GREEN TARGET COSTING AND CIRCULAR ECONOMY AS DRIVERS OF SUSTAINABLE COMPETITIVE ADVANTAGE: AN EMPIRICAL STUDY

Haider Atta Zabin
Department of Accounting
College of Administration and Economics,
University of Wasit, Wasit

Corresponding Author: hzbyen@uowasit.edu.iq
DOI: https://doi.org/10.57233/ijamer.v2i2.55

Article History: Received: 20 June 2026 | **Revised:** 22 June 2026 | **Accepted:** 24 June 2026 | **Published:** 25 June 2026

How to Cite This Article:
Zabin, H. A. (2026). Green target costing and circular economy as drivers of sustainable competitive advantage: An empirical study.*International Journal of Accounting, Management and Economic Review, 2*(2). https://doi.org/10.57233/ijamer.v2i2.55

Abstract
The increasing pressure from stakeholders for environmental and social performance, along with increased environmental regulation and limited natural resources, is compelling manufacturers to re-evaluate traditional cost management techniques. The purpose of this research paper is to analyze the relationship between Green Target Costing (GTC) and Circular Economy (CE) practices and SCA in the textiles industry. A quantitative, cross-sectional survey was administered to employees of the Wasit Textile and Sewing Factory in Iraq; of 68 distributed questionnaires, 64 valid responses were obtained. Data were analyzed using descriptive statistics, Cronbach's alpha, one-sample t-tests, Pearson correlation, and multiple regression analysis in IBM SPSS Statistics. Results show that GTC ($\beta = 0.512$, $p < .001$) and CE ($\beta = 0.431$, $p < .001$) are each positively and significantly associated with SCA, together explaining 71.4% of its variance ($R^2 = 0.714$) when entered simultaneously in a multiple regression model. These findings support the individual and combined explanatory relevance of GTC and CE for SCA in this setting, although the additive model used here does not test whether their joint effect differs from, or exceeds, their separate effects.

Keywords: Green Target Costing; Circular Economy; sustainable competitive advantage; resource efficiency; environmental cost management

1.0 Introduction

Over the last few decades, global manufacturing activity has changed considerably, largely as a result of growing environmental concerns (Mayndarto & Sularto, 2026; Beleya et al., 2025; Oliveros-Sepulveda et al., 2025), declining natural resources, and increased regulatory pressure. Firms in resource-intensive sectors, in particular, may have little choice but to undertake wholesale re-evaluations of their operating models and cost structures to integrate environmental constraints without sacrificing the economic bottom line (Beleya et al., 2025; Oliveros-Sepulveda et al., 2025). Thus, in this backdrop, sustainable development has moved from a peripheral goal of the corporate agenda to a key strategic imperative, fundamentally changing how organizations create value, minimize costs, and establish competitive positioning (Figge et al., 2002).

Traditional cost management tools, such as traditional target costing, were developed primarily with the objective of optimizing financial results through the establishment of production cost

targets based on market-driven price targets (Daowadueng, 2024). However, these tools were not originally intended to incorporate the full range of environmental sustainability: the costs of resource use, waste disposal, carbon emissions, and ecosystem destruction. The growing pervasiveness of environmental externalities due to regulation and market mechanisms has made the limitations of conventional cost management increasingly clear (Bennett et al., 2011). Therefore, an increasing number of studies have called for environmentally extended versions of well-established cost management systems that incorporate life-cycle environmental costs alongside traditional financial costs.

In this respect, Green Target Costing (GTC) appears to be an important step forward. Green Target Costing extends the logic of traditional target costing by helping firms bring environmental cost reduction targets into the product development and production planning process. Instead of treating environmental costs as incidental overheads, GTC incorporates them as explicit targets to be minimized from the early stages of product design, thus pursuing sustainability within the context of cost management practice (Setthasakko, 2010). The GTC concept's proactive orientation sets it apart from traditional approaches to environmental compliance, which are typically reactive.

Concomitantly, the Circular Economy (CE) has been associated with a disruptive paradigm for industrial organization, in contrast to the traditional linear system of resource use extract, produce, and dispose. The CE model was specifically introduced to diminish the interdependency of economic growth and resource use, retaining the value of materials and products at their highest utility for as long as possible through reuse, remanufacture, refurbishment, or recycling (Voulvoulis, 2022). It allows organizations to reduce their reliance on virgin inputs, avoid the creation of wastes, and generate value from material otherwise treated as waste (Daowadueng, 2024).

There is a very much analogous theoretical background for GTC and CE. Both paradigms deal with the issues of resource efficiency and waste avoidance (including various types of pollution), have life cycle oriented approaches, and aim at the integration of environmental concerns into the mainstream of value generation. Together they provide a combined approach to sustainable manufacturing and thus enable more environmental gains along with reduced costs and improved competitive advantage. At the same time, while complementarity of the two approaches seems to be intuitive, research into their joint impacts on sustainable competitive advantage is rare, especially in developing country contexts where manufacturing industries suffer from various structural rigidities and institutional pressures exerted by the businesses themselves.

The objective of this study is to address this limitation by investigating empirically the linkage between GTC and CE integration as factors that contribute to sustainable competitive advantage of Wasit Textile and Sewing Factory. This research problem has been stated as follows: "How strategic integration of GTC and CE influence knowledge of sustainable competitive advantage for textile manufacturing firms?" The major objectives of this study are: (i) To identify and conceptualize GTC-CE integration in the context of textile manufacture industry, (ii) To examine the effect of GTC on sustainable competitive advantage, (iii) To examine the effect of CE on sustainable competitive advantage, and (iv) To investigate the combined effect of GTC-CE integration on sustainable competitive advantage in a textile manufacture context.

2.0 Literature Review

Besides its relevance at the firm level, Green Target Costing, as an adjacent policy tool, has close connections with broader international policies such as the Circular Economy. In particular, the EU's Green Deal seeks to achieve a carbon-neutral economy for Europe by 2050 through lifecycle considerations, resource efficiency, and eco-design (European Commission, 2019). The combination of GTC and CE within this strategic plan is not arbitrary, as both approaches include cost reductions in production alongside the increased use of material and manufacturing resources that could help in meeting broader goals of sustainability at the global governance level. This adds to the strategic significance of the current research, even though the results presented in this paper, based on a single case study in Iraq, should be generalized carefully.

