

VILNIUS UNIVERSITY
KAUNAS FACULTY

INSTITUTE OF SOCIAL SCIENCES
AND APPLIED INFORMATICS

International Business Management study programme
Code 6211LX019

KASHISH GUPTA

MASTER'S THESIS

APPLICATION OF CIRCULAR ECONOMY PRINCIPLES IN BUSINESS

ŽIEDINĖS EKONOMIKOS PRINCIPŲ TAIKYMAS VERSLE

Kaunas 2026

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Kaunas 2026

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List of Abbreviations

- CE- Circular economy
- CMU - Circular Material Use
- EU- European Union
- OECD - Organisation Economic Co-operation and Development.
- SMEs - Small to Medium-sized Entrepreneurs.
- B2B - Business-to-Business
- EMF - Ellen MacArthur Foundation.
- GDP - Gross Domestic Product
- CSR Corporate Social Responsibility.
- R&D - Research and Development
- SDG- Sustainable Development Goals

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Introduction

Relevance of the Topic

The circular economy (CE) has gained greater significance for businesses because linear models of production and consumption are no longer viable due to resource scarcity, environmental degradation, and climate change. McKinsey (2016) notes that circular-economy strategies can create enormous savings for businesses in terms of costs and new sources of revenue. The circular economy also encourages the reuse, repair, remanufacturing, and recycling of products, materials and resources, thus extending their useful life to the maximum, decreasing waste and reliance on virgin sources (Kirchherr et al., 2017). For businesses, the given shift is not only an environmental imperative but also a strategic opportunity to become more efficient and cost-effective, and to provide an alternative source of value.

At the European Union level, the importance of the circular economy is strongly supported by policy efforts, including the Circular Economy Action Plan, which positions circularity as a major driver of sustainable development and competitiveness (European Commission, 2020). The EU institutions are actively persuading companies to reform and redesign products, reconsider their business models, and embrace circular practices throughout value chains (European Parliament, 2023). Consequently, companies doing business in the European market have been under growing pressure to comply with regulations and stakeholder demands to incorporate the principles of the circular economy into their operations. According to the Government of Canada (2020), Circular economy plans, driven by governments, are also promoted outside Europe, as seen in national approaches such as the Canadian circular economy strategy.

In practice, as a business, implementing a circular economy may support innovation, supply-chain resilience, and corporate reputation (Stahel, 2019). The circular business model, such as product-as-a-service, take-back schemes and industrial symbiosis, helps businesses to seize the value and have a long-term relationship with their customers. The desired benefits, however, do not come automatically but are subject to successful implementation.

Scientifically, the circular economy is a relatively new area of research with a variety of definitions, models, and approaches (Kirchherr & van Santen, 2019). This necessitates additional research examining how the idea of the circular economy can be implemented in business practice

in a systematic and efficient way, thereby validating the topicality of this subject for academic research.

Level of Problems Investigation

The conceptual foundations of the circular economy, its potential for sustainability, and its implications for economic systems have attracted scientific research on the topic in recent years. Kirchherr et al. (2017) reviewed a considerable number of definitions of the circular economy and reported conceptual ambiguity and inconsistency in the field. In the same vein, Murray et al. (2017) stressed the interdisciplinary character of the circular economy and noted that it is understood differently across academic fields. These studies provide a good theoretical background but also highlight fragmentation in the research landscape.

The implementation of circular economy at the business level (and circular business models in particular) is increasingly analyzed with reference to the literature. The review of circular business model innovation tools conducted by Bocken et al. (2019) identified major strategies for bridging resource loops and reducing their rates. Geissdoerfer et al. (2020) also analysed the role circle business models play in value creation and capture. Researchers like Awan & Sroufe (2022) generally agree that the concept of a circular economy can be used to foster sustainable business growth when it becomes part of its business strategies.

Nevertheless, various studies indicate that it is difficult to implement in practice. Ghisellini et al. (2016) and Kirchherr et al. (2018) have pointed out that there is a range of financial, technological, organizational, and regulatory barriers restricting the successful implementation, particularly of small and medium-sized businesses. Given the abundance of literature on these barriers, there are still few studies that compare the various models of the circular economy and assess their applicability in business. Consequently, the process of systematic implementation of the principles of a circular economy by business is still understudied, and companies need to choose the models with the goal of modeling in the context of their situation, which also implies a definite gap in the research.

Problem Statement

Although the circular economy is gaining academic and policy attention, many businesses face a challenge translating it into effective, practical business practices. As a matter of fact, isolated

circular projects, such as recycling or waste reduction, are frequently implemented in companies without involving product design, business models, or strategic decisions in circular principles. This generates a disparity between the theory of the circular economy and the reality of business. Moreover, enterprises often lack clear outlines and systematic methods for applying and assessing circular-economy practices, which restrict their potential to achieve economic and sustainability-linked gains and inhibit the broader adoption of circular-economy principles.

Research problem question

How to apply circular economy principles in business?

Essence of the Problem

The essence of the issue is that there is no systematic, well-organized method for applying the principles of a circular economy in business to produce tangible economic and sustainability effects.

Object of the thesis

The object of the thesis is the application of circular economy principles in business.

Aim of the thesis

To analyse the application of circular economy principles in business and develop recommendations on how to integrate these principles more effectively into companies' operations.

Objectives of the thesis

1. At the theoretical level, investigate the aspects of applying the circular economy in business.
2. To analyze the empirical level of research regarding applying the circular economy principles to business.
3. After evaluation of theoretical and empirical research findings, a theoretical model was constructed for applying the circular economy principles to business.
4. Empirically test the developed research model and provide recommendations for businesses for the effective application of circular economy principles into practice.

Thesis and Research Methods

The study in the current master's thesis will be founded on the secondary research and primary quantitative research. According to Alford & Teater (2025), secondary research enables researchers to generalise the existing knowledge and create conceptual frameworks. Thus, the theoretical and analytical sections of this thesis rely on the current literature, scientific research, and institutional reports on the implementation of the principles of the circular economy in business. Moreover, primary data are collected through a questionnaire survey to test the empirically developed research model and investigate the practical implementation of the principles of the circular economy in business (Murray et al., 2017).

In the theoretical section of the thesis, the circular economy, its principles, and the most significant theoretical models applicable to business are considered using general scientific methods, such as analysis, synthesis, systematization, and comparison (Kirchherr et al., 2017). Such approaches allow defining, contrasting, and organizing various scholarly perspectives on the adoption of the circular economy in business.

The empirical and analytical parts of the thesis rely on secondary empirical data from prior research and on primary quantitative survey data. Various models of the circular economy are analysed through comparative analysis and logical synthesis and assessed in terms of their applicability to business practice (Geissdoerfer et al., 2020). The main survey data are intended to assess respondents' perceptions of the principles of the circular economy, circular business practices, barriers to implementation, enabling factors, and business outcomes. Based on the general theoretical, analytical, and empirical results, a conceptual map of applying the principles of a circular economy to business is created and assessed.

Structure of the Thesis

The thesis includes an introduction, theoretical chapter, analytical chapter, empirical research chapter, conclusions and recommendations, references, summary and appendices. The introduction gives the relevance of the topic, research problem, object, aim, objectives, research methods, and theoretical and practical significance. Chapter one explains the theoretical background of the principles of a circular economy in business. It assesses the evolution of the circular economy concept, its key principles, and the important business-related models (Kirchherr and van Santen, 2019). Chapter two is the analytical section of the thesis and is based on secondary empirical research. It juxtaposes scholarly resources, institutional evidence, business practices,

outcomes, barriers, and enabling factors in the implementation of a circular economy (Bocken et al., 2019). The third chapter presents the empirical study, which uses a quantitative questionnaire survey. It examines the data using descriptive statistics, reliability, correlation, regression, and moderation regression. Lastly, conclusions and recommendations summarise the findings and provide practical business recommendations.

Literature References in Thesis

The sources of literature used in this master's thesis include peer-reviewed scientific journal articles, scholarly books, and institutional reports, all of which are authoritative on the subject of the circular economy and its application in business. The theoretical section of the thesis is based mostly on the scientific literature discussing the conceptual basis of the circular economy, its principles, and its applicability to sustainable business development. Among the most important scholarly works, one can note the conceptualization and definition of the circular economy, as well as the analysis of the development of the sustainability paradigm, including the works by Kirchherr et al. (2017) and Murray et al. (2017). The sources offer a theoretical overview of the extent, goals, and intricacies of implementing the circular economy.

The thesis is also extensively studied on the subject of circular business models and value creation mechanisms. Articles by Bocken et al. (2019) are used to describe the concept of circular business model innovation tools, whereas articles by Geissdoerfer et al. (2020) are analyzed to understand how circular business models help create and capture value at the firm level. The practical issues businesses face on the path to embracing the principles of a circular economy can be discussed using literature on barriers to implementation and enabling factors, such as Ghisellini et al. (2016).

Besides academic journals, institutional publications are also used to support the practical and policy context of the research in the thesis. The Ellen MacArthur Foundation's published reports are used to elaborate on popular models of the circular economy and on business-based systems of implementation, especially those in practice. Moreover, the contextualisation of the application of the concept of circular economy in the European business and regulatory context is done with the help of policy documents and strategic communications released by the European Union institutions, such as the European Commission and the European Parliament.

The thesis presents an empirical discussion based solely on prior published empirical studies and documented business cases. Only sources that have been proven credible and peer-reviewed by scientists, and accepted by institutions, guarantee the academic validity, topicality, and integrity of the study.

Theoretical Significance

The theoretical value of this thesis is that the concept and theoretical models of the circular economy are systematically structured and compared in terms of their application by the business. The review and comparison of various models of the circular economy make the study helps to understand how abstract principles of the circular economy can be applied to organisational logic and business processes better. According to Kirchherr and van Santen (2019), the variety and inconsistency of theoretical approaches are among the primary issues in circular economy studies, as individual approaches are often too limited to be applicable. This thesis is capable of addressing this challenge because it attempts to synthesise the available theories into a conceptual framework devoted to business implementation. The constructed theoretical framework is composed of existing theoretical knowledge and discoveries from the empirical literature, the combination of which provides an opportunity to explain the application of the principles of the circular economy in the business environment in a more consistent manner. By so doing, the study will add value to the academic discourse by reinforcing the connection between the theory of the circular economy and the practicality of its implementation, thereby justifying future theoretical and empirical studies in this area.

Practical Significance

The practical importance of this thesis is exhibited in its possible practicality to be put to use by the business and ensure the application of the principles of the circular economy more efficiently. The findings present managers and decision-makers with an organised summary of various circular economy strategies and information about the integration of the strategies into business practice. According to Stahel (2019), the key to the successful implementation of a circular economy is the alignment of circular strategies with value-creation mechanisms, as explicitly discussed in this thesis. The theoretical framework constructed during the work may be used as an assessment instrument to analyse the presence of current circular initiatives and assist in making a strategic decision based on the design of the product, business model innovativeness, and resource

management. Besides, the outcomes can assist organisations to find the main implementation issues and evaluate their internal capacity towards circularity. Explaining the operationalisation of the concepts of a circular economy, the thesis allows businesses to choose circular solutions that can best fit their operational capabilities, competitive markets, and long-term sustainability goals.

