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Understanding the Impact of Circular Transitions on Company Performance

Examining the roles of Change Management and Talent Acquisition in facilitating this relationship

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Abstract

Circular Economy (CE) is founded on principles such as reducing, reusing, and remanufacturing. The appeal of CE lies in its potential to both drive sustainability and economic growth, which is emphasized in previous research. The aim of this study is to further research the relationship between CE and organizational performance, by looking at whether a transition to CE makes the company a more attractive employer and if the effect of CE on performance can be explained by talent acquisition. Finally, the role of change management in strengthening the relationship between CE and performance was examined.

Using a mixed-method approach, this study integrated quantitative data from a closed survey and qualitative data from an open-ended survey. The relationships in the quantitative data was explored using multiple regression models and a mediation analysis. The quantitative results overall showed a positive impact of both CE and remanufacturing on performance metrics and the ability to attract talent. However, it was slightly less significant for remanufacturing. The mediation analysis revealed that talent acquisition played an important role in driving performance during a transition to CE. Additionally, the effect of change management was proven to be minimal. The qualitative data supported most of these findings and gave more in-depth insights into the observed trends. However, for change management it provided contradicting insight, claiming that it played an important role in driving performance in a company.

Keywords – Circular Economy, Remanufacturing, Performance, Talent Acquisition, Change Management.

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Phrase	**Abbreviation**
Business-to-Business	B2B
Circular Economy	CE
Corporate Social Responsibility	CSR
Circular Business Models	CBM
Original Equipment Manufacturers	OEM
Return on Assets	ROA
Return on Equity	ROE
Average Cost of Capital	WACC
Gross Doemstic Product	GDP
Small-to- Medium Enterprises	SME
Organizational Change Cysnisism	OCC
Corporate Green Image	CGI
Variance Inflation Factor	VIF
Ordinary Least squares	OLS
General Data Protection Regulation	GDPR
Missing Completely at Random	MCAR
Multiple Imputation by Chained Equations	MICE
Predictive Mean Matching	PMM

Table 0.1: Commonly used words and their abbreviations

1 Introduction

According to the European Commission (EU, 2018), the world has been in an ecological deficit for the past 50 years, requiring the equivalent of 1.7 earths worth of resources to meet current material demands. As the world faces unprecedented challenges related to environmental sustainability, resource scarcity, and climate change, it becomes increasingly important to address these issues and find sustainable solutions. This ecological imbalance has caused a global shift from traditional linear business models based on the "take, make, waste" cycle. Increasing amounts of legislation and awareness are driving companies to adopt circular economy (CE) principles. In contrast to linear business models, circular business models focus on minimizing waste and maximizing resource efficiency. The transition to CE is caused by both environmental pressures and economic opportunities. Circular practices are, therefore, essential for businesses to help meet regulatory standards, stakeholder expectations, and the demands of customers.

The study aims to provide insights into the benefits of adopting circular practices. This is done by looking at how CE and remanufacturing impact organizational performance and the potential trade-offs between CE and company performance. Furthermore, the study looks at how change management and talent acquisitions affect this initial relationship. As companies adopt new business models, management strategies must adapt to them. This study examines companies within the United States, mainly focusing on remanufacturing within the business-to-business (B2B) sector. This particular sector was chosen as the market is associated with challenges related to sustainability.

Based on the increasing importance of sustainability, this thesis seeks to explore the following research question:

> **RQ:** How does the degree of circular economy and remanufacturing influence organizational performance, and how are these outcomes affected by talent acquisition and change management practices?

1.1 Scope of thesis

The study uses a mixed-methods approach to address the research questions, which incorporates quantitative and qualitative data. This approach helps provide a broad and in-depth understanding of the benefits and challenges of CE and remanufacturing.

Quantitative data was gathered from a survey conducted among leaders of companies in the US that have implemented CE to some degree. The quantitative data examined the effect of CE and remanufacturing on organizational performance and how talent acquisition and change management influence this relationship. Additional qualitative data was collected to help supplement and expand on results of the qualitative data analysis. The qualitative data was gathered through an open-ended survey, targeting individuals from the same demographic group as the quantitative data. While they are within the same demographic group, they are not the same individuals as the quantitative participants.

1.2 Thesis structure

The study uses a deductive approach. This involves developing hypotheses based on existing literature and testing them through quantitative and qualitative analyses (Saunders et al., 2019).

The introduction, chapter 1, gives an overview of the scope and purpose of the study and presents the research question. In addition, the conceptual model, illustrates the relationships between the variables and is presented in table 1.1. The model serves as the framework for the study.

The theoretical framework is presented in chapter 2. It includes the concepts of CE, related business models, and explanations of the performance metrics. It also presents essential concepts within change management and talent acquisition and how they are related to CE. Furthermore, in chapter 2.5.2, detailed descriptions of all hypotheses are provided. The hypotheses are based on the literature presented in section 2.

Chapter 4 explains the methodology and details the research design, methods, and data collection strategies for both the quantitative and qualitative data. Ethical issues related

to the methodology and data are also discussed.

The results in Chapter 5 include the results from both the quantitative and qualitative analysis. Linear regression models are used to present the relationship between the variables in the quantitative data, while the qualitative data presents deeper insights that help address gaps from the quantitative data. Chapter 6 takes the findings from chapter 5 and analyses them based on the literature presented in chapter 2. Finally, the reliability and validity of the study is discussed, followed by the limitations of the study and suggestions for future research. Conclusions from these discussions are presented in chapter 7.

1.3 Conceptual model

To visualize the relationship between the variables in the study, a conceptual model has been created. Based on the research question and the initial literature review, the model provides a clear framework for understanding how the variables interact.

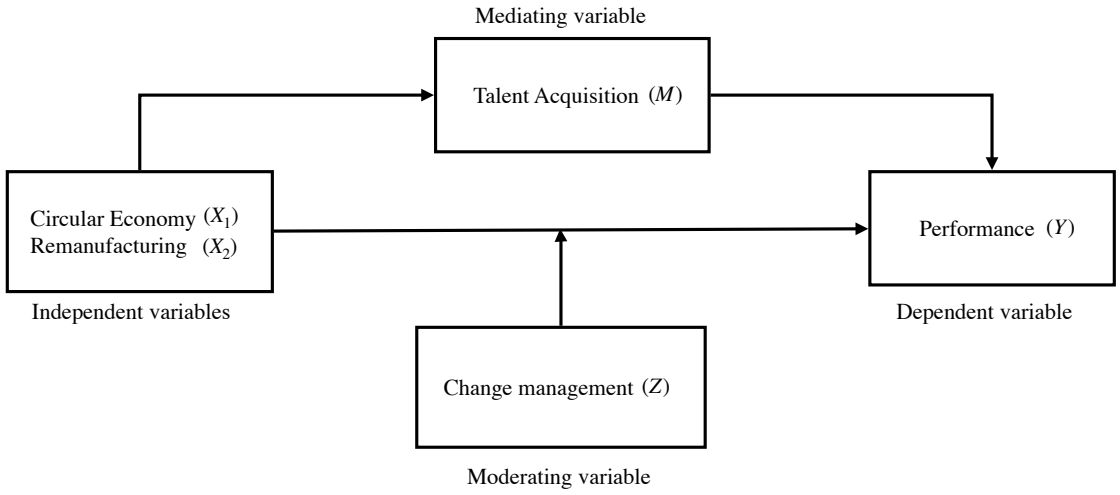

Figure 1.1: The conceptual model for the study

The conceptual model illustrated in Figure 3.1 shows an overview of how the variables in this study interact with one another. The independent variables, *Circular Economy* (X_1) and *Remanufacturing* (X_2) and the dependent variable *Performance* (Y) serve as the baseline for the study. Performance is measured through metrics such as sales growth, market share growth, employment growth, productivity, and profitability.

The model also introduces *Talent Acquisition* (M) as a mediating variable. This variable is included to explore whether the relationship between *Circular Economy* and *Performance* can be explained through the influence of talent acquisition.

Change management's (Z) role as a moderating variable is also explored. This is to examine if it affects the relationship between *Circular Economy* and *performance*.

From this theoretical model, each hypothesis created in paragraph 2.5.2 addresses a specific aspect of the model and helps answer the research question. The findings of the hypotheses are presented in chapter 5.

2 Theory

The theoretical framework is based on the conceptual model, presented in Chapter 1.1. Existing literature about the main variables and their relationship is used to develop this study's hypothesis, which is presented in chapter 2.5.2.

2.1 Circular Economy

Circular economy (CE) can explained by comparing it to its opposite, a linear economy. A linear economy is a more traditional production model characterized by a "take, make, waste" process, which includes creating non-recyclable products and throwing them away as waste after use. This is the most common economic model today (Lacy et al., 2020), however it is increasingly regarded as an unsustainable choice. The implementation of CE is therefore being promoted by governments and companies worldwide as a way to avoid these issues (Sariatli, 2017).

The concept of CE has been defined in various ways in the last decades, but there is no universal consensus regarding a precise definition (Kirchherr et al., 2017). Some definitions suggest CE can drive economic growth through the reusing of materials and products. However, other definitions focus on the reduction of overall production and consumption with the effect of limiting economic growth (Villalba-Eguiluz et al., 2023).

The Ellen MacArthur Foundation, which is seen as a leading authority on CE, has created four principles for generating economic value while promoting sustainability. These focus on consumption, lifespan of products, and reuse of materials. "The Power of the Inner Circle" involves cycling materials efficiently, with minimal processing. The "tighter" the circle is, the less the materials have to change to reuse the them. "Power of Circling Longer" is about extending the lifespan of products, parts, and materials. This can be done by either making more cycles possible or prolonging use, both of which reduce the need for new materials. "Power of Cascaded Use" discusses the changing purposes of materials as they degrade. This can include reusing old materials for insulation. Last, "Power of Pure Inputs" is about maintaining the integrity of materials and designing products with easy disassembly. This has the effect cost reduction and a more efficient recycling process. These principles show how CE supports sustainability goals and gives

companies ways for financial gain through innovative resource use and design (The Ellen McArthur Foundation, 2013).

The main goal of implementing a CE is to create a separation between economic growth and environmental degradation (Ghisellini et al., 2016). Instead of following the "take, make, waste" approach, companies are encouraged to maximize the life of products and resources. At the end of use, the products and their components are reintegrated into the system in zero-waste value chains to the greatest possible extent. The concept of CE eliminates most waste, changing how products are produced and consumed. In doing so, it separates economic growth from unnecessary resource usage and aligns it with societal progress, which makes for a much more sustainable way of doing business (Lacy et al., 2020). This separation between economic growth and resource usage comes from the extension of a product's lifetime and being able to reuse parts to help repair or create new products.

There are many ways to approach a circular economy. Circular business models (CBM) are important for implementing CE practices into organizational strategies. A CBM is defined by Geissdoerfer et al. (2020) as "Business models that are cycling, extending, intensifying, and/or dematerializing material and energy loops to reduce the resource inputs into and the waste and emission leakage out of an organizational system." This definition lays the groundwork for the different nuances present when implementing circular business models (Geissdoerfer et al., 2020).

2.1.1 Sustainability, Corporate Social Responsibility and Circular Economy

After having defined CE, the next step is to look at how it relates to broader frameworks like sustainability and corporate social responsibility (CSR). Integrating CE practices into business strategies often aligns with general sustainability and CSR goals, which benefit both society and businesses. CE, sustainability, and CSR are three concepts that share similarities and are often used when companies considers circular transitions. Defining these theories and highlighting their similarities is valuable for further theoretical exploration, as many aspects of sustainability and CSR remain relevant to the concept of CE.

CSR is defined by European Commission (2001) as "a concept whereby companies integrate social and environmental concerns in their business operations and in their interaction with their stakeholders on a voluntary basis". The concept of CSR is similar to the principles of CE, as they both focus on reducing environmental impact. While CSR focuses on voluntary efforts to address social and environmental concerns, CE takes a more direct approach by rethinking production processes to minimize waste and optimize resource use. They also provide the framework for organizations to achieve environmental and economic goals.

CE and Corporate Social Responsibility (CSR) often share common goals, with CSR working as a tool for showcasing CE and its capabilities (Morea et al., 2021). Despite this overlap, many companies recognize CE but have yet to fully integrate its principles into their CSR frameworks. Mazzucchelli et al. (2022) highlight that CE and CSR are increasingly seen as interconnected concepts. CE serves as a practical approach to realizing CSR goals. By implementing CE practices, companies can actively address critical issues like resource scarcity and environmental challenges, which are central to CSR's broader objectives. Essentially, CE allows firms to put CSR into practice (Santiago et al., 2024; Mazzucchelli et al., 2022). One could, therefore, argue that transitioning to CE increases the company's corporate social performance. Because of the growing demand for environmentally responsible businesses, adopting a circular economy could give organizations a competitive edge in attracting talent (Ma et al., 2022).

Sustainability is defined by United Nations Brundtland Commission (1987) as being able to fulfill the needs in society today without compromising the needs of future generations. This definition emphasizes the act of preserving the planet but does not describe concrete actions of how individuals or organizations can implement it. Even though the definitions have differences, they still share common ground. While sustainability and CE are interconnected, they remain distinct in nature. Sustainability has many dimensions, which go beyond the concept of regenerating new products out of previously produced material (Awan and Sroufe, 2022). Their combined implementation is seen as essential for improving market competitiveness and resource efficiency (Rosário et al., 2024). The goal of sustainability is to preserve resources for future generations, and CE provides ways to achieve this goal, through practices like waste reduction and resource optimization.

To summarize, CE, CSR, and sustainability are related but still different concepts. Sustainability presents the overarching goal of preserving resources for future generations, while CSR and CE offers tools to achieve this goal. CSR focuses more on businesses and incentivizing them to address environmental concerns. In contrast, CE provides a more practical approach by rethinking production processes to minimize waste and optimize resource use.

2.1.2 Triple Bottom Line

The triple bottom line is a framework created by the author John Elkington in 1994. The three P's: people, profit, and planet serve as the baseline for the triple bottom line, and they align with the goals of CE. By focusing on people and the planet, in addition to profit, the company shifts its focus away from the traditional "bottom line," which mainly focuses on profit. This broader approach, known as the triple bottom line, encourages businesses to view their social and environmental impact as equally important as their financial performance. (Elkington, 2004). By having companies consider these variables, paths toward sustainability and economic growth are created.

2.2 Remanufacturing

Remanufacturing is a key component of CE. It is defined as a process where used products or broken components are restored back to a functional state (Teixeira et al., 2022). Regeneration and resource efficiency are encouraged by bringing back products that are already manufactured into the production cycle. This aligns with CE's sustainability goals, which include reducing waste and extending the life span of products.

Kahn et al. (2021) looked at critical success factors that are needed to incorporate remanufacturing in the production cycle. Key factors include government incentives, involvement of management, and financial support related to product redesigning for easier remanufacturing. Baballe et al. (2023) look at both the benefits and challenges related to the concept of remanufacturing. Advantages include the use of fewer resources, less energy, and overall reduction of waste. They estimate that there is a higher profit margin at about 20-30% related to remanufactured products, which is higher than with standard production methods, which often see profit margins between 10-20 %. Another

benefit of remanufactured products is that it becomes easier to detect previous problems with the products and correct these to make them last longer in the future.

However, there are also challenges associated with remanufacturing. It can bring high upfront costs because of the need for product redesign. This can result in higher production and retail prices. Additionally, original equipment manufacturers (OEMs) may lose profits as third-party businesses replicate and sell components or refurbished versions of their products. This creates unintended competition, where OEMs must compete not only with third-party parts and refurbished goods but also with their own original products being resold by others (Baballe et al., 2023).

2.3 Circular Economy and Performance

After presenting the theories of CE and remanufacturing, the focus now shifts to examining their impact on performance. To understand the effects of CE on performance, there is a need for a definition of the term "performance". Drawing on insights from the research of Geissdoerfer et al. (2018), this study defines performance through key metrics such as sales, market share, employee growth, productivity, and profitability.

2.3.1 Profitability

Several studies, including Nosková et al. (2024), show that the implementation of CE has a clear positive impact on profitability within businesses. Ioannidis et al. (2021) and Kahn et al. (2021) found that the use of the "reduce, reuse, recycle" framework and general CE implementation improved financial performance within businesses. Mazzucchelli et al. (2022) found that waste reduction had a positive influence on financial outcomes, as well as a positive relationship between circular design practices and profitability. Zisopoulos et al. (2023) also found that remanufactured products have a positive effect on profit, which shows the benefits of extending product life cycles through remanufacturing.

Other studies focused on specific environmental initiatives linked to financial performance by looking at different financial metrics, such as return on assets (ROA) and Return on equity (ROE). For example, Bartolacci et al. (2018) found a positive relationship between financial performance (measured by ROA) and implementing more environmentally friendly waste collection. Bogdan et al. (2022) and Ionascu et al. (2018) showed that financial

metrics, including ROA, ROE, and earnings per share, were positively influenced by transparent waste management disclosures and the implementation of leasing in their company structure. Finally, Sarfraz et al. (2022) found that CE may cause financial benefits, although companies risk mitigating them because of weak improvements of weighted average cost of capital (WACC) and return on assets, high implementation costs, and long time horizons for returns.

2.3.2 Sales

CE practices are shown to have a positive impact on the amount of sales in a company (Nosková et al., 2024). Aryee and Kanda (2024) found that by implementing circular practices, the operational costs can be reduced. This allows firms to lower product prices, which then drives sales. Yu et al. (2022) points out that CE practices not only increase profitability and market share but also improve product quality and introduce new products, all of which are likely to boost sales. Similarly, Mazzucchelli et al. (2022) found that brand reputation, enhanced by CE practices, led to sales growth, emphasizing the importance of a brand with a strong focus on sustainability.

Moric et al. (2020) highlights that performance, measured by annual sales per employee, was influenced by the adoption of a circular economy. Their study had categories like "Adopters", "Prospective adopters", "Planners", or "Non-adopters", where they saw greater sales success among those in the CE adoption process. Additionally, Li et al. (2022) confirmed that circular practices such as "Reinvent and Rethink" and "Restore, Reduce, and Avoid" had a positive impact on sales performance, although the “Recirculate" strategy was less effective in driving sales. As shown by these studies, the implementation of CE principles often has the effect of increasing sales for many businesses.

2.3.3 Market Share

Nosková et al. (2024) also looked at how CE increased market share and found a positive relationship between them. Yu et al. (2022) found that circular improvements and product innovations also have a positive effect on market share. This helps show how important CE adoption is for companies seeking to increase their market position. Bogdan et al. (2022) provided further evidence that transparent waste management practices could

boost market share, as companies that reported environmental management activities outperformed competitors. Mazzucchelli et al. (2022) explored the connection between the 3R principles (waste treatment, reduction, and recycling) and brand reputation, concluding that the enhancement of brand reputation through the implementation of CE practices translated into improved market share.

Lastly, Rodríguez-González et al. (2022) demonstrated that implementing CE can enhance a company's market share. This is done by improving its environmental reputation and then attract eco-conscious consumers.

2.3.4 Employment

Horbach et al. (2015) found that CE practices can lead to an increase in job creation. This is particularly found in waste management and material recovery sectors. The study indicates that the shift to CE increases employment growth by increasing the demand for skilled labor in the green sectors.

Burger et al. (2019) points out that while the implementation of CE shows potential for increasing job opportunities, with the type of jobs created can vary across sectors. Laubinger et al. (2019) found that the transition to a circular economy is projected to create jobs in labor-intensive sectors such as recycling, repair, and remanufacturing, contributing to net employment gains of 0–2% in most scenarios. In contrast, job losses are expected for material-intensive industries such as construction.

2.3.5 Productivity

There is limited research regarding the direct effect of CE on productivity among employees. However, Corporate Social Responsibility has been found to enhance productivity by increasing employee involvement, motivation, and identification with company goals. Companies that are associated with the Domini Social Index 400, a benchmark for socially responsible businesses, on average, have s higher total sales per employee. This suggests that CSR initiatives can have a positive impact on workforce efficiency (Becchetti et al., 2005).

2.4 Change Management and Performance

Change management offers a guideline for implementing organization shifts, which is required when transitioning to CE. According to Sartori et al. (2018), change management refers to theories that guide companies through the complexities of organizational transformations. Kotter's 8 Steps to Organizational Change is one of many theories that can be used. The theories address the challenges companies face in organizational transformations and provide ways to manage these and successfully implement new practices, such as CE practices.

Well-executed leadership and change management are important steps to ensure a successful transition to CE. Huemer (2020) makes a point of the role leadership and strategic change management have on success in the European plastics industry. The study highlights Kotter's 8-Step model, showing that it works well with the concept of CE. The model's structured approach is beneficial when adopting a circular economy and is particularly helpful in industries focusing on recycling.

Leadership and change management are often highlighted as important for the successful implementation of CE. However, insights from Sohal and De Vass (2022) on Australian Small-to-Medium Enterprises (SME) show that passion and pragmatic leadership are important and point toward a more flexible, tailored approach for smaller enterprises. Soni et al. (2023) suggests a more collaborative approach, by emphasizing distributed leadership. Another study examined supply chain performance through case studies conducted in Brazil and Scotland, where success factors for adopting CE was identified (Sehnem et al., 2019). This included strong management support, focus on organizational culture, and effective stakeholder management. While change management models provide a foundation for change, there exists evidence that many different management styles can be used in the transition to CE.

In addition to leadership and change management theories, one must consider the factors that contribute to successful change management. Errida and Lotfi (2021) found 12 categories that influence the success of change management. Among these are the need for a clear vision, effective leadership, communication, motivation, and reinforcement. These categories are necessary for managing an effective circular transition.

Phillips and Klein (2022) analyzed 15 common strategies within 16 change management models and frameworks. They found that strategies focused on communication, stakeholder involvement, encouragement, organizational culture, vision, and mission play a role in a successful organizational change. These strategies make sure that employees and stakeholders remain engaged during the transition, positively impacting performance during the transition. Mukhlis and Tyas (2024) supports this in his studies by showing that change management can lead to an easier transition to the goal. Organizations can create strategies to address challenges by identifying both risks and opportunities. Effective change management enables businesses to minimize disruptions, ensuring a smoother transition while preparing employees and stakeholders for the changes ahead. Both Phillips and Klein (2022) and Mukhlis and Tyas (2024) emphasize that well-executed change management strategies are essential not only for maintaining performance but also for preparing and engaging any individual involved in an organizational shift.

In summary, effective change management can help simplify organizational transitions, such as the implementation of CE, by aligning the strategic vision with workforce support and stakeholder engagement.

2.4.1 Kotter's 8 steps

Kotter's 8-Step Change Model (Kotter, 1996) provides a structured approach for managers looking to implement organizational change. Kotters 8 steps is often utilized inthe transition to CE. The model outlines eight key steps to guide the process Kotter, 1996:

1. Create a sense of urgency.
2. Form a team.
3. Create a vision and strategy.
4. Communicate the vision to employees.
5. Remove barriers to change.
6. Create short-term goals.
7. Maintain momentum.
8. Institutionalize the change into the organization's DNA.

While the model has received both praise and criticism, it remains a popular tool in the field of change management. Ramasamy and Ramaswamy (2017) identified both strengths and weaknesses of the model. The structure of the model, the focus on a clear vision, and the setting of short-term goals to keep motivation high are seen as positive aspects of the model. However, they also pointed out some limitations. They found that the model lacks specific tools to execute change, is very focused on top-down leadership, and is more suitable for large-scale, one-time changes rather than smaller, ongoing adjustments that many organizations face today.

Appelbaum et al. (2012) looked at Kotter's 1996 change management model, and pointed out both its strengths and limitations. The model was praised for its structured framework. However, it was criticized for lacking robust empirical validation. The model was noted as an effective planning tool, but lacks focus on strategies for handling obstacles that occur during the implementation. While Kotters serve as a solid starting point for implementing change, it may require modifications or could be combined with other models.

2.4.2 Issues related to Change Management and Performance

The implementation of change management offers benefits related to performance but also presents certain challenges. By (2005) argues that there is a lack of empirical support for the use of change management theory and notes a high failure rate of approximately 70% on all change programs that are initiated. The need for new change management frameworks is emphasized.

Discontinuous change can hinder business success by leading to complacency among employees, inward focus, or resistance to initiatives. Internal resistance can again cause conflict and decrease team spirit, and a reduction in productivity. This indicates that support for change is not a given and needs to be incorporated into the strategy when transitioning to CE (By, 2005).

Mauss et al. (2023) found that successful implementation of CE requires change both within and outside of an organization, which can be hard to ensure. Aligning the long-term goals of CE with the short-term needs of businesses poses a challenge. The shift to circularity often demands changes in organizational culture and behavior, which can be difficult to manage and sustain over time.

Raineri (2011) adds to this critical perspective by demonstrating that while change management practices may positively impact the achievement of project objectives and timelines, their influence on core performance metrics such as sales, profit, and employee productivity is often uncertain. This suggests that even when change management is implemented effectively, its direct impact on key performance indicators, such as financial results and employee engagement, may be limited.

2.5 Talent Acquisition

This section focuses on how companies can use their corporate image and talent strategies to attract employees. Tkalac Verčič and Verčič (2024) found that all generational groups view sustainability as an essential factor in evaluating employer brands. Generation X had the most positive attitude toward sustainability, followed by Generation Z. Even though Generation Z currently has less financial influence compared to Generation X, their strong emphasis on sustainability in employer branding suggests they will have a significant impact as they enter the workforce.

To understand how one can attract talent, it is essential to understand how job seekers respond to information presented in job offers, especially when the goal is to attract skilled talent. This is important because companies and job seekers depend on job descriptions and company information during the hiring process. Companies use these messages to attract the right candidates, while job seekers use them to evaluate potential employers. (Carballo-Penela, 2019). The signal theory suggests that job seekers cannot fully access all relevant information about potential employers. Instead, they rely on limited and often incomplete information to form judgments about organizations. This information allows applicants to form an impression of the organization (Carballo-Penela, 2019).

2.5.1 The impact of Circular Economy on Talent Acquisition

A corporate green image (CGI) is when a company has a clear, sustainable image that communicates benefits to others, including job seekers. A strong corporate green image indicates that a company has high moral and prosocial values, along with positive benefits such as working conditions, including safe environments, fair treatment, and strong employee welfare. For an employee, being associated with a company like this can help with the sense of self-worth and dignity. Overall, promoting these symbolic and functional benefits enhances the firm's attractiveness to potential employees. (Ma et al., 2022).

There exists much literature related to the positive impact of an environmentally friendly corporate image on attracting potential employees. Research by Gatewood et al. (1993) indicates that applicants often base their choice of employer on perceptions of a company's image, while Bauer and Aiman-Smith (1996) found that firms with a pro-environmental

stance are perceived as more attractive employers. Corporate social performance is also found to provide a competitive advantage by drawing a larger pool of job candidates (Davis, 1973; Fombrun and Shanley, 1990). Applicants tend to be drawn to organizations that reflect values they consider important (Chatman, 1989), and CSR plays a key role in signaling these values and improving employer attractiveness (Turban and Greening, 1997). Companies like IBM and Microsoft have used this to their advantage this by highlighting their environmental initiatives in promotional materials, showing how social responsibility can be used to attract potential employees (Turban and Greening, 1997).

2.5.2 Talent Acquisition and its impact on Organizational Performance

In today's competitive landscape, an organization's talent is one of the most important sources of competitive advantage. The effective implementation of talent acquisition strategies boosts employee engagement, which in turn drives organizational performance and productivity. Research suggests that the more engaged the employees are, the higher their productivity levels will be (Hombalimath and Kinange, 2020).

Social Identity Theory (Turner and Oakes, 1986) shows how organizations can present themselves more attractive to potential employees. According to this theory, individuals categorize themselves into social groups, influencing their self-concept. The image and reputation of an organization can shape how employees view themselves. Employees who see themselves as an extension of a company may experience a boost in self-esteem when working for a company with a strong, positive reputation. This can enhance employee engagement, as employees are more likely to thrive in organizations that align with their values and provide a sense of prestige (Turban and Greening, 1997).

3 Development of Hypotheses

While many studies have explored the impact of circular economy and remanufacturing on organizational performance, incorporating mediating and moderating variables like talent acquisition and change management offers a new perspective. Performance is measured through metrics such as growth in sales, market share, employment, productivity, and profitability. Change management is measured by the variables *Perceived Importance of CE* and *Knowledge of CE*. The following section outline the variables, their interactions, and the hypotheses that form the basis of this study's empirical investigation. The hypothesis will be analyzed using linear regression models, highlighting the relationships between the variables.

$$X_1 : \text{Circular Economy (Independent variable)} \tag{3.1}$$

$$X_2 : \text{Remanufacturing (Independent variable)} \tag{3.2}$$

$$Y : \text{Performance (Dependent variable)*} \tag{3.3}$$

$$M : \text{Talent acquisition (Mediating variable)} \tag{3.4}$$

$$Z : \text{Change management(Moderating variable)*} \tag{3.5}$$

$$\beta_i : \text{Regression parameter} \tag{3.6}$$

$$\epsilon : \text{Error term} \tag{3.7}$$

**Expanded definition of performance metrics:*

$$Y : Y_1, Y_2, Y_3, Y_4, Y_5 \tag{3.8}$$

$$Y_1 : \text{Average sales growth} \tag{3.9}$$

$$Y_2 : \text{Average market share growth} \tag{3.10}$$

$$Y_3 : \text{Average employment growth} \tag{3.11}$$

$$Y_4 : \text{Average productivity growth} \tag{3.12}$$

$$Y_5 : \text{Profitability growth over the last three years} \tag{3.13}$$

**Expanded definition of Change management:*

$$Z : Z_1, Z_2 \tag{3.14}$$

$$Z_1 : \text{Perceived importance of CE (Moderating variable)} \tag{3.15}$$

$$Z_2 : \text{Knowledge about CE (Moderating variable)} \tag{3.16}$$

The hypotheses:

$$\text{Hypothesis 1:} \quad Y \sim \beta_0 + \beta_1 X_1 + \beta_2 X_2 + \epsilon \tag{3.17}$$

$$\text{Hypothesis 2A:} \quad M \sim \beta_3 + \beta_4 X_1 + \beta_5 X_2 + \epsilon \tag{3.18}$$

$$\text{Hypothesis 2B:} \quad Y \sim \beta_6 + \beta_7 M + \epsilon \tag{3.19}$$

$$\text{Hypothesis 2C:} \quad Y \sim \beta_8 + \beta_9 X_1 + +\beta_{10} X_2 + \beta_{11} M + \epsilon \tag{3.20}$$

$$\begin{aligned}\text{Hypothesis 3:} \quad Y \sim{}& \beta_{12} + \beta_{13} X_1 + \beta_{14} X_2 + \beta_{15} Z_1 + \beta_{16} Z_2 \\ &+ (\beta_{17} X_1 + \beta_{18} X_2) Z_1 + (\beta_{19} X_1 + \beta_{20} X_2) Z_2 + \epsilon\end{aligned} \tag{3.21}$$

3.1 Circular Economy practices and Performance

Existing research highlights both opportunities and challenges regarding CE. On the positive side, CE increases financial and operational performance by increasing resource efficiency, reducing waste, and fostering innovation (Geissdoerfer et al., 2018; Mazzucchelli et al., 2022). On the other hand, challenges associated with CE are often linked to business size, resource constraints, and high upfront investments. Smaller businesses could in particular have difficulties transitioning to CE and remanufacturing due to limited capital and internal expertise (Lacy et al., 2020, Mauss et al., 2023). The complexities in the early stages of CE implementation, and resistance among employees could also mitigate the positive effects of CE (Sohal and De Vass, 2022). Additionally, there is a lack of research on the effect CE has on productivity, which makes it of interest for this study.

