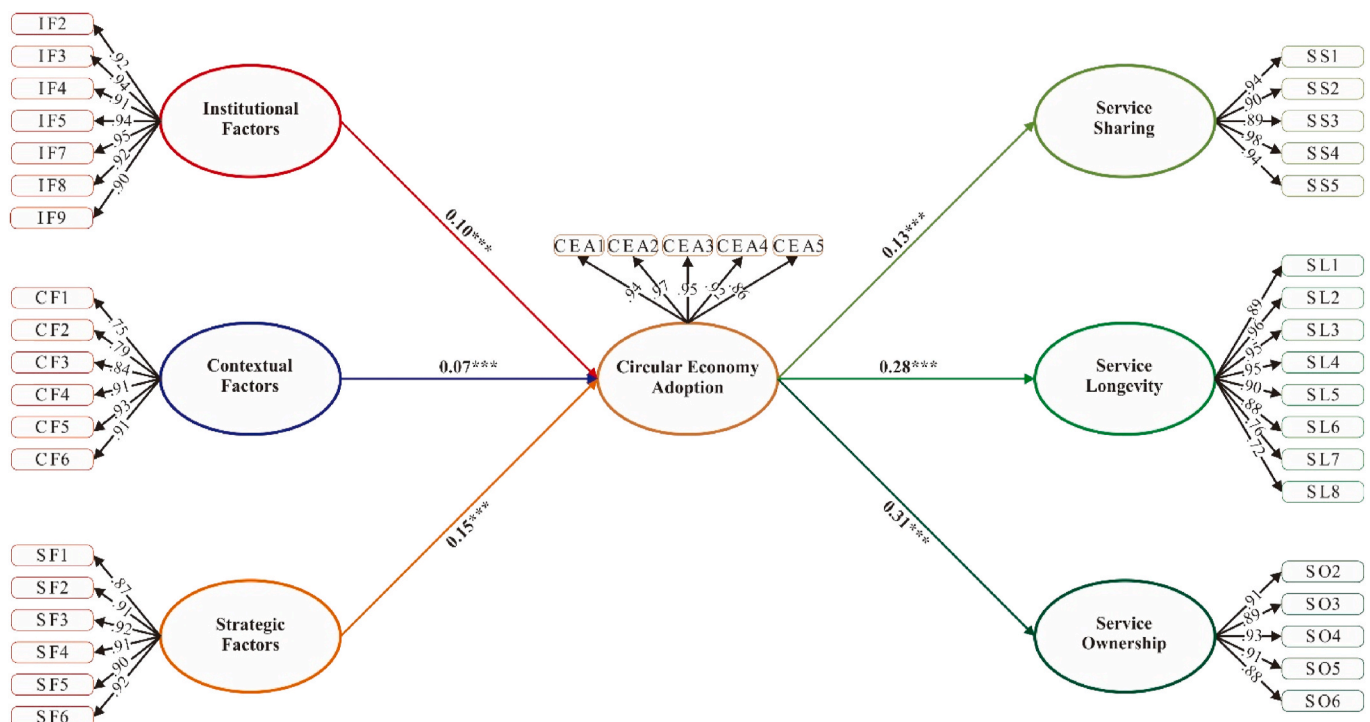


Fig. 2. Structural model.