Green Target Costing: Conceptual Foundations and Empirical Evidence

Green Target Costing is an advanced version of the traditional concept of target costing that introduces environmental cost objectives in the design phase of a product (Hraiga et al., 2025). The traditional concept of target costing was practiced in the Japanese automobile and electronics industries, wherein both competitive pricing in the marketplace and profit targets serve as the foundation of cost allowances and engineering objectives (Setthasakko, 2010). Green Target Costing takes the same principle and adds an additional requirement for reduction in environmental costs associated with energy costs, materials, emissions, waste treatments, and end-of-life costs alongside financial costs. Since the minimization of a product's effects throughout its life cycle needs to consider environmental aspects right from the design stage, material choices, and process engineering. Abbas (2025) further integrates GTC with activity-based budgeting, showing the complementarity of the two tools in producing more precise environmental cost data for strategic cost management.

Bennett et al. (2011) identify GTC as working particularly well when applied to product design, where most lifecycle costs are determined; arguing that late-stage environmental cost control is inherently reactive and therefore less effective than proactive design-embedded approaches. This argument is corroborated empirically by Figge et al. (2002), who find that embedding environmental cost targets in a sustainability-oriented management system leads to environmental cost reductions substantially larger than those achieved through end-of-pipe systems alone. Nakajima et al. (2015) investigate material flow cost accounting a tool complementary to GTC in Japanese manufacturing firms and find reductions of up to 30% in material waste costs for firms that set environmental cost targets in their designs, compared to non-adopting firms. Similarly, Burritt et al. (2009) find a positive association between GTC adoption and environmental investment decision-making in the Philippine rice industry, attributed to the discipline that environmental cost targets impose on design and procurement decisions. Al-Tuwaijri et al. (2004), using a sample of firms from developing countries, show that firms voluntarily adopting climate-related practices achieve superior financial and environmental performance, despite weaker regulatory enforcement. This observation is applicable to the Iraqi manufacturing sector because there are relatively poor environmental regulatory structures that have been put in place, yet competition forces manufacturers to respond to environmental issues.

Circular Economy: Concepts, Practices, and Impacts on Performance

From the early 2010s, inspired by the works of the Ellen MacArthur Foundation (2013), the concept of Circular Economy (CE) has taken a lot of momentum among academics and practitioners. Rather than renouncing the traditional take-make-dispose paradigm, the principle of CE is about making a closed-loop process where materials, components, and products remain in the loop for as long as they retain their value (Geissdoerfer et al., 2017). This is through approaches like maintenance, reuse, repair, remanufacture, and recycling in that order of increasing degradation of value (Angelis et al., 2018).

The business justification of CE implementation in the manufacturing industry is based on potential savings in the form of reduced input costs, revenues from secondary material flows and re-manufactured products, and reduced externalities related to waste disposal and regulations (Korhonen et al., 2018). A meta-analysis by Geissdoerfer et al. (2017) shows the presence of consistent proof of the positive influence of closed-loop material flows on the resource efficiency of companies.

In the textile sector, Dissanayake and Sinha (2015) discuss CE practices, stating that there are technical challenges in implementing textile recycling due to the long value chain of the textile industry. Nonetheless, even partial adoption of CE practices, such as take-back policies and use of recycled fibres, creates cost and performance advantages that can provide a company with competitive advantage due to increasing sustainability demands. Along with that, Amin et al. (2024) prove that CE practices adoption in the green garment industry positively influences sustainable performance of companies.

The theoretical contribution made by Bocken et al. (2018) is relevant to the research topic because of the three ways in which circular business models generate value: value retention (through prolonged use of materials and products), value recovery (from materials at the end of their life), and value creation (through innovative service and product circularity). Value retention, value recovery, and value creation have immediate implications for the cost structure and competitive strategy of a business organization, thus suggesting that CE can provide a competitive edge.

Green Target Costing and Circular Economy Integration

GTC and CE are different fields altogether, however, the combination of both these theories offers hope for a bright future, where GTC's cost-based value proposition would combine with CE's material efficiency approach. The underlying reason behind considering both these theories together is rooted in NRBV theory of the firm, based on the RBV model introduced by Barney (1991) and further developed by Hart (1995). The NRBV theory is based on the concept of environmental capabilities, such as pollution prevention, product stewardship, and sustainable development being complementary sources of competitive advantage in environment-constrained markets. Under the light of NRBV theory, the operational manifestation of product stewardship is none other than GTC, and that of sustainable development is CE.Since both competencies are based on similar organizational routines such as cross-functional design reviews, supplier involvement, and life cycle costs information, organizations that spend money developing GTC competency might also gain some ability to perform CE, which is in line with the significant correlation of 0.673 found in this study. This research aims at exploring GTC and CE as

concurrent factors that influence sustainable competitive advantage; however, it does not test any interaction between the two competencies.

Schaltegger et al. (2019) research the interaction between environmental cost management and circular materials and conclude that the combination of setting cost goals and circular materials flow goals enables a firm to be more efficient in resource use than adopting either strategy alone. Aureli et al. (2025) suggest that there is a need for development of management accounting systems to address circular economy goals; dialogue is suggested as a way to cope with the limitations of standard management accounting in this context.Kjaer et al. (2018) demonstrate through life-cycle assessment and target costing that the inclusion of circularity into the target cost structure enables not only cost savings but also reduced life-cycle environmental impacts. Leverage points at which general target costing and circular economy practices can interact are identified; these points relate mostly to the choice of materials and design for the end-of-use stage, yet no statistical confirmation of interaction is provided.

Theoretical Frameworks

This research is primarily based on a theoretical framework called the Natural Resource-Based View (NRBV), which is a theoretical extension of the Resource-Based View, according to which environmental capabilities such as pollution prevention, product stewardship, and sustainable development constitute sources of competitive advantage under environmental constraints (Hart, 1995). GTC represents operationalization of product stewardship capability, while CE represents operationalization of sustainable development capability. As per the NRBV, product stewardship capability involves reducing lifecycle impacts through embedding environmental cost targets within product designs while sustainable development capability refers to material loops closure in the entire value chain. H1 and H2 hypotheses in this research are derived mainly from this theory as both product-stewardship capability (GTC) and sustainable-development capability (CE) are expected to be positively related with sustainable competitive advantage. H3 hypothesis explores further by questioning whether the combination of both these capabilities offers any additional insights.