Despite the challenges highlighted in the literature, there is sufficient evidence to suggest that, for most companies, implementing circular economy and remanufacturing practices is positively associated with improved performance. The impact of circular economy practices on productivity has been under-researched, making for an interesting topic to

further research in this study. Building on these findings, the following hypothesis has been developed:

H1: The degree of circular economy and remanufacturing positively influence organizational performance metrics such as profitability, productivity, market share, employment, and sales.

3.2 Circular Economy practices and Talent Acquisition

Existing research indicates that adopting CE and remanufacturing can enhance a company's talent acquisition by changing company values to be in line with the growing sustainable trends. Ma et al. (2022) discusses how CE practices can be a signal of other positive aspects for a company, which appeals to sustainable minded potential employees. Tkalac Verčič and Verčič (2024) found that sustainability initiatives especially resonated with generation Z and X. Companies that incorporate CE often have a competitive edge in talent acquisition due to their positive brand image. Mazzucchelli et al. (2022) discusses how companies adopting CE practices build reputations as innovative and responsible organizations.

While the literature gathered mostly supports the relationship between CE and talent acquisition, contradicting findings exist, particularly in industries where sustainability initiatives are not fully implemented (Santiago et al., 2024). Despite this, the literature suggests a generally positive effect of CE on talent acquisition. Building on these insights, the following hypothesis has been developed:

H2A: The degree of circular economy and remanufacturing has a positive influence on talent acquisition.

3.3 Talent Acquisition and its effect on Performance

Existing research identifies both opportunities and gaps in understanding the relationship between talent acquisition and performance. By aligning employment strategies with sustainability goals it increases the company's employee attractiveness. Recruiting skilled employees who align with an organization's sustainability goals can also drive innovation and operational success (Turban and Greening, 1997; Ma et al., 2022). Furthermore,

the stability achieved by a reduction in turnover creates a foundation for consistent organizational performance improvement over time (Bauer and Aiman-Smith, 1996; Gatewood et al., 1993). Based on this information, hypothesis 2B is proposed:

H2B: Talent acquisition has a positive influence on performance metrics.

3.4 Talent Acquisition as a mediator between Circular Economy and Performance

The mediating effect of talent acquisition on the relationship between CE and performance is of interest based on the literature gathered. Hiring employees who value sustainability allows companies to take better use of the benefits CE brings to a company. The idea is that the employees are more innovative and can increase profitability, productivity, and market share (Geissdoerfer et al., 2018; Mazzucchelli et al., 2022). Companies that integrate sustainability into their operations attract employees who prioritize environmental and social responsibility, promoting a committed workforce. This has the effect of strengthening performance (Bauer and Aiman-Smith, 1996; Gatewood et al., 1993). These findings motivate the following hypothesis:

H2C: Talent acquisition mediates the relationship between circular economy, remanufacturing, and performance metrics.

3.5 Change Management's moderating role between Circular Economy practices and Performance

Change management plays an important role in moderating the transition between linear and CE models. Utilizing change management to implement new processes makes for a more structured approach to change. This has the effect of strengthening stakeholder collaboration, and nurturing innovation (Sehnem et al., 2019; Huemer, 2020). These skills are important when transitioning to CE, which often involve structural, cultural, and operational changes.

Models like Kotter's 8-Step Model give clear and structured ways of using change management, and include the need for involvement, communication, and short-term

wins to build momentum, among other steps (Kotter, 1996; Huemer, 2020). However, frameworks such as Kotters often need adapting to fit each individual companies challenges when transitioning to circularity, (Errida and Lotfi, 2021; Sohal and De Vass, 2022). Tailored leadership and change management approaches in relation to CE transitions have seen to improve performance during this process (Sehnem et al., 2019; Sohal and De Vass, 2022).

Given the literature, the following hypothesis is proposed:

H3: The implementation of change management moderates the relationship between circular economy, remanufacturing, and organizational performance metrics.

4 Methodology

This chapter outlines the methodological framework that will be used to analyze the data in this study. The data was collected on two separate occasions. The quantitative data have been gathered for a project called SmartSirk, which is managed by SINTEF Manufacturing AS, and the qualitative data have been collected specifically for this study to address the need for additional insights identified during the analysis of the quantitative data. To extract relevant information from the data, the conceptual model 1.1 has been created, and three main hypotheses have been developed to help guide the research, as shown in section 2.5.2. These hypotheses form the structure for how the data will be analyzed. The goal is to gain a clear understanding of the key drivers of performance during the transition to CE.

4.1 Research and Design Method

Both descriptive and exploratory research designs was chosen to reflect the qualitative and quantitative data. The descriptive aspect gives a systematic view of the current situation. The exploratory design adds flexibility, allowing the study to change based on new insights found in the analysis (Saunders et al., 2019). This combination gives the study a comprehensive understanding of the current situation while being adaptive to new insights. A cross-sectional analysis has been chosen for this, as it allows for the examination of the hypothesis at a specific point in time.

Sequential mixed methods were used to answer the research question in the study. Sequential mixed methods refer to a research design where the data collection occurs in multiple phases, and the researcher follows one method with another to expand or further explain the initial findings. A sequential explanatory design is used, where quantitative research is followed by qualitative (Saunders et al. (2019, p. 182)).

4.2 Data Collection

The section on data collection is divided into two parts: quantitative and qualitative data. This will highlight the different aspects involved in extracting relevant information from both methods.

4.2.1 Quantitative data collection - closed-answer survey

Quantitative methods are used in this survey as it is a simple way of getting a broad range of insight into a topic and makes it possible to test hypotheses (Saunders et al., 2019).

Objective data gathered included characteristics such as gender, age, job position, education, and firm size. In addition, subjective insights were collected, capturing leaders' personal experiences of the transition to CE. The survey data consisted of nominal data, such as gender and industry, and ordinal variables, with responses that had a ranked response.

The research design in this part of the study is based on a single-method quantitative methodology that uses a survey strategy to collect data through an internet questionnaire. The data collection was a structured self-completion questionnaire featuring closed questions that mainly use a 7-point Likert scale. This scale allows respondents to express their level of agreement with a statement, with a range of options from strong disagreement to strong agreement. The questionnaire can be found in the Appendix, as figure A.1.

4.2.1.1 Screeners

Screeners were added to ensure the responses were relevant to this study. The four screeners chosen by the team at SmartSirk included:

1. Are you thoroughly familiar with your company's history, strategy, operations, and how they have evolved over the past five years?
2. Do you work in a company in a manufacturing industry that targets B2B customers?
3. Has your company implemented at least one project related to sustainability in the last five years?

4. Has your company implemented a circular economy strategy to any degree?

While all participants responded "yes" to the first three screening questions mentioned above, some answered "no" to the fourth. Since implementing some level of a CE strategy was a prerequisite for relevance to this study, participants who answered no to question 4 were excluded from the survey. Additionally, an attention check was included to ensure participants remained attentive throughout the survey. Participants who failed the test were excluded from the analysis, as their responses could not be considered reliable.

4.2.1.2 Choice of variables in the Quantitative Survey

The variables used in the analysis were based on the survey made for the SmartSirk. As the broad scope of the full survey was not relevant for the quantitative analysis, the most relevant variables were carefully selected to fit this study. During the data analysis phase, it was beneficial to merge related questions into composite variables. This process involved combining responses from several items that measure the same or similar concept into a single variable. The merging of variables was done by calculating the mean of the elements in each selected variable within the data.

Variables were extracted to collect information about the performance of the company, focusing on key performance metrics. The variables include average growth in sales (Y_1), market share (Y_2), employment (Y_3), and productivity (Y_4), along with profitability (Y_5) over the past three years, in comparison to competitors. Unlike other variables, these performance metrics were not merged into composite variables. This was decided to be able to differentiate the effects on aspects of company performance, allowing for a more in-depth analysis. Keeping these variables separate makes it possible to assess different predictors and how they influence specific aspects of performance rather than observing their combined effects.

Four variables were extracted and merged into a single composite variable to measure the Degree of circular economy (X_1) within companies. These variables capture different ways companies implement strategic processes related to CE, including transitioning entirely to a CE strategy, investing in start-ups focused on circular strategies, developing circular strategies alongside conventional business practices, or acquiring and integrating companies with a CE focus. While these variables represent different models of CE,

merging them into one variable is appropriate for this study as the primary objective is to examine how the overall degree of CE impacts company performance. A similar approach was applied to measure the level of remanufacturing (X_2), where different methods of remanufacturing were merged into a single composite variable. This decision was made to focus on the overall impact of remanufacturing as a general practice rather than analyzing the effects of specific remanufacturing methods.

The variable for talent acquisition (M) was created as a composite measure by merging responses from two related items. One evaluates whether it is now easier to attract top talent, and the other measures whether the company has become a more attractive employer overall. Similarly, a composite variable was created to measure the Perceived Importance of Circular Economy (Z_1) within the company. This variable combines three items: one measures involvement in developing the circular economy strategy, another assesses whether the strategy development process has been professionally meaningful, and the last evaluates the importance of the circular economy strategy for the company's bottom line. Lastly, Knowledge about Circular Economy (Z_2) was treated as a single variable, measuring how familiar an individual is with CE practices within the industry.

4.2.1.3 Control variables

Control variables are used to isolate the effects of the independent variables by accounting for other factors that might influence the dependent variable (Saunders et al., 2019). By holding these variables constant, it is easier to identify the true relationship between the primary variables of interest. In this study, control variables such as industry type, turnover, education level, and leadership position are included to see that observed effects are not affected by these factors. This allows for a more accurate and reliable analysis of the results.

4.2.1.4 Cronbach's alpha

Cronbach's alpha is one of the most commonly used indexes for internal consistency, and was used to confirm the reliability of merged variables (Saunders et al., 2019). Internal reliability of a construct is measured by assessing how item responses correlate, with higher values indicating greater consistency. By comparing the amount of shared variance among variables within the merged construct, Cronbach's alpha looks at to what degree

the variables measure the same concept and provides a quantified index of this consistency (Collins, 2007). While standards for an acceptable alpha coefficient can vary based on theoretical considerations, a coefficient between 0.65 and 0.8 is generally recommended, with values below 0.5 deemed unacceptable (Goforth, 2015).

Table 4.1 presents the Cronbach's alpha values for the composite measures used in this study. All values exceed the minimum value. This demonstrates a high level of internal consistency and indicates that the items within each composite variable measure the same underlying concept.

Variable	**Variable type**	**Meaning**	**Cronbach's alpha**
Sales growth (Y_1)	Individual variable	Average sales growth compared to competitors over the past three years.	–
Market share growth (Y_2)	Individual variable	Average market share growth compared to competitors over the past three years.	–
Employment growth (Y_3)	Individual variable	Average employment growth compared to competitors over the past three years.	–
Productivity growth (Y_4)	Individual variable	Average productivity growth compared to competitors over the past three years.	–
Profitability (Y_5)	Individual variable	Profitability compared to competitors over the past three years.	–
Degree of circular economy (X_1)	Composite variable	Measures overall adoption of circular economy strategies, combining four circular business models.	0,683
Level of remanufacturing (X_2)	Composite variable	Measures adoption of remanufacturing practices as part of circular economy strategies.	0,783
Talent acquisition (M)	Composite variable	Measures ease of attracting talent and employer attractiveness following circular economy adoption.	0,919
Perceived importance of CE (Z_1)	Composite variable	Measures the perceived significance of the circular economy strategy for the company.	0,867
Knowledge about CE (Z_2)	Individual variable	Measures familiarity with circular economy practices in the industry.	–

Table 4.1: An overview of the variables used in the study, categorized into individual and composite variables. Cronbach's alpha values are provided for composite variables to indicate their reliability.

4.3 Qualitative data collection - open-ended survey

After analyzing the data from the quantitative survey, it became clear that more comprehensive qualitative information was needed. To address this, an open-ended survey was designed to gather additional insights from managers who fit the same demographic group. These managers are, however, not the same individuals used in the qualitative survey.

The results of the quantitative analysis highlighted the need to explore some topics in greater depth. Specifically, there was a lack of detail in the answers received, which is to expect from a quantitative analysis.

Qualtrics, a survey creation tool, was used to craft the qualitative survey. A list of seven questions, as shown in the appendix B.1.

4.3.1 Screeners

Prolific was selected as the survey distribution platform due to its extensive participant base and its ability to enlist a relevant audience for data collection. As it has a participant pool of over 200,000 people, it was seen as beneficial for collecting participants for this survey. Pre-screeners were to ensure that only individuals with managerial roles in organizations implementing CE principles were included. These included:

1. Role within the company (CEO or C-suite Executive, President, Vice President, Director, Associate Director, Senior Manager, Manager, Owner, Partner)
2. Approval rate (99%-100%)
3. Student status (Not currently Studying)
4. Employment status (full-time only)

Screeners were added to access participants relevant to the research. To narrow the search even further, a screener- survey was created to get a pool of unique applicants. They included the four previous screeners from the quantitative study, as seen in list 4.2.1.1.

To be considered relevant to the research, participants had to align with these four statements. From these prescreeners, 83 unique, possible participants were found. They

were all invited to the main survey, which included 7 questions on topics related to CE, remanufacturing, and performance. For the study, a limit of 50 participants was chosen.

4.3.2 Sampling

A deductive approach was used as it allows for testing specific hypotheses from already established theories (Saunders et al., 2019, p. 78). This makes it suitable for a study where the focus lies on analyzing how variables are affected. Deductive reasoning provides a structured framework that makes for conclusions based on empirical evidence.

4.3.2.1 Sampling Method

For this study, purposive sampling, a non-probability sampling technique, was used (Bisht, 2024). It was selected because it aligns with the research focusing on a specific subgroup. This approach made it possible to target participants with the most relevant insights, making sure that the data collected directly addressed the research questions. The goal of the survey was to gather insights from the pre established demographics. Homogeneous sampling is the most relevant in this scenario as it targets a specific subgroup where all participants share characteristics (Saunders et al., 2019).

4.3.2.2 Representativeness and Sample size

Since purposive sampling is a non-probability technique, it is recognized that the results of the study cannot be statistically generalized to the entire population of managers worldwide (Saunders et al., 2019). The aim was for theoretical representativeness, where the selected participants are expected to provide meaningful, case-specific insights rather than broad statistical statements. The size of the sample was determined based on resource availability and the nature of the research questions. Faber and Fonseca, 2014 discusses the importance of not having too excessive of a sample size. The achieved sample size of 50 participants is enough to achieve statistical representativeness (Hennink and Kaiser, 2022).

4.4 Ethical issues

Ethical issues related to the gathering and manipulating of data will always be of concern when dealing with interviews and surveys. Cint and Prolific are used as they are recognized entities within the data-collecting world. The participants were paid for their participation (Profilic, 2024, Cint, 2024). Prolific has the option of informed consent by presenting participants with key details, such as study nature and duration to ensure transparency. Prolific's platform also allows participants the freedom to withdraw at any point (Profilic, 2024). Other efforts include the use of unique Prolific IDs to keep participants anonymity and secure handling of data through encrypted servers.

5 Results

This chapter of the study presents the results from both quantitative and qualitative research. The results are organized and presented according to the hypotheses, which are presented in Chapter 2.5.2.

5.1 Quantitative Data Analysis

5.1.1 Demographics

The demographics presented in table 5.1 show a summary of the participants gender, age and educational level. The table shows that the most represented groups are female, individuals aged 35–44, and participants with bachelor's degrees.

	Count	Percentage
Gender		
Male	36	34.6%
Female	68	65.4%
Age		
19-24	2	1,9%
25-34	19	18.3%
35-44	47	45.2%
45-54	22	21.2%
55-64	13	12.5%
65+	1	1%
Education		
High school degree	12	11.5%
College without degree	14	13.5%
Associate degree	13	12.5%
Bachelor's degree	46	44.2%
Postgraduate	19	18.3%

Table 5.1: Demographic breakdown of survey participants by gender, age, and education.

Table 5.2 provides an overview of the industries the participants represent, along with their annual turnover and years operating. The most represented groups include companies in miscellaneous manufacturing, those with annual revenues between $10 and $50 million, and companies that have been operational for 11 to 25 years.

	Count
Industry Type	
Miscellaneous Manufacturing	19
Furniture and Related Product Manufacturing	14
Computer and Electronic Product Manufacturing	13
Transportation Equipment Manufacturing	7
Leather and Allied Product Manufacturing	5
Machinery Manufacturing	4
Petroleum and Coal Products Manufacturing	4
Nonmetallic Mineral Product Manufacturing	3
Printing and Related Support Activities	3
Plastics and Rubber Products Manufacturing	2
Chemical Manufacturing	1
Primary Metal Manufacturing	1
Wood Product Manufacturing	1
Others	27
Annual Turnover	
Below $500,000	2
$500,000 to $2.5 million	13
$2.5 million to $10 million	9
$10 million to $50 million	30
$50 million to $100 million	16
$100 million to $1 billion	19
Over $1 billion	15
Years Operational	
0-10 years	10
11-25 years	37
26-50 years	31
51-100 years	22
100+ years	4

Table 5.2: Demographic breakdown of the industry, annual turnover and years operational of the companies in the survey.

5.1.2 Descriptive statistics

Before presenting the results, descriptive statistics of the variables used in the regression analysis are outlined. Table 5.3 provides an overview of the central tendencies, variability, and distribution of the data, ensuring a clear understanding of the characteristics of the variables.

	N	Mean	Std Deviations	Median	Skew	Kurtosis	Standard error
Sales	104	5.57	1.01	5.00	-0.01	-0.91	0.10
Market share	104	5.47	1.08	6.00	-0.32	-0.64	0.11
Employment	104	5.38	1.35	5.00	-0.46	-0.53	0.13
Productivity	104	5.76	1.01	6.00	-0.41	-0.48	0.10
Profitability	104	5.70	1.05	6.00	-0.39	-0.11	0.10
Degree of circular economy	104	5.02	1.15	5.00	-0.28	-0.22	0.11
Degree of circularity	104	4.99	1.30	5.00	-0.62	0.33	0.13
Talent acquisition	104	5.46	1.23	5.50	-0.52	-0.45	0.12
Perceived importance of CE	104	5.58	1.19	5.67	-1.18	1.86	0.12
Knowledge about CE	104	5.77	1.31	6.00	-1.22	1.35	0.13

Table 5.3: The table summarizes descriptive statistics for the model variables. *N* indicates the number of observations. Mean is the average, std deviations measure variability, and median is the central value. Skew indicates asymmetry, kurtosis reflects the shape of the distribution, and standard error measures the precision of the mean.

The five first variables are performance metrics measured on a 1-7 Likert scale. The mean values for these variables range from 5.38 to 5.76, indicating generally moderate to high ratings across companies. The standard deviations, ranging from 1.01 to 1.35, suggest that while responses are relatively consistent, there is slightly more variability for some variables. Skewness and kurtosis values are close to zero, which implies that the distributions of these variables are relatively symmetric.

The mean values for the remaining variables range from 4.99 to 5.77, showing moderately high responses, particularly for *Knowledge about CE* (5.77) and *Perceived Importance of CE* (5.58). Standard deviations vary between 1.15 and 1.31, indicating moderate variability in participants' ratings. Skewness and kurtosis values suggest that most variables are close to normally distributed, though *Perceived Importance of CE* and *Knowledge about CE* exhibit slightly negative skewness, reflecting a tendency toward higher ratings.

5.1.3 Multiple Linear Regression

Multiple linear regression was used to analyze the relationships between the different variables in the study. To ensure the validity of the model, assumptions of linear regression were tested before proceeding with the analysis. The methods and tests used to verify these assumptions and address any potential violations are seen in the paragraph below. The results of linear assumptions for each model are discussed in the quantitative results below each hypothesis. Furthermore, the results of the tests are presented in "Robustness of Analysis" (Section C).

5.1.3.1 Testing for Normality

To assess whether the residuals followed a normal distribution, the Shapiro-Wilk test was used, as shown in Appendix, section C. This test identifies deviations from normality, where a significant result would suggest that the data may not follow a normal distribution (Ghasemi and Zahediasl, 2012). Additionally, QQ plots and histograms of the residuals were examined to visually inspect the distribution for signs of skewness or other irregularities.

One common approach to address issues relating to normality is to identify and remove outliers that may influence the distribution (Pek et al., 2018). Outliers can distort residuals and lead to non-normality, which can affect the validity of the regression model. Cook's Distance is a common method for detecting influential outliers. This measure identifies data points that have an unusually large influence on the regression results. Observations with a Cook's Distance value exceeding a certain limit are removed to improve the normality of residuals and the overall reliability of the model (Su and Tsai, 2011).

5.1.3.2 Testing for Multicollinearity

Multicollinearity, or the presence of high correlations between independent variables, can distort regression coefficients and reduce the ability to interpret the model. To detect multicollinearity, the Variance Inflation Factor (VIF) is commonly used. VIF measures how much the variance of a regression coefficient is inflated due to multicollinearity (Daoud, 2017). The results are shown in Appendix, section C.

When multicollinearity is detected, a solution can be to scale and centralize variables.

Scaling standardizes variables by transforming them to have a mean of 0 and a standard deviation of 1 (Kyriazos and Poga, 1931). By adjusting this, it made sure that the variables were measured on the same scale. This can reduce the effects of multicollinearity, especially when the problem happens due to differences in variable units. On the other hand, centralizing, is the process of subtracting the mean of each variable from its values. This centers the data around zero, and reduces the non-essential correlations caused by for instance interaction terms. These transformations do not change the relationships between variables but make the model coefficients more interpretable and, in general, stabilize the regression analysis (Kyriazos and Poga, 1931). By solving for multicollinearity in this way, the regression model can produce more reliable and meaningful results.

5.1.3.3 Testing for Heteroscedasticity

Heteroscedasticity happens when the variance of residuals is not constant across all levels of independent variables. The Breusch-Pagan can be applied to test for heteroscedasticity by identifying whether the residual variance is dependent on the independent variables (Breusch and Pagan, 1979). A significant result would indicate heteroscedasticity. One effective method to address heteroscedasticity is by using Newey-West standard errors. Newey-West standard errors adjust the calculation of standard errors by accounting for the presence of heteroscedasticity in the residuals (Newey and West, 1987). Unlike the standard ordinary least square approach, which assumes homoscedasticity (equal variance of residuals), the Newey-West method modifies the variance-covariance matrix to account for varying residual variances.

5.1.3.4 Testing for Autocorrelation

Autocorrelation is the correlation of residuals with themselves across observations. It is typically a concern in time-series data but can also be relevant in cross-sectional studies if certain patterns or groupings exist within the data. Although this study uses cross-sectional data, testing for autocorrelation is still appropriate, as dependencies between residuals may be a concern because of clustered observations or shared characteristics across groups. To test for autocorrelation, the Durbin-Watson test was used to evaluate whether residuals are independent. Values near 2 indicate no significant autocorrelation, while values closer to 0 or 4 suggest positive or negative autocorrelation.

In cases where autocorrelation is detected, Newey-West standard errors were applied to correct the issue. While the primary purpose of Newey-West standard errors is to address heteroscedasticity, they also provide adjustments for autocorrelation by modifying the variance-covariance matrix of the residuals (Newey and West, 1987).

The diagnostic tests and corresponding visual analyses mentioned were essential to help validate the assumptions of the linear regression model. By systematically testing for normality, multicollinearity, heteroscedasticity, and autocorrelation, the reliability and accuracy of the regression results were ensured. Appropriate corrective measures were implemented when needed to mitigate their effects and uphold the validity of the model.

5.1.4 Mediation

Mediation analysis is a statistical method used to examine whether the relationship between an independent variable (X) and a dependent variable (Y) is explained, in part or in whole, by a third variable, known as the mediator (M). Baron and Kenny (1986) proposed a widely used casual steps approach to test for mediation. This test involves completing a series of regression models to establish conditions necessary for mediation. The first step involves making the independent variable (X) significantly predict the dependent variable (Y), shown as path c' in the illustration. Second, the independent variable (X) must significantly predict the mediator (M), illustrated as path a in figure 5.1. Finally, when both the independent variable (X) and the mediator (M) are included in the regression model predicting the dependent variable (Y), the mediator (M) must significantly predict the dependent variable (Y), illustrated as path b. If the inclusion of M reduces the direct effect of X on Y, this indicates a mediating effect. Full mediation occurs if the relationship between X and Y becomes nonsignificant when M is included in the model, meaning that M fully explains the effect of X on Y. In contrast, partial mediation is observed if both the mediator and the independent variable remain significant, but the direct effect of X on Y is reduced.

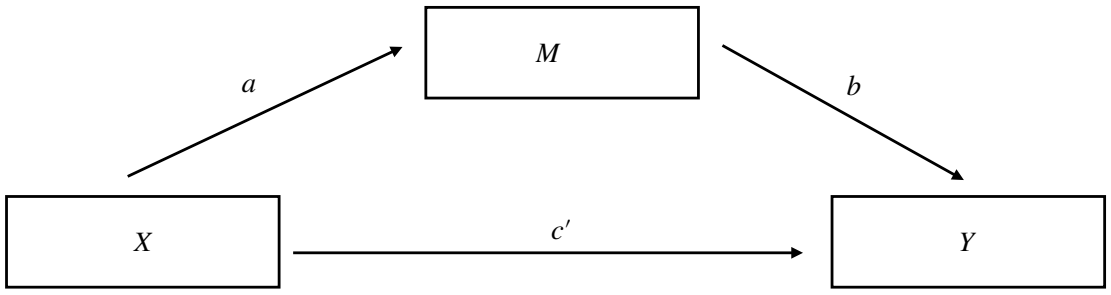

Figure 5.1: Mediation model

To quantify this mediation effect, a causal mediation analysis was employed to quantify the direct and indirect effects of an independent variable on a dependent variable through a mediator. In the analysis, the independent variables (*Degree of Circular Economy*, X_1 and*Level of Remanufacturing*, X_2) were hypothesized to influence the dependent variables (*Performance*, Y), both directly and indirectly via the mediator (*Talent Acquisition*, M).

The process involved three steps. First, a linear regression model was fitted to estimate the relationship between the independent variable (X_1, X_2) and the mediator (M). Second, another set of linear regression models was constructed to examine the effect of the independent variable and the mediator on each dependent variable (Y_1, Y_2, Y_3, Y_4, Y_5). Finally, the mediation effects were quantified by estimating the indirect effects (the effect on the independent variable on the dependent variable through the mediator), the direct effect (the effect of the independent variable directly on the dependent variable), and the total effect (the sum of both the direct and indirect effects). To enhance the robustness of the results, bootstrapping with 1,000 simulations was used to compute confidence intervals for the mediation estimates. The mediation process was repeated twice, once with *Degree of Circular Economy* as the independent variable and a second time with level of remanufacturing as the independent variable.

5.1.5 Data preprocessing

Data preprocessing involves preparing and cleaning the raw data to ensure its suitability for statistical modeling. During this stage, missing values (NA- values) were identified in the dataset. The missing data was determined to be missing completely at random (MCAR), meaning the missing values were randomly distributed and not correlated with other variables (Kang, 2013). In surveys, this typically happens when a respondent skips a question. Multiple imputation was used to address the missing values, creating several plausible datasets by filling in missing values multiple times. Using multiple plausible values accounts for the uncertainty in estimating what the missing values might be, avoiding creating false precision (Li et al., 2022).

The Multiple Imputation by Chained Equations (MICE) algorithm was used to perform this process. MICE generates multiple datasets by estimating missing values through a Bayesian approach and then combines them into a final dataset for analysis (Azur et al., 2011). For this dataset, predictive mean matching (PMM) was used as the imputation method. This approach predicts missing values by matching them with observed values that are statistically similar,ensuring that the imputed values remain realistic and within the observed range (Zhang, 2016). Five separate imputed datasets were generated to account for variability. Afterward, these datasets were combined to produce a single complete dataset for analysis. By incorporating multiple imputation through the MICE algorithm, it made sure that missing values were handled systematically and without bias. This resulted in a dataset that preserved the variability and relationships among the variables. This method was fitting for the survey data, as the MCAR assumption indicated that NA-values were not dependent on any specific factors in the dataset.

Furthermore, outliers in the dataset were identified and addressed. Initially, histograms and QQ plots of the residuals were examined to identify deviations from normality and detect potential outliers visually. Following the visual inspection, Cook's Distance was used to quantify the influence of individual data points on the regression model. Observations with Cook's Distance values exceeding the threshold for high influence were flagged as potential outliers, as shown in Appendix, chapter C. To ensure the validity and stability of the regression analysis, the most extreme outliers were removed from the dataset. After the removal of outliers, the dataset was reduced to 104 observations.