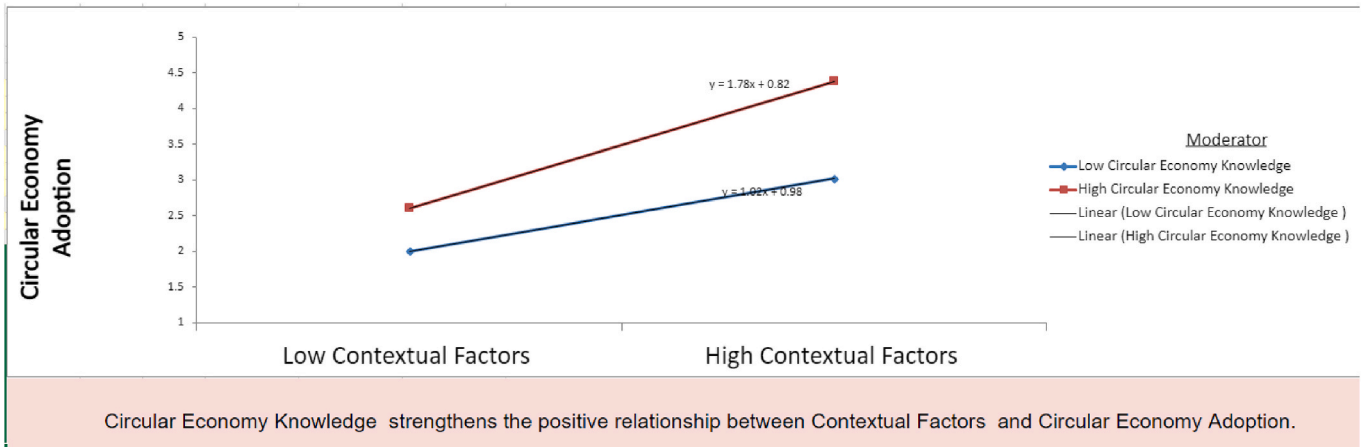


Fig. 3a. Moderating effect of circular economy knowledge on contextual factors and circular adoption.

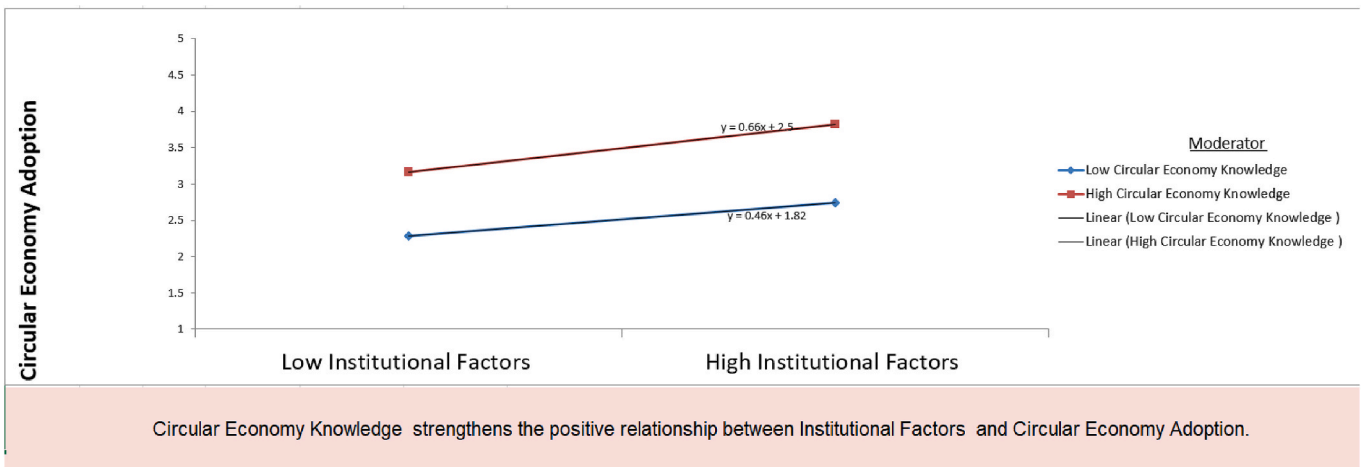


Fig. 3b. Moderating effect of circular economy knowledge on institutional factors and circular adoption.