For this study, Sustainable Competitive Advantage (SCA) can be described as the possibility for a firm to achieve sustained superior market performance through integration of economic performance, environmental performance, and social performance into its core business operations. In essence, this definition bears a conceptual connection with the general notion of the Environmental, Social and Governance (ESG) approach that is widely applied nowadays by investors and regulators when considering the sustainability of firms (Serafeim & Trinh, 2020); yet, ESG is not considered as a distinct concept and is not used as a variable in this study's conceptual model.

The second approach to theory is called Lifecycle Thinking and is considered a complementary perspective for explaining the connection between GTC and CE. Lifecycle Thinking is a concept that suggests thinking about resource consumption, costs, and environmental impact not only in the production process but in the whole life cycle of the product (Finnveden et al., 2009). Although GTC includes consideration of both economic and environmental impacts in the life cycle of products, CE considers material usage several times; therefore, they are complementary in terms of life cycle perspective but not in an integrated perspective.

Research Gap and Hypotheses

Despite the large literature that has already been reviewed, some gaps exist. Firstly, even though GTC and CE have individually been analyzed, there are not enough studies analyzing both variables in terms of their association with competitive performance at the same time. Secondly, in terms of the manufacturing industry in developing countries, there is little research carried out so far and the results derived from highly developed nations might not be generalized to less developed ones. Thirdly, the empirical relationship between GTC and CE in terms of their role in achieving sustainable competitive advantage in textile manufacturing is missing.

In order to bridge the above-mentioned gaps, the present research attempts to integrate the GTC and CE as key factors of sustainable competitive advantage and analyzes the related roles performed by these variables in a textile manufacturing firm in Iraq. The following hypotheses are suggested based on the theory and the empirical literature reviewed:

H_{01}. Green Target Costing has a significantly positive impact on sustainable competitive advantage in the Wasit Textile and Sewing Factory.
H_{02}. Circular Economy practices have a significant positive relationship with sustainable competitive advantage in the Wasit Textile and Sewing Factory.
H_{03}. Green Target Costing and Circular Economy, entered simultaneously in a multiple regression model, jointly and significantly explain variance in sustainable competitive advantage in the Wasit Textile and Sewing Factory.

3.0 Methodology

The design of this research is quantitative and relies on a positivist epistemology, which underpins systematic, objective measurement, statistical inference, and replicable methods suited to testing hypothesized relationships between variables (Clark et al., 2021). It is a cross-sectional survey design, using primary data collected at a single time point via a structured, self-administered questionnaire.

Sample and Setting

The study population consists of employees at the Wasit Textile and Sewing Factory, selected using a single-case, purposive sampling approach because the factory represents a state-owned, medium-sized industrial enterprise operating the complete textile production cycle from raw materials to finished garments, providing a contextually rich single-case setting in which to study GTC and CE. Given the case-study design and non-probability sampling, the findings are intended to offer analytically transferable insight into this specific organisational context rather than statistically generalizable claims about Iraqi manufacturing, developing-economy manufacturing, or the textile sector as a whole; broader claims are avoided in the Discussion and Conclusion. Questionnaires were distributed to all 68 employees across managerial, administrative, accounting, manufacturing, and technical functions who were accessible and willing to participate during the data-collection period; 64 valid responses were obtained. The results of distribution and retrieval are summarised in Table 1.

Table 1.
Distributed and Returned Questionnaires.

Number	Description
68	Distributed
64	Returned
94.1%	Response Rate (%)

Source: Authors compilation, 2026.

Variable Definitions

Independent Variable 1: Green Target Costing (GTC). Green Target Costing is a proactive, systematic, and strategic approach to managing environmental costs, aimed at setting reduction objectives for environmental costs to be integrated into the product design process (Mayndarto & Sularto, 2026). GTC is operationalized through a 10-item scale measured on a five-point Likert scale ranging from 1 (Strongly Disagree) to 5 (Strongly Agree). The measurement items are presented in Table 2.

Table 2.
Green Target Costing Measurement Items.

Item Description	Item No.
The factory establishes specific environmental cost reduction targets during product design.	GTC1
Environmental costs (energy, emissions, waste) are incorporated into product cost targets.	GTC2
Lifecycle environmental costs are explicitly considered when setting target costs.	GTC3
Design decisions are evaluated against both financial and environmental cost criteria.	GTC4
The factory monitors progress towards environmental cost targets throughout production.	GTC5
Supplier selection criteria include environmental cost performance alongside price.	GTC6
Green design principles are integrated into the target costing process.	GTC7
Environmental cost data are regularly reported to management for decision-making.	GTC8
The factory uses lifecycle cost analysis to assess the full environmental cost of products.	GTC9
Environmental cost reduction is treated as a strategic priority in cost management.	GTC10

Source: Authors compilation, 2026.

Independent Variable 2: Circular Economy (CE). Circular Economy is an industrial economy that is restorative or regenerative by intent and design where resource input, waste, emission, and energy leakage are minimized by closing product design loops through greater longevity, efficiency, and use of renewable resources. CE is operationalized through a 10-item scale covering five dimensions: material recirculation, waste minimization, product life extension, reverse logistics, and circular supply chain collaboration. The measurement items are presented in Table 3.

Table 3. Circular Economy Measurement Items.

Item Description	Item No.
The factory designs products with end-of-life material recovery in mind.	CE1
Production waste is systematically collected and reintroduced into the production process.	CE2
The factory uses recycled or secondary materials as inputs where feasible.	CE3

Product take-back or return programmes are in place to recover used materials.	CE4
The factory actively seeks to extend the useful life of equipment and products.	CE5
Suppliers are engaged to adopt circular material practices in their own operations.	CE6
The factory monitors the proportion of recycled content in its product inputs.	CE7
Circular economy principles are formally integrated into the factory's strategic planning.	CE8
The factory tracks and reports on material flows, including waste and recovery rates.	CE9
Investment decisions are evaluated for their contribution to closing material loops.	CE10

Source: Authors compilation, 2026.

Dependent Variable: Sustainable Competitive Advantage (SCA). Sustainable Competitive Advantage is the ability of the firm to sustain superior performance compared to competitors for a significant period, via possession of environmental and operational capabilities that are valuable, rare, and inimitable. It is measured using a 10-item scale encompassing cost leadership through eco-efficient practices, product differentiation through green product attributes, market responsiveness to environmental demands, and reputational capital generated through sustainability performance. The measurement items are presented in Table 4.

Table 4.
Sustainable Competitive Advantage Measurement Items.