5.1.6 Test of Hypothesis 1

Hypothesis 1 explores the impact of transitioning to a circular economy on organizational performance. A multiple linear regression analysis was performed to test this hypothesis. *Degree of Circular Economy* (X_1) and *Level of Remanufacturing* (X_2) serve as the independent variables, while performance metrics such as *Sales* (Y_1), *Market Share* (Y_2), *Employment* (Y_3), *Productivity* (Y_4) and *Profitability* (Y_5) serves as the dependent variables. The regression equations for each performance metric in Hypothesis 1 are presented below.

$$\textbf{Hypothesis 1:} \quad Y \sim \beta_0 + \beta_1 X_1 + \beta_2 X_2 + \epsilon \tag{5.1}$$

$$Y_1 \sim \beta_{0_1} + \beta_{1_1} X_1 + \beta_{2_1} X_2 + \epsilon \tag{5.2}$$

$$Y_2 \sim \beta_{0_2} + \beta_{1_2} X_1 + \beta_{2_2} X_2 + \epsilon \tag{5.3}$$

$$Y_3 \sim \beta_{0_3} + \beta_{1_3} X_1 + \beta_{2_3} X_2 + \epsilon \tag{5.4}$$

$$Y_4 \sim \beta_{0_4} + \beta_{1_4} X_1 + \beta_{2_4} X_2 + \epsilon \tag{5.5}$$

$$Y_5 \sim \beta_{0_5} + \beta_{1_5} X_1 + \beta_{2_5} X_2 + \epsilon \tag{5.6}$$

A series of diagnostic tests were performed to verify that the assumptions of linear regression were satisfied. The results of these tests are presented in Appendix "Robustness of the regression model" under Hypothesis 1 in D.1 and confirm that all necessary criteria for linear regression were met. The analysis was carried out based on these findings.

The results of the regression analysis, presented in Table 5.4, provide support for Hypothesis 1, indicating that transitioning to CE positively impacts various aspects of organizational performance. Specifically, the *Degree of Circular Economy* is as a significant predictor across all performance metrics, with particularly strong effects observed on *employment* ($\beta_{1_3} = 0.651$, $p < 0.01$) and profitability ($\beta_{1_5} = 0.421$, $p < 0.01$). The *Level of Remanufacturing* also shows positive associations with all performance metrics, though its effects are generally smaller and less consistent. It has the most significant impact on *Productivity* ($\beta_{2_4} = 0.262$, $p < 0.01$) and *employment* ($\beta_{2_3} = 0.190$, $p < 0.05$). Among

the control variables, annual turnover is a significant predictor of *Employment* and *Productivity*, while company industry significantly influences *Productivity* and *Profitability*. No significant effects are observed for the level of education or position of the leader. Furthermore, the models demonstrate moderate explanatory power, with R^2 values from 33.5% to 46.3%. These findings suggest that circularity serves as a driver of organizational performance and provides evidence in support of Hypothesis 1.

	Dependent variable:				
	Sales	Market share	Employment	Productivity	Profitability
	(1)	(2)	(3)	(4)	(5)
Degree of circular economy	0.400***	0.419***	0.651***	0.310***	0.421***
	(0.081)	(0.087)	(0.098)	(0.078)	(0.085)
Level of remanufacturing	0.169**	0.173**	0.190**	0.262***	0.137*
	(0.073)	(0.079)	(0.089)	(0.071)	(0.078)
Level of education (Control variable)	−0.069	0.061	−0.019	−0.107*	−0.061
	(0.066)	(0.071)	(0.081)	(0.064)	(0.070)
Annual turnover (Control variable)	0.076	0.047	0.131**	0.092*	0.046
	(0.052)	(0.056)	(0.064)	(0.050)	(0.055)
Company industry (Control variable)	0.016	0.014	0.017	0.037**	0.031*
	(0.016)	(0.018)	(0.020)	(0.016)	(0.017)
Leader position (Control variable)	−0.001	−0.002	−0.006	−0.005	−0.003
	(0.008)	(0.008)	(0.010)	(0.008)	(0.008)
Constant	2.172***	1.777**	0.079	2.125***	2.381***
	(0.630)	(0.682)	(0.769)	(0.610)	(0.668)
Observations	104	104	104	104	104
R^2	0.362	0.344	0.463	0.399	0.335
Adjusted R^2	0.323	0.303	0.430	0.362	0.294
Residual Std. Error (df = 97)	0.833	0.901	1.016	0.806	0.883
F Statistic (df = 6; 97)	9.191***	8.470***	13.935***	10.743***	8.133***
Note:					$^*p < 0.1$; $^{**}p < 0.05$; $^{***}p < 0.01$
					Significance levels: $^*p < 0.1$; $^{**}p < 0.05$; $^{***}p < 0.01$

Table 5.4: Regression results for Hypothesis 1, investigating the effect of circular economy and remanufacturing on organizational performance. The table includes control variables to account for their potential influence.

5.1.7 Test of Hypothesis 2

Hypothesis 2 consists of three sub-hypotheses, addressing the relationships between circular economy, remanufacturing, talent acquisition, and performance. The first sub-hypothesis (H2A) examines the impact of CE practices and remanufacturing initiatives on talent acquisition. The second sub-hypothesis (H2B) investigates the direct influence of talent acquisition on organizational performance. The third sub-hypothesis (H2C) evaluates whether talent acquisition serves as a mediating variable, connecting CE and remanufacturing to performance outcomes. These relationships are analyzed using three models: two multiple linear regressions to assess direct effects and a mediating analysis to explore the mediating role (indirect effect) of talent acquisition. The results of these analyses are presented below.

5.1.7.1 Test of Hypothesis 2A

Hypothesis 2A examines the relationship between circular economy and talent acquisition. This relationship is tested with a linear regression model. *Degree of Circular Economy* (X_1) and *Level of Remanufacturing* (X_2) serve as independent variables, while *Talent Acquisition* (M) serves as the dependent variable. The regression equation for Hypothesis 2A is presented below.

$$\textbf{Hypothesis 2A:} \quad M \sim \beta_3 + \beta_4 X_1 + \beta_5 X_2 + \epsilon \tag{5.7}$$

Diagnostic tests confirmed that the assumptions of linear regression were satisfied (detailed in the Appendix: “C), enabling the analysis to move forward. The results of the regression analysis are presented in Table 5.5.

The *Degree of Circular Economy* is found to have a significant and positive impact on talent acquisition ($\beta_4 = 0.656$, $p < 0.01$), indicating that firms implementing circular economy practices are more effective in attracting talent. Similarly, the *Level of Remanufacturing* also shows a positive and significant relationship with talent acquisition ($\beta_5 = 0.155$, $p < 0.05$), though the effect is smaller compared to the *Degree of Circular Economy*. Among the control variables, annual turnover is positively associated with talent acquisition, suggesting that larger firms may have a competitive advantage in attracting skilled

employees. Other control variables, including level of education, company industry, and leader position, do not have any statistically significant effects in this model.

The regression model demonstrates strong explanatory power, with an R^2 value of 0.520, indicating that 52% of the variance in talent acquisition is explained by the independent and control variables. The adjusted R^2 value of 0.490 confirms the robustness of the model. The F-statistic (17.523, $p < 0.01$) further supports the overall significance of the regression. Overall, the results provide evidence in support of Hypothesis 2, indicating that CE practices positively influence a firm's ability to attract talent.

	Dependent variable:
	Talent acquisition
Degree of circular economy	0.656^{***} (0.085)
Level of remanufacturing	0.155^{**} (0.077)
Level of education (control variable)	-0.011 (0.070)
Annual turnover (control variable)	0.113^{**} (0.055)
Company industry (control variable)	0.026 (0.017)
Leader position (control variable)	0.002 (0.008)
Constant	0.199 (0.665)
Observations	104
R^2	0.520
Adjusted R^2	0.490
Residual Std. Error	0.879 (df = 97)
F Statistic	17.523^{***} (df = 6; 97)
Note:	$^{*}p < 0.1$; $^{**}p < 0.05$; $^{***}p < 0.01$
	Significance levels: $^{*}p < 0.1$; $^{**}p < 0.05$; $^{***}p < 0.01$

Table 5.5: Regression analysis results for Hypothesis 2A, examining the effect of circular economy and remanufacturing on talent acquisition. Control variables are included.

5.1.7.2 Test of Hypothesis 2B

Hypothesis 2B explores the impact of talent acquisition on organizational performance. To test this hypothesis, a multiple linear regression analysis was performed, with *Talent Acquisition* (M) as the independent variable and various performance metrics (Y_1, Y_2, Y_3, Y_4, Y_5) as the dependent variables, which is seen in model 5.6. The regression equations for each performance metric in Hypothesis 2B are presented below.

$$\textbf{Hypothesis 2B:} \quad Y \sim \beta_6 + \beta_7 M + \epsilon \tag{5.8}$$

$$Y_1 \sim \beta_{6_1} + \beta_{7_1} M + \epsilon \tag{5.9}$$

$$Y_2 \sim \beta_{6_2} + \beta_{7_2} M + \epsilon \tag{5.10}$$

$$Y_3 \sim \beta_{6_3} + \beta_{7_3} M + \epsilon \tag{5.11}$$

$$Y_4 \sim \beta_{6_4} + \beta_{7_4} M + \epsilon \tag{5.12}$$

$$Y_5 \sim \beta_{6_5} + \beta_{7_5} M + \epsilon \tag{5.13}$$

Diagnostic tests were performed to validate the assumptions of linear regression. The Shapiro-Wilk test indicated deviations from normality, which were supported by QQ-plots and residual histograms. These revealed skewness in the data, as seen in section D.3.1. Further diagnostics, including the Breusch-Pagan test, seen in table D.11, and the Durbin-Watson test, as seen in table D.12, detected minor signs of heteroscedasticity and autocorrelation. To address these concerns, Newey-West standard errors were applied in the regression model, ensuring more accurate and reliable estimates. The VIF test, seen in table D.10 confirmed no evidence of multicollinearity. Although not all assumptions were perfectly satisfied, the use of standard errors, combined with the advantages of a large dataset, the analysis is expected to provide interpretable results. A comprehensive summary of the diagnostic tests is provided in Appendix as under paragraph D.1 .

	Dependent variable:				
	Sales	Market share	Employment	Productivity	Profitability
	(1)	(2)	(3)	(4)	(5)
Talent acquisition	0.462***	0.600***	0.624***	0.481***	0.535***
	(0.071)	(0.066)	(0.084)	(0.059)	(0.066)
Level of education (control variable)	−0.060	0.069	−0.007	−0.096*	−0.053
	(0.063)	(0.059)	(0.087)	(0.055)	(0.067)
Annual turnover (control variable)	0.027	−0.017	0.061	0.046	−0.013
	(0.058)	(0.043)	(0.060)	(0.045)	(0.051)
Company industry (control variable)	0.003	−0.003	−0.001	0.022	0.016
	(0.014)	(0.013)	(0.020)	(0.016)	(0.017)
Leader position (control variable)	−0.004	−0.005	−0.010	−0.010	−0.005
	(0.008)	(0.007)	(0.009)	(0.007)	(0.008)
Constant	3.067***	2.189***	1.662**	2.935***	2.905***
	(0.574)	(0.590)	(0.651)	(0.578)	(0.631)
Observations	104	104	104	104	104
R^2	0.327	0.473	0.345	0.393	0.406
Adjusted R^2	0.293	0.447	0.312	0.362	0.375
Residual Std. Error (df = 98)	0.851	0.803	1.116	0.807	0.831
F Statistic (df = 5; 98)	9.538***	17.620***	10.321***	12.679***	13.386***
Note:					$^{*}p < 0.1$; $^{**}p < 0.05$; $^{***}p < 0.01$
					Significance levels: $^{*}p < 0.1$; $^{**}p < 0.05$; $^{***}p < 0.01$

Table 5.6: Regression results for Hypothesis 2B, analyzing the relationship between talent acquisition and organizational performance across multiple performance metrics. The model incorporates control variables to account for their potential impact. Newey-West standard errors are applied to address potential heteroskedasticity and autocorrelation.

Model 5.6 displays the results with Newey-West standard errors. The analysis reveals that *Talent Acquisition* is significantly and positively associated with all dependent variables. The strongest effect is observed on *Employment* ($\beta_{7_3} = 0.624$, $p < 0.01$) and *Market Share* ($\beta_{7_2} = 0.600$, $p < 0.01$). The weakest effect was on *Productivity* ($\beta_{7_4} = 0.481$, $p < 0.01$), though the relationship remains statistically significant. The models explain a meaningful proportion of the variance in performance outcomes, with adjusted R^2 values from 0.293 to 0.447. The F-statistics for all models are significant ($p < 0.01$). In summary, the findings indicate that talent acquisition has a significant and positive impact on organizational performance, offering support to hypothesis 2B. Interpreting these findings must be done with caution, given the identified deviations from linear regression assumptions, particularly the assumption of normality and minor signs of heteroscedasticity and autocorrelation.

5.1.7.3 Test of Hypothesis 2C

In Hypotheses 1, 2A, and 2B, the direct effects between the independent and dependent variables were examined, establishing relationships between the *Degree of Circular Economy*, *Level of Remanufacturing*, *Talent Acquisition*, and *Performance*. These hypotheses aim to confirm whether relationships exist among the variables, a prerequisite for exploring mediation (Baron and Kenny, 1986). Because significant relationships were confirmed in the earlier hypotheses, the next step involved testing whether *Talent Acquisition* (M) serves as a mediating variable for the relationship between the independent variables (X_1, X_2) and the dependent variables (Y_1, Y_2, Y_3, Y_4, Y_5). The mediation equations for Hypothesis 2C is presented below.

$$\textbf{Hypothesis 2C:} \quad Y \sim \beta_8 + \beta_9 X_1 + \beta_{10} X_2 + \beta_{11} M + \epsilon \tag{5.14}$$

$$Y_1 \sim \beta_{8_1} + \beta_{9_1} X_1 + \beta_{10_1} X_2 + \beta_{11_1} M + \epsilon \tag{5.15}$$

$$Y_2 \sim \beta_{8_2} + \beta_{9_2} X_1 + \beta_{10_2} X_2 + \beta_{11_2} M + \epsilon \tag{5.16}$$

$$Y_3 \sim \beta_{8_3} + \beta_{9_3} X_1 + \beta_{10_3} X_2 + \beta_{11_3} M + \epsilon \tag{5.17}$$

$$Y_4 \sim \beta_{8_4} + \beta_{9_4} X_1 + \beta_{10_4} X_2 + \beta_{11_4} M + \epsilon \tag{5.18}$$

$$Y_5 \sim \beta_{8_5} + \beta_{9_5} X_1 + \beta_{10_5} X_2 + \beta_{11_5} M + \epsilon \tag{5.19}$$

Diagnostic tests were conducted to validate the assumptions of linear regression. The VIF test (Table D.14), indicated no evidence of multicollinearity. The Shapiro-Wilk (Table D.13) revealed deviations from normality, which was addressed by using Cook's distance to identify and manage potential outliers and reducing their influence on the model. Despite these adjustments, the criterion for normality was not fully met. However, given the large size of the dataset, the analysis proceeded. According to the central limit theorem, regression estimates remain robust in large samples, even with some violations of normality (Kwak and Kim, 2017). Additional diagnostic tests, including the Breusch-Pagan test (Table D.15) and the Durbin-Watson test (Table D.16), identified minor issues with heteroscedasticity and autocorrelation (see Appendix "Robustness of Regression Analysis", Table(C) for a more comprehensive summary of the diagnostic tests). To address these concerns, bootstrapping was employed. By resampling the data and generating empirical

distributions of the mediation effects, bootstrapping provided robust confidence intervals and significance estimates that are not reliant on normality or homoscedasticity. This approach ensured that the results remained reliable despite minor violations of regression assumptions, enhancing the validity of the mediation analysis. Table 5.7 displays the results of the mediation analysis.

Model	ACME	ADE	Total Effect	Prop. Mediated
Sales ∼ Circular Economy	0.156^{*}	0.244^{*}	0.4^{***}	0.39^{*}
Market share ∼ Circular Economy	0.321^{***}	0.0985	0.419^{***}	0.765^{***}
Employment ∼ Circular Economy	0.139	0.512^{***}	0.651^{***}	0.213
Productivity ∼ Circular Economy	0.204^{**}	0.316	0.31^{***}	0.657^{**}
Profitability ∼ Circular Economy	0.256^{***}	0.045	0.421^{***}	0.607^{***}
Sales ∼ Remanufacturing	0.0347	0.132	0.167^{*}	0.208
Market share ∼ Remanufacturing	0.0712	0.073	0.168^{*}	0.422
Employment ∼ Remanufacturing	0.0308	0.128	0.188^{*}	0.163
Productivity ∼ Remanufacturing	0.0452	0.214^{**}	0.26^{***}	0.174
Profitability ∼ Remanufacturing	0.0567	0.268	0.133	0.425

Table 5.7: Mediation Analysis Results for Hypothesis 2C, examining the role of *Talent Acquisition* as a mediating variable. The dependent variables represent different performance metrics and the independent variables are the *Degree of Circular Economy* and the *Level of Remanufacturing*. The table reports the Average Causal Mediation Effect (ACME), Average Direct Effect (ADE), Total Effect, and the Proportion Mediated

Table 5.7 shows that for the *Degree of Circular Economy*, the Average Causal Mediation Effect (ACME) values indicate a significant mediating effect of talent acquisition on organizational performance metrics, particularly for market share (ACME = 0.321, $p < 0.001$), profitability (ACME = 0.256,$p < 0.001$), and productivity (ACME = 0.204, $p < 0.01$). Furthermore, the high proportion mediated for market share (0.765) and profitability (0.607) underscores the importance of talent acquisition in explaining a substantial part of these relationships. This supports the partial or full mediation put forward in Hypothesis 2C, depending on the significance of the direct effect. For market share and profitability, the direct effects (ADE) remain significant, indicating partial mediation. For productivity, the high ACME and a reduction in the direct effect suggest a stronger mediating role. The effects on sales and employment are moderate but not as significant as on the other performance metrics.

In contrast, for Level of remanufacturing, the mediation effects are less pronounced. The ACME values for sales (0.0347), market share (0.0712), and productivity (0.0452) are small and not significant at conventional thresholds, indicating that talent acquisition does not strongly mediate these relationships. However, for market share, a moderately high proportion mediated (0.422) implies that talent acquisition still plays a role, but less prominently than in the CE context. These results suggest that the mediating role of talent acquisition is more pronounced when the *Degree of Circular Economy* is the independent variable rather than the level of remanufacturing.

Overall, the results partly align with Hypothesis 2C by demonstrating that talent acquisition significantly mediates the relationship between CE and several performance metrics, particularly profitability, market share, and productivity. However, the mediating effects are less consistent and weaker when remanufacturing is the independent variable.

5.1.8 Test of Hypothesis 3

Hypothesis 3 explores the moderating role of *Perceived Importance of CE* (Z_1) and knowledge about CE (Z_2) in the relationship between the *Degree of Circular Economy* (X_1), the *Level of Remanufacturing* (X_2), and various performance metrics (Y_1, Y_2, Y_3, Y_4, Y_5).

$$\begin{aligned}\text{Hypothesis 3:} \quad Y \sim{}& \beta_{12} + \beta_{13}X_1 + \beta_{14}X_2 + \beta_{15}Z_1 + \beta_{16}Z_2 \\ &+ (\beta_{17}X_1 + \beta_{18}X_2)Z_1 + (\beta_{19}X_1 + \beta_{20}X_2)Z_2 + \epsilon \end{aligned} \tag{5.20}$$

$$\begin{aligned} Y_1 \sim{}& \beta_{12_1} + \beta_{13_1}X_1 + \beta_{14_1}X_2 + \beta_{15_1}Z_1 + \beta_{16_1}Z_2 \\ &+ (\beta_{17_1}X_1 + \beta_{18_1}X_2)Z_1 + (\beta_{19_1}X_1 + \beta_{20_1}X_2)Z_2 + \epsilon \end{aligned} \tag{5.21}$$

$$\begin{aligned} Y_2 \sim{}& \beta_{12_2} + \beta_{13_2}X_1 + \beta_{14_2}X_2 + \beta_{15_2}Z_1 + \beta_{16_2}Z_2 \\ &+ (\beta_{17_2}X_1 + \beta_{18_2}X_2)Z_1 + (\beta_{19_2}X_1 + \beta_{20_2}X_2)Z_2 + \epsilon \end{aligned} \tag{5.22}$$

$$\begin{aligned} Y_3 \sim{}& \beta_{12_3} + \beta_{13_3}X_1 + \beta_{14_3}X_2 + \beta_{15_3}Z_1 + \beta_{16_3}Z_2 \\ &+ (\beta_{17_3}X_1 + \beta_{18_3}X_2)Z_1 + (\beta_{19_3}X_1 + \beta_{20_3}X_2)Z_2 + \epsilon \end{aligned} \tag{5.23}$$

$$\begin{aligned} Y_4 \sim{}& \beta_{12_4} + \beta_{13_4}X_1 + \beta_{14_4}X_2 + \beta_{15_4}Z_1 + \beta_{16_4}Z_2 \\ &+ (\beta_{17_4}X_1 + \beta_{18_4}X_2)Z_1 + (\beta_{19_4}X_1 + \beta_{20_4}X_2)Z_2 + \epsilon \end{aligned} \tag{5.24}$$

$$\begin{aligned} Y_5 \sim{}& \beta_{12_5} + \beta_{13_5}X_1 + \beta_{14_5}X_2 + \beta_{15_5}Z_1 + \beta_{16_5}Z_2 \\ &+ (\beta_{17_5}X_1 + \beta_{18_5}X_2)Z_1 + (\beta_{19_5}X_1 + \beta_{20_5}X_2)Z_2 + \epsilon \end{aligned} \tag{5.25}$$

Diagnostic tests confirmed that the assumptions for normality, heteroscedasticity and autocorrelation were satisfied (detailed in the Appendix: “Robustness of the regression model as C). However, when adding interaction terms, problems with multicollinearity emerged, as indicated by the VIF test (Table D.18). To address this issue, the values of the independent and moderating variables were scaled and mean-centered. This process reduced multicollinearity, ensuring that the interaction terms could be included without compromising the integrity of the regression analysis. These adjustments improved the stability and interpretability of the model, allowing for robust testing of the hypothesized moderating effects. The results of the regression analysis are presented in Table **??**.

Knowledge about CE, as a main effect, exhibits strong positive relationships with *Sales*

	Dependent variable:				
	Sales	Market share	Employment	Productivity	Profitability
	(1)	(2)	(3)	(4)	(5)
Degree of Circular economy	0.359***	0.340***	0.696***	0.196*	0.309***
	(0.110)	(0.125)	(0.141)	(0.110)	(0.116)
Level of remanufacturing	0.192*	0.174	0.217*	0.236**	0.093
	(0.100)	(0.113)	(0.127)	(0.099)	(0.105)
Perceived Importance of CE	−0.116	0.207	−0.115	0.184	0.033
	(0.134)	(0.152)	(0.171)	(0.134)	(0.142)
Knowledge about CE	0.380***	0.102	0.279*	0.195	0.403***
	(0.123)	(0.139)	(0.157)	(0.122)	(0.130)
Interaction: CE x Importance	−0.119	0.021	−0.014	−0.151*	−0.119
	(0.088)	(0.099)	(0.112)	(0.087)	(0.092)
Interaction: CE x Knowledge	−0.026	−0.033	−0.078	−0.065	−0.062
	(0.085)	(0.097)	(0.109)	(0.085)	(0.090)
Interaction: Remanufacturing x Importance	0.117	0.073	0.097	0.156*	0.174*
	(0.084)	(0.095)	(0.108)	(0.084)	(0.089)
Interaction: Remanufacturing x Knowledge	0.090	0.067	0.195*	0.123	0.022
	(0.083)	(0.095)	(0.106)	(0.083)	(0.088)
Level of education (Control Variable)	−0.217*	0.062	−0.262	0.012	−0.045
	(0.124)	(0.140)	(0.158)	(0.123)	(0.131)
Annual turnover (Control Variable 2)	0.291*	0.033	0.278	−0.022	0.064
	(0.148)	(0.167)	(0.188)	(0.147)	(0.156)
Company industry (Control Variable 3)	0.271*	0.166	0.037	−0.077	0.218
	(0.147)	(0.166)	(0.187)	(0.146)	(0.155)
Leader position (Control Variable 4)	−0.181	−0.118	0.013	0.133	−0.043
	(0.180)	(0.204)	(0.230)	(0.180)	(0.190)
Constant	5.499***	5.393***	5.361***	5.739***	5.614***
	(0.094)	(0.107)	(0.120)	(0.094)	(0.100)
Observations	104	104	104	104	104
R^2	0.448	0.377	0.491	0.449	0.429
Adjusted R^2	0.375	0.295	0.424	0.376	0.354
Residual Std. Error (df = 91)	0.800	0.906	1.021	0.798	0.845
F Statistic (df = 12; 91)	6.145***	4.595***	7.321***	6.172***	5.693***
Note:					$^{*}p < 0.1$; $^{**}p < 0.05$; $^{***}p < 0.01$
				Significance levels:	$^{*}p < 0.1$; $^{**}p < 0.05$; $^{***}p < 0.01$

Table 5.8: Regression analysis with knowledge about CE and perceived importance of CE as moderating variables

($\beta_{16_1} = 0.380$, $p < 0.001$), *Profitability* ($\beta_{16_5} = 0.403$, $p < 0.001$) and *Employment* ($\beta_{16_3} = 0.279$, $p < 0.05$). However, it shows weak relationships with *Market Share* and *Productivity*. Furthermore, the *Perceived Importance of CE* does not correlate significantly with any of the performance metrics. The hypothesized moderating roles of *Perceived Importance of CE* and *Knowledge about CE* are tested through interaction terms.

The interaction, *CE × Perceived Importance of CE*, is significant only for productivity ($\beta_{17_4} = -0.151$, $p < 0.05$), but with a negative coefficient. This suggests that higher perceived importance of CE unexpectedly reduces the positive impact of CE on productivity. For other performance metrics, the interaction is nonsignificant, providing little evidence that perceived importance enhances performance as a moderator in this context. The interaction, *CE × Knowledge about CE*, does not show significant effects across any of the performance metrics, indicating that while knowledge about CE has strong main effects on sale and profitability, it does not significantly enhance the impact of CE as a moderator.

The interaction, *Remanufacturing × Perceived Importance of CE*, shows some significance on *Productivity* ($\beta_{18_4} = 0.156$, $p < 0.05$) and profitability ($\beta_{18_5} = 0.174$, $p < 0.1$), suggesting that perceived importance of CE might amplify the effect of remanufacturing on these outcomes. The interaction, *Remanufacturing × Knowledge about CE*, is significant for employment ($\beta_{20_3} = 0.195$, $p < 0.1$), but the results are marginal. The interaction is nonsignificant for other outcomes.

The models demonstrate acceptable fit, with adjusted R^2 values ranging from 0.295 to 0.424 across performance metrics. The F-statistics confirm that the models are significant. Overall, the results do not support the hypothesis that *Perceived Importance of CE* and *Knowledge about CE* are moderating factors enhancing performance. While *Knowledge about CE* exhibits strong direct effects, its moderating effects are limited. *Perceived Importance of CE* moderates the relationship between remanufacturing and certain outcomes, but the significance is marginal and its interaction with CE itself does not show consistent enhancement of performance. These findings indicate that while CE initiatives and related knowledge have direct benefits for organizational performance, the hypothesized moderating roles of perceived importance and knowledge are not supported, offering limited evidence for Hypothesis 3.

5.1.9 Results of quantitative analysis

To summarize, the results of the quantitative analysis supported both hypotheses 1 and 2, while hypothesis 3 was not supported by the data. CE and remanufacturing are proven to have a significant effect on organizational performance. However, the effects of remanufacturing are less pronounced. The *Degree of Circular Economy* has the strongest effect on employment and profitability, while remanufacturing has the strongest effect on productivity.

Hypothesis (2A) shows that both CE and remanufacturing positively impact talent acquisition. Again, the effects of remanufacturing are less pronounced than the ones of CE. Hypothesis 2B further shows a significant effect of talent acquisition on organizational performance. When examining the mediating effect of talent acquisition in hypothesis 2C, strong significant effects are found. This is especially true for CE. Finally, in hypothesis 3, the *Perceived Importance of CE* and *Knowledge about CE* had little moderating effect on the relationship between CE and remanufacturing on performance, although knowledge of CE had a direct effect on performance.

5.1.9.1 Gaps in Quantitative Insights

For hypothesis 1, the quantitative results provided an overview of broad trends and significant relationships between the main variables. However, it did not capture underlying motivations, challenges, and organizational dynamics that helped shape these outcomes. For example, although the data showed a positive relationship between CE and profitability, it did not uncover the specific mechanisms driving this impact. Similarly, the analysis did not address barriers to performance and the challenges in implementing CE practices. There is also a lack of insight into how organizations navigate these obstacles and incorporate CE practices. Furthermore, the quantitative data showed less significance of remanufacturing than of CE on organizational performance. The qualitative data aims to bridge this gap.

Hypothesis 2A, 2B and 2C generally showed strong significant effects, which were all supported by the literature. There was, therefore, no need to bridge any major gaps in the results. To be able to give more detailed results a question about the exact parts of CE that makes a company attractive was proposed.

The variables representing change management in hypothesis 3 included *Perceived Importance of CE* and *Knowledge about CE*. While *Knowledge about CE* showed strong direct effects on sales and profitability, it did not significantly enhance the impact of CE or remanufacturing as a moderator. The *Perceived Importance of CE* did not have any significant direct effects and offered minimal moderating effects. As the variables for change management in the quantitative data only covers a small fraction of what change management involves, there was a need to address other important parts of change management. This included leadership, employee involvement, and communication. While performance outcomes were measured, it remains unclear how employees are supported and engaged throughout this transition or how leadership strategies influence the success of CE implementation. The processes of strategy creation and implementation were also not investigated. The qualitative data aims to bridge these gaps.