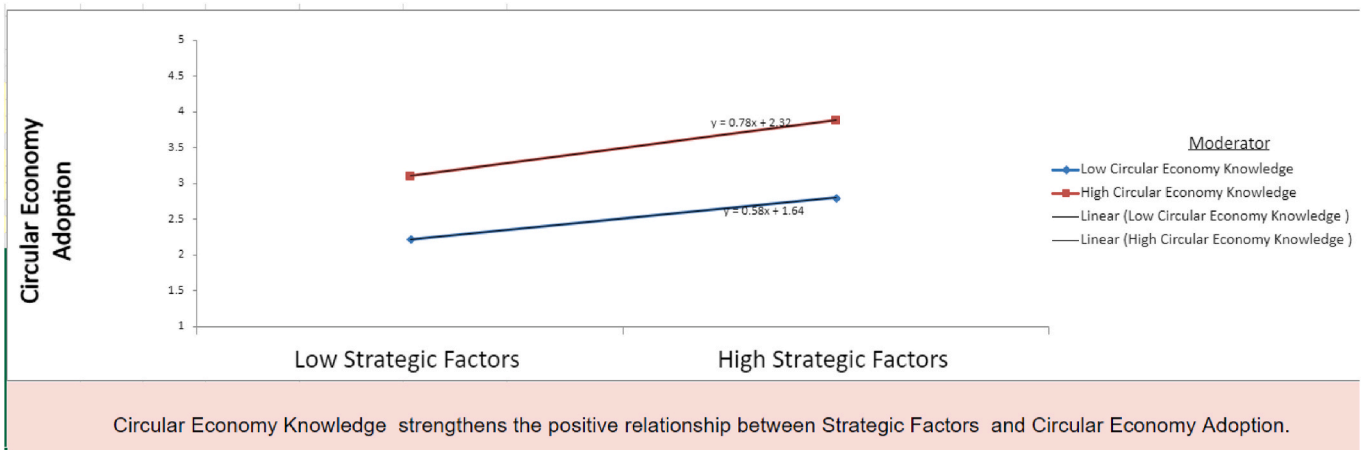


Fig. 3c. Moderating effect of circular economy knowledge on strategic factors and circular adoption.

Parida and Wincent, 2019; Jabbour et al., 2019). Also, the findings of this study lend support to Bansal’s (2005) argument that different dimensions of organisations, such as IF, influence the nature of organisational processes and systems towards sustainability.

A hypothesised model also suggests that CE adoption can positively influence sustainable service through three (3) channels – service

longevity, service sharing, and service ownership. The finding that CE adoption is associated with sustainable service outcomes (H4a,4b,4c) provides empirical support for the notion that CE as a dynamic capability can help service organisations acquire resources, learn new capabilities, and use these new capabilities to achieve sustainable service outcomes. Consequently, such organisations can achieve a competitive

advantage over their competitors. Furthermore, a robust SEM analysis proved that CE adoption could be crucial in helping service organisations achieve their sustainability goals. This research contributes to existing work concerning the impact of circular strategies on sustainable service (e.g. Lacy and Rutqvist, 2016; Elia et al., 2017; Genovese et al., 2017) by showing that service organisations should incorporate circular strategy when seeking to achieve sustainable advantage.

5.1. Theoretical implications

This study's model is to enhance sustainable service research by proposing a taxonomy of circular economy and organisational indicators to achieve sustainable service outcomes, such as service longevity, service sharing, and service ownership. Across many developing economies, service-driven economic transformation demonstrates the importance of knowledge-based activities. This paper demonstrates that circular knowledge, organisational factors, and circular economy adoption are interconnected. The application of circular economy to the Ghana service sector revealed that the intersection of circular initiatives and clean technologies is crucial in promoting sustainable service in a developing country. The three-way perspective on service sustainability dimensions illustrates how organisations can provide cleaner and more sustainable services. In theoretical terms, the framework underpinning this research is confirmed by unravelling a new direction and perspective on the sustainable service-CE nexus debate.

This study supports a growing body of literature examining how to accelerate the transition from a linear economy paradigm to a CE practice adoption paradigm through systemic change. This paper proposes organisational factors such as IF, CF, and SF as critical channels for accelerating CE practice adoption. A systemic and theoretically grounded approach to circular economy research is strengthened by introducing organizational factors to the circular disruption theoretical discussions.

There was also evidence that circular economy knowledge moderated the relationship between all three organisational factors, supporting H5a, H5b, and H5c. Researchers have shown that knowledge is a critical antecedent in enhancing organisational culture and processes (Teo and Bhattacharjee, 2014; Holten et al., 2016), but no research has explored circular economy knowledge and its moderating effects. As human capital generates a wealth of knowledge, employees at all levels of an organisation must be empowered to pursue circular initiatives, which can help the organisation develop more innovative and sustainable services. The findings that circular economy knowledge moderates the relationship between organisational factors and CE adoption suggest that service organisations should identify individual and organisational factors that enhance dynamic capabilities and circular economy knowledge sharing. It is essential to provide employees with training programs that develop high-quality dynamic capabilities and circular knowledge. This paper confirms previous studies (Ertürk and Vurgun, 2015; Newman et al., 2017) that conclude that empowered employees are more likely to show greater commitment to their organisations' new initiatives.