Item Description	Item No.
The factory's environmental practices contribute to lower production costs compared to competitors.	SCA1
Green product attributes enable the factory to differentiate itself in the market.	SCA2
The factory's environmental performance strengthens its reputation with customers.	SCA3
Sustainability practices enable the factory to meet regulatory requirements ahead of competitors.	SCA4
Environmental capabilities are difficult for competitors to replicate in the short term.	SCA5
The integration of environmental and cost strategies creates unique value for customers.	SCA6
The factory's circular economy practices reduce input costs below competitor levels.	SCA7
Sustainable practices support the factory's ability to enter environmentally sensitive markets.	SCA8
The factory's green cost management approach contributes to long-term financial sustainability.	SCA9
Environmental innovation capabilities provide a durable basis for competitive advantage.	SCA10

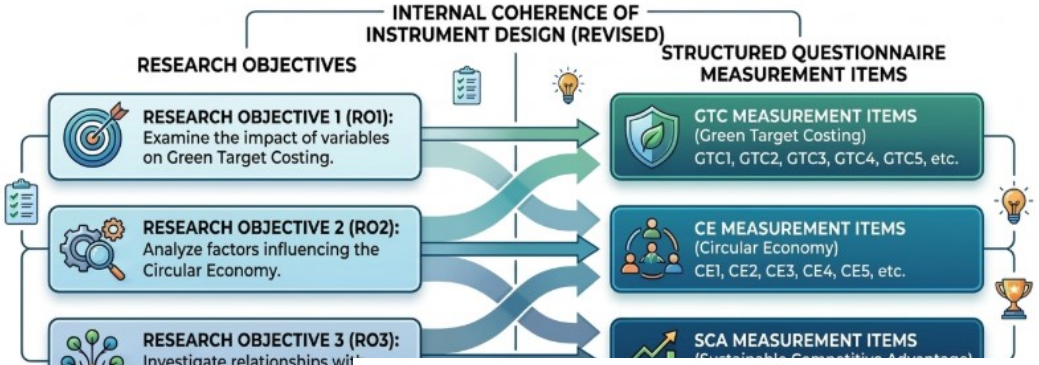


Figure 1. Diagram illustrating the alignment between revised study objectives and questionnaire items.

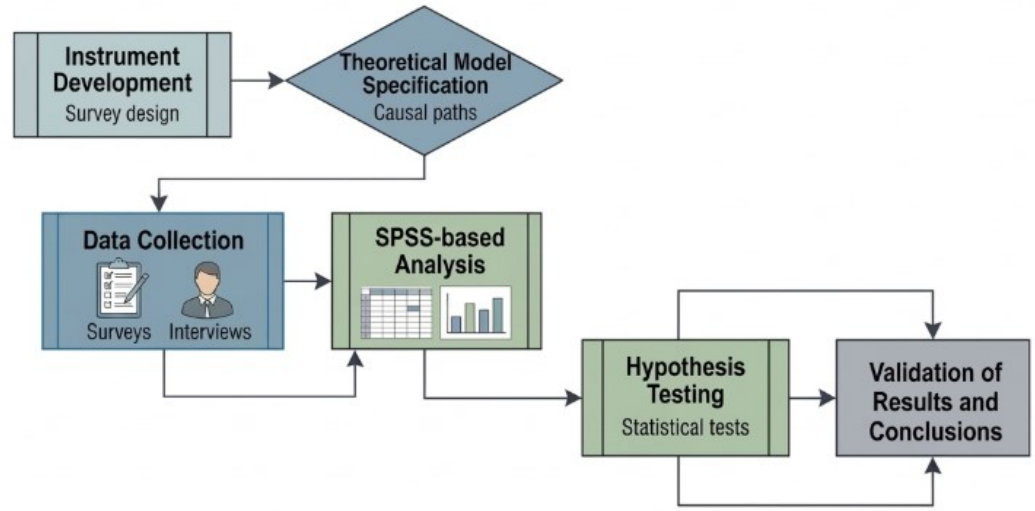


Figure 2. Algorithm of research development, testing, training, and validation.

Statistical Methods

All data were analyses using IBM SPSS Statistics Version 26. The following statistical procedures were employed in sequence, aligned with the study's objectives and hypotheses.

Descriptive Statistics

Means, standard deviations, and standard errors were calculated for each item and dimension. Mean values were interpreted based on a five-point Likert scale decision criterion: means lower than 2.33 indicate low agreement, means between 2.34 and 3.67 indicate moderate agreement, and means higher than 3.68 indicate high agreement.

Reliability Analysis Cronbach's Alpha

Cronbach's alpha coefficient was used to evaluate the internal consistency reliability of each dimension and for the overall instrument. The minimum acceptable value of Cronbach's alpha is 0.70 for social science research; values above 0.80 indicate good reliability, and values above 0.90 indicate excellent reliability.

Internal Consistency Validity

Internal-consistency reliability was assessed via the corrected item-total correlation for each item within its dimension, using a threshold of 0.40 or higher as an indicator of item-level coherence with its dimension (Daowadueng, 2024). Corrected item-total correlation is a reliability-adjacent diagnostic rather than a formal test of construct validity: it does not establish that items load on a single underlying factor, or that they are free of cross-loading with other dimensions. Formal construct validation of the newly developed GTC, CE, and SCA scales, through exploratory or confirmatory factor analysis, was not performed in this study and is acknowledged as a limitation; the validity claims made in this manuscript are accordingly restricted to internal-consistency reliability rather than construct validity.

One-Sample *t*-Test

Items within each of the GTC and CE dimensions were tested using one-sample t-tests to determine whether the mean response for each item differed significantly from the neutral midpoint of the Likert scale (test value = 3). These tests are descriptive: a significant result indicates that respondents' item-level agreement or disagreement departed from a neutral midpoint, showing that GTC and CE practices are perceived as present at the factory. They do not test H1 or H2, which concern the effect of GTC and CE on sustainable competitive advantage; the direct tests of H1 and H2 are the standardized regression coefficients reported in Section 4.5.

Correlation Analysis

Bivariate relationships between GTC, CE, and SCA were examined using Pearson product-moment correlation coefficients. Correlation coefficients above 0.50 are considered moderate to strong in the social science context, with statistical significance judged at the 0.01 and 0.05 levels. The correlation matrix also served as a preliminary check for multicollinearity in the subsequent regression analysis.