5.2 Qualitative Data Analysis

Following the initial quantitative survey, seven additional qualitative questions, as shown in table B.1, were developed in order to address the gaps in the data and provide a deeper understanding of the results. These questions were answered by 50 participants, and the findings are presented in alignment with each corresponding hypothesis.

5.2.1 Demographics

The demographics shown in 5.9 provides an overview of the participants gender, age and education. Men are the most represented gender, while participants aged 25–34 and those with bachelor's degrees are the most common in the other categories.

	Count	Percentage
Gender		
Female	16	32%
Male	34	68%
Age		
19-24	3	6%
25-34	26	52%
35-44	13	26%
45-54	3	6%
55-64	2	4%
65+	3	6%
Education		
High school degree	1	2%
College without degree	3	6%
Associate degree	5	10%
Bachelor's degree	21	42%
Postgraduate	20	40%

Table 5.9: Demographic breakdown of the qualitative survey participants by gender, age, and education.

5.2.2 Hypothesis 1

Based on the results from hypothesis 1, there was a need for further explanation related to the motivations behind adopting circular practices, and the specific ways these practices influence performance. The quantitative study showed less significant correlation between

remanufacturing and company performance, which was surprising as there was a strong correlation observed between CE and company performance. To investigate this further, the first qualitative question was designed to find the primary motivations for engaging in remanufacturing. Understanding whether companies are driven by internal performance goals, external pressures, or other factors may help explain why remanufacturing shows a weaker correlation to performance compared to CE practices.

> **Question one:** "What are the primary motivations for your company to engage in remanufacturing? Are there any external motives influencing the decision? Please elaborate."

Most respondents highlighted both cost savings and sustainability as the main reasons for pursuing remanufacturing. Internally, the participants highlighted cutting costs, using resources more efficiently, and making products last longer. Externally, regulations, market trends, and the growing demand for eco-friendly options were some of the key drivers. While many participants saw this as a way to align with sustainability goals, some also viewed it as a way to stand out in their respective competitive markets. Some responses focus on the positive aspects related to the increase in longevity of old products:

> "Loyalty to the product is a huge part of it. Obviously, costs are saved, but remanufacturing allows natural support for prior models."

Some participants highlighted a more direct focus on the potential for increased profit:

> "Our company is solely focused on profit (...) If we can make money off it, we'd probably do it."

There were also companies that saw this transition as an opportunity to pass the savings along to the customers:

> "To take advantage of the reusable and sustainable materials ... allows us to pass savings on to our clients."

These three responses shows different ways in how the companies interpret the benefits of remanufacturing. The insights demonstrate differences between customer-oriented approaches, profit-driven strategies, and sustainability-aligned practices in remanufacturing motivations.

The quantitative results highlighted an increase in profit but were not created to identify the specific factors contributing to this increase. This created a need to look closer at which parts of CE practices have the biggest impact on profitability. To address this gap, the following question was designed to identify the key drivers behind the observed profit increase:

Question two: "What specific aspects of circular economy practices (e.g., cost reductions, increased efficiency) have had the greatest impact on profitability?"

The biggest impact of the circular economy on profitability seems to come from cost reductions. Reusing materials, better managing of waste, and saving energy all contribute to lower expenses. Respondents also mentioned new revenue opportunities, like selling refurbished products or offering subscription models, as positive aspects of CE. Some participants focused on the reduced cost that came from the reuse of materials and the positive effect the reuse of materials had on the customers:

> "Reusing materials lowers costs. Better efficiency saves time and resources. Sustainable products attract more customers. These actions improve profits and support growth."

For others, there were specific changes related to the centralizing of the production.

> "Centralizing production has had the biggest impact. Doing everything at one location rather than at several has lowered costs and made our business model more effective."

On the flip side, some raised concerns about the practical and cost-effective side of implementation, with one participant stating:

> "Sometimes when you try to reuse or refurbish something old, it leads to additional problems like equipment being broken or continuous maintenance causing labor budgets to rise."

All three responses present a different view of how circular economy practices influence profitability. They show that while cost reductions, such as reusing materials and centralizing production, are significant contributors to profit growth, new revenue opportunities from sustainable products also play a role. They also emphasize the

challenges, such as increased maintenance costs or inefficiencies, which can outweigh some of the benefits. These insights show the balance between the advantages and potential obstacles companies face when adopting CE practices.

There was little information about the challenges or negative aspects of the implementation based on the quantitative analysis of how CE practices affect performance. This gap highlighted the need to understand the barriers companies face when adopting CE practices, as these obstacles could significantly influence performance outcomes. In question three, a definition of the concept of "performance" was included to avoid confusion among participants, which read: "Performance includes sales growth, market share growth, employment growth, and productivity growth, as well as profitability". It was followed by the question:

Question three: "Have there been challenges that prevented circular economy practices from contributing to increased performance in your organization? If so, what are they, and how did you handle them?"

To answer this question, participants pointed out financial and operational barriers, with one respondent noting the cost related to adapting the machinery to fit with CE:

> "The biggest challenge was the high initial cost of adapting our production systems to fit circular practices. It took time to see the returns."

Others highlighted the difficulty of integrating sustainable practices across their supply chains, with one participant writing:

> “We struggled to get suppliers on board. Some didn’t understand the value or were unwilling to change established processes.”

These insights underscore the complexity of aligning external partners with internal CE goals. Another theme was resistance among employees and the need for change management, with one participant explaining:

> “Some team members were skeptical about the new processes, especially when they required additional effort or training. We had to invest in workshops to build their confidence and show the long-term benefits.”

Despite these challenges, several respondents highlighted that proactive communication

and gradual implementation were effective in reducing resistance.

Finally, a question was designed to understand how employee turnover has changed following the implementation of CE practices. This relates to employment growth, aiming to determine whether there was a noticeable level of employee departures during the transition, alongside the increase of new hires.

Question four: "How has the employee turnover changed after implementing a circular economy?"

Many respondents reported that adopting CE practices positively influenced employee turnover, largely by improving job satisfaction and aligning with employees' values. Many managers disclosed that employees had greater purpose in contributing to sustainability initiatives, which helped improve retention. Additionally, companies noted that these practices created opportunities for learning new skills, as well as innovation, making roles more engaging and attractive. Two participants shared their thoughts on the relationship between employees and the company:

> "Since implementing circular economy practices, fewer employees are leaving. People feel proud to work for a company that cares about the environment. The work is more interesting, and employees feel more involved. Because of this, they are staying longer."

> "Employees often say they feel more engaged and motivated knowing their work contributes to something bigger, like reducing waste and promoting environmental responsibility. This sense of purpose has been a big factor in keeping people around."

However, not all experiences were positive. Some respondents noted that the transition created uncertainties or additional workloads that initially increased employee turnover.

> "In the early stages, we had some employees leave because they didn't feel comfortable with the new processes, but things stabilized as we provided better training and communication."

Other participants see the turnover as a wholly negative situation, with negative consequences in the form of more work for employees, trying to remedy issues caused by

the practice:

> "It has an increasingly negative impact on both turnover and the mentalities of employees who are stuck trying to remedy the fallout from the practice. Our customers demand a certain reliability, and this creates stress on employees attempting to remedy problems."

The findings highlight that CE practices generally improved job satisfaction and employee retention by aligning values, offering skill development, and fostering engagement. Some respondents mentioned initial resistance and workload challenges that temporarily increased turnover. In contrast, a few participants reported negative impacts, including an increase in stress and operational issues based on difficulties surrounding the implementation.

5.2.3 Hypothesis 2

To address the results in hypothesis 2, the three sub-hypothesis presented in 2.5.2 are looked at together. As remanufacturing had less significance on performance than CE, a question was created to get a deeper understanding of the positive impacts of remanufacturing, as this had less significance on performance than CE. To explore this, a question was designed to focus on how remanufacturing practices influence the company's appeal as an employer:

Question five: "What aspects of your organization's remanufacturing do you believe make it an attractive employer?"

Organizations involved in remanufacturing seem to have an edge when it comes to attracting employees, based on the answers from the survey. Sustainability, opportunities for skill development, and a sense of innovation are some of the aspects mentioned that seem to make these companies appealing. Comments include:

> "We care about the environment and people like that. Our work lets employees try new ideas and learn skills. We focus on reducing waste and being responsible. This makes our company a great place to work."

However, not all views were as positive. One respondent expressed skepticism, suggesting that profit is often prioritized over genuine environmental efforts:

> "The focus should be on conserving the planet's resources, but it never is. It's all profit-based."

Despite this comment, companies generally emphasize that implementing remanufacturing has made them a more attractive employer by promoting sustainability, innovation, and opportunities for skill development.

5.2.4 Hypothesis 3

While findings from the quantitative survey highlight the importance of change management in terms of knowledge and perceived importance of CE, there is a lack of clarity regarding the specific ways leadership and employee involvement affect performance outcomes. To explore these gaps, two qualitative questions were developed:

Question six: "How are employees in your company involved and supported during the transition to circular operations, and how is the transformation communicated to them?"

Several participants made a point of the importance of keeping employees engaged during the transition to circular operations. Many companies involved employees by seeking their input on changes, providing training, and ensuring open communication throughout the process. Respondents noted that employees were more likely to embrace the transition when they understood its purpose and were given the tools to succeed. Participants shared:

> "Employees were invited to workshops where they could share their insights and concerns about the transition. This made them feel valued and part of the solution."

> "We set up training programs tailored to specific departments, ensuring everyone understood how their roles fit into the broader circular economy goals."

Moving on, there was a lack of information surrounding the methods used for the transition to circular economy. To get a better understanding of how the transition was implemented, the following question was asked:

Question seven:" Who created the strategy for the transition to a circular economy, and who was in charge of implementing it? Was a standardized model related to change management theories used?"

The development and implementation of CE strategies varied among organizations, but a few recurring trends were seen. In most cases, senior leadership or dedicated sustainability teams were responsible for creating the strategy. Some companies explicitly incorporated frameworks like Kotter's 8 Step Model to guide the process. Others relied on less formalized

approaches. Responses include:

> "Our sustainability team worked closely with external experts to design the strategy. They also conducted workshops with employees to identify potential challenges and opportunities during implementation."

> "We used Kotter's model as a blueprint, particularly focusing on creating urgency and empowering action throughout the organization."

Across hypotheses, the transition to CE proves beneficial, with effects such as enhanced performance and talent retention to stronger organizational attractiveness. Involvement and change management seem to have the effect of strengthening these outcomes, which can help emphasize the importance of leadership and communication in achieving successful transitions. While some participants seem hesitant about the transition, and some have raised concerns, the overall feedback highlights the positive impact of adopting CE practices.

5.2.4.1 Table: qualitative data findings and quotes

This table summarizes the qualitative findings and pairs them with quotes from the qualitative survey.

Topic	Results from Qualitative Data	Quotes
Motivations Circular Economy Adoption	Companies are driven by both internal motivations, such as cost savings and resource efficiency, and external drivers, including regulations, market trends, and demand for sustainable products.	"Loyalty to the product is a huge part of it. Obviously costs are saved, but remanufacturing allows natural support for prior models." "Our company engages in remanufacturing to save costs and make better use of materials."
Impact on Profitability	The profitability of CE practices is primarily driven by cost reductions from reusing materials, managing waste, and improving efficiency. New revenue streams, such as refurbished products, also contribute.	"Reusing materials lowers costs. Better efficiency saves time and resources. Sustainable products attract more customers. These actions improve profits and support growth."
Challenges Implementation	High upfront costs, resistance from supply chain partners, and employee skepticism about CE practices are common barriers. Organizations addressed these through communication, training, and gradual adoption.	"The biggest challenge was the high initial cost of adapting our production systems to fit circular practices. It took time to see the returns." "We struggled to get suppliers on board. Some didn't understand the value."
Employer Attractiveness	Companies using remanufacturing and CE practices are seen as innovative and environmentally conscious, which appeals to job seekers who value sustainability and skill development opportunities.	"We care about the environment and people like that. Our work lets employees try new ideas and learn skills."
Employee Turnover and Satisfaction	CE implementation improve job satisfaction and retention by aligning employees' values with company missions, but some initial resistance and turnover were noted during the transition phases.	"We noticed a drop in turnover after introducing circular economy initiatives. Employees felt more connected to the company's mission."
Need for Employee Support and Training	Effective transitions to CE require proactive employee engagement through workshops, training, and clear communication about the benefits and goals of the new practices.	"Some team members were skeptical about the new processes, especially when they required additional effort or training." "We set up training programs tailored to specific departments."
Role Leadership and Strategy	Leadership teams often lead CE transitions, with some companies using formal change management frameworks like Kotter's model to ensure structured and effective implementation.	"Our sustainability team worked closely with external experts to design the strategy." "We used Kotter's model as a blueprint, particularly focusing on creating urgency and empowering action throughout the organization."

6 Discussion

This study investigates the impact of circular economy practices and remanufacturing on organizational performance, focusing on talent acquisition and change management as mediating and moderating variables. By using a mixed methods approach, the study uses quantitative analysis to identify significant relationships and qualitative data to address gaps that were not covered by the quantitative findings. In addition to this, it also provides additional context and depth. By combining both methods, the study seeks to answer the research question posed in chapter 1:

> **RQ:** How does the degree of circular economy and remanufacturing influence organizational performance, and how are these outcomes affected by talent acquisition and change management practices?

The quantitative analysis revealed a significant positive relationship between the degree of circular economy implementation and remanufacturing and organizational performance. Talent acquisition was identified as a significant mediating factor, however, the moderating effects of change management were minimal. The qualitative data added depth to these findings by providing explanations for the trends observed. It also gave different perspectives in some cases. Respondents highlighted factors like cost and resource savings, as well as sustainability, as key motivations for CE adoption. Challenges included implementation costs and general resistance from employees or partners.

This chapter is split into three sections. First, it looks at the theoretical implications of the findings and highlights how they build on or challenge existing research relating to CE practices, remanufacturing, and organizational performance. Second, the managerial implications are outlined, and recommendations for businesses looking to adopt or enhance CE strategies are provided. Finally, the study's validity and reliability are presented, along with its limitations, to critically assess the research process and highlight opportunities for future work.

6.1 Theoretical implications

6.1.1 Circular Economy and Performance

Hypothesis 1 in the study investigates the first part of the research question, specifically the effect of CE and remanufacturing on organizational performance metrics. The results from the quantitative and qualitative test of hypothesis 1, as presented in sections 5.1 and 5.2, along with relevant theoretical perspectives, are used to analyze and discuss the findings.

6.1.1.1 Profitability and sales growth

The quantitative results show a strong significant relationships between CE and financial performance metrics, such as profitability and sales. This fits with literature presented in chapter 2 (Ghisellini et al., 2016 and Geissdoerfer et al., 2018), which shows how CE can lead to an increase in resource efficiency, a stabilizing of operational costs, and help financial results. By addressing both environmental and economic goals, the implementation of CE fits in with the principles of the triple bottom line (Elkington, 2004). Participants in the qualitative analysis also emphasized the cost-saving opportunities of reusing materials. They mentioned that reusing materials often allowed businesses to reinvest funds into innovation and had a positive effect of profit margins. This aligns with studies that highlight how practices like waste reduction, sustainable product design, and extending product lifecycles are particularly effective in reducing costs and improving financial performance (Mazzucchelli et al., 2022; Yu et al., 2022; Zisopoulos et al., 2023; The Ellen McArthur Foundation, 2013).

Remanufacturing has a less significant effect on the quantitative results, though it still contributes modestly to financial performance metrics (profitability and sales). The qualitative analysis provided insights into this difference, showing that while reused products could generate new revenue streams, operational inefficiencies like increased maintenance and logistical complexities could compromise these benefits. One participant notes that frequent equipment breakdowns and continuous maintenance can drive up labor costs, straining budgets. Several participants also pointed out that the initial costs of adopting CE practices (such as remanufacturing) can be challenging, often delaying

financial returns. This finding is consistent with Sarfraz et al. (2022), who observed that high upfront investments and long implementation timelines can prevent profitability in the short term. Similarly, prior studies emphasize the resource-intensive nature of remanufacturing, which, if not efficiently implemented, can compromise its potential advantages (Geissdoerfer et al., 2018).

6.1.1.2 Market share

The quantitative results showed that CE has a significant positive impact on market share. This finding fits in with existing literature that emphasize how growing consumer expectations for eco-consciousness drive the adoption of CE practices (Yu et al., 2022). This strengthens a company's market position by aligning its products with sustainability (Nosková et al., 2024). Qualitative findings then points out that regulations, market trends, and the increasing demand for eco-friendly options are key motivators for adopting CE practices. Participants noted that CE not only supports sustainability goals but also provides a competitive edge in the marketplace, given the growing awareness of sustainability in society. Supporting this, studies found that companies actively reporting environmental management activities consistently outperformed competitors in this area (Bogdan et al., 2022).

Remanufacturing's impact on market share in the quantitative analysis is less pronounced. Insights from the qualitative analysis suggest that this could be related to challenges, including lack of customer awareness and demand for refurbished products. One participant mentioned that some clients initially preferred new equipment over remanufactured alternatives, which makes a point of the lack of familiarity with the positive aspects of remanufactured options. To address these barriers, the participant described using targeted marketing campaigns to educate clients about the value and reliability of remanufactured products.

6.1.1.3 Employment and productivity

Quantitative data indicate that employment is the performance metric most strongly influenced by CE practices, while productivity shows a moderate but positive relationship with CE adoption. This aligns with existing theory, which suggests that implementing CE strategies creates jobs and increases demand for skilled labor (Horbach et al., 2015).

Although the impact of CE on productivity is under-explored, research on corporate social responsibility has linked it to higher productivity through improved employee involvement and alignment with organizational goals (Becchetti et al., 2005). Qualitative insights further support these findings, showing how CE practices positively affect employee retention and engagement. Respondents pointed out that the adoption of CE practices increased job satisfaction by aligning with employees' values and giving them a stronger sense of purpose.

Additionally, the quantitative data indicated that remanufacturing has moderate effects on employment and productivity. This fits with the findings from Laubinger et al. (2019), which suggest that the transition to a CE would be expected to generate labor-intensive jobs in industries such as recycling, repair, and remanufacturing, contributing to net employment gains. The qualitative insights suggest that remanufacturing contribute positively to workplace-culture by putting an emphasis on sustainability, skill development, and innovation. Respondents pointed out that remanufacturing fit with environmental and economic goals, creating opportunities for employees to engage in meaningful work while addressing waste reduction and resource conservation.

6.1.2 Talent Acquisition

The second part of the research question looks at how talent acquisition influences the relationship between the degree of circular economy and the level of remanufacturing on performance metrics. This is explored through Hypothesis 2. The results from testing these hypotheses, as shown in 5, along with the related literature, are used to discuss the findings.

Hypothesis 2A examines the impact of circular economy and remanufacturing on talent attraction. The quantitative results indicate a strong and significant relationship between the degree of circular economy and talent attraction. While remanufacturing also demonstrates a significant impact, its influence is smaller compared to that of CE. These findings align with existing research indicating that job seekers are drawn to companies with prosocial reputations, as these are seen as more responsible and appealing employers (Fombrun and Shanley, 1990). The concept of Corporate Green Image further explains this, highlighting how companies that promote strong ethical values are more attractive

to potential employees (Turban and Greening, 1997). Organizations such as these do not only offer practical benefits, but also enhance employees' sense of purpose and self-worth. The qualitative data complements this perspective, with respondents highlighting how organizations appeal to talent through their focus on sustainability. Employees often report feeling more engaged and motivated when their work contributes to a larger purpose, such as reducing waste and promoting environmental responsibility.

Hypothesis 2B examines the effect of talent acquisition on organizational performance. The quantitative results indicate that talent acquisitions significantly improve all performance metrics. This is supported by theory, which indicates that an organization's talent is the most significant source of competitive advantage. The effective implementation of talent management strategies boosts employee engagement, which in turn drives organizational performance and productivity (Hombalimath and Kinange, 2020). This theory is reflected in the quantitative findings. Here, talent acquisition shows a particularly strong positive effect on market share and productivity.

Additionally, hypothesis 2C explores the roles of circular economy and remanufacturing as a mediating variable. The quantitative results suggest that talent attraction acts as a strong mediating variable between circular economy and organizational practices. Although its mediating role for remanufacturing is smaller, it remains significant. Qualitative data further supports these findings, with respondents pointing out that adopting CE practices helped improve employee retention by providing a sense of purpose. These insights support the research, showing that meaningful work drives employee engagement, which drives organizational performance. Retaining skilled employees minimizes the costs and disruptions associated with turnover. Companies with lower turnover rates tend to be more competitive, as long-term employees bring expertise which translates into better performance (Fosu et al., 2024). The social identity theory (Turner and Oakes, 1986) further supports this mediation mechanism. Employees who identify with sustainable organizations are more likely to exhibit higher levels of commitment and engagement, which directly impacts productivity and profitability. This suggests that sustainability practices not only attract employees but also create employees that are more aligned with the organization's goals.

6.1.3 Change Management

The final part of the research question explores how change management affects the relationship between circular economy, remanufacturing, and organizational performance. This relationship is explored in Hypothesis 3 where *Perceived Importance of CE* and *Knowledge about CE*, two key components within change management, act as moderating variables.

The quantitative findings reveal that knowledge about CE has a significant direct effect on organization performance, while the *Perceived Importance of CE* does not show any significant effects on any performance metrics. Additionally, the moderating effects of these variables are inconsistent, with most interactions proving to be insignificant. The few interactions that do show significance are marginal and difficult to interpret, limiting their practical relevance. This can be better understood by examining theories that emphasize the challenges in change management. Raineri (2011) argues that while change management practices can help achieve project goals, their impact on organizational performance is often uncertain. This highlights how challenging it can be to turn effective change management into clear performance improvements. Additionally, theory shows that the shift to circularity often demands significant changes in organizational culture and behavior (Mauss et al., 2023). This may explain the limited role of perceived importance and knowledge about CE as moderators, as they are insufficient on their own to drive meaningful change without broader cultural alignment and strategy.

The survey used for quantitative analysis included *Perceived Importance of CE* and *Knowledge about CE* as the only variables to represent change management. These two factors alone do not reflect the full scope of change management, and their limited significance in the results showed a need for further investigation. This is why the qualitative research explores other aspects of change management, such as involvement, communication, and strategy implementation.

The qualitative findings consistently emphasize the importance of engaging employees during the transition to circular operations. Respondents noted that employees were more likely to embrace the transition when they clearly understood its purpose and were provided with the tools needed for success. For instance, some participants mentioned

organizing workshops where employees could share insights and concerns. Tailored training programs were also mentioned as a way to ensure employees understood how their specific roles aligned with broader CE goals. These findings are supported by scholars who found that communication, stakeholder involvement, encouragement, and organizational culture are critical to successful organizational change (Errida and Lotfi, 2021; Phillips and Klein, 2022). Strategies that prioritize these elements make sure that employees and stakeholders stay engaged throughout the transition, which in turn improves performance (Phillips and Klein, 2022).

The findings also showed that the strategies for transitioning to a circular economy varied among organizations. In most cases, the leaders or dedicated sustainability teams were responsible for creating and implementing the strategy. Some organizations adopted structured frameworks, such as Kotter's 8-Step Model, to guide the process. For example, one organization emphasized creating a sense of urgency to drive action across the company, which is the first step in Kotter's 8-Step Model for change management (Kotter, 1996). Huemer (2020) points out the effectiveness of Kotter's 8-Step Model in providing a structured framework for driving organizational change and aligning it with sustainability goals. However, the findings found that most organizations used less formalized approaches, working closely with external experts and employees to identify challenges and opportunities during the implementation phase.

6.2 Managerial implications

The results presented in Chapter 5 help provide a basis for the managerial implications. Key implications include:

6.2.1 Tailoring Circular Economy Strategies

Companies face different challenges and needs when transitioning to CE. Quantitative data show variations in organizational readiness and resource availability, while qualitative responses mention key challenges including helping employees understand the value of CE in their daily work. To address this, some organizations introduced CE gradually, focusing on smaller, achievable goals. These early successes helped build trust and gain employee support for broader changes.

This gradual approach reflects the principles of Kotter's 8-Step Model (Kotter, 1996), particularly the importance of creating "short-term wins" to build momentum. It also aligns with CBM, which focuses on tailoring CE strategies to fit an organization's specific context and resources (Geissdoerfer et al., 2018). The Ellen McArthur Foundation (2013) also makes a point of the value of flexibility in adopting CE and how adaptable approaches can make for more effective outcomes.

Based on the literature and results, there are ways to tailor CE strategies based on a company's unique situation. First, the use of CMBs to establish a foundation for implementing a CE. Then, as The Ellen McArthur Foundation (2013) suggests, the company can identify what is needed for the company to thrive during the transition. By creating short-term goals, small victories can also be celebrated, which in turn builds momentum. This can serve as a motivation for employees (Kotter, 1996).

Based on this research and literature, it is suggested to create a sense of value and use Kotter 8 steps to help the employees to see the benefits of CE. By including incremental approaches, it will help give employee and stakeholders a sense of purpose.

6.2.2 Talent Acquisition

From the literature and results gathered, there is a clear understanding that talent acquisition positively impacts organizational performance. Qualitative insights from

Question 4 emphasize that incorporating sustainability into recruitment strategies can attract talent. Branding, through promoting a strong corporate green image (CGI) and offering opportunities for skill development, enhance the company's appeal to potential employees while keeping the current workforce loyal and engaged. This engagement directly contributes to improved productivity and profitability (Turban and Greening, 1997).

Among the theories that can help lay the foundation for managerial implications is the Signal Theory by Carballo-Penela (2019) and the Social Identity Theory Turner and Oakes, 1986. Environmental branding is also critical in communicating sustainability commitments. One respondent was dissatisfied because of how profit could overshadow sustainability. Managers can take different steps to improve talent acquisition. Integrating sustainability into recruitment strategies can be beneficial. By emphasizing sustainability initiatives and promoting a green corporate image, organizations can attract environmentally conscious talent that is aligned with their goals. Furthermore, branding, through a strong CGI has been shown to attract employees who value environmental and social responsibility (Turban and Greening, 1997).

Providing skill development opportunities for employees is another effective strategy, as it increases employee engagement and the company's appeal to potential employees (Turban and Greening, 1997; Turner and Oakes, 1986). Balancing sustainability with a clear financial focus is also important. By focusing too much on profit, at the expense of sustainability, a company risks damaging the relationship between employees and the organization, as found in the qualitative data.

Finally, by aligning organizational values with sustainability, it has the effect of strengthening employee engagement (Turner and Oakes, 1986). By reflecting these values in recruitment and internal practices, organizations can attract and retain employees who align with the concept of CE. Regularly monitoring and adjusting communication strategies based on employee feedback can also be beneficial, as it opens for trust through the CE transition process, as found by Carballo-Penela, 2019 and qualitative data.

6.2.3 Leadership and Employee Engagement in CE

Employee engagement seem to play a role in the successful implementation of CE based on literature and data. Insights from Question 6 found that employee involvement, in the form of tailored workshops and training programs contributes to connecting employees with CE goals. These initiatives nurture a sense of inclusion and value among employees, encouraging their commitment to organizational objectives and reducing resistance to change. Participants specifically noted that seeing their contributions acknowledged in workshops helped them feel like integral parts of the future of the company.

The findings align with Hussain et al. (2018), who point out that employee involvement help promote trust in a transition. In addition, activities such as workshops play into Kotter's focus on empowering employees and implanting change into an organization (Kotter, 1996). However, as mentioned in qualitative responses, lack of communication during transitions can lead to skepticism and lack of engagement (Mauss et al., 2023).

Organizations should focus on employee engagement by having training, workshops and opening up for communication. These are important factors to successfully implement CE. Training programs can help employees see their role in the circular transition, as stated in the qualitative responses. Workshops open up for feedback, which can make employees feel valued (Hussain et al., 2018) and transparent communication is important to reduce skepticism (Mauss et al., 2023 and Kotter, 1996). By setting a clear vision and encouraging collaboration, leadership can also positively affect the transition to CE.

6.3 Reliability and Validity

6.3.1 Reliability

Reliability in a survey refers to the consistency and stability of the data collected. A reliable survey makes sure that the same results would be expected if the survey was repeated under similar conditions (Saunders et al., 2019, p. 516). The main threats to reliability include participant bias, researcher bias and researcher error.

6.3.1.1 Participant Bias

When a participant changes their behavior or response because of what they think the researcher expects, participant bias might occur. This threatens the reliability of the study. The following section outlines the participant bias that might have occurred in both the quantitative and qualitative studies and the steps taken to prevent them in each study.

In the quantitative study, leaders provided self-reported data, which introduced a risk of social desirability bias. This occurs when participants present themselves or their company in a more positive light, especially on sensitive topics like company performance (Grimm, 2010). To reduce this risk, anonymity and confidentiality were ensured to minimize any pressure to give socially desirable answers. Another concern was participants answering based on what they thought the researchers wanted to hear. To address this, neutral and unbiased language was used in the survey questions to avoid leading participants toward specific answers (Drost, 2011). Self-reported data also depends on the participant's ability to recall events. Misremembering and incomplete details can threaten the quality of the answers. To handle this, the questions were designed within specific time frames by asking "In the past year..." to help participants recall events and give more accurate responses. The questions were also designed to be as clear as possible and not too vague or overly general.

Superficial answers is one of the main sources to participant bias in the qualitative data. If the participants feel unmotivated or do not fully understand the questions, the answers could reflect this. This was addressed by giving clear instructions and explaining how much their input was valued and appreciated. There was also added a minimum character

requirement of 100 characters, to make sure the responses were detailed enough. A potential risk with open-ended survey, is that participants experience fatigue which could lead to rushed or incomplete answers. To avoid this, the survey was designed to take a maximum of 20 minutes.

For both studies, participants were selected through a participant recruitment platform, to access a diverse and relevant sample. The quantitative participants were gathered through Cint, whilst the qualitative data was gathered through Prolific. Transferability was assured by having a diverse participant pool, as this increases the likelihood of the results being applied to more contexts. However, to reduce sampling bias, there were established inclusion criteria through the use of screening questions. The screeners made sure that participants who met the study´s requirement were the only ones who could proceed. This minimized the risk of gathering unrelated or low-quality data.