Scope and Comparators

This thesis is limited to the use of the circular economy concept at the business level, not to macroeconomic analysis or policy-based evaluation. The research will focus on the organisational practices, business models, and the mechanisms of implementation that apply to the firms in the various industries. The investigation is guided solely by secondary data and relies on scientific literature and previously published empirical research results, as stated by Ghisellini et al. (2016). It takes a comparative approach in analysing and evaluating various models and frameworks of the circular economy, where the strengths and limitations may be evaluated in different business environments. Such a comparative approach is helpful in gaining a more in-depth insight into how the principles of the circular economy can be implemented in various organisational and industry contexts. These boundaries enable the thesis to have a narrow, manageable scope of analysis and, at the same time, be relevant to a wide range of business applications.

1. Theoretical Aspects: Application of Circular Economy Principles in Business

1.1 Evolution and Interpretations of the Circular Economy

Circular economy is the reaction to the increased constraints of the conventional linear economic models that are premised upon the take-make-dispose principle of resource consumption, which is becoming less and less realistic because of resource depletion, environmental degradation, and climate change (Murray et al., 2017). When these challenges started showing up, other economic conceptions started emerging that were concerned with the efficiency of resources, thinking systemically, and long-term sustainability. These preliminary thoughts constituted the conceptual basis of the current so-called circular economy.

The origins of the concept of a circular economy may be found in the systems-based perspectives on economic development and environmental limits. The initial institutional concept of a circular economy centred its attention on the redesign of industrial systems, which avoid waste and retain value stated by the Ellen MacArthur Foundation in 2013. Also, Murray et al. (2017) noted that the operation of economic activity is within the finite ecological conditions, which necessitates the shift of one-directional material flows towards closed-loop systems. The materials in this perspective cannot be considered as waste products, but they are also resources that are in a continuous circulation within the economic system. This was a significant shift in the models of production that were efficiency-oriented in the short run towards long-range models that focused on the stewardship and regeneration of the resources. Gradually, these concepts developed into more well-organised theories of production, consumption, and waste management.

With the growth of attention to the concept, researchers tried to give the circular economy a more specific meaning. Kirchherr et al. (2017) performed a thorough analysis of 114 definitions of the concept of the circular economy and proved that the idea is considered differently in academic, policy, and business terms. Based on their analysis, the majority of the definitions focus on minimising resource inputs, the minimisation of waste, and the closure of material loops by reusing, recycling, and recovering. Nevertheless, there was also a lack of conceptual consistency that was identified by the authors, where some of the definitions are indifferent towards the narrow perspective of waste management, some are indifferent towards the broader systemic approach involving business models, innovation, and value creation.

The circular economy has also been taken to be a wider framework of sustainability-based interpretation and not necessarily an environmental or technical one. According to Geissdoerfer et al. (2017), a circular economy was characterised as a regenerative economic system in which economic growth and resource consumption are not coupled, which is achieved through the redesign of industrial systems. Under this connotation, the concept of circle economy is tightly connected to the concept of sustainable development because the former aims at balancing the performance of the economy with the environment and social welfare (Puntillo, 2022). This viewpoint lays emphasis on the fact that circularity entails core transformations in the creation, delivery, and sustainability of value within economic systems and not individual acts, like recycling.

The interdisciplinary nature of the circular economy theory has been an important contribution to its development. As Murray et al. (2017) stated, a number of academic traditions are applied in the circular economy: ecological economics, industrial ecology, and sustainability science. This interdisciplinary background makes the concept more or less analytical, but it also adds to conceptual ambiguity, because various disciplines focus on various goals, mechanisms, and outcomes. Subsequently, according to Keles et al. (2025), the circular economy may be understood as a technical approach to optimise the material flows or as a paradigm system that seeks to change the economic systems.

The institutional interpretations have contributed greatly to the development of the present-day interpretations of the circular economy, especially in the context of business and policy practice. The Ellen MacArthur Foundation has been at the forefront of fostering a business-oriented and practical understanding of the concept. The Ellen MacArthur Foundation (2021) states that the circular economy relies on three principles: doing away with waste and pollution, circulating products and materials at the highest value, and regenerating natural systems. This interpretation puts great emphasis on product design, thinking of lifecycle and value retention, and it is particularly useful as regards business use.

The development of the thought of the circular economy on the basis of linear thinking to the circular system can be well explained using visual representations. The system of a circular economy needs to manage the material flows within production and consumption through coordination, as explained by Pauliuk (2018). These illustrations remain evidence of the

transformation of economic models that move towards one-directional material flows to a closed loop and regenerative model.

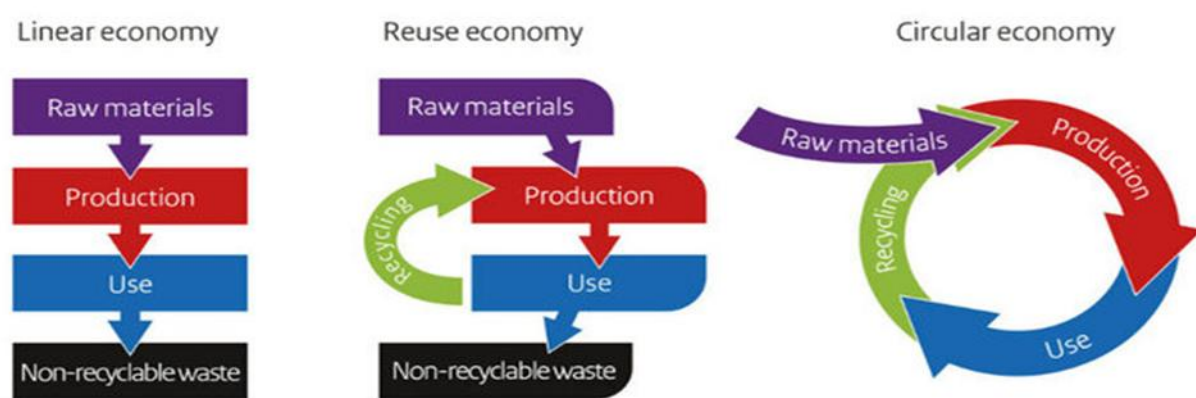


Figure 1:evolution of circular economy thinking from linear to regenerative system (Bonciu, 2020)

The process of switching the linear economy to the reuse-oriented economy and eventually to a completely circular economy is shown in Figure 1. The figure outlines how material flows gradually transform the one-way process that produces non-recyclable waste into the cyclic process that emphasises reuse, recycling, and incessant material circulation. Such a visual representation will help to realise that the circular economy was not a clearly defined concept that appeared at once with the overall shift in economic thinking, technological progress, and environmental consciousness, but rather a gradual evolution of these factors as they changed.

The number also helps to enforce the thought that the modern models of the circular economy are the repercussions of the theoretical models and development rather than a paradigm shift. According to Corvellec et al. (2021), the shift to circular systems is an indication of a growing understanding of the necessity to redesign economic processes and make them more waste-free, value-retaining, and ecologically operating.

In order to generalise the various definitions of the circular economy as expressed in the literature, a comparative overview of some of the major definitions and focal points is given below.

Author Institution	/	Year	Focus of the definition	Key elements emphasised
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Kirchherr et al.	2017	Systemic economic model aimed at reducing resource inputs and waste	Closing material loops, waste reduction, system-wide perspective
Murray et al.	2017	Interdisciplinary sustainability concept	Economic–environmental balance, systemic change
Geissdoerfer et al.	2017	Regenerative sustainability paradigm	Value creation, decoupling growth from resource use
Ellen MacArthur Foundation	2021	Practical and business-oriented model	Lifecycle thinking, value retention, and regeneration of natural systems.

Table 1: Evolution of circular economy definitions and key elements (Author, 2026)

The table outlines the conceptualisation of the circular economy by various authors and institutions and shows some areas of similarity and points of divergence in the priorities. Although there is a difference in the definitions, there are other common elements that seem to recur throughout the literature. Kirchherr et al. (2017) talk about the idea of resource loops as one of the most notable aspects because it implies maintaining materials and products in service by using reuse, repair, remanufacturing, and recycling strategies. The reuse and recycle of materials is broadly considered to be a key to minimising the amount of waste production and lowering the reliance on the extraction of virgin resources.

The other important aspect of circular economy interpretations by the Ellen MacArthur Foundation (2016) is the value retention, which is concerned with ensuring that all economic value of products and materials is held as long as possible, as opposed to them being treated as outputs that get discarded. This aspect is especially applicable in the business setting, as it will aid in the creation of novel business models that will prolong the product life cycles and generate long-term value.

Another block of the circular economy that is critical is lifecycle thinking. In this method, attention is paid to environmental and economic effects in the whole lifecycle of products (design and production) to use and end-of-life management stated by Geissdoerfer et al. (2017). Lifecycle

thinking is a business strategy that includes the introduction of circular ideals into the product design phase and aims to promote more responsible choices and optimisation of the system.

According to the Ellen MacArthur Foundation (2021), Waste prevention by design is one more critical component of the circular economy that designates products and processes to avoid waste and pollution instead of dealing with them at the end of the life cycle.

According to the review of the definitions, interpretations, and conceptual advancements, the circular economy in this thesis is defined as a systemic economic model that seeks to sustain the value of products, materials, and resources in a closed-loop process, lifecycle considerations, and regenerative processes, and sustainable business development. The given working definition will serve as a conceptual basis for the further discussion of the models of the circular economy and their implementation in the business that is discussed in the following passages of the theoretical part.

1.2 Theoretical Models of Circular Economy.

Having outlined the concept of the circular economy and its major aspects in the previous section 1.1, this section will explore the principal theoretical frameworks of the circular economy that have been developed in both the scholarly literature and institutional practice. This section aims to critically review existing models to gain an insight into how well the principles of the circular economy are organised theoretically, what their strengths are, and what their weaknesses are. This discussion is not yet concerned with the actual business application but aims at the theoretical foundation of creating a personal theoretical framework in Section 1.3.

The system model created by the Ellen MacArthur Foundation is one of the most powerful theoretical models of the circular economy. According to the explanation of the Ellen MacArthur Foundation (2021), this model differentiates between biological and technical cycles and underlines the fact that materials are constantly circulated and the natural systems are regenerated. Corvellec et al. (2021) explain that the key strength of this model is that it has a clear systemic logic that aids in conceptualising the circular economy as an alternative to the linear production systems. Nevertheless, according to Thorley et al. (2021), even with its good visual and conceptual clarity, the model is very abstract and offers little information on how the organisations would operationalise the idea of circular in the context of particular business settings.

The other notable theoretical framework is the ReSOLVE model that attempts to operationalise principles of the circular economy in strategic areas of action. The report of the Ellen MacArthur Foundation (2023) identifies six centrally located actions found in the ReSOLVE framework, including: regenerate, share, optimise, loop, virtualise, and exchange, which describe the circularity pathways. The good thing about this model is that it is structured, and organisations get to know various strategic paths of circular transition. Negatively, the ReSOLVE framework is still somewhat general and descriptive, providing very few details of how prioritisation or implementation sequencing, or performance measurement occurs and therefore, is less useful in practice without some further adaptation stated by Klein et al. (2020).