Multiple Regression Analysis

The joint and individual effects of GTC and CE on sustainable competitive advantage were measured using multiple regression analysis (MRA), with GTC and CE entered simultaneously as predictors. The regression equation is: $SCA = \beta0 + \beta1GTC + \beta2CE + \varepsilon$, where $\beta1$ and $\beta2$ are the standardized regression coefficients for GTC and CE respectively, and ε is an error term. This additive specification estimates the separate contribution of each predictor and their combined explanatory power (R^2); it does not include a GTC × CE interaction term and therefore does not test whether the two practices interact synergistically. The coefficient of determination (R^2) states the percentage of variance in SCA predicted by the model; F-statistics evaluate model-level significance, while t-statistics ($\alpha = 0.05$) assess the significance of individual predictors.

4.0 Data Analysis and Discussion

Descriptive Statistics

Table 5shows the descriptive statistics for all items in the study instrument. Each item reported are the arithmetic mean, standard deviation and standard error based on the 64 valid samples.

Table 5.
Descriptive Statistics for Study Variables.

Item	Mean	Std. Dev.	Std. Error
GTC1	4.09	0.712	0.087
GTC2	3.97	0.741	0.091
GTC3	3.88	0.783	0.096
GTC4	4.02	0.729	0.089
GTC5	3.94	0.756	0.092
GTC6	3.76	0.812	0.099
GTC7	4.11	0.698	0.085
GTC8	3.85	0.767	0.094
GTC9	3.91	0.744	0.091
GTC10	4.04	0.717	0.088
CE1	4.07	0.721	0.088
CE2	3.93	0.758	0.093
CE3	3.81	0.796	0.097
CE4	3.72	0.831	0.102
CE5	3.98	0.741	0.091
CE6	3.79	0.809	0.099
CE7	3.88	0.762	0.093
CE8	4.03	0.712	0.087
CE9	3.84	0.778	0.095
CE10	3.96	0.749	0.092
SCA1	4.12	0.693	0.085
SCA2	4.08	0.714	0.087
SCA3	4.15	0.681	0.083
SCA4	3.99	0.738	0.090
SCA5	3.87	0.769	0.094
SCA6	4.06	0.721	0.088
SCA7	3.94	0.752	0.092
SCA8	4.01	0.731	0.089
SCA9	4.09	0.707	0.086
SCA10	3.96	0.743	0.091

Source: Authors' computation, 2026.

The descriptive statistics analysis shows that, all items in the three dimensions recorded above 3.68 mean score and shows a high level of agreement. The grand mean of GTC dimension is 3.96, which application ranges from must-have (from item 3.76GTC6: supplier selection criteria) to thin silver (from item 4.11GTC7: integration green design principles). The CE dimension achieved a grand mean roughly equal to 3.90, with item means between 3.72 (CE4: product take-back programmes) and 4.07 (CE1: end-of-life design). With items ranging from 3.87 (SCA5: inimitability of environmental capabilities) to 4.15 (SCA3: reputational effects), the SCA dimension obtained the highest grand mean of 4.03. Standard deviation values for all items ranged from 0.681 to 0.831 revealing homogeneous responses without maximal polarization between respondents.*4.2.* Validity and Reliability Analysis

Internal Consistency-Green Target Costing Dimension

The internal consistency validity of the GTC dimension was assessed by computing corrected item-total correlations for each of the ten items. As reported in Table 6, all corrected item-total correlations exceed the recommended threshold of 0.40, ranging from 0.681 (GTC6) to 0.774

(GTC7), confirming that each item contributes adequately to the measurement of the underlying construct.

Internal Consistency-Circular Economy Dimension

The internal consistency validity of the CE dimension was similarly assessed. As shown in Table 7, corrected item-total correlations for all CE items range from 0.674 (CE4) to 0.752 (CE8), all substantially exceeding the 0.40 threshold. These results confirm the convergent validity of the CE measurement scale.

Overall Cronbach's Alpha

Table 8 shows that all dimensions and the overall instrument achieved excellent levels of internal consistency. The Cronbach's alpha coefficients for GTC ($\alpha = 0.901$), CE ($\alpha = 0.897$), and SCA ($\alpha = 0.906$) all exceed the 0.90 threshold for excellent reliability. The overall instrument alpha of 0.934 further confirms the high internal consistency of the measurement instrument. All corrected item-total correlations (Tables 6 and 7) exceed the 0.67 threshold, well above the 0.40 cut-off, indicating that each item adequately reflects the variance of its underlying construct.

Table 6.

Internal Consistency-Dimension 1 (Green Target Costing, 10 Items).

Item	Mean	Std. Dev.	Corrected Item-Total Correlation	Cronbach's Alpha if Item Deleted
GTC1	4.09	0.712	0.761	0.892
GTC2	3.97	0.741	0.743	0.893
GTC3	3.88	0.783	0.718	0.895
GTC4	4.02	0.729	0.752	0.892
GTC5	3.94	0.756	0.736	0.893
GTC6	3.76	0.812	0.681	0.897
GTC7	4.11	0.698	0.774	0.891
GTC8	3.85	0.767	0.712	0.895
GTC9	3.91	0.744	0.729	0.894
GTC10	4.04	0.717	0.758	0.892

Source: Authors' computation, 2026.

Table 7.

Internal Consistency-Dimension 2 (Circular Economy, 10 Items).

Item	Mean	Std. Dev.	Corrected Item-Total Correlation	Cronbach's Alpha if Item Deleted
CE1	4.07	0.721	0.748	0.889
CE2	3.93	0.758	0.731	0.890
CE3	3.81	0.796	0.702	0.892
CE4	3.72	0.831	0.674	0.894
CE5	3.98	0.741	0.739	0.890
CE6	3.79	0.809	0.694	0.893
CE7	3.88	0.762	0.718	0.891
CE8	4.03	0.712	0.752	0.889
CE9	3.84	0.778	0.709	0.892
CE10	3.96	0.749	0.733	0.890

Source: Authors' computation, 2026.

Table 8.
Cronbach's Alpha Reliability Test.

Dimension	Number of Items	Cronbach's Alpha
Green Target Costing (GTC)	10	0.901
Circular Economy (CE)	10	0.897
Sustainable Competitive Advantage (SCA)	10	0.906
Overall Instrument	30	0.934

Source: Authors' computation, 2026.

Hypothesis Testing-One-Sample t-Tests

One-Sample *t*-Test: Green Target Costing

All GTC and CE dimensions across both groups had mean scores above the neutral midpoint of 3, all $p < 0.001$ (Tables 9 and 10). This confirms respondent had substantial agreement with almost all the practices of GTC and CE, offering item level support for H1 and H2.