6.3.1.2 Researcher Bias

Researcher bias occurs when a researcher's expectations or assumptions on the study influences the results. For the qualitative survey, external researchers provided feedback to identify and correct any issues with biased or leading questions in the survey. Their involvement made sure that the qualitative questions were based on objective assessment.

Confirmability was prioritized by using direct participant quotes to support interpretations in the qualitative analysis. This approach made sure that the results came directly from the participants and not the researcher's interpretation of them. External researchers also assisted during the analysis of both the quantitative and qualitative data, making sure that the hypotheses were grounded in established theory and that appropriate methods were applied to analyze the data effectively. By integrating external perspectives into the objective methods, the potential for researcher bias impacting the study was reduced, contributing to more reliable findings.

6.3.2 Validity

6.3.2.1 Internal Validity

Internal validity includes the degree to which a study accurately establishes a causal relationship or measures what it is intended to measure Saunders et al., 2019. There were used several methods to eliminate issues that could compromise the validity of the findings.

Selection bias was minimized by using participant recruitment platforms (Prolific and Cint) who has access to diverse participants groups. This increases the generalizability of the findings by making sure that the sample was broad and varied. Additionally, triangulation was achieved by sourcing participants for the two surveys from separate participant groups (Saunders et al., 2019). Triangulation involves using several methods or data sources to study the same phenomenon. This allows for cross-verification of the results. In this case, combining quantitative and qualitative data provided a thorough understanding of the research topic, as the strengths of one method could make up for the weaknesses in the other.

The quantitative analyses included control variables in the regression models to account for external factors that might influence the outcomes and isolate the effect of the independent variables. This prevents the study from having confounding variables. By holding these variables constant, it is easier to identify the true relationship between the primary variables of interest.

In regards to data quality, there were a few responses that had traits of being generated by artificial intelligence such as ChatGPT. These results were detected as they appeared excessive or unnatural and were removed from the analysis to prevent them from skewing the result. Attention checks were used to make sure the participants were paying attention. The participants who failed the attention check were removed from the dataset. Additionally, participants were only permitted to complete each survey once, preventing testing effects, where repeated exposure to the same questions might cause participants to alter their responses over time.

6.3.2.2 External Validity

External validity is the extent to which the findings of this study can be generalized across different contexts, industries, and geographic regions Saunders et al., 2019. The study used purposive sampling to make sure that participants were relevant to the study's objectives and capable of providing meaningful insights. The aim was theoretical representativeness, where participants provided insights from their professional experiences. All participants were also selected from the same country to minimize variability. This allowed for more reliable results by making sure that societal or regional variations did not influence responses.

The quantitative data had a sample size of 104, while the qualitative data had 50. These sample sizes were big enough to reduce the likelihood of sampling errors and to make sure that the analysis identified significant relationships.

In terms of temporal validity, the findings are relevant outside of the time frame of the study. However, the effects of CE practices often take time to materialize, and such long-term impacts are not fully captured by the current study. The cross-sectional design, chosen due to time constraints, provided a snapshot of the relationship between CE practices and company performance. While this approach offers important insights, it does not account for how these practices and their outcomes evolve over time.

6.3.2.3 Construct Validity

Construct validity evaluates whether the variables in the study accurately reflect the theoretical concepts they are meant to measure. The quantitative study included survey questions based on the framework from Geissdoerfer et al. (2018). This ensures that the study was grounded in a well-established theory, which strengthens the relevance of the findings and contributes to the study's construct validity by aligning the measured constructs with proven theoretical foundations. Additionally, clear definitions of circular business models and performance metrics were applied in the surveys. This made sure that the questions were clear and easy to understand, making it easier for the participant to interpret and respond accurately. This further strengthens the validity of the collected data.

6.3.2.4 Statistical Conclusion Validity

Statistical conclusion validity evaluates the robustness and reliability of the statistical analyses conducted in this study Saunders et al., 2019. The survey was designed with multiple questions covering various aspects of CE practices and performance. Asking similar questions in different ways helps capture more accurate data, confirm consistency in responses, and provide a stronger foundation for reliable analysis. To further evaluate the internal reliability of the constructs, Cronbach's alpha was calculated for the merged variables. Cronbach's alpha compares the amount of shared variance among responses, and makes sure that the merged variables are reliable for the analysis. The Cronbach alpha values for the merged variables in the study (seen in Table 4.1) ranged from 0.65 to 0.95 which are within the acceptable limits.

Finally, sensitivity analysis and diagnostic tests were taken to address potential issues in the regression models. Normality was inspected using the Shapiro-Will test and analyzing histograms and QQ plots for the residuals, which is seen in the appendix in section 7. Multicollinearity was assessed using Variance Inflation Factor (VIF), heteroscedasticity and autocorrelation in the data were examined using the Breusch Pagan- and Durbin Wattson test.

6.4 Limitations and implications for future research

Even though the quantitative and qualitative analyses provide valuable insights, there are several limitation that needs to be addressed. The limitations are discussed below, and suggestions for future research are also presented.

Reliance on self-reported data can create potential biases, especially in the quantitative study. Respondents may overestimate the success of CE practices or underestimate challenges because of an overly positive view of the company. Future research could address this limitation by including objective measures like financial performance metrics in their studies. Objective indicators are not as easily influenced as subjective responses by an individual's perceptions or biases. It could therefore provide calculable, verifiable results. By triangulating self-reported data with objective indicators, future research could achieve a more accurate understanding of the impact of CE practices.

Solely focusing on the managers' and their perspectives may negate the experiences of employees who are also affected by the implementation of CE practices. Future research could benefit from exploring employees perspectives to get a broader understanding of how CE affects the workplace. Variables like employee engagement, job satisfaction, and assumed barriers could be researched to gain insight into how transitions are experienced at an operational level. This approach would allow researchers to gather employees' personal opinions about the CE practices, instead of relying exclusively on managers' assumptions of employees feelings. Additionally, gaining insight into the perspective of job applicants when examining the impact of CE practices on talent acquisition could be valuable. This could provide first-hand insight into what the applicant values in potential employees instead of relying on the leader's assumption of what the applicant prioritize.

Another limitation is the geographical reach. All the companies in the study are based in the United States, and it may end up restricting the applicability of the findings to other areas. By looking at other countries, one could gain insights of how different areas regulations and cultural attitudes influence the implementation of CE practices. Regions with stricter sustainability policies, like countries within the European Union, could be an interesting area of study. For example, recent EU legislation requires companies to implement user-upgradable batteries in consumer electronics. This forces companies

to redesign products to comply with these regulations (European Commission, 2023). Expanding the geographical scope could give a more in-depth understanding of how policy frameworks and cultural contexts affect organizational strategies and the adoption of CE principles.

Future research could also focus more on certain aspects, such as examining a single industry type and comparing companies based on factors such as size and age. This could help by differentiating the challenges and opportunities that help shape the implementation of CE practices in different contexts. Similarly, by studying differences in company size, it can be seen how larger organizations implement circular strategies compared to small and medium-sized enterprises, which may face challenges related to resource- or operational-related constraints. It could also be interesting to look at the operational years of a company to see whether newer companies find it easier to adopt CE principles compared to older businesses. This could give a more in-depth understanding and also make it easier to give specific recommendations to businesses looking to adopt CE principles.

Another limitation is related to the study's cross-sectional design, which only looks at a snapshot of the relationship between CE practices and company performance. The long-term effects of CE transitions were not able to be captured in this study. To look at long-term benefits and challenges related to CE, one could implement a longitudinal design for future studies.

It is important to consider the quality of responses, especially related to the qualitative data. As the survey has been conducted online, without direct interaction between the researcher and participants, there is a potential risk of compromised data quality or falsification. Particularly the use of AI tools, such as ChatGPT, to generate answers related to the questions in the survey is a relevant problem. While there were taken measures to identify and exclude such responses, there is still a chance that some answers went unnoticed. For future research, qualitative data could benefit from being collected through interviews instead of open-ended surveys. Interviews make it possible to clarify questions and gain more detailed answers by being able to talk to the participants directly. This could also reduce the likelihood of AI-generated or insincere responses.

In this study, different types of circular business models were merged into a single category, as the focus was on the overall effect of CE practices rather than the specific characteristics

of the individual models. Similarly, different remanufacturing practices were grouped together instead of being analyzed separately. This study wanted to look at broader trends instead of specific mechanisms, and the approach was, therefore, a good fit. However, it could be interesting to differentiate between different types of CBMs and remanufacturing practices in future studies to provide more specific insights. This could be beneficial as different models face different challenges related to implementation, costs, and effectiveness in achieving CE goals.

Another limitation is that not all regression models met the criteria for linear regression, which affects the reliability of the results. Some of the models detected issues with normality or minor issues with heteroscedasticity and autocorrelation. This suggests that the assumptions of linear regression were not met. To address this, future research could consider another regression model, such as ordinal or logarithmic regression. Because the data did not fully meet the assumptions required for linear regression, these approaches could be better suited for the quantitative dataset. The robustness and accuracy of the results could possibly be elevated by exploring these alternative methods.

By addressing these limitations, future research could help build on this study's findings and broaden the knowledge surrounding the topic of circular economy.

7 Conclusion

This study explores the impact of implementing circular economy practices on key performance metrics, and e The conclusion aims to answer the research question, by using the hypotheses developed in the study.

The quantitative test of hypothesis 1 found that transitioning to CE had a positive impact on organizational performance, with strong effects on profitability and employment growth. The effects of remanufacturing on performance are less consistent. The qualitative data further supported this by emphasizing that circular practices allow for cost-savings and an increase in resource efficiency. The less significant effect of remanufacturing on performance could be explained by the high initial cost and lack of customer awareness, which results in customers favoring new products over reused ones.

Hypothesis 2A shows that CE practices significantly enhance talent acquisition by aligning with sustainability values and encouraging innovation. Remanufacturing has a less significant impact. Hypothesis 2B confirms that talent acquisition contributes to improved organizational performance across various metrics. Talent acquisition mediates the relationship between circular economy practices and performance, as seen in the results of hypothesis 2C. The mediating role of remanufacturing is less pronounced. The qualitative data offer more insight into what parts of CE make the company more attractive. This included employees feeling more engaged when their work contributes to a bigger purpose and aligns with their values. This, in turn, increases their productivity.

Hypothesis 3 shows that the moderating effects of perceived importance and knowledge about circular economy practices on performance are limited. However, knowledge exhibits strong direct effects on performance. The limited significance can be explained by the narrow scope of change management. These factors are insufficient on their own to drive change without broader cultural alignment and strategy. Other variables within change management were explored in the qualitative analysis. It showed that by engaging employees, using workshops, and clear communication, the companies could ensure a smoother transition and increase their performance. Overall, the study shows that when coupled with strategic talent and change management, CE practices can be a beneficial way of achieving environmental sustainability and economic performance.

Declaration on the use of AI tools in the work on this master's thesis

Name and version: *ChatGPT (4.O)*

Reason for use: organizing data, generating ideas, finding synonyms & summarizing articles for simple reading.

Name and version: *Grammarly Pro* Reason for use: generating synonyms, providing options for ways to structure sentences.

We are aware that we are responsible for all content of this master's thesis, including the parts where AI tools are used. We are responsible for ensuring that the thesis complies with ethical rules for privacy and publication.

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Appendices

A Quantitative survey

No.	Survey Question
S4 (Screener)	Has your company implemented a circular economy strategy to any degree?
1	How do you estimate your company's following performance metrics compared to your industry rivals:
1A	Average sales growth for the last three years
1B	Average market share growth for the last three years
1C	Average employment growth for the last three years
1D	Average productivity growth for the last three years
2A	Profitability for the last three years
2B	Return on assets for the last three years
2C	Return on sales for the last three years
4A	I will likely actively look for a new job in the next year
4B	I often think about quitting
4C	I will probably look for a new job in the next year
5A	Reuse or repair of products (the product/s is taken back from the customer, but not transformed into a new product/s)
5B	Remanufacturing/refurbishing or recycling of products (the product/s is taken back, and is transformed into a new product/s)
5C	Offering the customers incentives to return products for the above purposes
14A	The company as a whole has completely transitioned from a conventional business strategy to a circular economy strategy
14B	The company has invested in a start-up focusing on a circular economy strategy, with its own brand, employees, and resources
14C	The company retains its conventional business strategy while at the same time developing a circular economy strategy, either as a part of the existing organization, a spun-off subsidiary, or a joint venture
14D	The company has acquired a different company focusing on a circular economy strategy and integrated it into its own organization
15A	I have been involved in the development of a circular economy strategy
15B	The strategy development process has been professionally meaningful for me
15C	The circular economy strategy that has been developed is important for the company's bottom line
15D	I know a lot about the circular economy in my industry
17	How would you describe your comments on the transition?
18A	It is easier now to attract top talent
18B	The company is clearly a more attractive employer now, after the transition

Table A.1: Survey Questions (Quantitative Part.1)

No.	Survey Question
20A	Brand building
20B	Innovation
20C	Reputation building
20D	Launch of new products/services
20E	High quality of products/services
20F	Customization/tailoring
20G	High level of customer/user service
20H	Low prices
21	How central is sustainability in the positioning of your company brand in your view?
22A	I am interested in sustainability topics in my industry
22B	I am probably more interested in sustainability topics than most people in my industry
23	My knowledge of sustainability in general is:
26	What is your company's annual turnover?
27	What is your company's industry?
28	What is your position in the company?
29	In which U.S. state is the HQ of your company located?
30	Gender
31	Age
32	What education do you have?

Table A.2: Survey Questions (Quantitative part.2)

B Qualitative survey

No.	Survey Question
1	What are the primary motivations for your company to engage in remanufacturing? Are there any external motives influencing the decision? Please elaborate.
2	What specific aspects of circular economy practices (e.g., cost reductions, increased efficiency) have had the greatest impact on profitability?
3	Performance includes sales growth, market share growth, employment growth, and productivity growth, as well as profitability. Have there been challenges that prevented circular economy practices from contributing to increased performance in your organization? If so, what are they, and how did you handle them?
4	What aspects of your organization's remanufacturing do you believe make it an attractive employer?
5	How has the employee turnover changed after implementing a circular economy?
6	How are employees in your company involved and supported during the transition to circular operations, and how is the transformation communicated to them?
7	Who created the strategy for the transition to a circular economy, and who was in charge of implementing it? Was a standardized model related to change management theories used?

Table B.1: Survey Questions (Qualitative)

C Detecting Outliers

Cook's Distance was used to identify outliers in models that had the most issues with normality and heteroscedasticity. After examining all models, those in Hypothesis 2C showed the largest deviations from normality and issues with heteroscedasticity before removing the outliers. To address this, we identified the outliers and evaluated whether they were due to data entry errors, measurement inaccuracies, or represented meaningful extreme cases within the data. After this, we decided to remove the outliers that exhibited extreme cases, as their influence significantly distorted the model's assumptions and results.

The top plots shows the residuals versus fitted values, highlighting patterns or deviations, while the bottom plots displays Cook's Distance, which identifies influential observations.

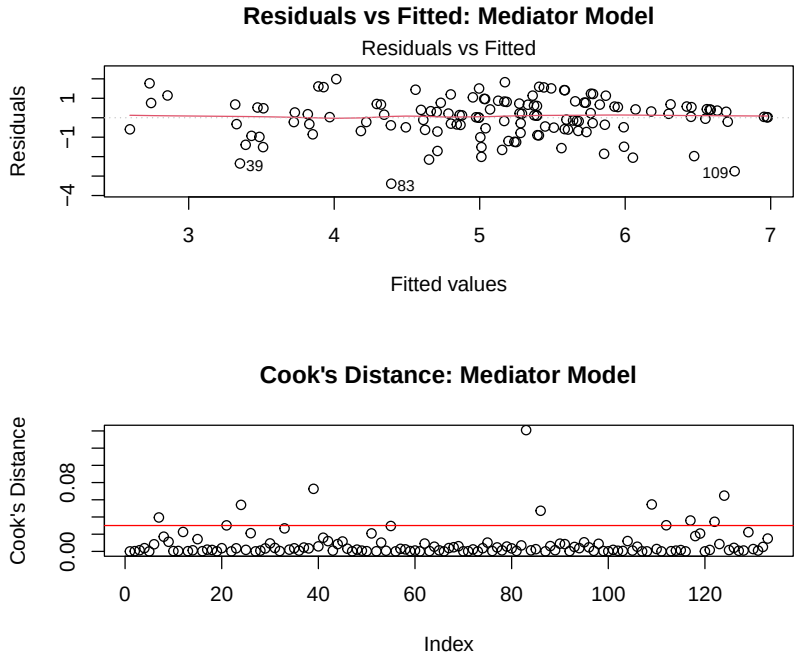

Figure C.1: Diagnostic plots for the mediator model in hypothesis 2C

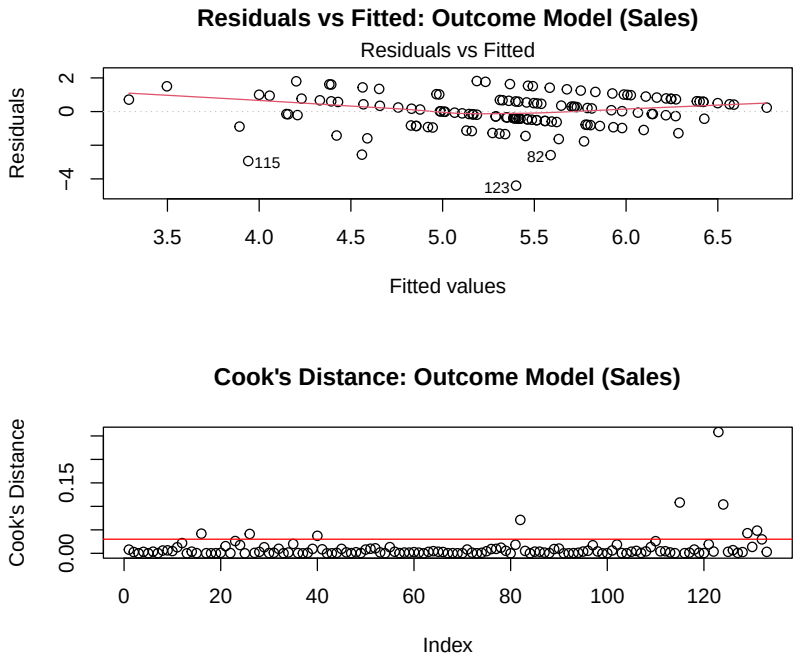

Figure C.2: Diagnostic plots for the outcome model in hypothesis 2C, with Sales (Y_1) as dependent variable

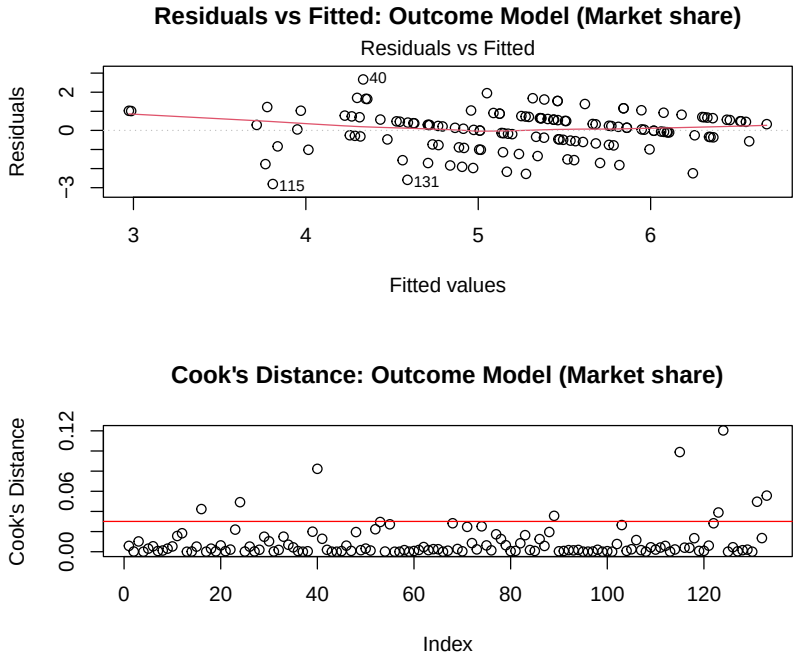

Figure C.3: Diagnostic plots for the outcome model in hypothesis 2C, with Market share (Y_2) as dependent variable

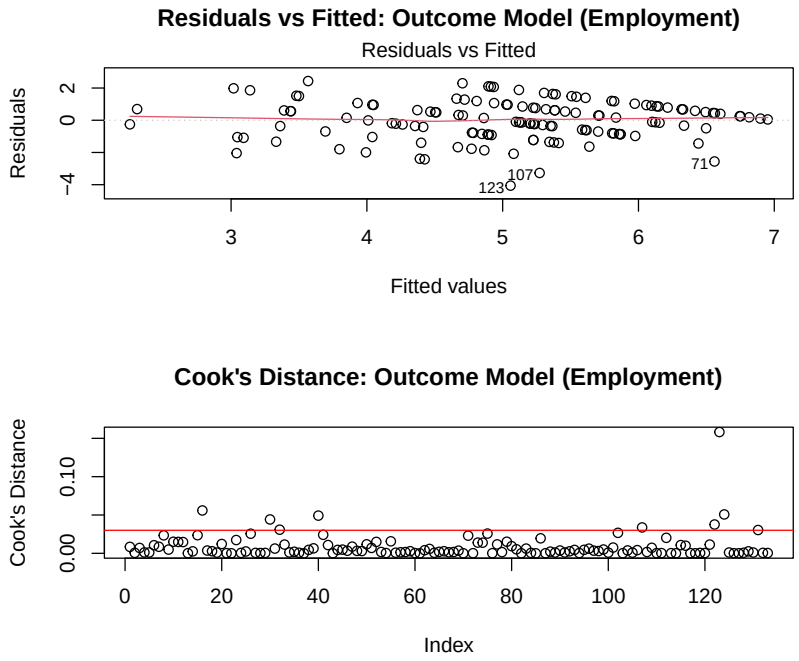

Figure C.4: Diagnostic plots for the outcome model in hypothesis 2C, with Employment (Y_3) as dependent variable

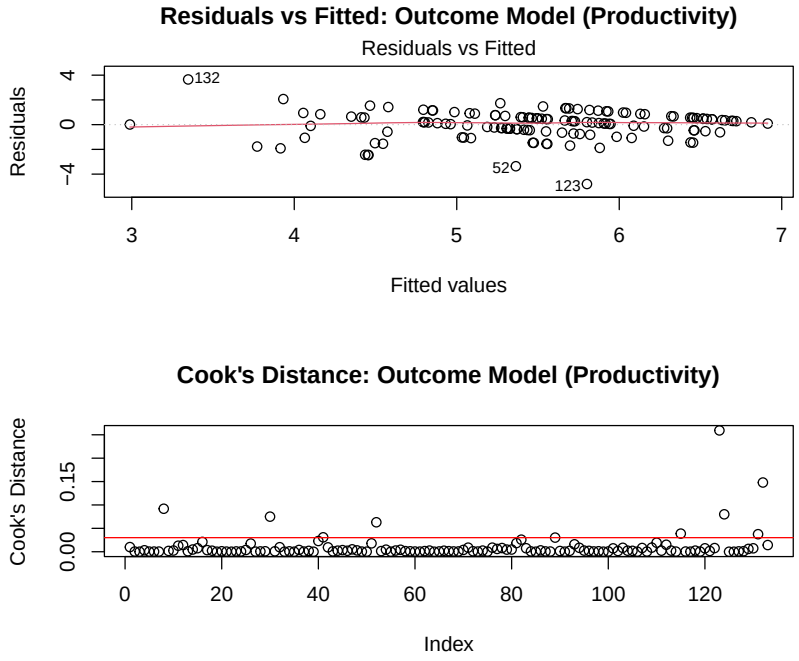

Figure C.5: Diagnostic plots for the outcome model in hypothesis 2C, with Productivity (Y_4) as dependent variable

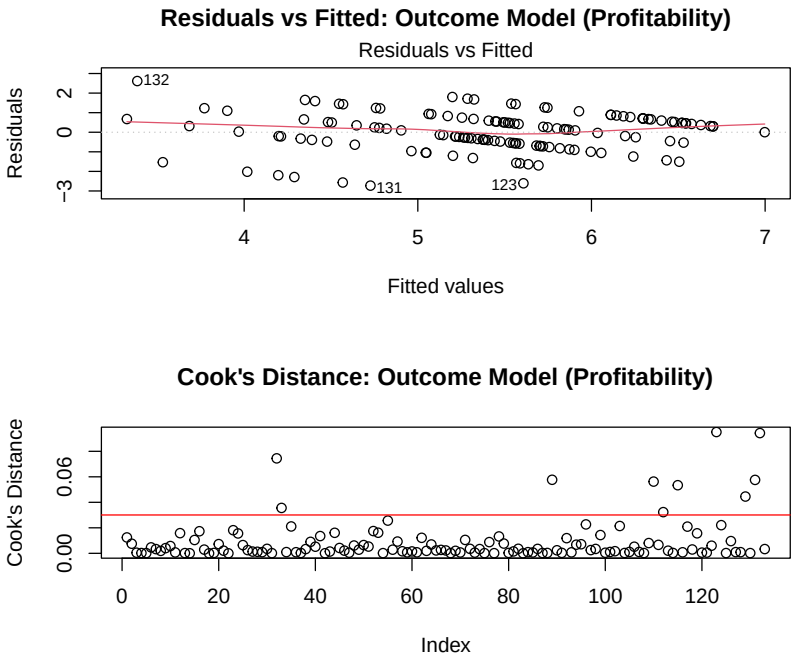

Figure C.6: Diagnostic plots for the outcome model in hypothesis 2C, with Profitability (Y_5) as dependent variable

D Robustness of analysis

D.1 Hypothesis 1

$$\textbf{Hypothesis 1:} \quad Y \sim \beta_0 + \beta_1 X_1 + \beta_2 X_2 + \epsilon \tag{D.1}$$

$$Y_1 \sim \beta_{0_1} + \beta_{1_1} X_1 + \beta_{2_1} X_2 + \epsilon \tag{D.2}$$
$$Y_2 \sim \beta_{0_2} + \beta_{1_2} X_1 + \beta_{2_2} X_2 + \epsilon \tag{D.3}$$
$$Y_3 \sim \beta_{0_3} + \beta_{1_3} X_1 + \beta_{2_3} X_2 + \epsilon \tag{D.4}$$
$$Y_4 \sim \beta_{0_4} + \beta_{1_4} X_1 + \beta_{2_4} X_2 + \epsilon \tag{D.5}$$
$$Y_5 \sim \beta_{0_5} + \beta_{1_5} X_1 + \beta_{2_5} X_2 + \epsilon \tag{D.6}$$

D.1.1 Checking for normality

1. Shapiro-Wilk Normality test: all p-values over 0.05 indicating no problems with normality

	Model	W	P-value
1	Residuals H1: Sales ((Y_1)	0.99	0.81
2	Residuals H1: Market share (Y_2)	0.98	0.17
3	Residuals H1: Employment (Y_3)	0.99	0.68
4	Residuals H1: Productivity (Y_4)	0.98	0.22
5	Residuals H1: Profitability (Y_5)	0.99	0.58

Table D.1: Shapiro-Wilk Test Results for Hypothesis 1

2. Double checked with histograms, QQ-plots, and kernel density plots for the residuals:

Dependent variable: Sales growth (Y_1)

$$Y_1 \sim \beta_{0_1} + \beta_{1_1} X_1 + \beta_{2_1} X_2 + \epsilon \tag{D.7}$$

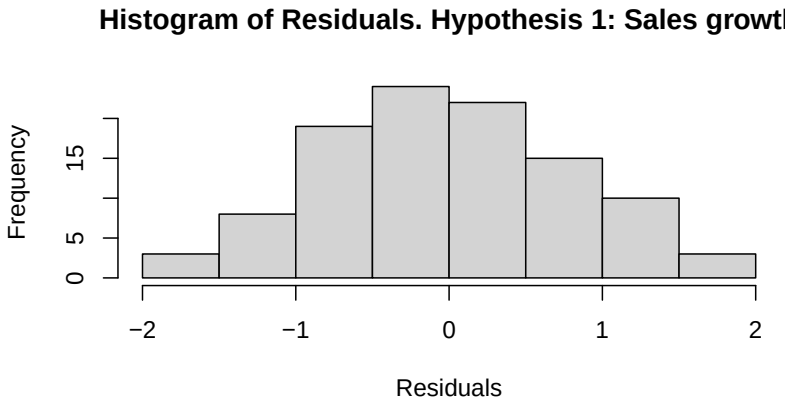

Figure D.1: Histogram for the residuals of *Sales growth* (Y_1) in Hypothesis 1

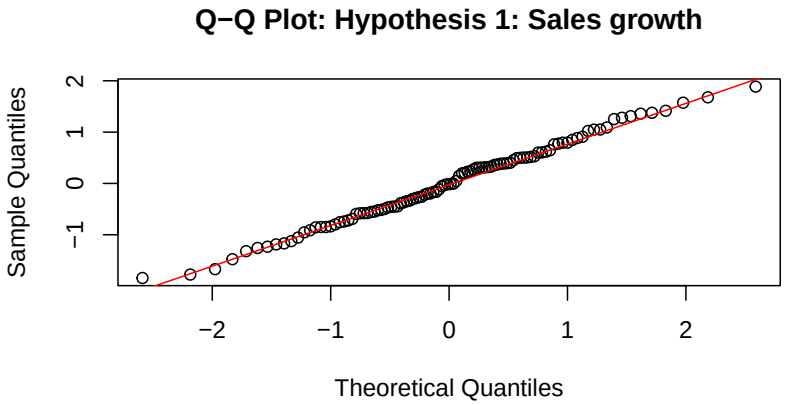

Figure D.2: QQ- plot for the residuals of *Sales growth* (Y_1) in Hypothesis 1

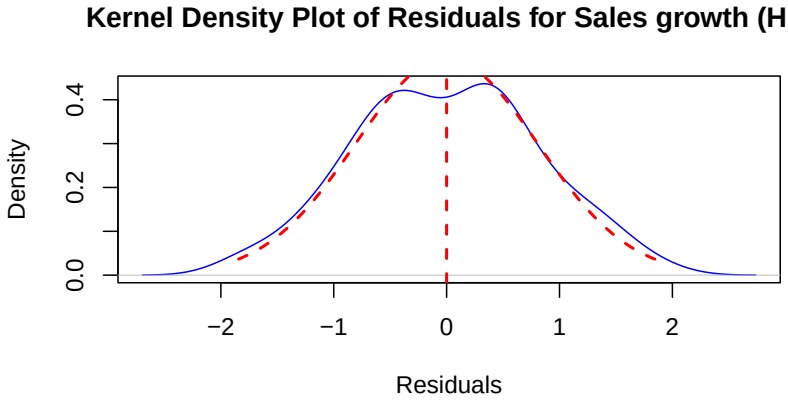

Figure D.3: Kernal density plot for the residuals of *Sales growth* (Y_1) in Hypothesis 1