The Performance Economy model created by Stahel and MacArthur is a variant of a different theoretical approach towards the problem of circularity. This model has its emphasis on the lengthening of the product lives, preservation of ownership of the products, and the replacement of products with services, as Stahel (2019) concludes. This model has the advantage of being closely related to the principles of the circular economy and the creation of economic value. According to Schroeder et al. (2018), It can be especially achieved via product-as-a-service and long-term relationships with customers. Neligan et al. (2022) explain that the model is, however, mostly relevant to the durable goods and business-to-business scenarios, which restricts its applicability to any industry and operation scale.

Another powerful theoretical approach is the Cradle to Grave model that places much emphasis on product design and material security. This model suggests that the materials are supposed to flow in a continuous cycle, either in a biological or technical cycle, without causing any harm to the environment, as Geissdoerfer et al. (2017) noted. One of the greatest strengths of this model is its design philosophy, which is clear and promotes innovation and material transparency. Meanwhile, in its criticism, Hoang & Böckel (2024) indicate that Cradle-to-Cradle is primarily concerned with product-level design and does not take into account wider organisational, supply-chain and institutional requirements needed to achieve comprehensive circular implementation.

As pointed out in the academic literature, these theoretical models are very different when it comes to scope, scale, and focus. Bocken et al. (2019) have elaborated those certain models give material efficiency and environmental results priority, and others focus on business models, service innovation, and business systemic transformation. Such diversity has the advantage of making the

circular economy theory more diverse, but it also creates fragmentation, as there is no one model that can give a complete framework that can be applicable to every industry and organisational setting.

Model	Author / Institution	Main theoretical focus	Key strengths	Main limitations	Industry fit	Policy support level
CE System Model	Ellen MacArthur Foundation	Closed loops and regeneration	Strong systemic logic, clear visualisation	Abstract, limited operational guidance	Manufacturing, construction	High (EU policy alignment)
ReSOLVE Framework	Ellen MacArthur Foundation	Strategic circular actions	Structured action categories	Broad, non-prescriptive	Cross-industry	High
Performance Economy	Stahel	Value retention and services	Strong link to economic value	Limited sectoral scope	Durable goods, B2B	Medium
Cradle-to-Cradle	McDonough & Braungart	Design-based circularity	Strong material and design logic	Limited system perspective	Consumer goods, materials	Medium

Table 2: Comparative overview of major theoretical models of circular economy (Author, 2026)

The comparative analysis provided in Table 2 points to significant similarities and differences between the principal theoretical frameworks of the circular economy with reference to their focus,

applicability, and limitations. Despite the fact that all models are intended to assist the process of transforming a linear to a circular system, they are markedly different when it comes to the conceptualisations of the circular system and the utility of such models in business terms. National policy campaigns also enable the implementation of the circular economy, especially by regulatory and incentive-based frameworks stated by the Federal Environment Ministry in 2021. The model of the circular economy system created by the Ellen MacArthur Foundation accentuates the priorities of the closed material loops and regeneration. This model provides a clear systemic vision of the way materials are to circulate in both biological and technical cycles, as explained by the Ellen MacArthur Foundation. Its key strength is its holistic vision and close alignment with the policy of the European Union circular economy (European Parliament, 2015). It is, however, too abstract to be of direct operational use to businesses because it gives minimal instructions on how to apply it at the level of the firm. The ReSOLVE framework is a circular economy framework that transforms the principles into six areas of strategic actions created by the Ellen MacArthur Foundation as well. Such frameworks, as Murray et al. (2017) mentioned, are useful in organising circular thinking and increasing awareness of various approaches to circularity. The power of ReSOLVE is that it has a wide applicability in industries. Meanwhile, its non-prescriptive quality might be a weakness since, without further utilities, businesses might not be able to prioritise actions or evaluate performance. The Performance Economy framework suggested by Stahel is based on the idea of increasing the life cycle of products and transitioning to service business models. This strategy, in turn, establishes a good connection between circularity and the creation of economic value, as Stahel (2019) argued. The model, however, is best applicable in durable goods and business-to-business set-ups, and this restricts its application in service-based or fast-moving consumer goods industries. The Cradle to Cradle model created by McDonough and Braungart focuses on designing in a circular way and the technological safety of the material. According to Geissdoerfer et al. (2017), this model is a good basis for product-level innovation. Nonetheless, it does not have the capacity to tackle wider business and supply-chain issues due to its narrow focus on organisational and system-wide aspects. In general, the comparison shows that the current circular economy models can be a good but incomplete choice. The models in isolation do not give a complete framework on which business can be applied, hence the need to come up with a combined theoretical model in the following section.

The reviewed models, from a critical point of view, focus on what circularity is expected to accomplish, yet offer less insight into the manner in which circular economy principles can be holistically incorporated into a business system. According to Murray et al. (2017), the fact that different models of the circular economy are not coherent with each other indicates the general theoretical confusion surrounding the subject. Vermunt et al. (2019) emphasised that organisational and institutional barriers cause the failure of many initiatives related to the circular economy, but not technological ones. This poses a dilemma to businesses who have a dilemma in whether to compete with conflicting frameworks without having clear standards on which to select or integrate.

In general, the review of the current theoretical frameworks reveals that despite its own conceptual development, the circular economy theory is still incomplete and divided in terms of business applications. This theoretical gap reveals the importance of developing a more comprehensive model integrating the thinking about the system, principles of design, business logic, and policy. This gap is taken care of, which forms its own theoretical model of the circular economy application in business, which is performed in Section 1.3.

1.3 Theoretical insights of circular economy application to business

Having discussed the development of the concept of the circular economy and evaluated the key theoretical frameworks in the foregoing sections, this section deals with how the principles of the circular economy can be used in business practice. The aim of this part is to integrate theoretical information found in the literature, as well as to come up with a personal theoretical framework that becomes explanatory in terms of the translation of this concept of the principles of the circular economy into business processes and results. Moreover, this section presents a research model, including hypotheses, based on the theoretical framework and preconditioning further analytical research.

The literature constantly notes that the implementation of the principle of the circular economy in business needs than individual environmental programs. Circular economy implementation, according to Murray et al. (2017), is a systemic change which has an impact on the design of products, the way these products are produced, the business models, and the decisions made by managers. It means that the implementation of the circular economy should be incorporated into the business strategy, but not a series of self-contained sustainability measures. Circular initiatives

are usually shallow when they are not linked to both strategic and operational activities, and the results are not significant economical or sustainability-wise.

One of the key concepts of applying the concept of circular economy in business is regeneration. Regeneration is defined as the process of restoring and reinforcing natural and economic systems as opposed to minimising adverse environmental effects. According to the definition provided by the Ellen MacArthur Foundation (2021), regeneration may be explained as the process of moving towards the elimination of resource depletion towards systems where natural capital is actively restored and retained in its value. Regeneration in the business context refers to the creation of products and processes that will reduce waste, increase the lifecycle of products, and promote a sustainable flow of resources. This principle will shift the focus from the short-term efficiency gains to the long-term value creation and resiliency.

Theoretically, the implementation of the circular economy in business can be organised based on three mutually related areas that is, circular principles, business practices, and business outcomes. According to Batista et al. (2023), circular principles reflect the logic of circularity, business practices reflect the operationalisation of these principles in organisations, and business outcomes reflect the results of the applied circle in terms of economics and sustainability. The third-dimensional structure helps to develop a systematic idea of how abstract ideas of the circular economy are turned into actual value for business.

Circular principles are the initial stage of the application of the circular economy. According to Kirchherr et al. (2017), closing resource loops, reducing waste, and preserving value to economic systems are some of the important circular principles. The principles inform strategic business decisions regarding the design of the product, sourcing, manufacturing processes, and disposition. The absence of a clear comprehension of these principles may present circular initiatives as disjointed, contradictory, or activities that adhere to compliance-related requirements stated by Nguyen and Le in 2025. As such, the application of circular principles should be well defined and made in the course of business implementation.

The second model dimension is on the circles' business practices, which converts the principles of the circle into business activities. According to the statements made by Bocken et al. (2019), these practices involve circular product design, reverse logistics systems, product life extension strategies, and business models involving services. The capabilities of organisations, investment

and coordination across the value chains are necessary in these practices. Notably, not all businesses can easily integrate and embrace these practices, which are determined by the nature of the industry, technological preparedness, and strategic orientation presented by Vermunt et al. (2019). This is the reason why the implementation of the circular economy is so different in organisations.

The third aspect of the implementation of the circular economy is related to the business results. According to Geissdoerfer et al. (2020), proper execution of the principle of a circular economy can result in better efficiency of the resources, cost minimisation, increased innovation capacity, and competitive advantage. Besides that, circular practices can enhance corporation reputation and help meet regulatory and stakeholder requirements. According to Baah et al. (2021), companies that effectively implement circular practices tend to have a higher level of stakeholder trust and legitimacy. Nevertheless, these results cannot be assured and require the depth, consistency and alignment of circles implementation to strategy.

On the grounds of the synthesis of these theoretical perspectives, a personal theoretical framework of the implementation of the elements of a circular economy into business is created. The model regards the application of circular economy as a process where the principles of the circle affect the business activities, which also bring about economic and sustainability-related impacts. The principle of regeneration helps to guide all the processes in this approach, connecting the environmental restoration with long-term generation of business value. The model incorporates

the fragmented theoretical ideas into a coherent framework that is specifically oriented towards business applications.

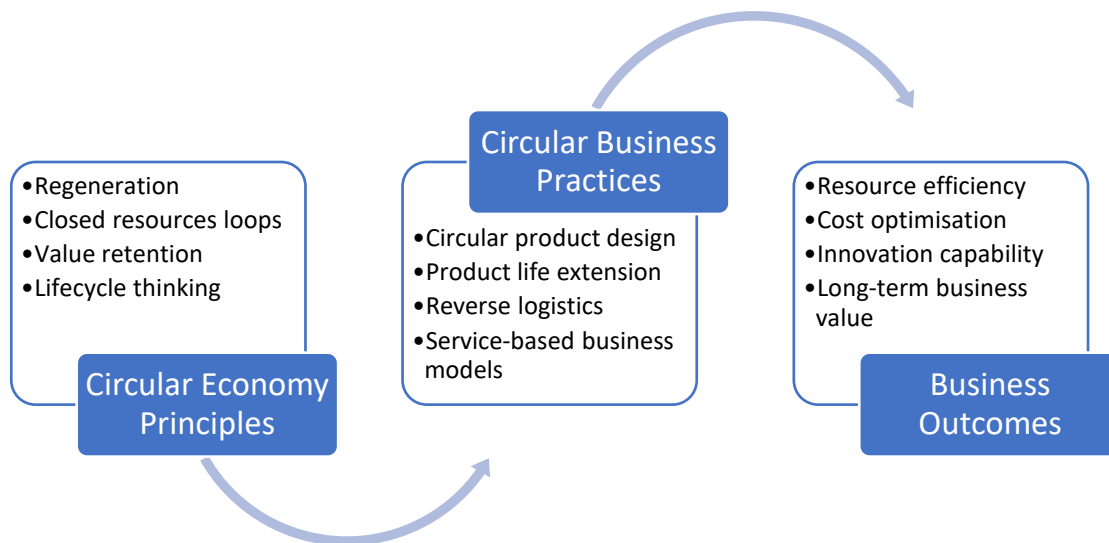


Figure 2: Theoretical Model of Circular Economy Application in Business (Author, 2026)

The theoretical model of the application of the circular economy in business, designed in this study, is shown in Figure 2. The original element of the model can be understood as the principles of the circular economy, such as regeneration, closed resource cycles, value retention, and lifecycle thinking. The second element is the notion of circular business practices, where these concepts are implemented in practice, including the design of circular products, product life cycle policies, reverse logistics, and service business models. The third element is business outcomes, which include improved resource efficiency, being innovative, and creating long-term value. The directional movement of the model shows that business practices are created through the circular principles, and then they give rise to the economic and sustainability-related results.