Table 9.
For Green Target Costing we perform the One-sample t-Test (Test Value = 3).

Item	Mean	t-Value	*p*-Value	Decision
GTC1	4.09	12.76	0.000	Significant
GTC2	3.97	10.89	0.000	Significant
GTC3	3.88	9.42	0.000	Significant
GTC4	4.02	11.46	0.000	Significant
GTC5	3.94	10.22	0.000	Significant
GTC6	3.76	7.67	0.000	Significant
GTC7	4.11	13.06	0.000	Significant
GTC8	3.85	9.04	0.000	Significant
GTC9	3.91	10.00	0.000	Significant
GTC10	4.04	12.00	0.000	Significant

Table 10.
One-Sample t-Test for Circular Economy (Test Value = 3).

Item	Mean	t-Value	*p*-Value	Decision
CE1	4.07	12.16	0.000	Significant
CE2	3.93	10.05	0.000	Significant
CE3	3.81	8.57	0.000	Significant
CE4	3.72	7.08	0.000	Significant
CE5	3.98	10.81	0.000	Significant
CE6	3.79	8.27	0.000	Significant
CE7	3.88	9.50	0.000	Significant
CE8	4.03	11.84	0.000	Significant
CE9	3.84	8.84	0.000	Significant
CE10	3.96	10.52	0.000	Significant

Source: Authors' computation, 2026.

One-Sample *t*-Test: Circular Economy

The one-sample t-test results for the Circular Economy dimension are presented in Table 10. All ten CE items returned mean scores significantly above the neutral midpoint of 3 ($p < 0.001$), with means ranging from 3.72 (CE4) to 4.07 (CE1). These findings provide item-level evidence that respondents recognize and practice CE principles within the factory, supporting H2.

Correlation Analysis

Table 2 indicates strong and highly significant positive correlations between all three variables. GTC was associated more strongly with SCA ($r = 0.782$, $p < 0.01$) than CE ($r = 0.741$, $p < 0.01$). GTC and CE's inter-predictor correlation ($r = 0.673$, $p < 0.01$) is below the common threshold of 0.85 for identifying troublesome multicollinearity which indicates that the two predictors measure sufficiently different constructs to warrant their joint entry into the regression equation.

Table 11.

Pearson Correlation Matrix.

Variable	GTC	CE	SCA
GTC	1.000	0.673**	0.782**
CE	0.673**	1.000	0.741**
SCA	0.782**	0.741**	1.000

** Correlation is significant at the 0.01 level (two-tailed).

Source: Authors' computation, 2026.

Multiple Regression Analysis

The overall multiple regression results indicate the model is statistically significant ($F = 81.24$, $p < .001$), with GTC and CE together accounting for a substantial proportion of variance in SCA ($R^2 = 0.714$, Adjusted $R^2 = 0.705$). This means that GTC and CE, entered simultaneously, explain about 71.4% of the variance in sustainable competitive advantage in this sample. Both predictors have significant positive standardized coefficients on SCA, with GTC a stronger predictor than CE ($\beta = 0.512$, $t = 6.847$, $p < .001$ vs. $\beta = 0.431$, $t = 5.762$, $p < .001$). These results support H1 and H2, and are consistent with H3 in the specific sense that both predictors jointly and significantly explain variance in SCA when entered together; they do not, however, test or confirm a synergistic or interactive effect beyond the sum of the two predictors' separate contributions, since no GTC × CE interaction term was estimated.

Table 12.

Multiple Regression Results (Dependent Variable: SCA).

Predictor	Beta (Standardised)	t-Value	*p*-Value	R^2	Adjusted R^2	F-Statistic
GTC	0.512	6.847	0.000	0.714	0.705	81.24**
CE	0.431	5.762	0.000			

** $p < 0.01$. Model: $SCA = \beta_0 + 0.512(GTC) + 0.431(CE) + \varepsilon$.

Source: Authors' computation, 2026.

Interpretation of Results

The empirical findings of this research strongly support all three hypotheses, indicating that both Green Target Costing and practices within the Circular Economy are positively; significantly and substantively correlated to sustainable competitive advantage in Wasit Textile & Sewing Factory. This indicates that on a five-point scale from "not at all" to "very much so," respondents rated these practices as meaningfully present and operationally relevant (all minimum mean scores = 3.76) but one-sample t-test results for each item confirm that these perceptions were significantly different from neutral.

An interesting empirical finding is that GTC predicts SCA more strongly (β = 0.512) than does CE (β = 0.431). This may reflect the more immediate, design-stage discipline associated with GTC, compared with the typically more capital-intensive and longer-payback nature of circular investments under CE. Both predictors are highly significant, and the combined R^2 of 0.714 indicates that GTC and CE together account for a large share of variance in SCA in this sample. This additive result does not, however, establish that implementing GTC and CE together produces a larger competitive advantage than implementing either strategy alone, since that comparison would require an interaction term or a comparative model that this study did not estimate.

The strategic and informational dimensions of the CE adoption, i.e., circular strategic integration (CE8: cor=0.752) and monitoring of material flows (CE9: cor=0.709), correlate significantly with competitive outcomes. This emphasises the fact that CE should be embedded in planning and reporting systems and not just another operational initiative. The moderate correlation among the predictors (r = 0.673) corroborates the anticipated complementarity between GTC and CE (firms adopting one are likely to adopt another; hence, they can reinforce each other).

Comparison with Previous Studies

The evidence for a considerable competitive advantage associated with GTC is well aligned with Figge et al. (2002), who find that firms with lifecycle cost targets perform better on environmental and financial outcomes, and Burritt et al. (2009), who similarly find a positive association between adoption of environmental management accounting and cleaner production in the manufacturing sector. This study extends these findings to the context of Iraqi manufacturing and shows that the benefits of GTC observed elsewhere are also present in this setting, consistent with Al-Tuwaijri et al. (2004); as a single-case study, however, this finding should be read as context-specific rather than broadly generalizable.

The significant relationship of CE with competitive advantage is consistent with earlier theoretical and empirical work by Geissdoerfer et al. (2017) and Bocken et al. (2018). This is particularly relevant to the textile context, where even partial CE adoption has been shown to generate cost and differentiation advantages (Dissanayake & Sinha, 2015). These findings suggest that CE practices at the Wasit factory have reached a level of maturity linked to tangible competitive results, albeit with the inherent challenges toward textile circularity noted in the literature.