Dependent variable: Market share (Y_2)

$$Y_2 \sim \beta_{0,} + \beta_{1,} X_1 + \beta_{2,} X_2 + \epsilon \tag{D.8}$$

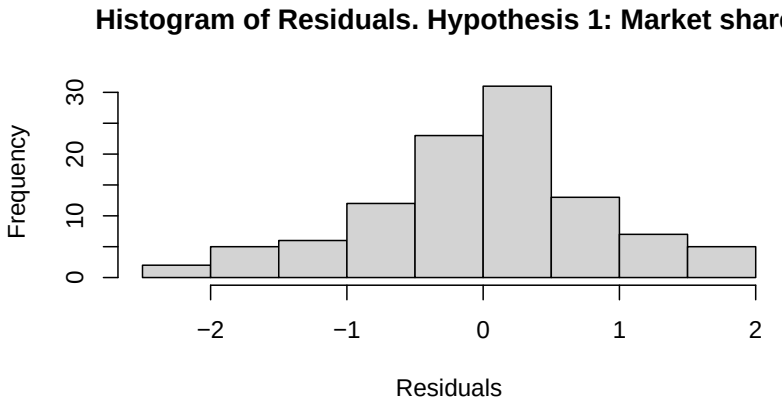

Figure D.4: Histogram for the residuals of *Market share* (Y_2) in Hypothesis 1

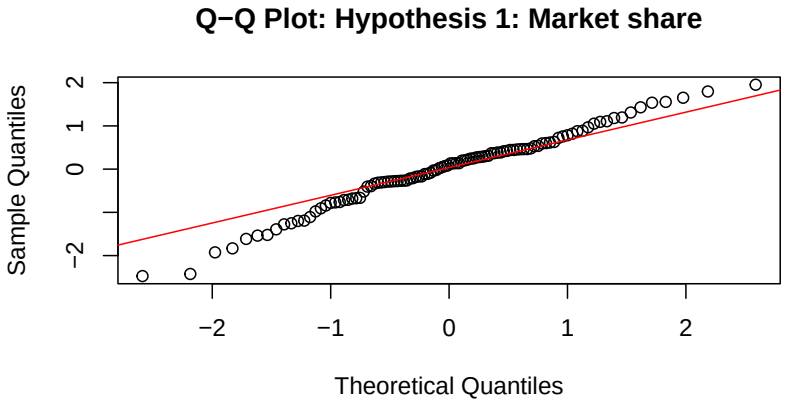

Figure D.5: QQ-plot for the residuals of *Market share* (Y_2) in Hypothesis 1

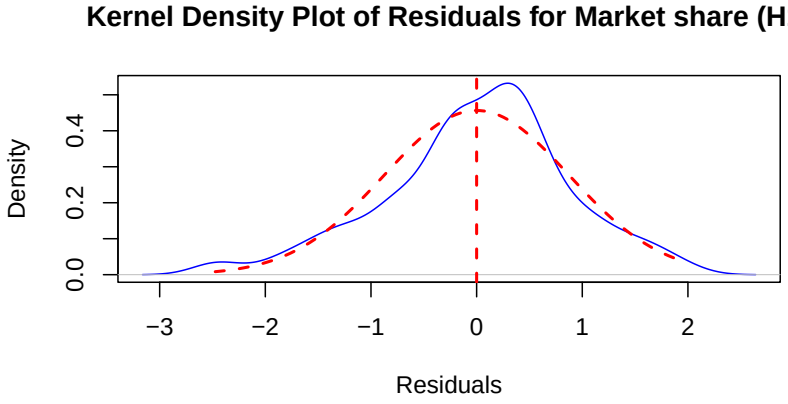

Figure D.6: Kernal density plot for the residuals of *Market share* (Y_2) in Hypothesis 1

Dependent variable: Employment (Y_3)

$$Y_3 \sim \beta_{0,} + \beta_{1,} X_1 + \beta_{2,} X_2 + \epsilon \tag{D.9}$$

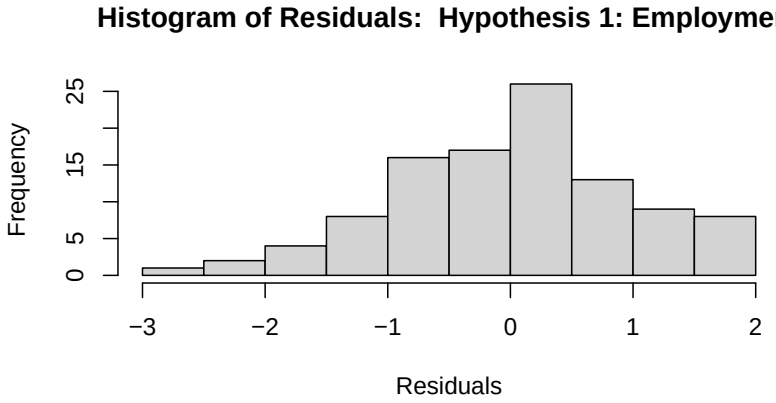

Figure D.7: Histogram for the residuals of *Employment* (Y_3) in Hypothesis 1

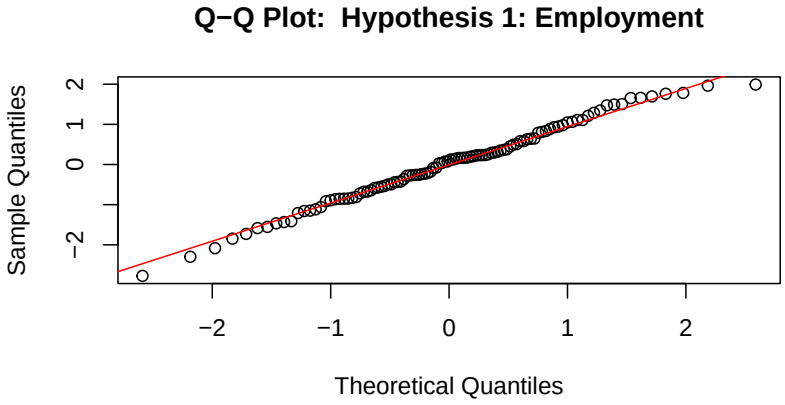

Figure D.8: QQ- plot for the residuals of *Employment* (Y_3) in Hypothesis 1

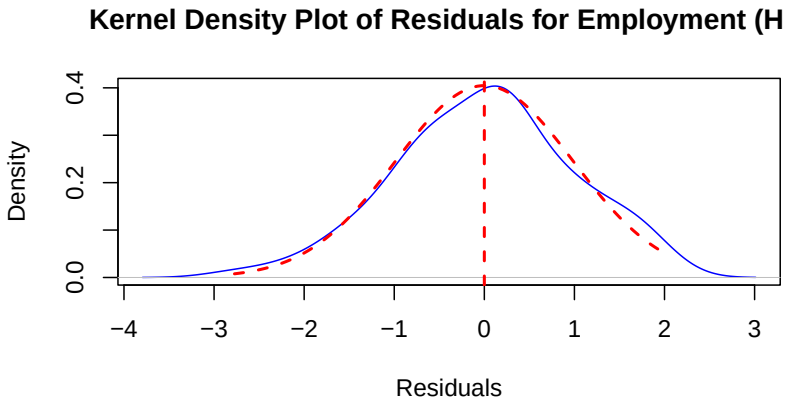

Figure D.9: Kernal density plot for the residuals of *Employment* (Y_3) in Hypothesis 1

Dependent variable: Productivity (Y_4)

$$Y_4 \sim \beta_{0_4} + \beta_{1_4} X_1 + \beta_{2_4} X_2 + \epsilon \tag{D.10}$$

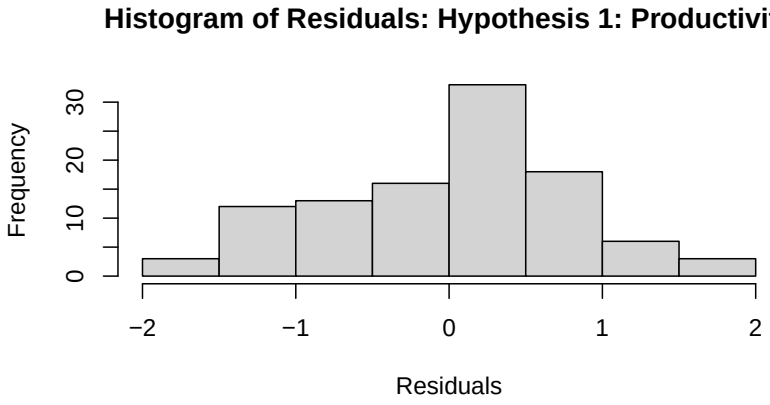

Figure D.10: Histogram for the residuals of *Productivity* (Y_4) in Hypothesis 1

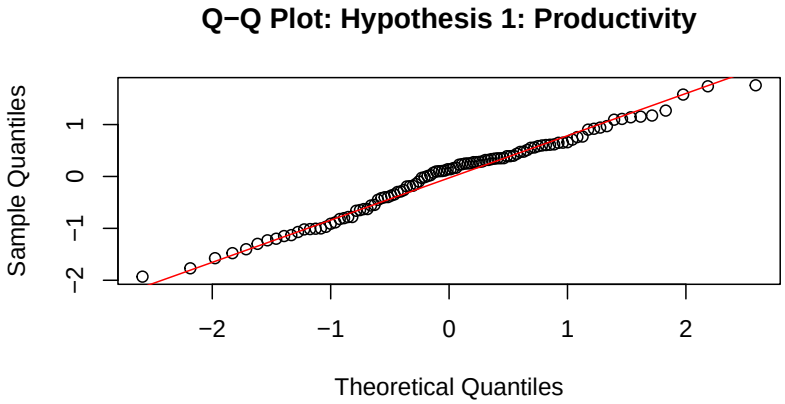

Figure D.11: QQ-plot for the residuals of *Productivity* (Y_4) in Hypothesis 1

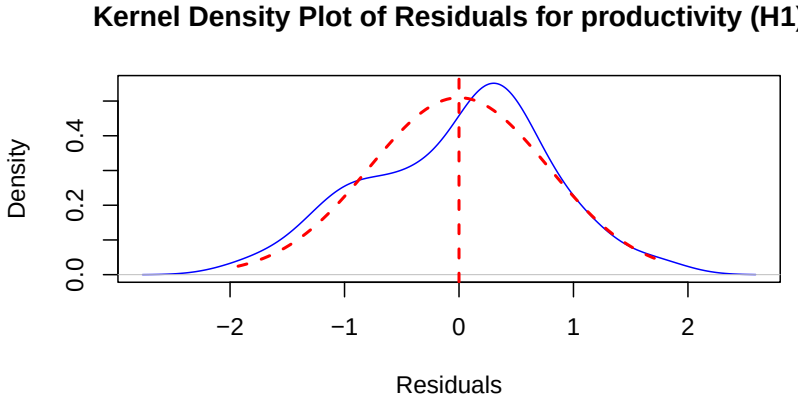

Figure D.12: Kernal density plot for the residuals of *Productivity* (Y_4) in Hypothesis 1

Dependent variable: Profitability (Y_5)

$$Y_5 \sim \beta_{0_5} + \beta_{1_5} X_1 + \beta_{2_5} X_2 + \epsilon \tag{D.11}$$

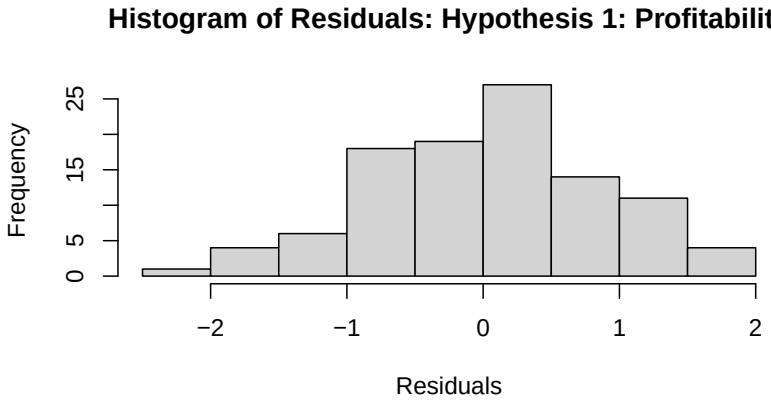

Figure D.13: Histogram for the residuals of *Profitability* (Y_5) in Hypothesis 1

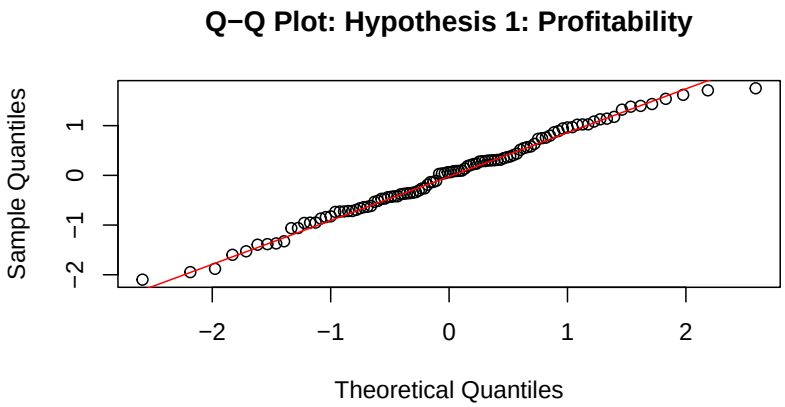

Figure D.14: QQ- plot for the residuals of *Profitability* (Y_5) in Hypothesis 1

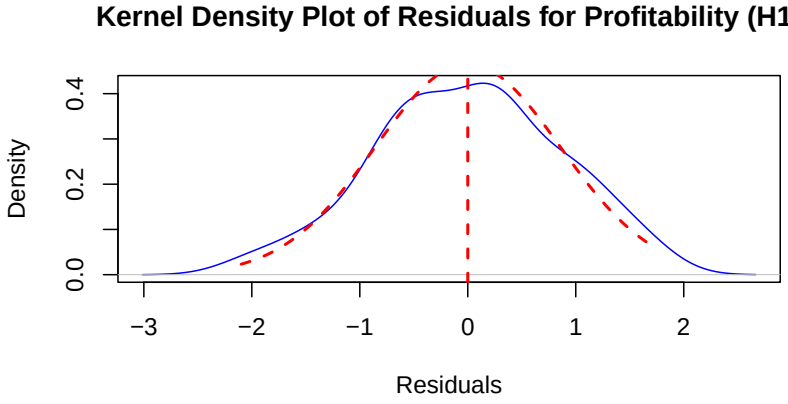

Figure D.15: Profitability for the residuals of *Profitability* (Y_5) in Hypothesis 1

D.1.2 Testing for multicollinearity

Testing for multicollinearity using the Variance Inflation Factor (VIF). All VIF values are below 5, indicating no or low multicollinearity.

Predictor	VIF
Degree of circular economy (X_1)	1.28
Level of remanufacturing (X_2)	1.34
Level of education (control variable)	1.03
Annual turnover (control variable)	1.07
Company industry (control variable)	1.07
Leader position (control variable)	1.14

Table D.2: Variance Inflation Factor (VIF) Results for Hypothesis 1

D.1.3 Testing for heteroskedasticity

Testing for heteroskedasticity using the Breusch Pagan- test. All p-values over the 0.05 threshold indicate no sign of heteroskedasticity

	Model	BP	Df	P - value
1	Hypothesis 1: Sales (Y_1)	7.28	6.00	0.30
2	Hypothesis 1: Market share (Y_2)	3.03	6.00	0.81
3	Hypothesis 1: Employment (Y_3)	3.04	6.00	0.80
4	Hypothesis 1: Productivity (Y_4)	6.29	6.00	0.39
5	Hypothesis 1: Profitability (Y_5)	6.52	6.00	0.37

Table D.3: Breusch-Pagan Test Results for Hypothesis 1

D.1.4 Testing for autocorrelation

Testing for autocorrelation using the Durbin Watson- test. All P-values over the 0.05 threshold indicate no sign of autocorrelation

	Model	DW	P - value
1	Hypothesis 1: Sales (Y_1)	1.91	0.33
2	Hypothesis 1: Market share (Y_2)	1.92	0.35
3	Hypothesis 1: Employment (Y_3)	2.08	0.67
4	Hypothesis 1: Productivity (Y_4)	1.87	0.25
5	Hypothesis 1: Profitability (Y_5)	1.82	0.18

Table D.4: Durbin-Watson Test Results for Hypothesis 1

D.2 Hypothesis 2A

$$\textbf{Hypothesis 2A:} \quad M \sim \beta_3 + \beta_4 X_1 + \beta_5 X_2 + \epsilon \tag{D.12}$$

D.2.1 Testing for normality

1. Testing for normality using the Shapiro-Wilk Normality test. **P-value: 0.55**, which is over the 0.05 threshold, indicating no problems with normality

	Model	W	P-value
1	Residuals H2A: Talent acquisition ((M)	0.99	0.55

Table D.5: Shapiro-Wilk Test Results for Hypothesis 2A

2. Double checked with histograms, QQ-plots, and kernel density plots for the residuals:

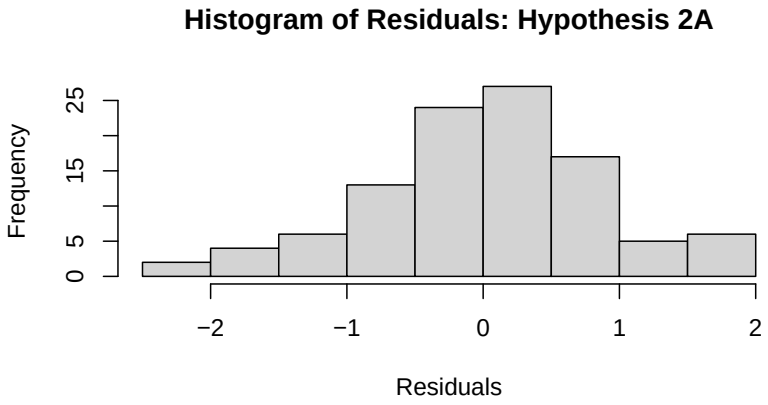

Figure D.16: Histogram for the residuals of Talent acquisition (M) in Hypothesis 2A

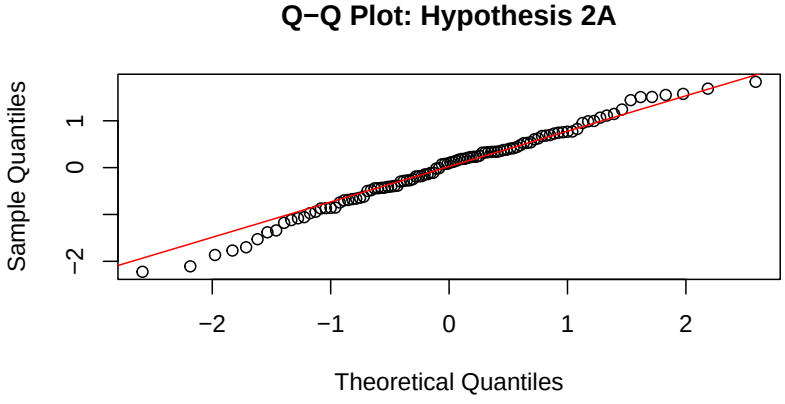

Figure D.17: QQ plot for the residuals of Talent acquisition (M) in Hypothesis 2A

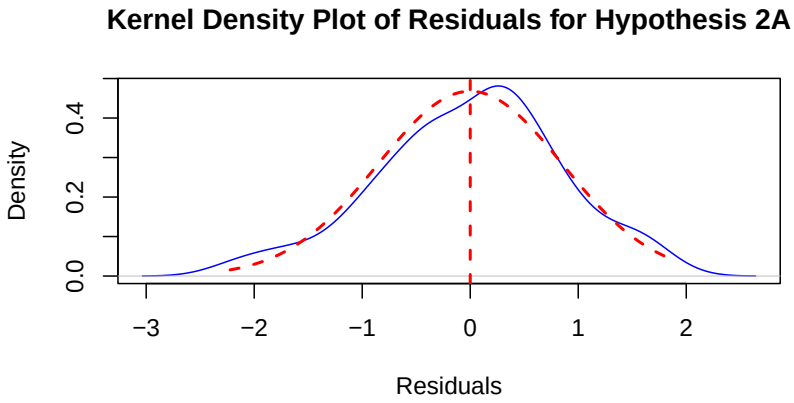

Figure D.18: Kernal density plot for the residuals of Talent acquisition (M) in Hypothesis 2A

D.2.2 Testing for multicollinearity

Testing for multicollinearity using the Variance Inflation Factor (VIF). All VIF values are below 5, indicating no or low multicollinearity.

Predictor	VIF
Degree of circular economy (X_1)	1.28
Level of remanufacturing (X_2)	1.34
Level of education (control variable)	1.03
Annual turnover (control variable)	1.07
Company industry (control variable)	1.07
Leader position (control variable)	1.14

Table D.6: Variance Inflation Factor (VIF) Results for Hypothesis 2A

D.2.3 Testing for heteroskedasticity

Testing for heteroskedasticity using the Breusch Pagan- test. P-value over the 0.05 threshold indicates no sign of heteroskedasticity

	Model	BP	Df	P- value
1	Hypothesis 2A: Talent acquisition (M)	6.02	6.00	0.42

Table D.7: Breusch-Pagan Test Results for Hypothesis 2A

D.2.4 Testing for autocorrelation

Testing for autocorrelation using the Durbin Watson- test. P-value over the 0.05 threshold indicate no sign of autocorrelation

	Model	DW	P - value
1	Hypothesis 2A: Talent acquisition (M)	2.03	0.57

Table D.8: Durbin-Watson Test Results for Hypothesis 2A

D.3 Hypothesis 2B

$$\textbf{Hypothesis 2B:} \quad Y \sim \beta_6 + \beta_7 M + \epsilon \tag{D.13}$$

$$Y_1 \sim \beta_{6_1} + \beta_{7_1} M + \epsilon \tag{D.14}$$
$$Y_2 \sim \beta_{6_2} + \beta_{7_2} M + \epsilon \tag{D.15}$$
$$Y_3 \sim \beta_{6_3} + \beta_{7_3} M + \epsilon \tag{D.16}$$
$$Y_4 \sim \beta_{6_4} + \beta_{7_4} M + \epsilon \tag{D.17}$$
$$Y_5 \sim \beta_{6_5} + \beta_{7_5} M + \epsilon \tag{D.18}$$

D.3.1 Testing for normality

1. Testing for normality using the Shapiro-Wilk Normality test. P-values for the residuals of Y_2 (0.0007) and Y_4 (0.0006) are under the 0.05 threshold and indicate problems with normality. The residuals for Y_1, Y_3 and Y_5 are over the threshold and do not indicate any problems with normality.

	Model	W	P - value
1	Residuals H1: Sales (Y_1)	0.98	0.1181
2	Residuals H1: Market share (Y_2)	0.95	0.0007
3	Residuals H1: Employment (Y_3)	0.97	0.0112
4	Residuals H1: Productivity (Y_4)	0.95	0.0006
5	Residuals H1: Profitability (Y_5)	0.98	0.1318

Table D.9: Shapiro-Wilk Test Results for the residuals of Hypothesis 2B

2. Double-checked with histograms, QQ plots, and kernel density plots for the residuals.

Dependent variable: Sales growth (Y_1)

$$Y_1 \sim \beta_{6_1} + \beta_{7_1} M + \epsilon \tag{D.19}$$

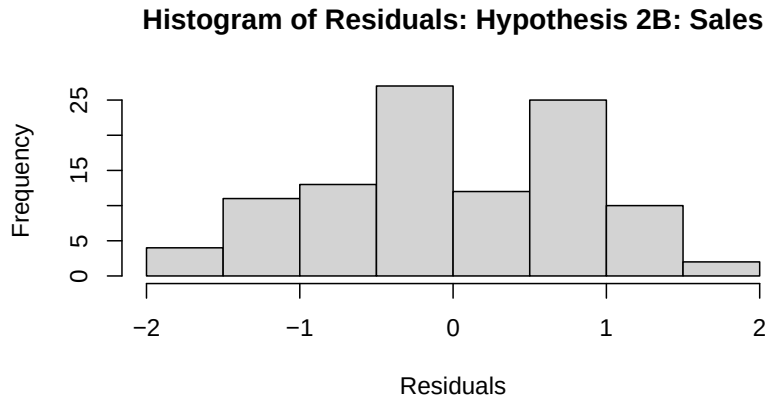

Figure D.19: Histogram for the residuals of *Sales* (Y_1) in Hypothesis 2B

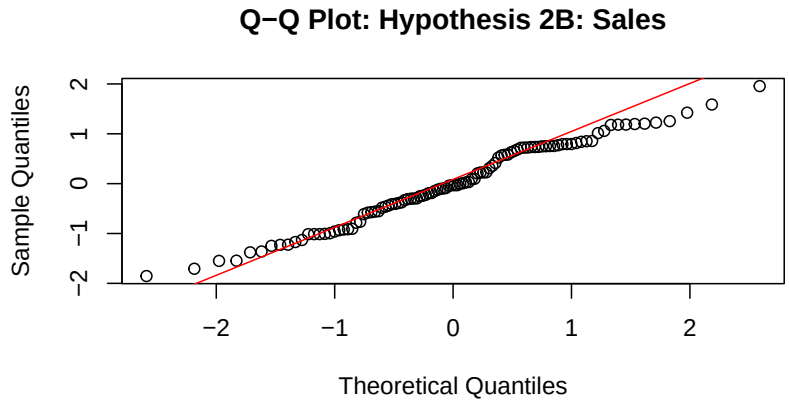

Figure D.20: QQ plot for the residuals of *Sales* (Y_1) in Hypothesis 2B

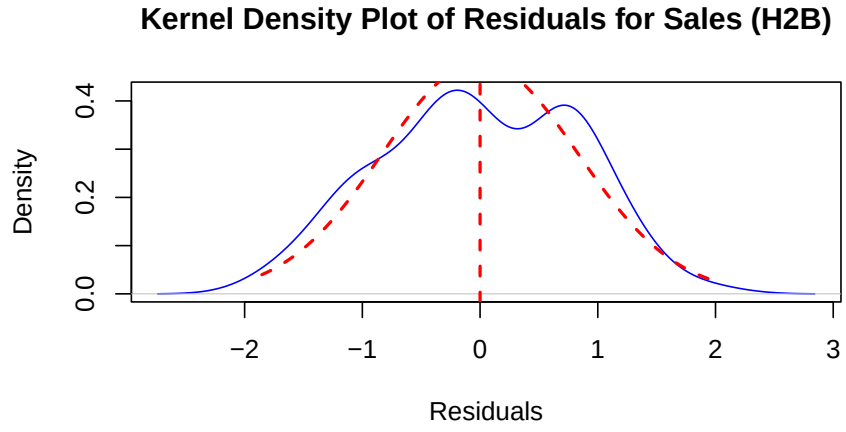

Figure D.21: Kernal density plot for the residuals of *Sales* (Y_1) in Hypothesis 2B

Dependent variable: Market share (Y_2)

$$Y_2 \sim \beta_{6_2} + \beta_{7_2} M + \epsilon \tag{D.20}$$

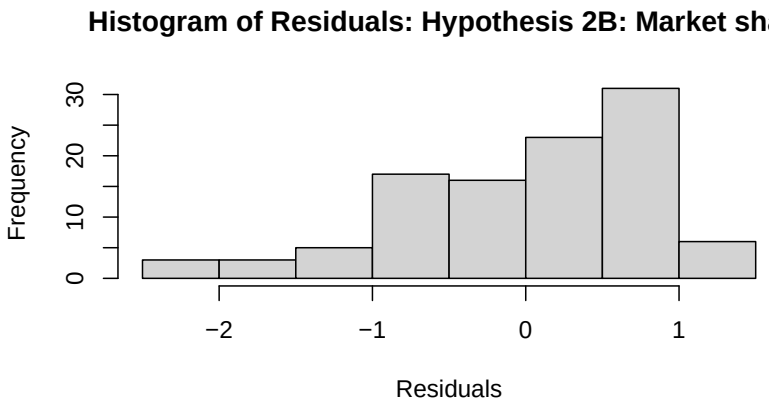

Figure D.22: Histogram for the residuals of *Market share* (Y_2) in Hypothesis 2B