The theoretical model is used for two purposes. First, it includes a variety of theoretical perspectives in one conceptual framework that discusses how the principles of the circular economy can be implemented in business. Second, it offers a platform on which analytical investigation is possible through establishing key components and relationships that can be studied in a more orderly way. Notably, the model is still hypothetical and has yet to test the relationship of causality. On the whole, the theoretical framework derived in this section helps to gain a better-organised approach to how the principles of a circular economy can be applied to business. The framework remedies the disconnect proposed in earlier studies on circular economy by combining

the principles, business operations and business outcomes into one model. The success of the implementation of the circular economy is, according to Bocken et al. (2019), defined by alignment between the strategic intent and operational implementation. Moreover, as emphasised by Berry et al. (2022), organisational capabilities such as managerial commitment and internal coordination are also critical in helping firms surmount the symbolic circular efforts. Moreover, Ghoreishi (2023) demonstrated that business model innovation is a prominent process that drives quantifiable performance gains grounded in the principles of a circular economy. These insights, taken together, attest to the correctness of the proposed theoretical model and to its suitability for adoption as the basis for further analytical research on the implementation of the circular economy in the business sphere.

As the literature on the circular economy shows, the concept has already become a well-established theoretical domain, with a plethora of definitions, models, and frameworks supporting it. The studies by Kirchherr et al. (2017) and Murray et al. (2019) indicate that the three aspects of thinking about the circular economy are built on the concepts of systemic change, resource looping, and the retention of long-term value. At the same time, the institutional inputs, such as those of the Ellen MacArthur Foundation (2021), are powerful conceptualizations that focus on regeneration and closed material loops. Despite this sound theoretical base, the literature shows a high degree of fragmentation, especially in business applications. According to Bocken et al. (2019), existing models tend to concentrate on a certain aspect, including product design, material flows, or business models, without considering them in a unified structure that can be implemented in an organizational context. Moreover, empirical research by Berry et al. (2022) indicates that several companies cannot put the principles of the circular economy into practice due to organizational and strategic limitations, rather than a lack of conceptual knowledge. Although in recent times studies have begun to investigate how business model innovation can translate the principles of the circular economy into performance outcomes, these studies are dispersed across different theoretical viewpoints (Ghoreishi, 2023). As such, the literature on a combined business-oriented theoretical framework connecting the principles of circling, operating practices, and business outcomes is seen to have a gap. The theoretical model that was created as part of this thesis plays into this gap by integrating major lessons learned in the literature in a formalised framework that describes the operationalisation of principles of circular economy in business. The model also provides a coherent basis for analytical research by making regeneration a steering

principle and deliberately connecting principles, practices, and outcomes, offering a more consistent picture of the implementation of the circular economy concept at the business level.

This master's thesis part examined how the principles of the circular economy have been applied in business through a systematic review of the theoretical basis and available academic models. The paper has looked at the development of the concept of the circular economy, its key interpretations and the most impactful theoretical models, such as the Circular Economy System Model, the ReSOLVE framework, the Performance Economy model, and the Cradle-to-Cradle approach. By comparison, the study illuminated the ability of circular principles of regeneration, value retention, lifecycle thinking, and closed resource loops to be applied to business logic and business operations. The discussion found that there was a severe theoretical gap in the disaggregation of the already existing circular economy models. Although previous frameworks have made significant contributions to understanding particular aspects (e.g., product design, strategic actions, or service-based models), none provides a comprehensive framework that integrates circular principles, business activities, and quantifiable business results. This integration deficiency puts an operationalist uncertainty on businesses trying to do it systematically. To fill this gap, the thesis developed a conceptual theoretical model that relates circular principles to circular business practices and, consequently, to economic and sustainability-related outcomes. Positioning regeneration as a motivating principle and focusing on strategic alignment, the model adds to a systematic approach to learning how the concept of circularity can be incorporated into business systems rather than seen as individual, environment-focused practices. For businesses, the results indicate that a successful implementation of the circle requires strategic focus, manager commitment, business model innovations, and value-chain coordination. Nevertheless, the research is weak in its use of secondary data and its conceptual analysis and lacks empirical validation. Further studies ought to be able to empirically test the suggested model in other industries, explore sector-specific implementation channels and consider quantifiable performance indicators to assess the performance of the circular economy in a more accurate way.

2. Empirical investigation level of application of circular economy principles in business

The aim of the chapter is to appraise the empirical stage of the application of the circular economy (CE) in business practice. Although the other chapter was dealing with theoretical backgrounds and models, this chapter will be dealing with actual evidence in academic research findings, institutional reports, and statistical data. The goal is to identify the extent to which the principles of the circle are applied in businesses, the quantifiable outcomes of such application, and the obstacles and facilitating conditions for success. The chapter relies on secondary empirical evidence, including peer-reviewed literature, EU and OECD reports, and institutional reports, such as those of the Ellen MacArthur Foundation and the European Commission. In order to determine patterns and draw conclusions that may be employed in business practice, the analysis uses the approaches of systematisation, comparison and synthesis.

2.1 Circular Economy implementation: empirical results on business outcomes

Empirical studies show that applying the principles of the circular economy (CE) in business yields quantifiable economic, environmental, and strategic impacts. Whereas the theoretical chapter defined the conceptual advantage of circularity, this section examines the performance of these ideals in practice, grounded in empirical research by other scholars and institutions. The analysis will also seek to assess how the implementation of the circular economy generates real business value and in what scenarios the value can be realised.

In order to organise the empirical data, Table 3 is a summary of major scholarly and institutional research on the subject of circular economy implementation and its effects on the business outcomes. The chosen studies employ various methodological strategies, such as systematic literature review, survey, quantitative analysis, and industry case study, allowing for a thoroughly evaluate the available empirical evidence.

Author	Research Objective	Method / Data	Key Empirical Findings
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Geissdoerfer et al. (2020)	Analyse circular business models and firm performance	Systematic literature review (100+ empirical studies)	Circular models improve resource efficiency and innovation when strategically integrated
Bocken et al. (2019)	Evaluate circular business model innovation tools	Comparative empirical review	Firms combining multiple circular strategies gain a stronger competitive advantage.
Kirchherr et al. (2018)	Identify barriers to CE implementation in EU firms	Survey (300+ EU companies)	Cultural resistance and lack of incentives outweigh technological barriers
Vermunt et al. (2019)	Analyse barriers across CE business models	Empirical EU firm analysis	Organisational and institutional barriers are dominant
Baah et al. (2021)	Assess stakeholder influence on CE adoption	Quantitative study	CE adoption increases stakeholder trust and organisational legitimacy
European Commission (2020)	Evaluate CE's impact on the EU economy	EU statistical reports	Circular strategies reduce material costs by up to 20%
McKinsey (2016)	Assess the economic potential of CE	Industry case analysis	Circular models could generate 0.6 trillion in annual material savings in Europe.

Table 3: Experimental data on the implementation of the circular economy and its business performance (Author, 2026)

Table 3 provides empirical evidence that implementing the circular economy can indeed improve business performance. Some of the studies define the enhancement of resource efficiency, the ability to innovate, cost-cutting and competitiveness in the long term. For example, Geissdoerfer et al. (2020), based on extensive empirical studies, find that circular business models improve resource efficiency and innovation outcomes. Nevertheless, their result also underscores that such

advantages can be realized only when the principle of circles is incorporated into business activities tactically, rather than used in a vacuum.

On the same note, Bocken et al. (2019) show that companies that implement a combination of various types of circles, i.e. product life extension, reuse, and service-based models, gain better competitive advantages compared with companies that introduce single circular initiatives. It indicates that the best way to implement the circular economy is to focus on it as a system, rather than individual environmental activities. From a business perspective, this underscores the need for holistic circular approaches rather than piecemeal ones.

The macroeconomic level is the macro level that institutional reporting substantiates. The European Commission (2020) notes that implementing circular economy measures may reduce the costs of materials used by businesses by up to 20 percent, especially in industries that use a lot of materials. The McKinsey Company, partnering with the Ellen MacArthur Foundation, projects that, in 2030, the primary-resource benefits of a circular economy in Europe will be approximately 0.6 trillion, and total economic benefits will be approximately 1.8 trillion when other impacts are taken into consideration. These results confirm that the principles of the circular economy are not merely beneficial to the environment, but also of great economic value, supporting their applicability to long-term business sustainability.

The empirical studies, however, also indicate the lack of automatic positive results. The research conducted by Kirchherr et al. (2018) and Vermunt et al. (2019) indicates that the success of the initiatives of a circular economy may often be constrained by organisational and institutional barriers. Their results reveal that cultural resistance, absence of managerial support, and poor business incentives are greater barriers compared to technological barriers. This implies that the organisational readiness is more critical to the success of the circular economy implementation than technical capability.

Another valuable dimension is introduced by Baah et al. (2021), who show that the implementation of the circular economy has a positive effect on the trust of stakeholders and organisational legitimacy. Companies that proactively use circular principles are seen as more responsible and future-oriented, which helps them to build stronger relationships with their customers, investors, and other interested parties. This reputational advantage helps justify the view that implementing

the circular economy contributes to intangible business value in addition to quantifiable financial results.

One significant perspective highlighted by the empirical literature is strategic alignment. Firms that incorporate circular principles into their business enjoy more robust, sustainable advantages than companies that view circularity as a sustainability mandate. This is a direct confirmation of the theoretical perspective in Chapter 1, which focused on regeneration, lifecycle thinking, and value retention as strategic and not operational concepts.

Moreover, the research findings indicate that innovation is central to transforming the principles of the circle into business results. Implementing the circular economy often requires redesigning products, supply chains, and service-based business models. Companies with greater capacity for innovation are consequently better placed to gain from circular transformation (Suchek et al., 2021). On the other hand, companies that are not innovative slow down in their progress and their performance improvement is limited. In general, the empirical data show that the implementation of the circular economy can improve the performance of businesses (Kwarteng et al., 2021), but the magnitude of these positive effects is determined by organisational conditions, strategic integration, and corporate commitments. Circular principles cannot solely be applied when they are not accompanied by proper business practices and internal capabilities.