The R^2 obtained in this study (0.714) is comparable to, and somewhat higher than, that reported in the related combined model of Schaltegger et al. (2019) (R^2 = 0.632), lending some cross-context support to the proposition that GTC and CE are usefully studied as related strategic practices rather than in isolation. This comparison concerns the combined explanatory power of two simultaneously entered predictors in each study, not a formally tested interaction or synergy effect, and should be interpreted accordingly.

Limitations and Anomalies

The comparatively lower mean responses for supplier engagement items, GTC6 (mean = 3.76) and CE6 (mean = 3.79), suggest that supply chain integration of environmental cost and circular practices is still at an early stage. This finding is in line with Kjaer et al. (2018) and Nakajima et al. (2015), who identify supplier collaboration as a dimension of CE that is complex to

implement. The consistency of this pattern across industries and geographic contexts suggests that limited supply chain integration may be a broader, systemic issue rather than a firm-specific deficiency.

The lower adoption intensity observed for CE relative to GTC is consistent with CE being more capital-intensive and having longer payback horizons than the information- and design-based investments required for GTC. This interpretation aligns with Korhonen et al. (2018), who observe that the economic rationale for managing and limiting operational environmental externalities may be more evident than the rationale for circular investment in geographies where secondary material markets are still developing.

5.0 Conclusion and Recommendations

This paper aimed to investigate the effect of integrating Green Target Costing and Circular economy on Sustainable Competitive Advantage in Wasit Textile & Sewing Factory. Using data from 64 respondents along with an extensive set of quantitative analytical methods, the study provides a number of key theoretical and practical outputs.

The main findings are threefold. First, consistent with the Natural Resource-Based View, GTC is positively and significantly associated with sustainable competitive advantage. Second, CE is also positively and significantly associated with sustainable competitive advantage, indicating that circular material strategies are linked to competitive outcomes beyond cost savings alone. Third, when entered simultaneously, GTC and CE together explain 71.4% of variance in sustainable competitive advantage, supporting H1, H2, and H3 in the sense defined in this study namely, that both practices jointly and significantly explain variance in SCA. These results do not establish that executing GTC and CE together produces a larger competitive advantage than executing either strategy separately, since this study did not estimate an interaction or comparative model; that question is identified here as a priority for future research using the appropriate statistical design.

These findings provide actionable recommendations about how Competitiveness Textile manufacturing enterprises incorporate GTC in the product design and costing processes against predetermined goals of environmental costs in the design stage while recording their progress along the production value chain. They should focus on CE capabilities especially embedding circular principles into strategic planning and measuring material flows as these dimensions have the closest links to competitive outcomes. Firms should also improve supplier environmental competencies to strengthen gaps in supply chain integration, and design Environmental Cost Accounting systems that capture full lifecycle costs and circular material flow savings.

Based on these results, it is recommended that the Wasit Textile and Sewing Factory pursue sustainability practices through concrete operational steps. These could include establishing dedicated material recovery processes to feed the manufacturing loop systematically, and formally incorporating green target cost ceilings into the eco-design phase of each product line. Doing so may strengthen the factory's sustainable competitive advantage and could offer a starting point for similar enterprises elsewhere in the Iraqi textile and garment sector considering their own environmental performance and competitiveness; given the single-case design, this recommendation should be validated in other settings before being generalized.

Several limitations should be acknowledged. That said, the study offers an in-depth analysis of a unique context using the single-firm case study design, but limits generalizability to other firms in the wider Iraqi manufacturing sector. A limitation is that the cross-sectional survey design denies causal inference or longitudinal testing of the pathways through which integration with GTC-CE advances competitive results. Common method bias is a limitation of self-reported data as well, though the collection of objective performance data could avoid this in future studies.

Our study makes a substantial contribution by calling future research to replicate this study with other manufacturing firms across different regions of Iraq and other developing economies, in comparison making it possible to note the contextual boundary conditions. Longitudinal designs that follow firms along its gradual enhancement of the sustainability capabilities would be very valuable in capturing how this relationship between GTC-CE integration and competitive outcomes develops over time. Qualitative case study interviews with mainstream senior managers could complement the GTC-CE interrelations by shedding more light on their resultant schemes for enabling due competitive advantage, and thus offer a further understanding into the processes of strategy that govern the empirical correlations established in this paper.

Two further limitations should be recognized. First, the empirical conclusions are based on a single company within the textile industry, with hypothesis testing (H1-H3) based on 64 respondents; this sample size and single-case design limit the generalizability of the findings to other sectors or to manufacturing more broadly (Yin, 2018). Second, the research focuses on internal operations at the factory level, with little attention to upstream or downstream supply chain actors, particularly material suppliers and downstream traders of final products (Svensson & Padin, 2012). Future research should extend these analyses to a more representative sample across a range of industries and across the wider value chain in order to confirm the relationships identified here.

References

Abbas, R. M. (2025). Integration of green target costing and activity-based budgeting. *Journal of Management and Economics, 5*, 10-24.

Al-Tuwaijri, S. A., Christensen, T. E., & Hughes, K. E. (2004). The relations among environmental disclosure, environmental performance, and economic performance: A simultaneous equations approach. *Accounting, Organizations and Society, 29*(5-6), 447-471. https://doi.org/10.1016/S0361-3682(03)00032-1

Amin, M. B., Asaduzzaman, M., Debnath, G. C., Rahaman, M. A., & Oláh, J. (2024). Effects of circular economy practices on sustainable firm performance of green garments. *Oeconomia Copernicana, 15*(3), 637-682. https://doi.org/10.24136/oc.2795

Angelis, R. D., Howard, M., & Miemczyk, J. (2018). Supply chain management and the circular economy: Towards the circular supply chain. *Production Planning & Control, 29*(6), 425-437. https://doi.org/10.1080/09537287.2018.1449244

Aureli, S., Foschi, E., & Paletta, A. (2025). Management accounting for a circular economy: Current limits and avenue for a dialogic approach. *Accounting, Auditing & Accountability Journal, 38*(2), 291-319. https://doi.org/10.1108/AAAJ-04-2022-5766

Barney, J. B. (1991). Firm resources and sustained competitive advantage. *Journal of Management, 17*(1), 99-120. https://doi.org/10.1177/014920639101700108

Beleya, P., Murugesan, T. K., Mukthar, K. P. J., & Shukla, N. (2025). World class sustainable manufacturing: A rational approach for sustainable competitive advantage. *Frontiers in Sustainability, 6*, Article 1710455. https://doi.org/10.3389/frsus.2025.1710455

Bennett, M., Schaltegger, S., & Zvezdov, D. (2011). Environmental management accounting. In M. Abdel-Kader (Ed.), *Review of management accounting research* (pp. 53-84). Palgrave Macmillan.