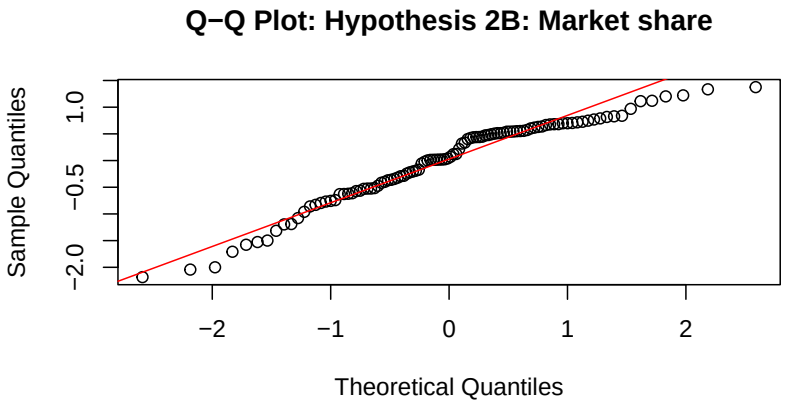

Figure D.23: QQ plot for the residuals of *Market share* (Y_2) in Hypothesis 2B

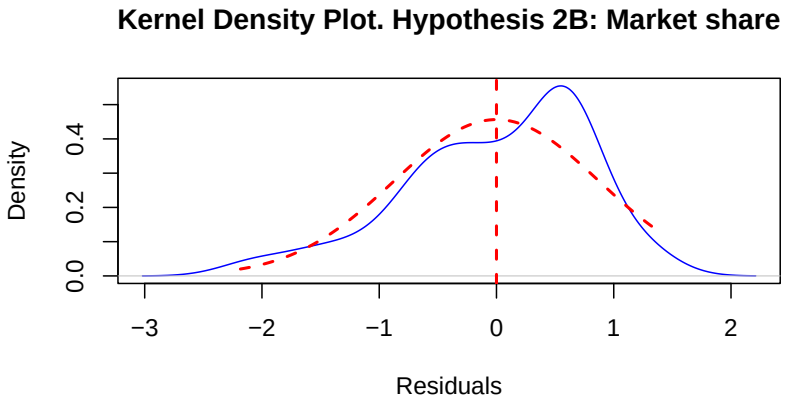

Figure D.24: Kernal density plot for the residuals of *Market share* (Y_2) in Hypothesis 2B

Dependent variable: Employment (Y_3)

$$Y_3 \sim \beta_{6_3} + \beta_{7_3} M + \epsilon \tag{D.21}$$

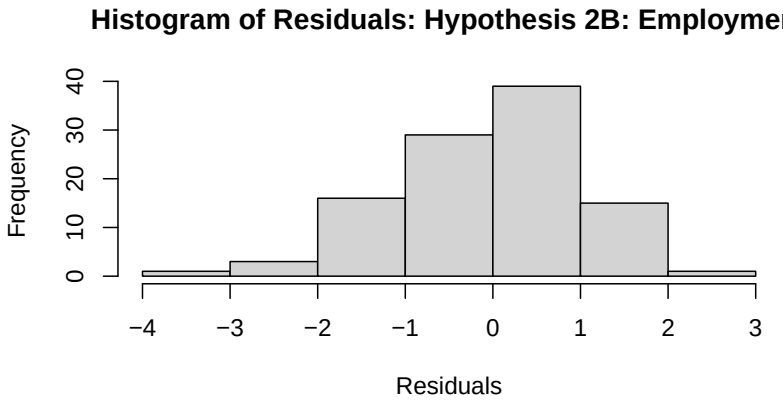

Figure D.25: Histogram for the residuals of *Employment* (Y_3) in Hypothesis 2B

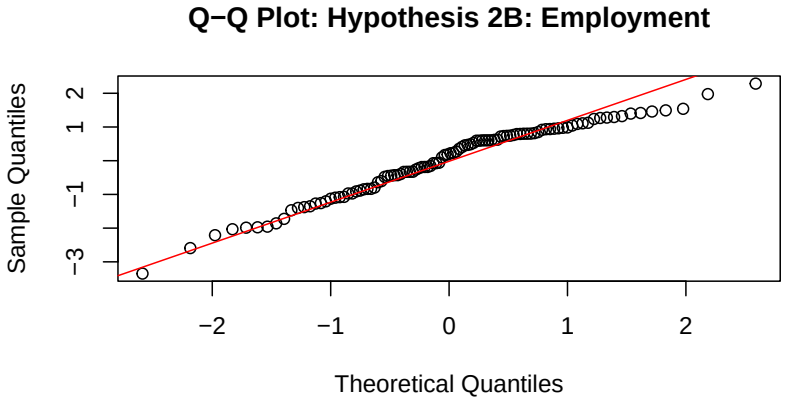

Figure D.26: QQ plot for the residuals of *Employment* (Y_3) in Hypothesis 2B

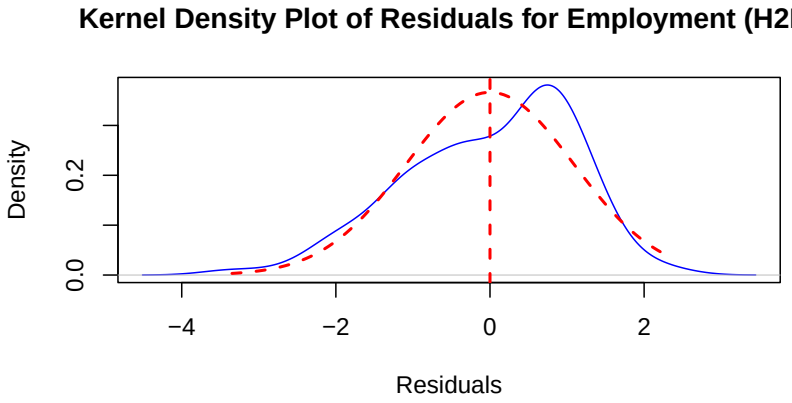

Figure D.27: Kernal density plot for the residuals of *Employment* (Y_3) in Hypothesis 2B

Dependent variable: Productivity (Y_4)

$$Y_4 \sim \beta_{6_4} + \beta_{7_4} M + \epsilon \tag{D.22}$$

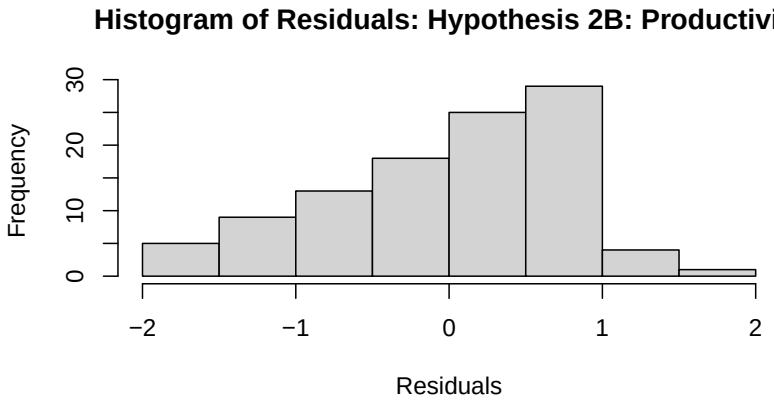

Figure D.28: Histogram for the residuals of *Productivity* (Y_4) in Hypothesis 2B

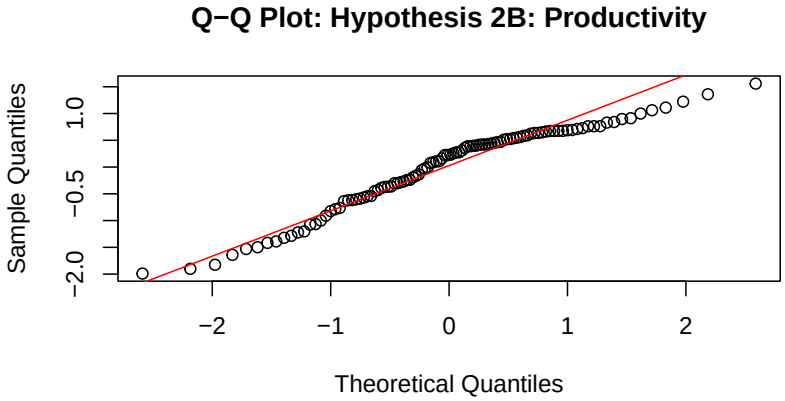

Figure D.29: QQ plot for the residuals of *Productivity* (Y_4) in Hypothesis 2B

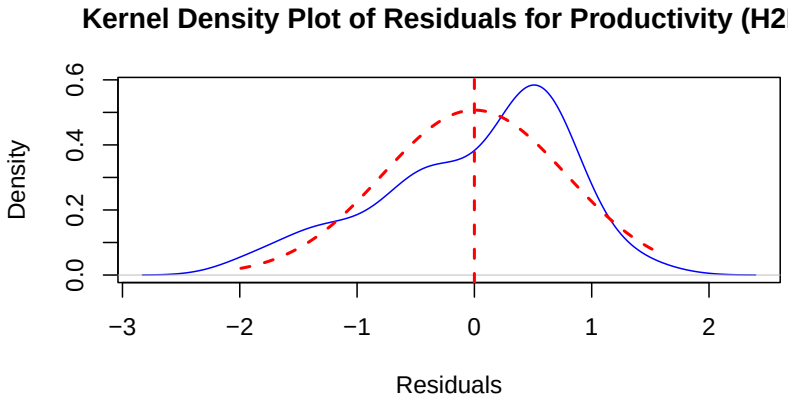

Figure D.30: Kernal density plot for the residuals of *Productivity* (Y_4) in Hypothesis 2B

Dependent variable: Profitability (Y_5)

$$Y_5 \sim \beta_{6_5} + \beta_{7_5} M + \epsilon \tag{D.23}$$

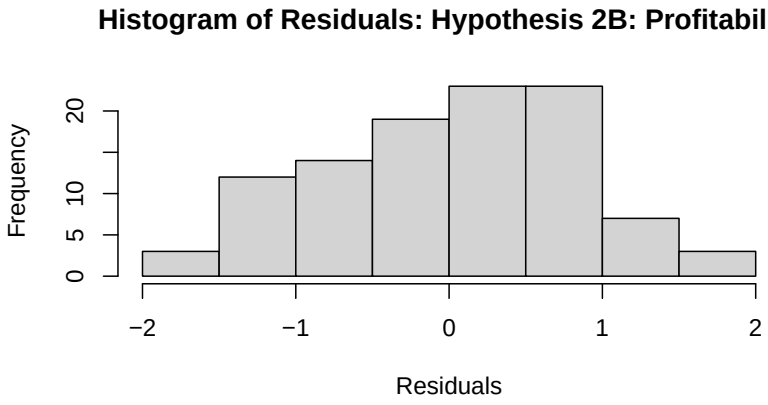

Figure D.31: Histogram for the residuals of *Profitability* (Y_5) in Hypothesis 2B

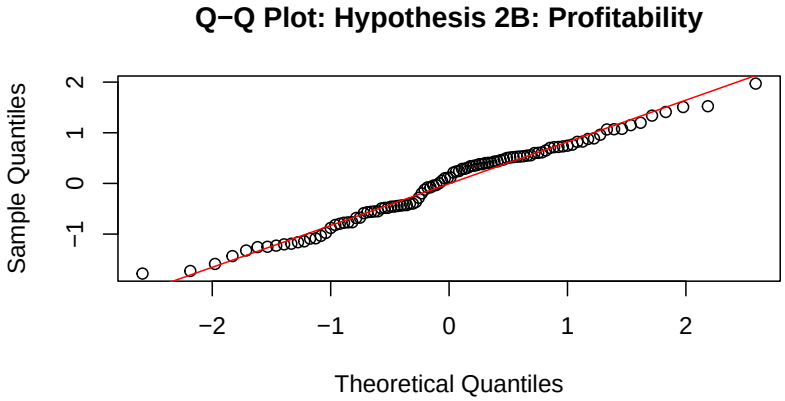

Figure D.32: QQ plot for the residuals of *Profitability* (Y_5) in Hypothesis 2B

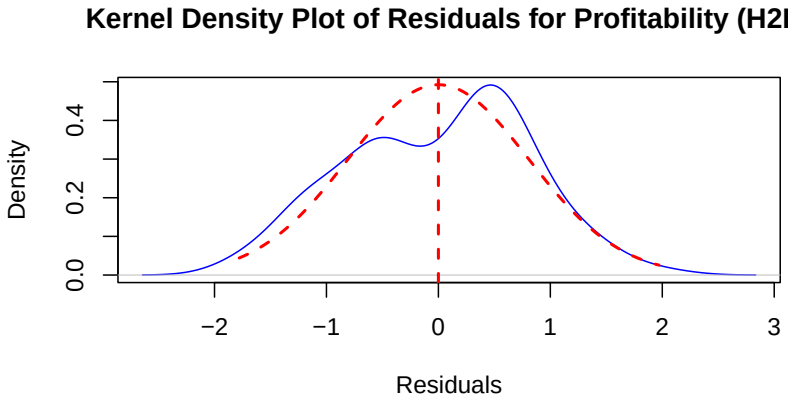

Figure D.33: Kernal denstiy plot for the residuals of *Profitability* (Y_5) in Hypothesis 2B

D.3.2 Testing for multicollinearity

Testing for multicollinearity using the Variance Inflation Factor (VIF). All VIF values are below 5, indicating no or low multicollinearity.

Predictor	VIF
Talent acquisition (M)	1.03
Level of education (control variable)	1.03
Annual turnover (control variable)	1.08
Company industry (control variable)	1.08
Leader position (control variable)	1.09

Table D.10: Variance Inflation Factor (VIF) Results for Hypothesis 2B

D.3.3 Testing for heteroskedasticity

Testing for heteroskedasticity using the Breusch Pagan- test. P-value for the residuals of Y_2, Y_3, Y_4 and Y_5 are over the 0.05 threshold and indicate no/low evidence of heteroskedasticity. The residuals for Y_1 (0.03) indicate some problems with heteroskedasticity.

Model	BP	Df	P-value
Hypothesis 2B: Sales (Y_1)	12.52	5.00	0.03
Hypothesis 2B: Market share (Y_2)	1.32	5.00	0.93
Hypothesis 2B: Employment (Y_3)	3.07	5.00	0.69
Hypothesis 2B: Productivity (Y_4)	2.63	5.00	0.76
Hypothesis 2B: Profitability (Y_5)	8.66	5.00	0.12

Table D.11: Breusch-Pagan Test Results for testing heteroskedasticity, for Hypothesis 2B

D.3.4 Testing for autocorrelation

Testing for autocorrelation using the Durbin Watson- test. P-value for the residuals of Y_1, Y_2, Y_3 and Y_5 are over the 0.05 threshold and indicate no/low evidence of autocorrelation. The residuals for Y_4 (0.04) indicate some problems with autocorrelation.

Model	DW	P - value
Hypothesis 2B: Sales (Y_1)	1.76	0.11
Hypothesis 2B: Market share (Y_2)	1.92	0.36
Hypothesis 2B: Employment (Y_3)	1.94	0.40
Hypothesis 2B: Productivity (Y_4)	1.64	0.04
Hypothesis 2B: Profitability (Y_5)	1.80	0.16

Table D.12: Durbin-Watson Test Results for testing autocorrelation for Hypothesis 2B

D.4 Hypothesis 2C

In hypothesis 2C, the mediating effect of talent acquisition (M) in the relationship between circular economy (X_1), remanufacturing (X_2) and performace (Y) is examined. A causal mediation analysis was conducted using the mediation package in R. Since mediation analysis is not inherently a regression model, it is not possible to directly test assumptions of linearity on the mediation itself. The mediation analysis combines information from the mediator model and the outcome models. Ensuring the reliability of both models is essential for the validity of the mediation analysis.

The mediator model investigates the effects of the independent variables (X_1 and X_2) on the mediator (M). The outcome models examine the effect of the independent variables (X_1 and X_2) **and** the mediator (M) on the dependent variable (Y_1, Y_2, Y_3, Y_4, Y_5).

The mediation analysis combines information from the fitted mediator and outcome models. While mediation analysis itself is not a regression model and does not assume linearity directly, the mediator and outcome models must meet the assumptions of linear regression as they are linear models. If these models do not satisfy linearity, the coefficients may be biased or misleading.

The mediator model investigates the effects of the independent variables (X_1 and X_2) on the mediator (M). This model is consistent with the one presented in Hypothesis 2A. The equation is:

$$M \sim \beta_3 + \beta_4 X_1 + \beta_5 X_2 + \epsilon \tag{D.24}$$

Here, the linearity assumptions for the mediator model have been previously assessed (See section D.2 Hypothesis 2A).

Furthermore, we had to look at the outcome models. The outcome models looks at the effect of the independent variables (X_1 , X_2) and the mediator (M) on the dependent variables (Y_1, Y_2, Y_3, Y_4, Y_5).

$$Y_1 \sim \beta_{8_1} + \beta_{9_1} X_1 + \beta_{10_1} X_2 + \beta_{11_1} M + \epsilon \tag{D.25}$$
$$Y_2 \sim \beta_{8_2} + \beta_{9_2} X_1 + \beta_{10_2} X_2 + \beta_{11_2} M + \epsilon \tag{D.26}$$
$$Y_3 \sim \beta_{8_3} + \beta_{9_3} X_1 + \beta_{10_3} X_2 + \beta_{11_3} M + \epsilon \tag{D.27}$$
$$Y_4 \sim \beta_{8_4} + \beta_{9_4} X_1 + \beta_{10_4} X_2 + \beta_{11_4} M + \epsilon \tag{D.28}$$
$$Y_5 \sim \beta_{8_5} + \beta_{9_5} X_1 + \beta_{10_5} X_2 + \beta_{11_5} M + \epsilon \tag{D.29}$$

The outcome models are below tested for the assumptions of linearity.

D.4.1 Testing for normality

1. Testing for normality using the Shapiro-Wilk Normality test. P-value for the residuals of Y_2 (0.01) is under the 0.05 threshold, indicating problems with normality. Rest of the residuals are over the threshold, indicating no problems with normality

	Model	W	P - value
2	Residuals H2C: Sales (Y_1)	0.99	0.37
3	Residuals H2C: Market share (Y_2)	0.96	0.01
4	Residuals H2C: Employment (Y_3)	0.99	0.72
5	Residuals H2C: Productivity (Y_4)	0.98	0.08
6	Residuals H2C: Profitability (Y_5)	0.99	0.35

Table D.13: Shapiro-Wilk Test Results for the outcome models in Hypothesis 2C

2. Double-checked with histograms, QQ plots, and kernel density plots for the residuals

Dependent variable: Sales (Y_1)

$$Y_1 \sim \beta_8, + \beta_9, X_1 + \beta_{10}, X_2 + \beta_{11}, M + \epsilon \tag{D.30}$$

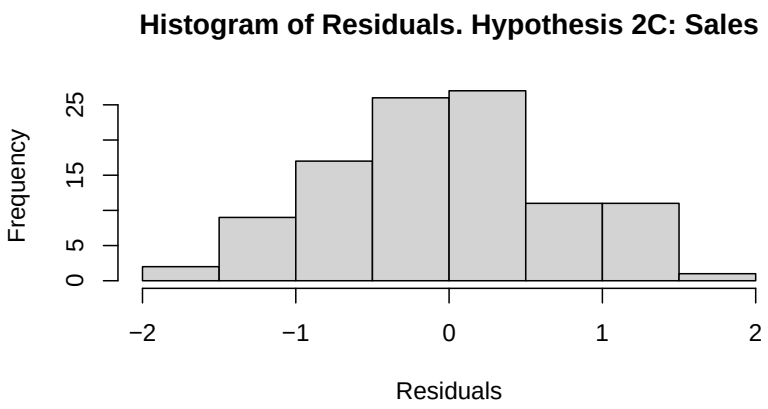

Figure D.34: Histogram for the residuals of *Sales* (Y_1) in Hypothesis 2C

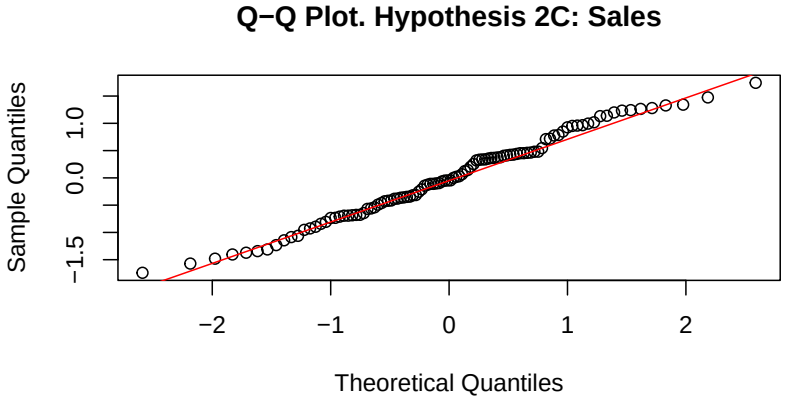

Figure D.35: QQ plot for the residuals of *Sales* (Y_1) in Hypothesis 2C

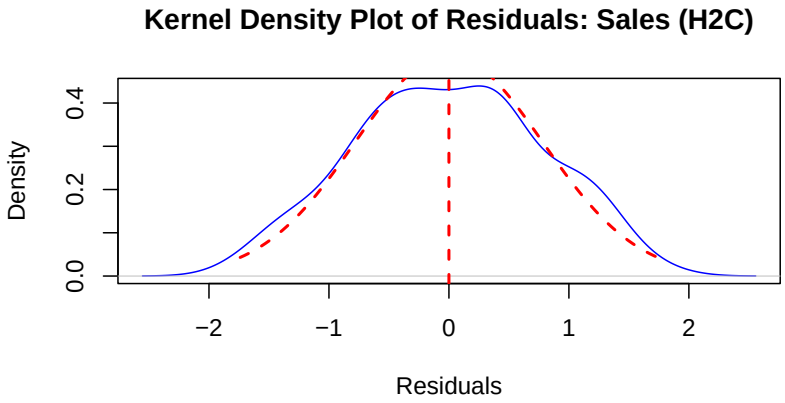

Figure D.36: Kernal denstiy plot for the residuals of *Sales* (Y_1) in Hypothesis 2C

Dependent variable: Market share (Y_2)

$$Y_2 \sim \beta_8 + \beta_9 X_1 + \beta_{10} X_2 + \beta_{11} M + \epsilon \tag{D.31}$$

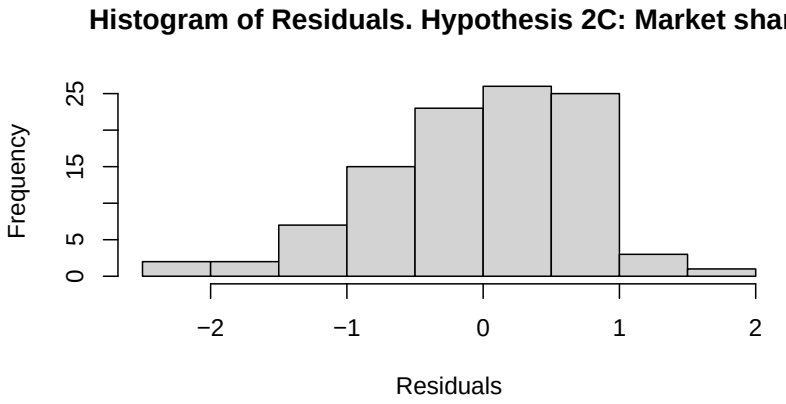

Figure D.37: Histogram for the residuals of *Market share* (Y_2) in Hypothesis 2C

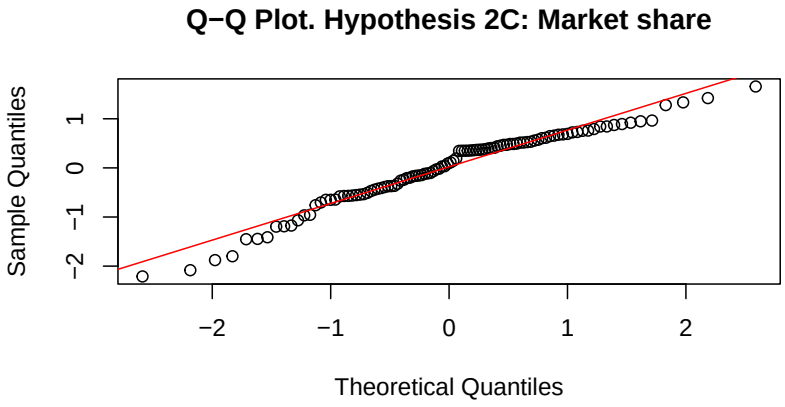

Figure D.38: QQ plot for the residuals of *Market share* (Y_2) in Hypothesis 2C

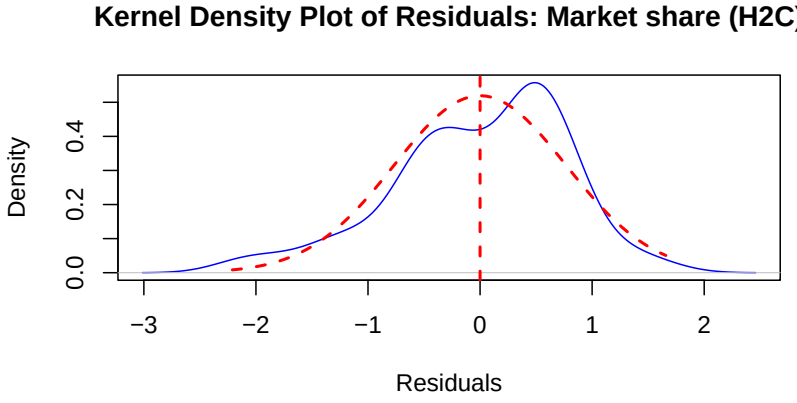

Figure D.39: Kernal denstiy plot for the residuals of *Market share* (Y_2) in Hypothesis 2C

Dependent variable: Employment (Y_3)

$$Y_3 \sim \beta_{8_3} + \beta_{9_3} X_1 + \beta_{10_3} X_2 + \beta_{11_3} M + \epsilon \tag{D.32}$$

(D.33)

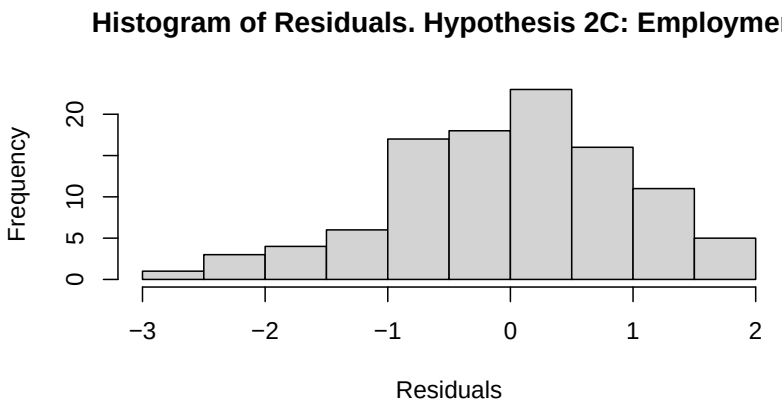

Figure D.40: Histogram for the residuals of *Employment* (Y_3) in Hypothesis 2C

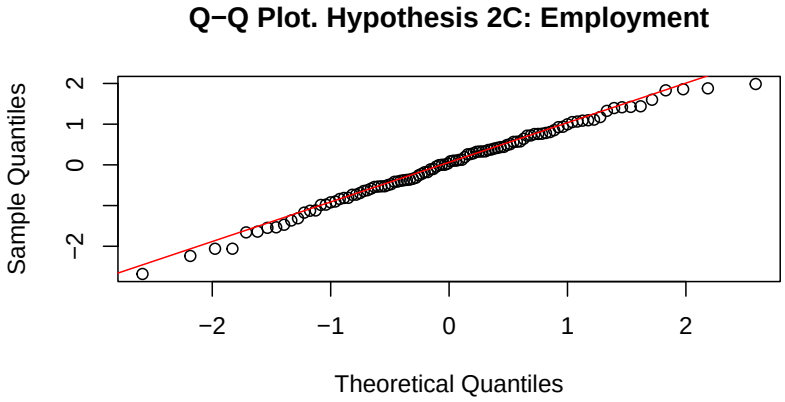

Figure D.41: QQ plot for the residuals of *Employment* (Y_3) in Hypothesis 2C

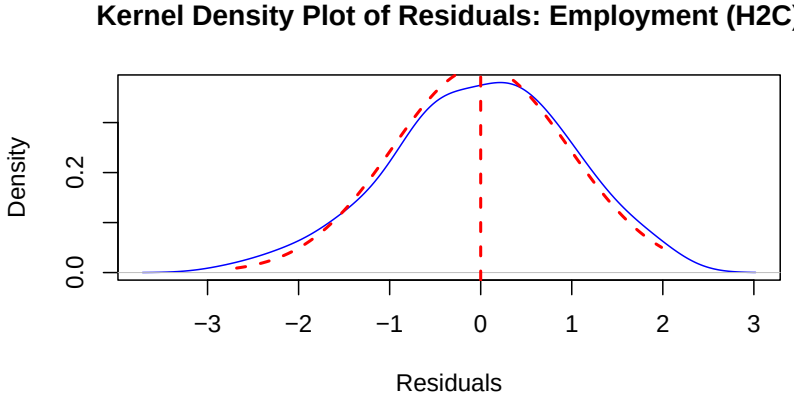

Figure D.42: Kernal denstiy plot for the residuals of *Employment* (Y_3) in Hypothesis 2C

Dependent variable: Productivity (Y_4)

$$Y_4 \sim \beta_{8_4} + \beta_{9_4} X_1 + \beta_{10_4} X_2 + \beta_{11_4} M + \epsilon \tag{D.34}$$

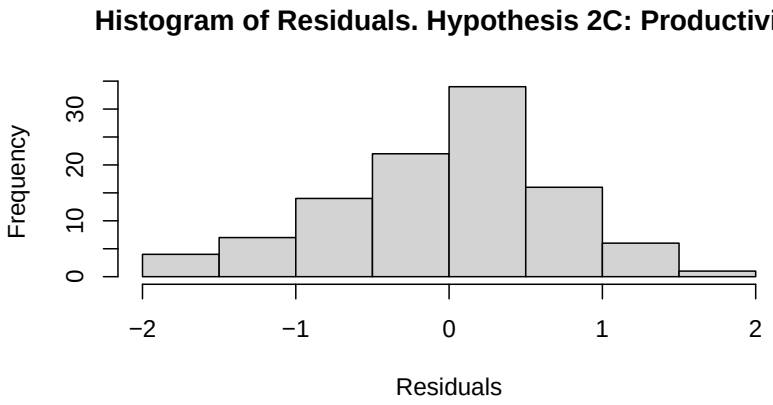

Figure D.43: Histogram for the residuals of *Producitivity* (Y_4) in Hypothesis 2C