Therefore, according to the empirical research analysis, we can say that the implementation of the circular economy has a positive impact on the business performance, resource efficiency, innovation performance, and competitive advantage, and it is feasible when the principles of the circular economy are systematically incorporated into the business strategy and ensured by organizational commitment.

2.2 Statistical Measures of Circular Economy Performance at the EU

In addition to academic results, statistical evidence is a valuable source of information for assessing the practicality of the principles of a circular economy (CE) in business. The influence of circular strategies at the firm level is supported by empirical research, but statistical indicators offer an opportunity to assess the broader economic environment and the real progress of the circular transformation at the national and industry levels. In this part, the statistical data are analysed using the Eurostat, European Commission, and OECD reports to assess the level of the currently developed stages of the circular economy in the European Union.

In order to offer a systematic description of the statistical measures of the performance of the European Union in the circular economy, the important comparative variables are summarised in Table 4.

Indicator	EU Average / Trend	High-performing countries	Lower-performing countries	Empirical implications for business	Key source
Circular Material Use Rate (CMU)	11–12% (recent years)	Netherlands, Belgium, France	Several Southern and Eastern EU countries	The majority of firms still rely on virgin materials; circular sourcing remains limited.	Eurostat (2024)
Material cost reduction potential	Up to 20% in selected sectors	Germany, Netherlands	Less visible in SME-dominated economies	Circular strategies generate measurable cost savings in material-intensive industries.	European Commission (2023) Federal Environment Ministry (2024)
Employment in CE-related activities	Increasing trend	Western and Northern EU	Slower growth in Eastern EU	Circular economy supports job creation in repair, recycling, and remanufacturing.	European Commission (2023)
SME participation in CE	Relatively low	Large firms dominate adoption	SMEs face higher barriers	Access to finance and knowledge is	OECD (2023)

				critical for wider CE diffusion	
Sectoral CE maturity	Higher in manufacturing	Automotive, construction, packaging	Service sectors	CE progress is more visible in material-intensive industries	Eurostat (2024); OECD (2023)
Policy and regulatory support	Uneven across the EU	Countries with national CE strategies	Fragmented policy environments	Regulatory clarity accelerates business adoption of CE practices	European Commission (2023)

Table 4: Circular Economy Performance Measures in the European Union Statistically (Author, 2026)

Table 4, which shows the comparative indicators, proves that the development of the circular economy in the European Union is rather moderate and uneven. Despite the fact that certain countries and areas can be seen to be making measurable advances, the institutional, economic, and organisational disparities between member states and the size of firms point to the fact that the phenomenon of circular transformation is firmly shaped by institutional, economic, and organisational factors.

The circular material use rate (CMU) is one of the principal statistical indicators applied to determine the performance of the circular economy. Eurostat (2024) indicates that the EU CMU rate has been staying at around 11-12% in recent years. It implies that the recycled sources of materials in the European economy are only 1/10, as most of the materials still have to be mined during their extraction. Though this is a positive move compared to previous decades, it ensures that the general structure of the economy is still mostly linear.

Circular performance inequalities are also emphasised by international comparison. The Netherlands, Belgium and France have higher circular material use rates as compared to most other EU member states (Federal Environment Ministry, 2024). The advantage of these countries

includes an improved recycling infrastructure, a more sophisticated waste management system, and better industrial symbiosis networks. Conversely, the Southern and Eastern European nations show lower rates of circularity, and this can be attributed to variations in the regulatory framework, investment capacity, and technological preparedness (Mazur-Wierzbicka, 2021). This comparison validates the idea that it is not entirely market forces that dictate the performance of the system of a circular economy, but the national policy structures and institutional support.

Besides material use rates, statistical indicators are used to declare the economic topicality of the implementation of the circular economy. According to the WBCSD (2020), companies using the circular approach can save up to 20% in the cost of materials in some manufacturing industries. The most noticeable cost cuts are in construction, packing, and the building of motor industries, where material intensity is magnified. These results show that circular solutions produce quantifiable financial benefits and present clear economic incentives to companies that have material-intensive businesses.

Circular transition is also socially and economically relevant based on employment data. The European Parliament (2023) identifies circular economy activities (repair, reuse, refurbishing, recycling and waste reduction) as ways to prolong the lifecycle of products and contribute to more sustainable economic development. Since repair and reuse systems are more labour-intensive than the linear production model, the development of the circular economy leads to local employment. This ascertains the fact that circular transformation is in line with the green agenda as well as the overall sustainable development agenda.

Along with these positive trends, there are also adverse results of statistical data showing structural challenges. The majority of EU firms, which are comprised of small and medium-sized enterprises (SMEs), have a higher obstacle to adopting the circle as compared to large corporations (Bassi & Dias, 2020). The analysis of OECD (2023) shows that SMEs do not simply have access to capital or technological know-how and specific knowledge necessary to transform them into circles. This organisational weakness limits the proliferation of circular economic practices by the larger economy.

The presence of sectoral differences can also be observed in statistical information. Circular progress can be seen more clearly in the manufacturing and industrial sector, where it is possible to measure material flows and waste streams more precisely (Agata Mesjasz-Lech et al., 2024).

Circularity in service industries, on the contrary, is often associated with digitalisation, sharing platforms or business model innovation, yet not with making use of material. This implies that materialistic-based circularity is better represented by the existing statistical metrics than service-based or intangible circular innovations.

Combined, the statistical evidence shows both quantifiable improvements and institutional constraints to the European circular transition. Despite the current progress in recycling, resource use, reduction of costs, and employment, the overall rate of the use of materials in circles is comparatively low (Dumée, 2021). This means that structural redesign must be made more circular economy in the sense that circular principles should be integrated with business long-term strategies as opposed to gradual waste management only. Regarding business, it is proven that transition in the circular economy is relevant economically, but not complete yet. Circular opportunities are greater for firms that are in countries with a stable regulatory framework and have developed recycling infrastructure (Awan & Sroufe, 2022). On the other hand, organisations in environmentally less favourable contexts experience high costs of transition and uncertainty.

As a result, the discussion of statistical indicators proves that the implementation of the circular economy in the European Union is at a moderate pace and is distributed unequally across the countries and sectors. Regulatory transparency, institutional facilitation, and organisational preparedness at the firm level are very critical to the transition. These structural circumstances can be used to understand the reasoning why the implementation of the circular economy faces certain organisational and financial obstacles, discussed in the next section.

2.3 Business practice barriers and enabling factors

Despite empirical studies and statistical data proving the economic and environmental advantages of the introduction of the concept of a circular economy (CE), the process of the replacement of linear models with circular models is complicated and unequal. Numerous companies face considerable problems in the process of implementing a circular approach in their work. Meanwhile, there are some facilitating conditions that enhance the probability of successful implementation. The knowledge of these barriers and drivers is crucial to the explanation of why certain companies can have positive results and others cannot.

In order to standardise the primary findings, Table 5 provides a summary of the empirical data on the barriers and the enabling factors affecting the implementation of the circular economy in business.

Author	Focus	Key Findings
Kirchherr et al. (2018)	Barriers in EU firms	Cultural resistance, low consumer demand, and lack of incentives
Vermunt et al. (2019)	CE business model barriers	Organisational complexity and institutional misalignment
Ghisellini et al. (2016)	CE transition challenges	Financial constraints and regulatory uncertainty
Stahel & MacArthur (2019)	Performance economy success factors	Service-based models strengthen long-term value capture
Awan & Sroufe (2022)	CE and sustainable growth	Strategic integration increases sustainability performance
Berry et al. (2022)	Organisational readiness	Managerial commitment is critical for success

Table 5: Circular Economy Implementation Empirical Evidence of Barriers and Enabling Factors (Author,2026)

According to the empirical data provided in Table 5, obstacles to the implementation of the circular economy are more of an organisational than a technological nature. Kirchherr et al. (2018) concluded that in most cases, cultural resistance in organisations and the lack of strong consumer demand in circular products a negative stimuli to investments in circular models. This implies that the decisions on adoption are highly affected by internal attitudes and the environment.

Vermunt et al. (2019) also highlight the issue of organisational complexity as one of the key challenges. The circular business models might need to involve collaboration in supply chains, production system redesign, and other stakeholder coordination. These changes in the structure enhance the work of the managers and demand long-term devotion. Misalignment in institutions, such as ineffective regulations and ambiguous policy frameworks, also lower business confidence in circular investments.

Another key condition is financial barriers. According to Ghisellini et al. (2016), the high start-up costs may be a characteristic feature of the circular transformation, especially when it comes to redesigning products or updating technology or creating reverse logistics. Limited access to capital exposes small and medium-sized enterprises to such financial constraints, especially. Uncertainty in regulation also discourages long-term investment planning.

Nevertheless, the enabling factors are also clear in empirical research studies. Stahel (2019) shows that product-as-a-service systems and other service-based and performance-oriented types of business models enable a company to keep ownership and maximise value retention. The models decrease the reliance on materials and enhance the relationship with customers. This observation is in line with the theoretical idea of value preservation.

Another significant factor of success is strategic integration. Awan and Sroufe (2022) demonstrate that firms that align their corporate strategy with the principles of the circular economy have a more significant sustainability performance than companies that implement the principles of the circular economy only at the operational level. This shows that circularity has to be part of the long-term strategic planning and not an individual sustainability project.

The key facilitating factor identified is that of managerial commitment. Berry et al. (2022) believe that organisational readiness to undergo circular transformation is largely affected by the leadership orientation towards sustainability. Circular initiatives do not have enough resources and internal coordination without the obvious backing of top management. Managerial devotion thus becomes a motivating power that enhances the connection between circularity and real practice.

The other notable thing is that partnership in value chains contributes to circular success. Companies that collaborate with suppliers, customers, and recycling partners have enhanced capabilities to apply closed-loop systems and minimise waste. Such a collaborative strategy will make the situation less uncertain and share the costs and risks among the parties more equally.

In general, all the empirical evidence indicates that the primary barriers to the implementation of a circular economy are not the limitation of technology but are organisational resistance, financial constraints and institutional complexity. On the other hand, strategic alignment, managerial dedication, innovation ability and collaborative networks are enabling factors.

Analytically, these findings support the argument by showing that the implementation of the circular economy is a broad organisational change. Companies that place the concept of circularity as a strategic focus and invest in innovation have a higher chance of scoring good business results. Conversely, firms that consider circular practices as mere regulations tend to have low benefits.

Overall, empirical studies have shown that obstacles to implementing the circular economy are mostly organisational and institutional, whereas facilitating factors, including strategic integration, managerial commitment, and business model innovation, have a high potential to promote successful circular transformation.

2.4 Circular Economy Application in Business Research Model

The research model of circular economy application in business is stated in line with the theoretical framework discussed in Chapter 1 and the analysis of the empirical evidence in Sections 2.1-2.3. This model is designed to describe the translation of the principles of the circular economy into business practice and the impact that this process has on quantifiable business performance. The model combines theoretical considerations with empirical evidence and offers an analytical framework related to the research question of the effective application of principles of the circular economy in business.