5.2. Managerial implications

The influence of customers, suppliers, governments, and others, may be essential to developing sustainable service strategies (Ayuso et al., 2011; Boons et al., 2013). Management should recognise the importance of initiating circular actions earlier along their supply chain to engage relevant partners in collaborative sustainability initiatives that can allow them to differentiate themselves from their competitors. CE adoption can drive sustainable service and provide them with innovative ideas, technology, human capital, and capabilities that can support their aspirations to innovate, grow, and, more importantly, achieve sustainable service results. Accelerating CE practice adoption can help organisations leverage cross-organisational resources to achieve a

sustainable competitive advantage over their competitors. Organisations undertaking circular actions will maximize their dynamic capabilities, resulting in superior sustainability outcomes.

The study further supports previous scholarly writings asserting that CE practice adoption is associated with social impacts that are mostly peripherally discussed and sporadically incorporated in CE discussions (MacArthur, 2017; Murray et al., 2017). This paper suggests that managers should accelerate CE practices adoption to drive sustainable service provision for their customers, although it has significant social implications. The paper suggests that CE-driven sustainable service can promote democratic modes of production and consumption, where consumers can be empowered, trust between providers and consumers can be built, and social capital can be promoted. However, managers need to pay attention to the negative social impacts that accelerating CE practice adoption can bring to their businesses, such as disruptions to their workforce model, as warned by Repp et al. (2021).

Also, CE investments within developing economies' service sectors create different types of value for the country's economy. This study identified how circular knowledge could encourage companies to invest more in cleaner and sustainable service innovations through CE initiatives. The findings of this research indicate that companies can invest in CE initiatives through a sustainability-integrated investment approach. This study's framework is confirmed, in practical terms, that the more a company promotes circular practices toward sustainable outcomes, the more willing that company is to invest in innovative and knowledge-based activities that drive cleaner and sustainable service delivery. Thus, to promote sustainable service provision for their customers, managers must consider the factors emphasised in this research to help accelerate CE practice adoption.

6. Conclusion

This study explored how organisational factors and CE combine to influence sustainable service and what processes underlie that influence. There is an indirect relationship between organisational factors and CE adoption and a direct relationship between CE adoption and sustainable service. Survey data from managers of service-providing organisations were used in this study.

This paper presents three main findings. First, organisational factors (IF, CF, SF) positively correlate with CE adoption. Second, CE adoption positively affects sustainable service provision. Lastly, circular economy knowledge moderates the relationship between organisational factors and CE adoption in a way that strengthens it. Considering sustainable service's position as the paradigmatic service genre in service research, the study hopes that these results will spur additional research to discover additional mediators and moderators of the performance effects of this type of service. In light of the growing importance of the service sector and the growing prominence of circular economy models and approaches, findings about the influence of CE adoption in emerging economies have important implications for managers and researchers alike.

6.1. Limitations of the study

There are at least four limitations to this first effort to operationalise sustainable service at the organisational level and uncover the role of a CE. Still, these limitations also provide fertile ground for future research. This paper aims first to investigate how CE adoption can impact sustainable service. Considering this, a broader perspective could provide interesting avenues for future research. Using multilevel research into the external interaction involving stakeholders and partners of organisations may help better understand CE adoption and diffusion within service organisations and how external factors influence organisations (Amankwah-Amoah, 2016; Smith et al., 2019). Future research on this topic may also provide useful insight. Second, the study developed a moderated model to measure key antecedents of sustainable service at

the organisational level. Even though this study evaluated the validity and reliability of the proposed model, other studies may aim to enhance this measurement and test its viability by applying it to different datasets. In addition, the data for this research were cross-sectional. The causal relationships established in the proposed model may be empirically tested by conducting further longitudinal research. Thirdly, as the study suggests possible social impacts of CE-driven sustainable service outcomes, future studies can further explore the social implications of CE disruptions in the service sector in other contexts. Such studies will help provide new insights into the social dimension of the CE debate, which has received less attention in previous studies. Finally, this paper has not examined the association between sustainable service and organisational performance. This could be an important area for future research. In order for sustainable service to gain acceptance as a key tool to improve competitive advantage in the corporate world, there is a need to increase the understanding of how and to what extent these services contribute to an organisation's performance.