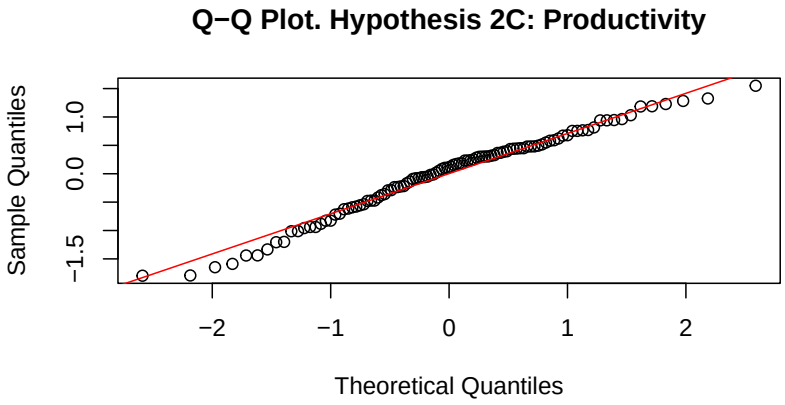

Figure D.44: QQ plot for the residuals of *Producitivity* (Y_4) in Hypothesis 2C

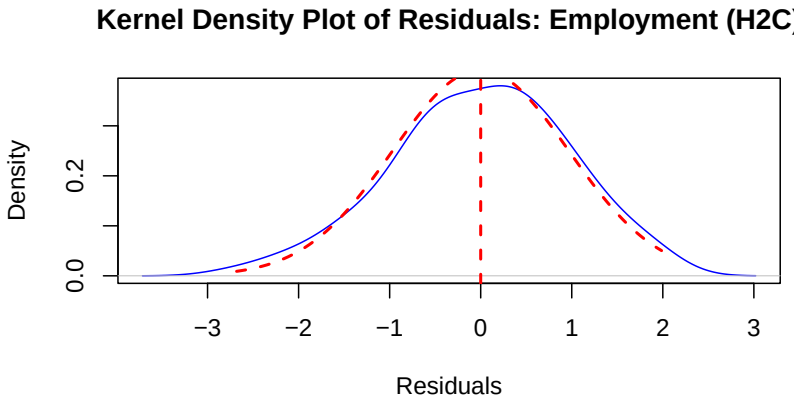

Figure D.45: Kernal denstiy plot for the residuals of *Producitivity* (Y_4) in Hypothesis 2C

Dependent variable: Profitability (Y_5)

$$Y_5 \sim \beta_{8_5} + \beta_{9_5} X_1 + \beta_{10_5} X_2 + \beta_{11_5} M + \epsilon \tag{D.35}$$

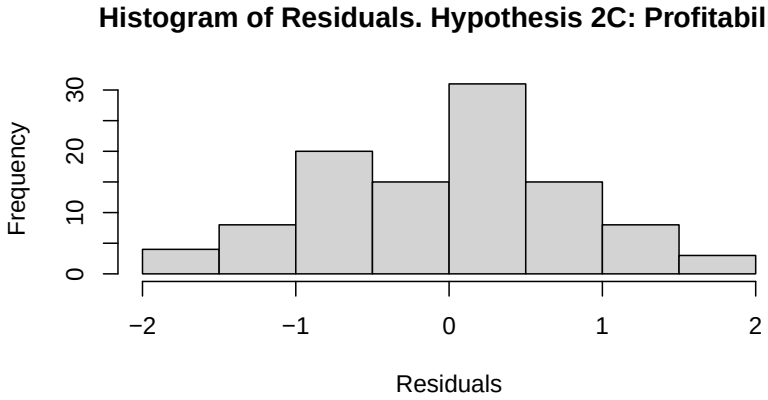

Figure D.46: Histogram for the residuals of *Profitability* (Y_5) in Hypothesis 2C

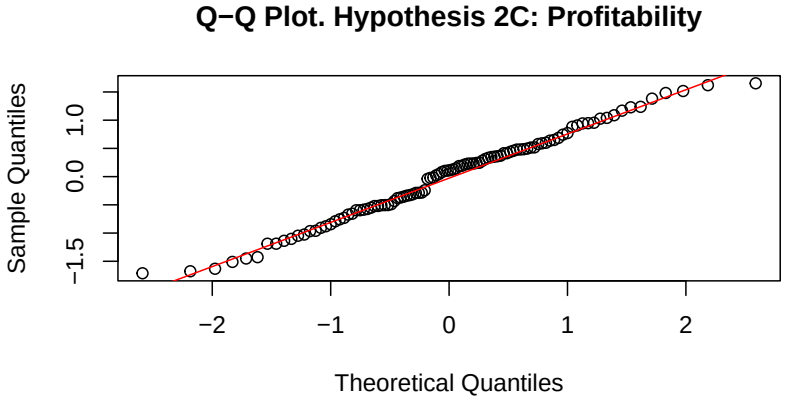

Figure D.47: QQ plot for the residuals of *Profitability* (Y_5) in Hypothesis 2C

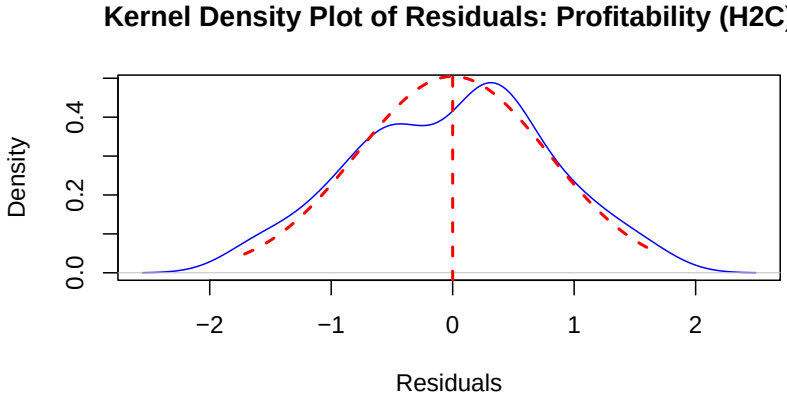

Figure D.48: Kernal denstiy plot for the residuals of *Profitability* (Y_5) in Hypothesis 2C

D.4.2 Testing for multicollinearity

Testing for multicollinearity using the Variance Inflation Factor (VIF). All VIF values are below 5, indicating no or low multicollinearity.

Predictor	VIF
Talent acquisition (M)	2.08
Degree of circular economy (X_1)	2.06
Level of remanufacturing (X_2)	1.40
Level of education (control variable)	1.03
Annual turnover (control variable)	1.12
Company industry (control variable)	1.10
Leader position (control variable)	1.14

Table D.14: Variance Inflation Factor (VIF) for Predictors Hypothesis 2C

D.4.3 Testing for heteroskedasticity

Testing for heteroskedasticity using the Breusch Pagan- test. P-value for the residuals are over the 0.05 threshold and indicate no/low evidence of heteroskedasticity.

	Model	BP	DF	P - value
1	Hypothesis 2C: Sales (Y_1)	13.28	7.00	0.07
2	Hypothesis 2C: Market share (Y_2)	2.44	7.00	0.93
3	Hypothesis 2C: Employment (Y_3)	4.97	7.00	0.66
4	Hypothesis 2C: Productivity (Y_4)	9.13	7.00	0.24
5	Hypothesis 2C: Profitability (Y_5)	8.77	7.00	0.27

Table D.15: Breusch-Pagan Test Results, testing heteroskedasticity, for Hypothesis 2C

D.4.4 Testing for autocorrelation

Testing for autocorrelation using the Durbin Watson- test. P-value for the residuals are over the 0.05 threshold and indicate no/low evidence of autocorrelation.

	Model	DW	P - value
1	Hypothesis 2C: Sales (Y_1)	1.82	0.19
2	Hypothesis 2C: Market share (Y_2)	1.90	0.32
3	Hypothesis 2C: Employment (Y_3)	2.07	0.65
4	Hypothesis 2C: Productivity (Y_4)	1.72	0.08
5	Hypothesis 2C: Productivity (Y_4)	1.79	0.14

Table D.16: Durbin-Watson Test Results, testing autocorrelation for Hypothesis 2C

D.5 Hypothesis 3

$$\text{Hypothesis 3:} \quad Y \sim \beta_{12} + \beta_{13}X_1 + \beta_{14}X_2 + \beta_{15}Z_1 + \beta_{16}Z_2 + (\beta_{17}X_1 + \beta_{18}X_2)Z_1 + (\beta_{19}X_1 + \beta_{20}X_2)Z_2 + \epsilon \tag{D.36}$$

D.5.1 Testing for normality

1. Testing for normality using the Shapiro-Wilk Normality test. P-value for the residuals are over the threshold, indicating no problems with normality

Model	W	P - value
Residuals H3: Sales (Y_1)	0.99	0.63
Residuals H3: Market share (Y_2)	0.98	0.25
Residuals H3: Employment (Y_3)	0.99	0.68
Residuals H3: Productivity (Y_4)	0.98	0.17
Residuals H3: Profitability (Y_5)	1.00	0.97

Table D.17: Shapiro-Wilk Test Results for the residuals in Hypothesis 3

2. Double-checked with histograms, QQ plots, and kernel density plots for the residuals

Dependent variable: Sales (Y_1)

$$Y_1 \sim \beta_{12_1} + \beta_{13_1}X_1 + \beta_{14_1}X_2 + \beta_{15_1}Z_1 + \beta_{16_1}Z_2 + (\beta_{17_1}X_1 + \beta_{18_1}X_2)Z_1 + (\beta_{19_1}X_1 + \beta_{20_1}X_2)Z_2 + \epsilon \tag{D.37}$$

Figure D.49: Histogram for the residuals of Sales (Y_1 in Hypothesis 3

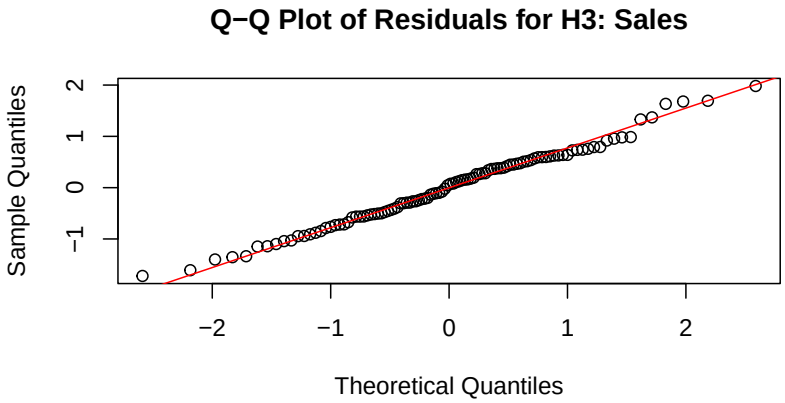

Figure D.50: QQ plot for the residuals of Sales (Y_1 in Hypothesis 3

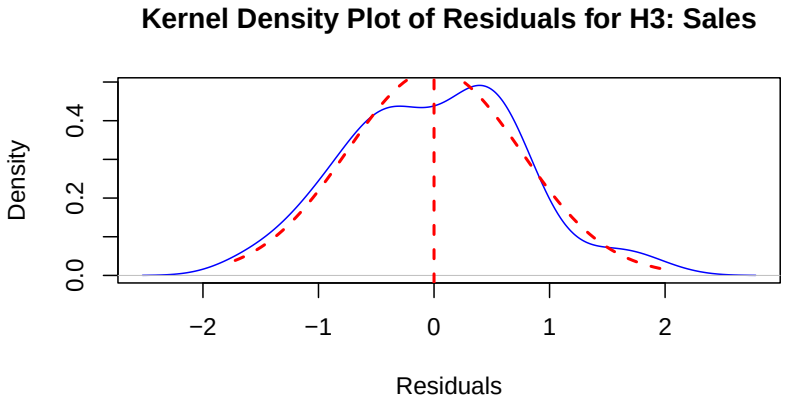

Figure D.51: Kernal denstiy plot for the residuals of Sales (Y_1 in Hypothesis 3

Dependent variable: Market share (Y_2)

$$\begin{aligned} Y_2 \sim \beta_{12_2} + \beta_{13_2} X_1 + \beta_{14_2} X_2 + \beta_{15_2} Z_1 + \beta_{16_2} Z_2 \\ + (\beta_{17_2} X_1 + \beta_{18_2} X_2) Z_1 + (\beta_{19_2} X_1 + \beta_{20_2} X_2) Z_2 + \epsilon \end{aligned} \tag{D.38}$$

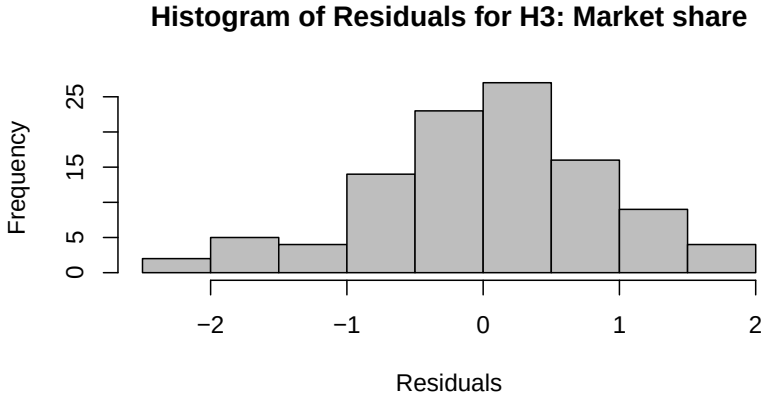

Figure D.52: Histogram for the residuals of Market share (Y_2) in Hypothesis 3

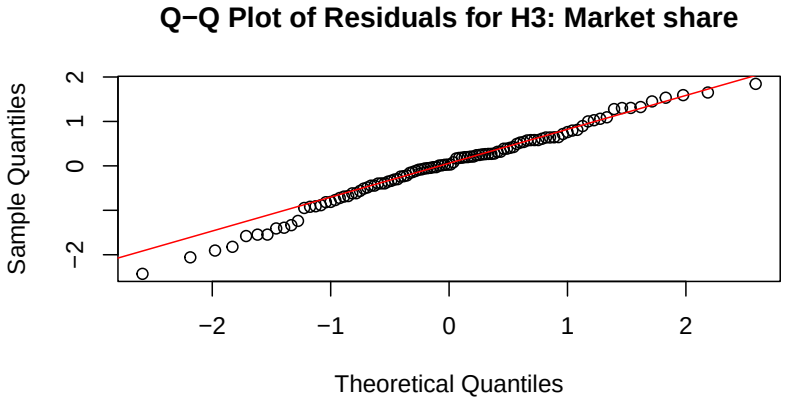

Figure D.53: QQ plot for the residuals of Market share (Y_2) in Hypothesis 3

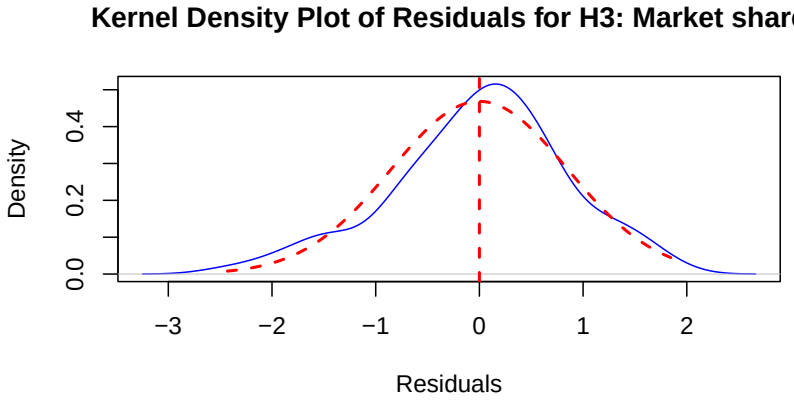

Figure D.54: Kernal denstiy plot for the residuals of Market share (Y_2) in Hypothesis 3

Dependent variable: Employment (Y_3)

$$Y_3 \sim \beta_{12_3} + \beta_{13_3} X_1 + \beta_{14_3} X_2 + \beta_{15_3} Z_1 + \beta_{16_3} Z_2 + (\beta_{17_3} X_1 + \beta_{18_3} X_2) Z_1 + (\beta_{19_3} X_1 + \beta_{20_3} X_2) Z_2 + \epsilon \tag{D.39}$$

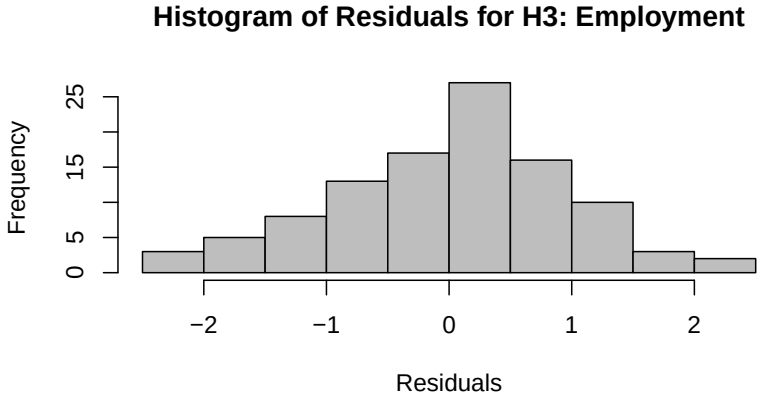

Figure D.55: Histogram for the residuals of Employment (Y_3) in Hypothesis 3

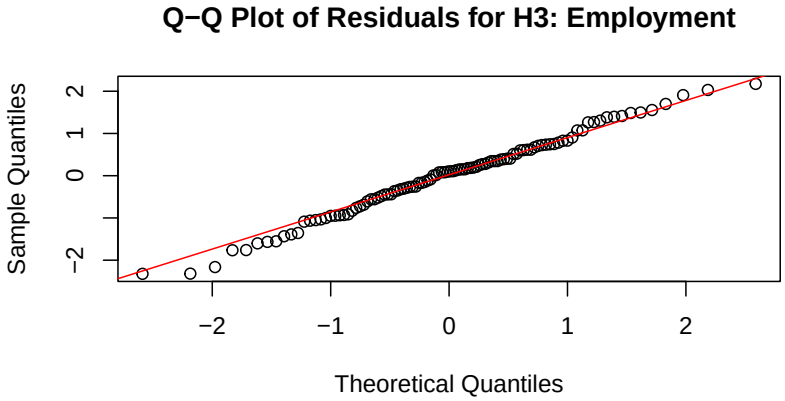

Figure D.56: QQ plot for the residuals of Employment (Y_3) in Hypothesis 3

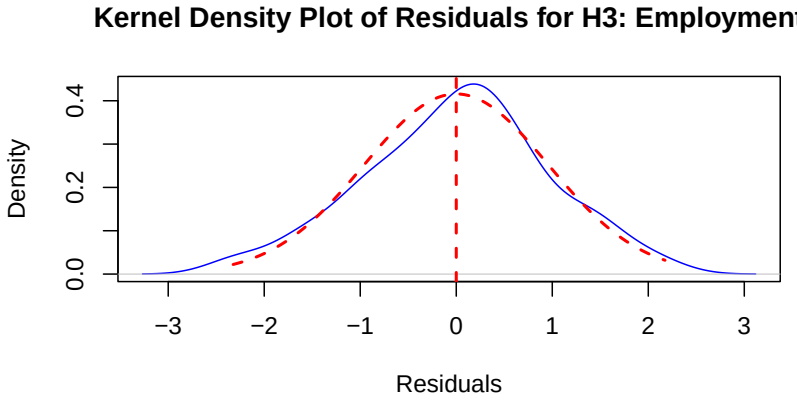

Figure D.57: Kernal denstiy plot for the residuals of Employment (Y_3) in Hypothesis 3

Dependent variable: Productivity (Y_4)

$$Y_4 \sim \beta_{12_4} + \beta_{13_4}X_1 + \beta_{14_4}X_2 + \beta_{15_4}Z_1 + \beta_{16_4}Z_2 + (\beta_{17_4}X_1 + \beta_{18_4}X_2)Z_1 + (\beta_{19_4}X_1 + \beta_{20_4}X_2)Z_2 + \epsilon \quad \text{(D.40)}$$

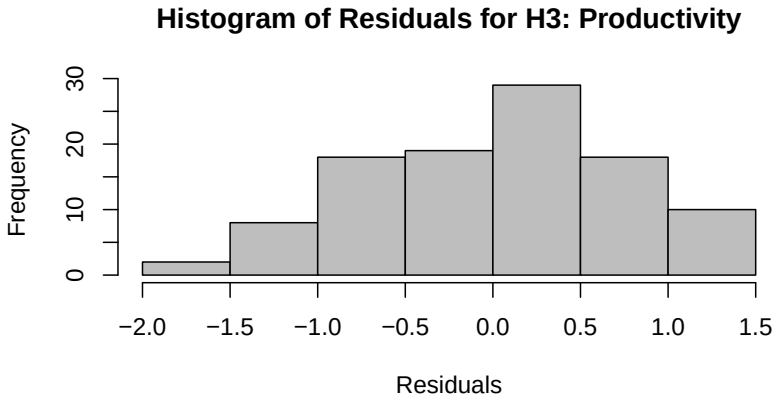

Figure D.58: Histogram for the residuals of Productivity (Y_4) in Hypothesis 3

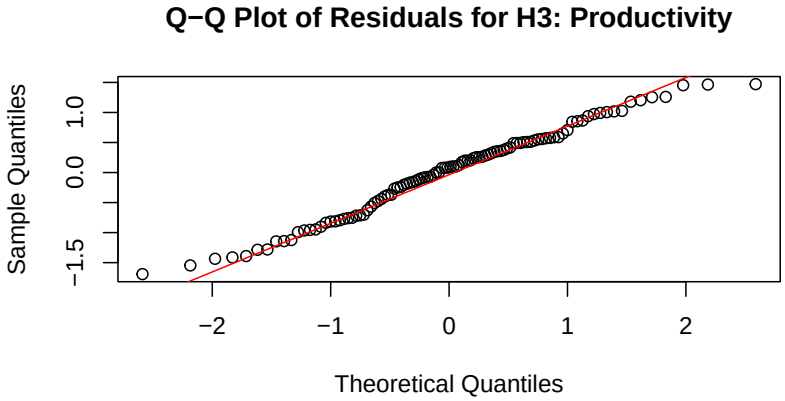

Figure D.59: QQ plot for the residuals of Productivity (Y_4) in Hypothesis 3

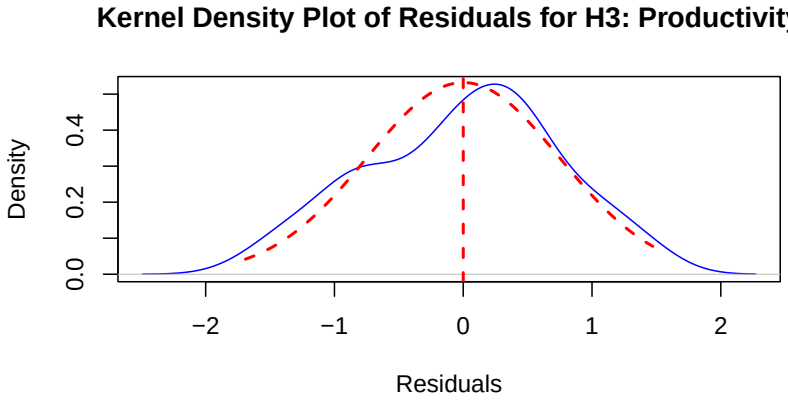

Figure D.60: Kernal denstiy plot for the residuals of Productivity (Y_4) in Hypothesis 3

Dependent variable: Productivity (Y_3)

$$Y_5 \sim \beta_{12_5} + \beta_{13_5}X_1 + \beta_{14_5}X_2 + \beta_{15_5}Z_1 + \beta_{16_5}Z_2 + (\beta_{17_5}X_1 + \beta_{18_5}X_2)Z_1 + (\beta_{19_5}X_1 + \beta_{20_5}X_2)Z_2 + \epsilon \quad \text{(D.41)}$$

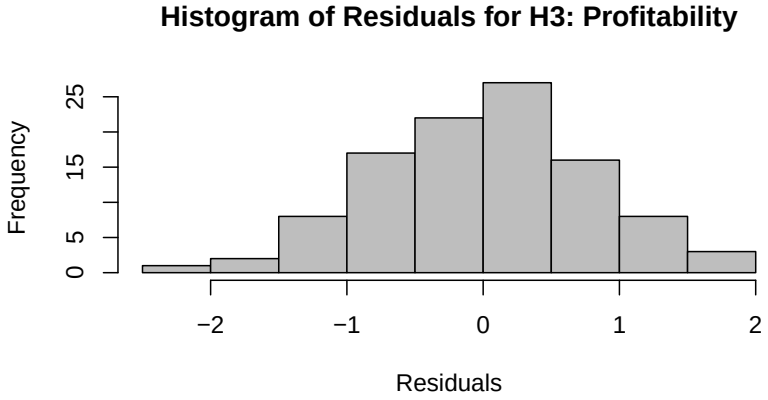

Figure D.61: Histogram for the residuals of Productivity (Y_4) in Hypothesis 3

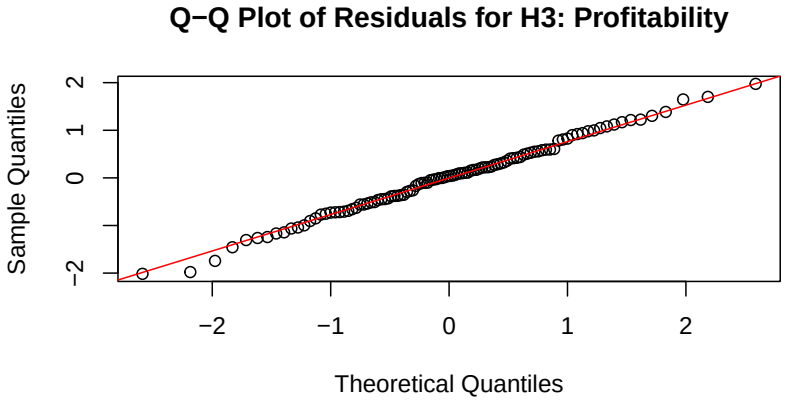

Figure D.62: QQ plot for the residuals of Productivity (Y_4) in Hypothesis 3

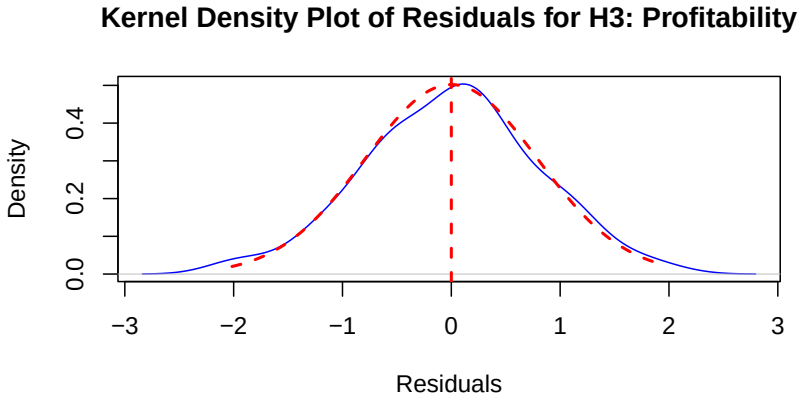

Figure D.63: Kernal denstiy plot for the residuals of Productivity (Y_4) in Hypothesis 3

D.5.2 Testing for multicollinearity

Testing for multicollinearity using the Variance Inflation Factor (VIF). Most of the variables are under the below, indicating no multicolinearity. However, some of the interaction terms are over threshold.

Predictor	VIF
Degree of circularity (X_1)	1.95
Level of remanufacturing (X_2)	2.90
Knowledge about CE (Z_1)	2.43
Perceived importance of CE (Z_2)	1.59
Level of education (Control variable) 1	1.23
Annual turnover (Control variable) 2	1.17
Company industry (Control variable) 3	1.14
Leader position (Control variable) 4	1.12
Degree of CE x Importance	3.06
Degree of CE x Knowledge	3.82
Remanufacturing x Importance	6.89
Remanufacturing x Knowledge	7.98

Table D.18: Variance Inflation Factor (VIF) Results for Multicollinearity with Interaction Terms for Hypothesis 3

D.5.3 Testing for heteroskedasticity

Testing for heteroskedasticity using the Breusch Pagan- test. P-value for the residuals are over the 0.05 threshold and indicate no/low evidence of heteroskedasticity.

Model	BP	DF	P - value
Residuals H3: Sales (Y_1)	10.47	12.00	0.57
Residuals H3: Market share (Y_2)	8.18	12.00	0.77
Residuals H3: Employment (Y_3)	6.54	12.00	0.89
Residuals H3: Productivity (Y_4)	16.72	12.00	0.16
Residuals H3: Profitability (Y_5)	11.32	12.00	0.50

Table D.19: Breusch-Pagan Test Results, testing heteroskedasticity, for Hypothesis 3

D.5.4 Testing for autocorrelation

Testing for autocorrelation using the Durbin Watson- test. P-value for the residuals are over the 0.05 threshold and indicate no/low evidence of autocorrelation

Model	DW	P - value
Residuals H3: Sales (Y_1)	1.99	0.49
Residuals H3: Market share (Y_2)	1.98	0.45
Residuals H3: Employment (Y_3)	2.08	0.65
Residuals H3: Productivity (Y_4)	1.78	0.13
Residuals H3: Profitability (Y_5)	1.83	0.19

Table D.20: Durbin-Watson Test Results,testing autocorrelation for Hypothesis 2C