The empirical discussion proves that the implementation of the circular economy is not a one-managerial measure, but rather, a structured and interdependence procedure. To begin with, the companies embrace the principle of the circular economy [regeneration, lifecycle thinking, value retention, and closed resource loops]. These principles are a strategic direction towards circularity and decision-making in product designs, manufacturing processes, resource utilisation, and product life. Circular economy principles are identified as an independent variable in the research model since they set the process and direction of a circular change within the organisation.

Second, empirical evidence shows that circular economy principles result in the introduction of certain business practices that are circular. These methods consist of circular product design, product life extension, reverse logistics, recycling, remanufacturing, and a service-oriented business model. The research that was evaluated in Section 2.1 indicates that companies that adopt the ideas of a circle have a higher chance of bringing in these practices. Meanwhile, Section 2.3 points out that the organisational readiness and strategic alignment determine the effectiveness of the implementation of these practices. The concept of circular business practices is considered a

mediating variable in the research model since it conveys the impact of the idea of the circular economy on business performance.

Third, empirical studies have always shown that circular business practices have quantifiable business outcomes. The results are an increase in resource efficiency, performance in the area of innovation, and a competitive position in the long-term perspective. The European Commission and empirical research of Geissdoerfer et al. (2020) and Bocken et al. (2019) can prove that companies that employ circular practices minimise material dependence, increase the ability to innovate, and improve their competitiveness. These outcomes are the dependent variable in the research model since they show the outcomes of circular economy implementation.

Nonetheless, empirical studies also show that the connection between the principles of circular economy and the circular business practices is not natural. Section 2.3 has shown that managerial commitment is a decisive element that determines whether circular principles can be effectively converted into operational practices or not. Companies that have effective leadership backing, strategic focus and proper allocation of resources will be more effective in enforcing circular initiatives. On the other hand, the companies in which the managers are not committed tend to have disjointed or symbolic circular activities. Thus, the research model will incorporate managerial commitment as a moderating variable, enhancing the association between the principles of the circular economy and the practices of the circular businesses.

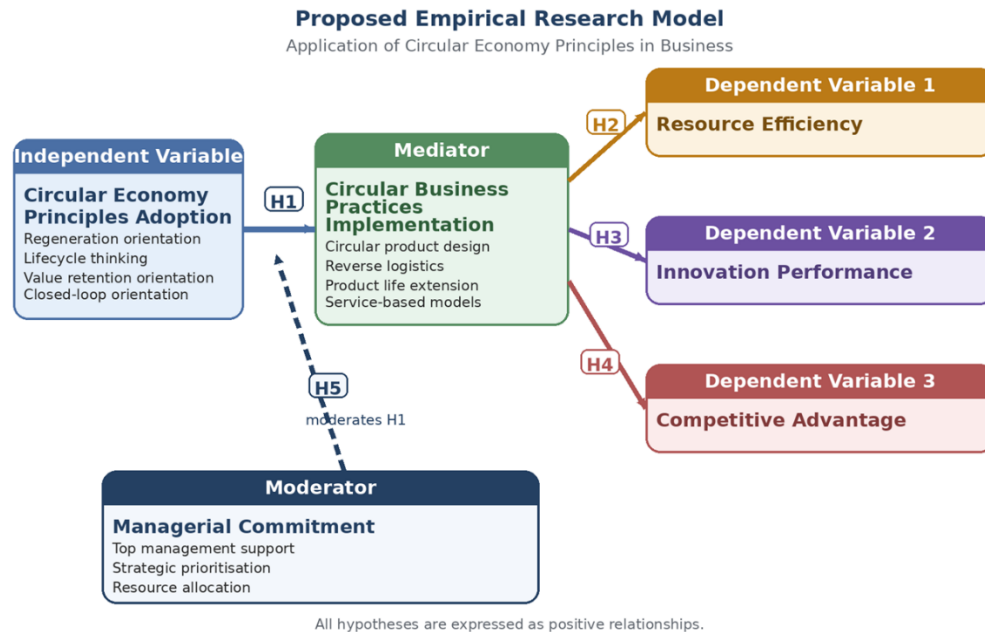


Figure 3 Circular Economy Applications Research Model in Business (Author,2026)

The proposed research model is seen in Figure 3. The model presupposes the sequential relationship that assumes the principles of the circular economy affect the implementation of the circular forms of business, which ultimately impact business performance. The first relationship is moderated by managerial commitment, which enhances the effectiveness and consistency of the implementation. This structure is directly related to the empirical results in this chapter and the fact that it aligns with the theoretical assumptions that came out in Chapter 1.

According to this conceptual logic and based on the reviewed empirical evidence in this chapter, the following hypotheses are developed:

- H1. The adoption of circular economy principles is positively associated with the implementation of circular business practices.
- H2. Circular business practices are positively associated with resource efficiency.
- H3. Circular business practices are positively associated with innovation performance.
- H4. Circular business practices are positively associated with competitive advantage.

H5. Managerial commitment positively moderates the relationship between the adoption of circular economy principles and circular business practices, such that the relationship becomes stronger as managerial commitment increases.

This research model describes how the concept of a circular economy is translated into business practice and how it yields quantifiable business value. It explicitly refers to the principles of the circular economy as the independent variable, circular business practices as the mediating variable, business outcomes as the dependent variables, and managerial commitment as the moderating factor.

In this analytical chapter, the empirical level of circular economy application in business was assessed by combining the results of academic research with statistical data on the development of a circular economy in Europe and in the selected international contexts. The discussion was centred on the real-life application of the principles of the circular economy, their quantifiable business effects, and the most significant aspects that determine whether the process of the circular transformation in companies succeeds or fails. As it was proved by empirical factors that are discussed in Section 2.1, the implementation of the circular economy can produce tangible economic and strategic gains, such as the optimised use of resources, increased performance in terms of innovation, reduced costs, and increased competitive advantage. Nonetheless, these gains do not come on a silver platter, and they rely on the extent of application and integration of the principles of the circle in organisational approaches. Statistical indicators analysed in Section 2.2 presented objective data on the development of the European Union in the field of the economy. Although there has been improvement in recycling, material efficiency, and job creation, the degree of circularity is average. The significant disparities across countries, industries, and firm sizes show that the transition to circles is uneven, particularly among small and medium-sized enterprises. Section 2.3 exposed that the primary obstacles to the implementation of the circular economy are organisational and institutional, but not technological, and the facilitating factors are managerial commitment, innovation capacity, cross-value chain collaboration, and business model redesign. Lastly, Section 2.4 integrated theoretical and empirical knowledge into a research concept that demonstrated how the circular economy principle affects business performance by promoting circular business practices supported by managerial dedication.

3. Empirical Research on the Application of Circular Economy Principles in Business

This chapter reports the empirical research carried out to assess the perceptions of the respondents on the implementation of the principles of the circular economy in business organisations. The chapter provides an explanation of the research methodology, the data collection process, and statistical analysis techniques, including descriptive, correlation, regression, moderation, and mediation analysis. The empirical results are discussed in the context of the proposed research model and the theoretical considerations presented in Chapters 1 and 2.

3.1 Research Methodology

This part explains the methodological foundation of the empirical study. It adheres to the lecture format, stating the research aim, objectives, research method, questionnaire design, survey sample, research organisation and data processing methods. These aspects explain the process of collecting the primary quantitative data, organising and preparing the data to be further analysed and interpreted.

The object of Empirical Research

The object of the empirical research is respondents' perceptions of the application of circular economy principles, circular business practices, managerial commitment, and perceived business outcomes in business organisations.

Aim of the Empirical Research

The aim of the empirical research is to evaluate how respondents perceive the relationship between circular economy principles, circular business practices, managerial commitment, and perceived business outcomes in business organisations.

Empirical Research Objectives

The following are objectives that guide the empirical research.

1. To understand the perceptions of the respondents about the use of circular economy principles in business organisations.
2. To evaluate the perceived circular business practices in organisational settings.

3. To assess perceived business results of circular business practices in terms of resource efficiency, innovation performance and competitive advantage.
4. To investigate the importance of managerial commitment for the implementation of circular economy initiatives.
5. To test the hypotheses of the developed empirical research model presented in the analytical chapter of the thesis.

Research Method

This is an empirical study using a quantitative research method, with primary data collected via an online questionnaire. The research is based on respondents' perceptions of the principles and practices of circular economy in business organizations, managerial commitment, and perceived business outcomes, rather than on the actual performance of the organizations. The use of quantitative research was chosen because the answers to the questions were measurable and could be statistically analysed across the constructs of the research model developed in this study (Ghanad, 2023). Constructed on a 5-point Likert scale (from 1 = strongly disagree to 5 = strongly agree), the questionnaire statements were measured (South et al., 2022). The data collected were analysed in Microsoft Excel. The results of the descriptive statistical analysis were obtained through frequencies, percentages, mean values, standard deviations and ranking analysis to assess the perceptions of the respondents and to determine the strongest and weakest constructs evaluated. The internal consistency of the constructs of the questionnaires was tested through reliability analysis with Cronbach's Alpha. The correlation analysis was used to look at the relationships between the circular economy principles, circular business practices, managerial commitment, resource efficiency, innovation performance, and competitive advantage. The empirical model was tested with multiple regression analysis to test the explanatory relationships and research hypotheses. Moderation regression analysis was used to assess the moderating effect of managerial commitment, and mediation analysis with the Sobel test to determine if circular business practices mediated the relationships between the circular economy principles and perceived business outcomes. These statistical methods were deemed suitable as they allowed for systematic testing and interpretation of the research model and hypotheses developed. The basic regression assumptions were also examined prior to the final statistical analysis, such as linearity, normality, homoscedasticity, and outlier screening.

Questionnaire Design

The questionnaire was designed from the theoretical and analytical research model presented in Chapters 1 and 2. It was designed to gather primary quantitative data on the perception of the respondents on the implementation of the circular economy in the business organisations. The questionnaire was conducted in English and had five main parts. The first section gathered information on the respondent and organisation, such as their position, firm size, industry, firm age and market scope. The second section assessed perceptions on the principles of circular economy (strategic integration, lifecycle, waste prevention, value retention and resource recovery). In the third part, circular business practices such as circular design, reverse logistics, product life extension, recovery systems and service-based business models were assessed. The fourth section assessed perceived business outcomes and was broken down into three subconstructs: resource efficiency, innovation performance, and competitive advantage. The fifth section assessed managerial commitment by management support, provision of resources, encouragement of employees, monitoring of progress and strategic orientation over the long term. The items of the questionnaire were developed and adapted from the literature reviewed in the theoretical and analytical chapters, among others, the conceptual approaches of Kirchherr et al., and the Ellen MacArthur Foundation. The statements were rated on a 5-point Likert scale from strongly disagree to strongly agree (South et al., 2022).