Bocken, N. M. P., Schuit, C. S. C., & Kraaijenhagen, C. (2018). Experimenting with a circular business model: Lessons from eight cases. *Environmental Innovation and Societal Transitions, 26*, 118-130. https://doi.org/10.1016/j.eist.2018.02.001

Bryman, A., & Bell, E. (2015). *Business research methods* (4th ed.). Oxford University Press. (Google Books)

Burritt, R. L., Herzig, C., & Tadeo, B. D. (2009). Environmental management accounting for cleaner production: The case of a Philippine rice mill. *Journal of Cleaner Production, 17*(4), 431-439. https://doi.org/10.1016/j.jclepro.2008.07.005

Clark, T., Foster, L., Sloan, L., & Bryman, A. (2021). *Bryman's social research methods* (6th ed.). Oxford University Press.

Daowadueng, P. (2024). The determinants affecting the implementation of target costing in startup firms. *Decision Science Letters, 13*(3), 535-544. https://doi.org/10.5267/j.dsl.2024.5.007

Dissanayake, D. G. K., & Sinha, P. (2015). An examination of the product development process for fashion remanufacturing. *Resources, Conservation and Recycling, 104*, 94-102. https://doi.org/10.1016/j.resconrec.2015.09.008

Edirisinghe, L. G. L. M., De Alwis, A. A. P., & Wijayasundara, M. (2024). Sustainable circular practices in the textile product life cycle: A comprehensive approach to environmental impact mitigation. *Environmental Challenges, 16*, Article 100985. https://doi.org/10.1016/j.envc.2024.100985

Ellen MacArthur Foundation. (2013). *Towards the circular economy: Vol. 1. An economic and business rationale for an accelerated transition*. Ellen MacArthur Foundation. (Ellen MacArthur Foundation)

European Commission. (2019). *The European Green Deal* (Communication from the Commission to the European Parliament, the European Council, the Council, the European Economic and Social Committee and the Committee of the Regions, COM(2019) 640 final). European Commission. (EUR-Lex)

Figge, F., Hahn, T., Schaltegger, S., & Wagner, M. (2002). The sustainability balanced scorecard: Linking sustainability management to business strategy. *Business Strategy and the Environment, 11*(5), 269-284. https://doi.org/10.1002/bse.339

Finnveden, G., Hauschild, M. Z., Ekvall, T., Guinée, J., Heijungs, R., Hellweg, S., Koehler, A., Pennington, D., & Suh, S. (2009). Recent developments in life cycle assessment. *Journal*

of Environmental Management, 91(1), 1-21. https://doi.org/10.1016/j.jenvman.2009.06.018

Geissdoerfer, M., Savaget, P., Bocken, N. M. P., & Hultink, E. J. (2017). The circular economy: A new sustainability paradigm? *Journal of Cleaner Production, 143*, 757-768. https://doi.org/10.1016/j.jclepro.2016.12.048

Hart, S. L. (1995). A natural-resource-based view of the firm. *Academy of Management Review, 20*(4), 986-1014. https://doi.org/10.2307/258963

Hraiga, R. A., Jaber, A. N. H., & Abbas, A. A. (2025). The role of green target costing in achieving sustainable competitive advantage in economic units. *Journal of Economics and Administrative Sciences, 31*(1), 155-173. https://doi.org/10.33095/a42m8y73

Jasch, C. M. (2009). *Environmental and material flow cost accounting: Principles and procedures*. Springer. https://doi.org/10.1007/978-1-4020-9028-8

Kjaer, L. L., Pigosso, D. C. A., McAloone, T. C., & Birkved, M. (2018). Guidelines for evaluating the environmental performance of product/service-systems through life cycle assessment. *Journal of Cleaner Production, 190*, 666-678. https://doi.org/10.1016/j.jclepro.2018.04.108

Korhonen, J., Honkasalo, A., & Seppälä, J. (2018). Circular economy: The concept and its limitations. *Ecological Economics, 143*, 37-46. https://doi.org/10.1016/j.ecolecon.2017.06.041

Mayndarto, O., & Sularto, L. (2026). Management accounting strategies for environmental cost control and performance optimization in green manufacturing companies. *Jurnal Ilmiah Manajemen Kesatuan, 14*(1), 537-548. https://doi.org/10.37641/jimkes.v14i1.4416

Nakajima, M., Kimura, A., & Wagner, B. (2015). Introduction of material flow cost accounting (MFCA) to the supply chain: A questionnaire study on the challenges of constructing a low-carbon supply chain to promote resource efficiency. *Journal of Cleaner Production, 108*, 1302-1309. https://doi.org/10.1016/j.jclepro.2014.10.044

Oliveros-Sepúlveda, D., Bascompta, M., & Sepúlveda, G. F. (2025). Environmental and closure costs in strategic mine planning: Models, regulations, and policies. *Resources, 14*(3), Article 41. https://doi.org/10.3390/resources14030041

Schaltegger, S., Hörisch, J., & Freeman, R. E. (2019). Business cases for sustainability: A stakeholder theory perspective. *Organization & Environment, 32*(3), 191-212. https://doi.org/10.1177/1086026617722882

Serafeim, G., & Trinh, K. (2020). *A framework for product impact-weighted accounts* (Harvard Business School Working Paper No. 20-076). Harvard Business School. https://doi.org/10.2139/ssrn.3532472

Setthasakko, W. (2010). Barriers to the development of environmental management accounting: An exploratory study of pulp and paper companies in Thailand. *EuroMed Journal of Business, 5*(3), 315-331. https://doi.org/10.1108/14502191011080836

Svensson, T., & Padin, J. (2012). Sustainable business models in supply chains: A framework for analysis. *Journal of Business & Industrial Marketing, 27*(8), 606-616. https://doi.org/10.1108/08858621211273582

Voulvoulis, N. (2022). Transitioning to a sustainable circular economy: The transformation required to decouple growth from environmental degradation. *Frontiers in Sustainability, 3*, Article 859896. https://doi.org/10.3389/frsus.2022.859896

Yin, R. K. (2018). *Case study research and applications: Design and methods* (6th ed.). SAGE.