Appendix 1

A team of five (5) graduate research assistants self-administered a structured questionnaire survey between July and November 2021. The questionnaire had three (3) main sections. Section 1 of the questionnaire contained an introductory letter highlighting a brief profile of the research team, the research's aim and the participants' voluntariness. The second section captures the socio-demographic characteristics of respondents in terms of gender, age, level of education, and working experience. The third part of the survey instrument consisted of a series of statements (manifest variables) measuring the eight (8) latent variables (CF, IF, SF, circular knowledge, CE adoption, service sharing, service longevity, and service ownership) employed in the study as depicted in Table 1. The variables used in the study were measured on a 5-point Likert scale where 1 represents 'strongly disagree', and 5 means 'strongly agree'.

The latent constructs employed in this study were developed through an in-depth literature review. A 2-stage process recommended by Abunyewah et al. (2020) and Fatemi et al. (2020) was used to ensure the validity and reliability of the constructs. First, the developed constructs underpinned by in-depth literature were provided to a team of academics for assessments and evaluation. Upon receipt of the team's feedback, a discursive-dialogical clarification meeting was organised between the researchers and the academics. A negotiated common understanding was achieved after the meeting, and the feedback was incorporated and sent to a team of practitioners for further assessment. Prior to including the practitioners' feedback, a process involving dialogue clarification of manifest and implied meanings of their comments was undertaken. This ensured that the negotiated common understanding employed in everyday communication was reflected in the draft questionnaire. The feedback from scholars and practitioners significantly improved the readability of the survey instrument. Next, the revised questionnaire was piloted with 41 employees, with only 30 (17 males and 13 females) returning a fully completed questionnaire. The sample used aligns with the recommended threshold of 10–30 samples during piloting (Isaac and Michael, 1995). The data from the pilot survey was analysed to ascertain the reliability and validity of the constructs. The results showed that the reliability of the constructs was higher than the recommended cut-off of greater than or equal to point seven ($\alpha \geq 0.7$) and the 'constructs' validity greater than point five (validity >0.5). Due to the unavailability of data on the profile of service organisations in Ghana, the research team used the internet to compile a list or sample frame of firms. The identified service organisations were contacted via email or telephone to ascertain their willingness to participate in the study. In addition, some service organisations that participated in the study were recommended by others (snowballing sampling). Top management employees within service organisations that agreed to participate in the study were approached, and those who voluntarily decided to participate were all provided equal opportunities to contribute.

Prior to the data collection, appointment dates and times were booked with respondents based on their availability and preferences. On the day of questionnaire administration, the trained research assistants provided each participant with the research information sheet and consent form to read and sign. Only those that signed the consent form were allowed to participate in the study. The five (5) graduate research assistants connected with 1087 employees meeting the study's inclusion criteria. However, 493 top management employees (representing a response rate of 45.35%) from the service industry voluntarily participated in the study through a face-to-face method. In recruiting participants for the study, the research team was guided by the characteristics of the service industry in Ghana. The sample selected for the study reflected the key features of the sector, such as high SME coverage, dominated by males, retailers and youths. The team adopted the following strategies to ensure that the sample obtained was appropriately representative and inclusively meaningful. A sample quota was set to reflect the industry's key features, and a brief workshop was organised to emphasise the study's benefits to service organisations and the government's service sector policy. Furthermore, a simple random sampling was adopted to give each participant who satisfied the selection criteria to participate.

As a result of non-consensus in the determination of sample size adequacy and reliability in SEM, this study's sample size was guided by similar studies (Hussey and Egan, 2007; Malesios et al., 2020). The sample size chosen followed the rule of thumb that a minimum of 100–150 samples is required to undertake a SEM analysis (Bentler and Chou, 1987; Kline, 2005), 10 cases per variable (Markus, 2012) and 20–25 cases per variable (Bentler and Chou, 1987).

Appendix 2

Before the analysis, the questionnaire surveys administered were carefully vetted to check for errors and inconsistencies. Follow-ups were made on questionnaires with errors and inconsistencies. In addition, data were carefully screened to identify missing variables, outliers, and multicollinearity

CRediT authorship contribution statement

Michael Odei Erdiaw-Kwasie: Conceptualization, Methodology, Validation, Formal analysis, Investigation, Data curation, Writing – original draft, Writing – review & editing, Visualization. **Matthew Abunyewah:** Conceptualization, Methodology, Validation, Formal analysis, Investigation, Data curation, Writing – original draft, Writing – review & editing, Visualization. **Salifu Yusuf:** Formal analysis, Writing – original draft. **Angela Erdiaw-Kwasie:** Visualization, Formal analysis.