Construct	Indicator	Questionnaire Item	Measurement Scale	Source
Circular Economy Principles	Strategic integration of CE	CE principles are integrated into organisational strategy	5-point Likert scale	Kirchherr et al. (2017); Ellen MacArthur Foundation (2021)
	Lifecycle thinking	The organisation considers lifecycle impacts in decision-making	5-point Likert scale	Geissdoerfer et al. (2017)

	Waste and pollution reduction	The organisation actively reduces waste and pollution	5-point Likert scale	Ellen MacArthur Foundation (2021)
	Closed resource loops	The organisation supports reuse and recycling practices	5-point Likert scale	Kirchherr et al. (2017)
Circular Business Practices	Circular product/process design	The organisation applies circular product or process design	5-point Likert scale	Bocken et al. (2019)
	Reverse logistics	The organisation applies recovery or reverse logistics systems	5-point Likert scale	Bocken et al. (2019)
	Product life extension	The organisation supports repair, reuse, or refurbishment	5-point Likert scale	Stahel (2019)
	Service-based business models	The organisation applies service-oriented circular models	5-point Likert scale	Geissdoerfer et al. (2020)
Resource Efficiency	Waste reduction	Circular practices improve resource efficiency	5-point Likert scale	Geissdoerfer et al. (2020)

	Cost optimisation	Circular practices reduce operational costs	5-point Likert scale	European Commission (2020)
Innovation Performance	Innovation capability	Circular practices support innovation and new opportunities	5-point Likert scale	Bocken et al. (2019)
Competitive Advantage	Competitive position	Circular practices improve competitive advantage	5-point Likert scale	Awan & Sroufe (2022)
	Organisational reputation	Circular practices improve organisational reputation	5-point Likert scale	Baah et al. (2021)
Managerial Commitment	Management support	Management actively supports CE implementation	5-point Likert scale	Berry et al. (2022)
	Resource allocation	Management allocates resources for CE initiatives	5-point Likert scale	Berry et al. (2022)
	Strategic priority	CE implementation is treated as a long-term priority	5-point Likert scale	Awan & Sroufe (2022)

Table 6: Operationalisation of Research Constructs and Measurement Indicators (Author, 2026)

Survey Sample

The empirical research was conducted with employees and managers in business organisations in various industries and organisational settings. The respondents were from companies in services,

manufacturing, retail, logistics, construction and other industries. The professional groups comprised top management, middle management, sustainability specialists, operations specialists and other staff with general organisational expertise on sustainability projects, organisational activities and managerial processes for the implementation of the circular economy. The results of the survey indicated that the majority of respondents belonged to middle management and that most organisations were in the services sector and had a national market scope.

The research used convenience sampling, a non-probability sampling technique, as the sample was selected based on availability and willingness to participate in the online questionnaire. Convenience sampling was deemed to be suitable as it provided an efficient way to access respondents across different organisational settings, and minimised time and resource constraints. The results, however, do not necessarily reflect the views of all business organisations, as the sample was not representative. However, the variety of respondents in terms of organisational position, sector, firm size, firm age and market scope has helped to gain different organisational perspectives relevant to the empirical research objectives. There were 384 valid respondents in the final empirical sample. For quantitative analysis with a maximum population variance, the number of responses is usually considered adequate if there are approximately 384 responses at a 95% confidence level with a 5% margin of error (Nur Indri Rahayu et al., 2024). All collected questionnaires were checked prior to analysis, and only complete and valid questionnaires were used in the final empirical data set for statistical analysis and hypothesis testing.

Research Organisation

The empirical research took place in the practical part of the preparation of the master's thesis, in which primary quantitative data on the perception of respondents on the implementation of the circular economy in business organisations were collected. The online questionnaire survey was carried out from March 28th to April 28th in 2026 and sent via email, LinkedIn, University, Organisation and Business communications. The online distribution allowed for efficient access to respondents from various organisational settings and standardisation of data collection procedures. The respondents were employees and managers with a general organisational sustainability knowledge, organisational operation and managerial process knowledge related to the implementation of the circular economy. The questionnaire explained to the respondents that the study was only for academic purposes in a master's thesis and that all responses were treated

confidentially and analysed in an aggregated form. All survey participants were asked to volunteer, and informed consent was obtained prior to completing the questionnaire. The respondents were also told that their participation would be anonymous and that no personally identifiable information would be collected. Participants could drop out of the survey at any time before submission. Ethical standards of confidentiality, anonymity, voluntary participation and responsible academic data use were adhered to throughout the research process (Kang and Hwang, 2023).

3.2 Research Data Analysis and Discussion

This section presents the analysis and discussion of the questionnaire responses from 384 valid respondents on the topics of the principles of circular economy, circular business practices, managerial commitment, and perceived business outcomes in business organizations. The main empirical patterns were identified by descriptive statistical analysis, such as frequency, percentage, mean, standard deviation and ranking analysis. Further, reliability, correlation, regression, moderation and mediation analyses were performed to assess the research model and hypotheses developed. The interpretation of the mean scores was based on five categories of agreement, from very low to very high agreement, such as: 1.00–1.80 = very low agreement, 1.81–2.60 = low agreement, 2.61–3.40 = moderate agreement, 3.41–4.20 = high agreement, and 4.21–5.00 = very high agreement.

Demographic and Organisational Profile of Respondents

Table 7 shows the organisational and professional profile of the respondents who were part of the empirical research. A total of 384 valid answers to the questionnaire were analysed. The research is based on the perception of the respondents on the implementation of the circular economy in business organisations, so the profile of the respondents is presented not in terms of personal demographic characteristics, but organisational and professional characteristics. The profile variables are: Respondent position, Firm size, Industry sector, Firm age and Market scope.

Profile variable	Dominant category	Frequency	Percentage
Respondent's position	Middle Management	176	45.83%

Firm size	Mid-sized Firms	150	39.06%
Industry	Services	138	35.94%
Firm Age	11-20 years	159	41.41%
Market Scope	National	202	52.60%

Table 7: Demographic and organisational profile of respondents (Author, 2026)

The middle management employees constituted the largest group of respondents in the sample (45.83%). This suggests that a large proportion of respondents may have had a role in operational decision-making and organisational implementation processes related to sustainability and business practices. The majority of organisations were mid-sized, with 39.06% of respondents, and the largest industry group was services with 35.94% of respondents. Most organisations had been running for 11-20 years, indicating that many of the respondents were from relatively established organisations with well-established structures. Furthermore, the majority of respondents were from companies that were primarily based in national markets. Overall, the sample represents respondents with relevant organisational and professional knowledge to assess perceptions of the circular economy principles, circular business practices, managerial commitment and perceived business outcomes.

Circular Economy Principles Analysis

This section presents a qualitative analysis of the respondents' views on the principles of the circular economy that were part of the questionnaire. The results reveal high agreement on all principles, suggesting that respondents are generally aware of the relevance of principles of circular economy to business practice. The highest mean score ($M = 3.58$) was found for closed resource loops, indicating that respondents perceive the closest connection between the application of circular economy and the reduction of reliance on virgin materials by reusing, recovering and recycling. This aligns with the study by Kirchherr et al. (2017), which has identified closing material loops and waste reduction as key pillars of the circular economy.

Circular economy principle	N	Mean	Standard deviation	Rank	Interpretation

Strategic integration of CE principles	384	3.42	1.02	5	High Agreement
Lifecycle thinking	384	3.55	0.93	3	High Agreement
Waste and pollution prevention	384	3.44	1.02	4	High Agreement
Value retention	384	3.56	0.97	2	High Agreement
Closed resource loops	384	3.58	0.92	1	High Agreement

Table 8: Descriptive statistics of circular economy principles (Author, 2026)

Value retention was second ($M = 3.56$), indicating that respondents are also aware of the need to retain products, components and materials for longer. This aligns with the Ellen MacArthur Foundation's value retention principle, which is business-oriented. Lifecycle thinking was the third ($M = 3.55$) and was used to support the discussion, which focused on the importance of considering environmental and operational impacts throughout the product and process lifecycle to implement the circular economy.

Waste and pollution prevention ($M = 3.44$) and strategic integration ($M = 3.42$) were ranked comparatively low, but were still in the high-agreement range. This result confirms the analytical discussion in Chapter 2, in which Ghisellini et al. (2016) and Kirchherr et al. (2018) discussed the conceptual understanding of the circular economy principles by many firms, but pointed out that there are still organisational, financial and strategic obstacles to systematically embedding circularity in the business strategy. In general, the results suggest that respondents' perception of operational circular activities is stronger than their perception of long-term strategic circular integration in organisations.

Circular Business Practices Analysis

This section discusses the respondents' views on the implementation of circular business practices in business organisations. The results show a high level of consensus on most of the practices examined, which suggests that the respondents are positive in the sense that they believe in the relevance of circular activities in their organisations. The service-based business models achieved the highest mean score ($M = 3.70$) – that means that the respondents strongly relate circularity to value creation beyond one-time product sales. The result corroborates the findings of Chapter 2,

in which Geissdoerfer et al. (2020) suggested that service-oriented models are important for sustainable value creation and circular business transformation.

Respondents view collection, return and recovery as relatively well-established circular practices with a rank 2 ($M = 3.67$), placing these practices second. This aligns with the results of Bocken et al. (2019), who found reverse logistics and recovery activities to be key operational processes when implementing circular businesses. Extension of the product life cycle was the third most mentioned strategy ($M = 3.51$), in line with Stahel (2019), who pointed out the necessity for the maintenance, repair, reuse, refurbishment and remanufacturing strategies to extend the value of the product and reduce resource dependency.

Circular Business Practices	N	Mean	Standard deviation	Rank	Interpretation
Circular product/process design	384	3.31	0.98	5	Moderate agreement
Reverse logistics/recovery systems	384	3.67	0.89	2	High agreement
Product life extension	384	3.51	0.99	3	High agreement
Waste/by-product value recovery	384	3.42	0.98	4	High agreement
Service-based business models	384	3.70	0.89	1	High agreement

Table 9: Descriptive statistics of circular business practices (Author, 2026)

Waste and by-product recovery ($M = 3.42$) was in the higher range of agreement, and circular product and process design had the lowest mean score ($M = 3.31$), which was only moderately high. This could suggest that recovery- and service-based practices are more advanced than design-oriented approaches to circularity. The result also confirms the analysis in Chapter 2 by Ghisellini et al. (2016), who noted that companies may face implementation challenges when embedding circularity into product design and long-term strategic processes. The standard deviation values range from 0.89 to 0.99, indicating moderate variation in respondents' perceptions. The results indicate that respondents have a positive attitude towards circular business practices, but perceptions differ between operational and strategic practices.

Perceived Business Outcomes Analysis

The perceptions of respondents about the business results resulting from circular economy practices in organisations are analysed in this section. The business outcomes are analysed separately by the three perspectives of resource efficiency, innovation performance and competitive advantage, as implementing the circular economy might simultaneously generate benefits for the organisation in key operational, innovation and strategic areas.