Declaration of competing interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

Data availability

The authors do not have permission to share data.

to ensure that the factors generated applied to the statistical procedures. During the data entry, 13 questionnaires were excluded because more than half of the questions in the survey were unanswered by respondents. Then, further analysis, including an exploratory factor analysis (EFA), a confirmatory factor analysis (CFA) and structural equation modelling (SEM), were run to test the proposed model for the study. First, an EFA was run to determine the factors that effectively define each construct. The EFA results helped estimate the CFA and test the structural model. The purpose of the CFA was to assess the validity of the measurement model using construct validity and the Goodness-of-fit (GOF) indices- Goodness-Of-Fit Index (GFI), Adjusted Goodness of Fit Index (AGFI); Comparative Fit Index (CFI); Incremental Fit Indices (IFI); Normed-Fit Index (NFI); and Residual Mean Square Error of Approximation (RMSEA). Next, construct validity was tested using standardised factor loadings, average variance extracted, and construct reliability. Following the validation of the measurement model, the structural model was estimated to ascertain the relationship between the latent and manifest variables, path coefficients and the model fit using the GOF indices.

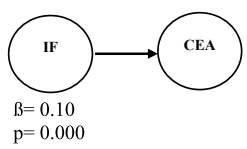
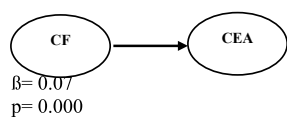
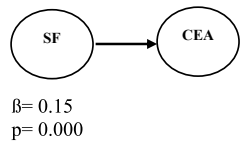
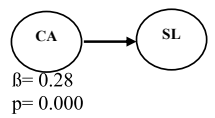
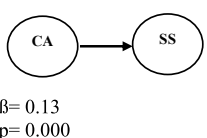
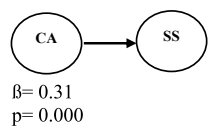
Although multiple regression (MR) is applicable for analysing this study, its inherent weakness of assuming perfect measurement of variables and lack of robustness in estimating measurement error and model misspecification (Bohrnstedt and Carter, 1971; Musil et al., 1998) rendered SEM much preferred choice. SEM as a multivariate statistical technique is not new (Jöreskog and Sörbom, 1987); however, the diffusion of the technique in service sustainability research is relatively new. For example, Tsou et al. (2019) investigated the impact of sharing economy service experience on behavioural intention using SEM. Similarly, Gbongli et al. (2020) examined financial services sustainability and utilised SEM as an analytical approach. As shown in previous studies, the robustness of the results and the ability of the SEM technique to answer the research questions were great motivations for the team to adopt the analytical approach.

Furthermore, the team adopted the SEM technique in this study because the approach can simultaneously estimate multiple interrelated relationships of both endogenous and exogenous variables. Byrne (2012) also shared that the SEM technique is unique due to its ability to explicitly assess measurement error, impose a structure and test how it fits data. The SEM also uses fit indices to evaluate the models, providing the opportunity to assess the implication of theoretical observations. Also, the SEM technique has the inherent strengths of assessing the psychometric properties and estimating relationships among constructs that are corrected for biases caused by random error and construct-irrelevant variance (Bollen, 1989).

Appendix 3

This section summarises the overall studies, including the hypotheses' outcomes.

Table 5
Hypotheses of the study

Hypotheses	Path	Outcome
H1: IF positively influence CE adoption	 <p>IF → CEA β = 0.10 p = 0.000</p>	Supported
H2: CF positively influence CE adoption	 <p>CF → CEA β = 0.07 p = 0.000</p>	Supported
H3: SF positively impact CE adoption	 <p>SF → CEA β = 0.15 p = 0.000</p>	Supported
H4a: CE adoption positively influence service longevity	 <p>CA → SL β = 0.28 p = 0.000</p>	Supported
H4b: CE adoption positively impact service sharing	 <p>CA → SS β = 0.13 p = 0.000</p>	Supported
H4c: CE adoption positively influence service ownership	 <p>CA → SS β = 0.31 p = 0.000</p>	Supported

(continued on next page)

Table 5 (continued)

Hypotheses	Path	Outcome
H5a: CE knowledge moderates the relationship between IF and CE adoption		Supported
H5b: CE knowledge moderates the relationship between CF and CE adoption		Supported
H5c: CE knowledge moderates the relationship between SF and CE adoption		Supported

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