Perceived business outcome	N	Mean	Standard Deviation	Rank	Interpretation
Material waste reduction	384	3.48	0.92	3	High agreement
Resource efficiency	384	3.51	0.91	2	High agreement
Cost reduction	384	3.57	0.92	1	High agreement

Table 10: Descriptive statistics of resource efficiency (Author, 2026)

Table 10 presents respondents' perceptions of the outcomes of resource efficiency from circular economy practices. The top three mean scores were for cost reduction ($M = 3.57$), resource efficiency ($M = 3.51$), and material waste reduction ($M = 3.48$). The same applied to all items, meaning they are all still at high agreement, which suggests a positive relationship between circular economy practices and operational efficiency and resource optimisation. This discovery confirms the arguments in Chapters 1 and 2 that implementing the circular economy can help address waste and put resources to better use.

Perceived business outcome	N	Mean	Standard Deviation	Rank	Interpretation
New product/service development	384	3.64	0.90	1	High agreement
Innovation capability	384	3.49	1.02	3	High agreement
New business opportunities	384	3.55	0.90	2	High agreement

Table 11: Descriptive statistics of innovation-performance (Author, 2026)

Table 11 describes the analysis of the innovation-performance outcomes associated with the practices of the circular economy. The highest mean scores were associated with new product and service development ($M = 3.64$), new business opportunities ($M = 3.55$) and innovation capability ($M = 3.49$). The results corroborate those of Bocken et al. (2019), who contended that circular business practices can enable innovation and new value creation opportunities within the organisation.

Perceived business outcome	N	Mean	Standard Deviation	Rank	Interpretation
Competitive position	384	3.60	0.90	2	High agreement
Organisational reputation	384	3.46	0.97	3	High agreement
Long-term business value and resilience	384	3.68	0.91	1	High agreement

Table 12: Descriptive statistics of competitive advantage (Author, 2026)

Table 12 presents the competitive advantage results of circular economy practices. The highest mean score ($M = 3.68$) was found for long-term business value and resilience, followed by competitive position ($M = 3.60$) and organizational reputation ($M = 3.46$). Findings indicate that the respondents have positive connotations for circularity and its link to long-term strategic competitiveness and organisational sustainability.

Managerial Commitment Analysis

This section examines the management's commitment (as a facilitating condition) perceived by the respondents in the implementation of the circular economy in their business organisations. Results show strong agreement across all items measuring managerial commitment, indicating that respondents believe managerial support is a relevant factor in implementing circular economy practices. The highest mean score corresponds to top management support, indicating a high level of practice and respondents' confidence in top management's support for circular economy initiatives. This result confirms the scholar's findings of Awan and Sroufe (2022), who indicated managerial leadership as an underlying factor that fuels sustainability-oriented organisational transformation in Chapter 2.

Managerial commitment item	N	Mean	Standard deviation	Rank	Interpretation
Top management support	384	3.76	0.93	1	High agreement
Resource allocation	384	3.56	0.91	4	High agreement
Employee encouragement	384	3.50	0.98	5	High agreement
Progress monitoring	384	3.57	0.95	3	High agreement

Long-term strategic priority	384	3.68	0.88	2	High agreement
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Table 13: Descriptive statistics of managerial commitment (Author, 2026)

The second strategic priority was the long-term strategic issue $M = 3.68$, indicating that long-term strategic consideration of the organisation is also part of circular economy implementation as perceived by participants. This aligns with Berry et al. (2022), who claimed that a strategic managerial commitment is required to sustain circular transition processes within organisations. The results further confirmed resource allocation and progress monitoring rate as falling within the high-agreement category, meaning that the respondents feel that support mechanisms in the organisation are relatively well developed. The mean score of employee encouragement was low ($M = 3.50$), but there was still high agreement given. This could be a sign that managers are seen to be more supportive at the strategic level than in direct involvement in employee engagement initiatives. A standard deviation of 0.88-0.98 reflects moderate variation among the perceptions of the respondents. Overall, the results indicate that managerial commitment is considered one of the leading facilitating conditions for implementing the circular economy in organisations and for a long-term organisational transition.

Summary of Main Empirical Findings

This section presents summary statements about the findings of the empirical research at the construct level. The table shows that respondents have a fairly positive perception of the implementation of the circular economy in business organisations, as all the analysed constructs fall into the high-agreement category.

summary table						
Construct	Number of items	N	Overall mean	Standard deviation	Rank	Interpretation
Circular economy principles	5	384	3.51	0.70	6	High agreement
Circular business practices	5	384	3.52	0.68	4	High agreement
Resource Efficiency	3	384	3.52	0.70	5	High agreement
Innovation Performance	3	384	3.56	0.70	3	High agreement
Competitive Advantage	3	384	3.58	0.73	2	High agreement
Managerial commitment	5	384	3.61	0.68	1	High agreement

Table 14: Summary of Descriptive Statistics of Research Constructs (Author, 2026)

Managerial commitment had the highest mean score overall ($M = 3.61$), and respondents strongly believe that implementing a circular economy will be successful if management is committed to it, sets a priority for it and makes an organisational resource commitment. Relatively high evaluations were also given to competitive advantage ($M = 3.58$) and innovation performance ($M = 3.56$), indicating respondents' positive association between circular practices and the organisations' competitiveness and innovation-related results in the long term. Circular business practices ($M = 3.52$), resource efficiency ($M = 3.52$) and circular economy principles ($M = 3.51$) also stayed in the high-agreement realm. The standard deviation range between 0.68 and 0.73 suggests that the perception of the respondents with regard to the constructs being analysed is quite consistent.

Reliability Analysis

This section compares the internal consistency of the questionnaire constructs before performing correlation, regression, moderation and mediation analysis. To assess the questionnaire items' consistency in measuring the intended constructs, Cronbach's Alpha was used for the quantitative analysis of numerical survey data (Amirrudin et al., 2021). Reliability was interpreted as follows: < 0.60 = weak reliability; 0.60 to 0.69 = questionable reliability; 0.70 to 0.79 = acceptable reliability; 0.80 to 0.89 = good reliability; and 0.90 or higher = excellent reliability. The internal consistency of the circular economy principles ($\alpha = 0.77$), circular business practices ($\alpha = 0.77$), and managerial commitment ($\alpha = 0.78$) was acceptable. The reliability of the resource efficiency measure ($\alpha = 0.64$), the innovation performance measure ($\alpha = 0.61$), and the competitive advantage measure ($\alpha = 0.69$) was questionable but still acceptable. The relatively low Alpha values might be related to the small number of items in the subconstructs. In general, the results showed that the constructs were reliable enough for further empirical analysis and hypothesis testing.

Reliability Analysis of Questionnaire Constructs			
Construct	Number of items	Cronbach's Alpha	Interpretation
Circular economy principles	5	0.77	Acceptable reliability
Circular business practices	5	0.77	Acceptable reliability
Resource efficiency	3	0.64	Questionable reliability
Innovation performance	3	0.61	Questionable reliability
Competitive advantage	3	0.69	Questionable reliability
Managerial commitment	5	0.78	Acceptable reliability

Table 15: Reliability analysis of questionnaire constructs (Author, 2026)

Regression Assumption Testing

To increase the credibility of the empirical findings, basic regression assumptions were examined before conducting correlation, regression, moderation, and mediation analyses. Linearity was evaluated by line-fit plots for each regression model (H1–H5), and the relationship between the constructs analysed seemed to be linear enough to proceed with regression analysis. Normality

was assessed using histogram analysis of residuals; the distributions were approximately normal, with no significant deviations that would affect the statistical analysis. Homoscedasticity was checked using residual plots against the predicted values; the residuals were randomly distributed around zero with no funnel shape. Standardised residuals (z-scores) were used for outlier screening. A few values were slightly above the recommended ± 3 limit, but they were not deemed extreme enough to affect the regression results, especially given the relatively large number of respondents (384). The overall assumption-testing results showed that the regression models used were appropriate and statistically valid for the subsequent hypothesis testing and empirical testing of the research model.

Assumption	Method	Result
Linearity	Line-fit plots across H1–H5 regression models	Approximately linear relationships were observed between the analysed variables
Normality	Histogram analysis of residuals	Residuals were approximately normally distributed across the regression models
Homoscedasticity	Residual plots against predicted values	Residuals were randomly distributed without a strong funnel-shaped pattern
Outliers	Standardised residual (z-score) inspection	A small number of mild outliers slightly exceeded the ± 3 threshold, but no serious distortion affecting the regression analysis was identified

Table 16: Summary of Regression Assumption Testing Results (Author, 2026)

The Correlation Analysis

The correlation matrix shows positive relationships between all the constructs analysed in the research model. The correlation between circular economy principles and circular business practices is positive and strong ($r = 0.73$), meaning that the stronger the circular economy principles are perceived in organisations, the stronger the circular business practices are perceived. Circular business practices also demonstrate positive correlations with resource efficiency ($r = 0.74$), innovation performance ($r = 0.70$) and competitive advantage ($r = 0.64$), suggesting that the

respondents generally believe that circular business activities are associated with positive organisational outcomes. The relatively strong positive relationships between managerial commitment and resource efficiency ($r = 0.76$), innovation performance ($r = 0.73$), and competitive advantage ($r = 0.74$) may indicate that there is a positive link between managerial support, strategic priority and organisational commitment with the implementation of the circular economy and the related business outcomes. The highest correlation is between managerial commitment and resource efficiency, and the lowest correlation is between circular economy principles and competitive advantage ($r = 0.61$), but this correlation is still positive. The results overall suggest significant positive relationships between the constructs in the research model.

Correlation matrix of research model constructs						
Construct	Circular economy principles	Circular business practices	Resource Efficiency	Innovation Performance	Competitive Advantage	Managerial commitment
Circular economy principles	1	0.73	0.70	0.65	0.61	0.67
Circular business practices	0.73	1	0.74	0.70	0.64	0.69
Resource Efficiency	0.70	0.74	1	0.70	0.71	0.76
Innovation Performance	0.65	0.70	0.70	1	0.70	0.73
Competitive Advantage	0.61	0.64	0.71	0.70	1	0.74
Managerial commitment	0.67	0.69	0.76	0.73	0.74	1

Table 17: Correlation matrix of research model constructs (Author, 2026)

Regression Analysis and Hypothesis Testing

The statistical relationships will be examined in the research model by applying regression analysis. The analysis investigates the positive association between the analysed organisational outcomes and the circular economy principles and circular business practices. The regression models also evaluate the explanatory power and statistical significance of the relationships suggested in the hypotheses H1–H4 in the context of the empirical research.

Model summary of regression analysis		
R Square	Adjusted R Square	Significance F
0.526	0.525	p < 0.001

Table 18: Model summary of H1 regression analysis (Author, 2026)

Regression coefficients			
Predictor variable	Coefficient	P-value	Interpretation
Circular economy principles	0.704	p < 0.001	Significant Positive Relationship

Table 19: Regression coefficients for H1 (Author, 2026)

The first regression model was used to test the positive relationship between the principles of circular economy and circular business practices. The regression model was statistically significant with a significance F at $p < 0.001$. The R-square value of 0.526 means that circular economy principles are able to explain around 52.6% of the variation in the circular business practices, and the Adjusted R-square value of 0.525 means that the explanatory power of the model remains stable after adjustment. The regression coefficient for circular economy principles was positive and statistically significant ($\beta = 0.704$, $p < 0.001$), which means that the stronger the respondents' perception of circular economy principles, the stronger is also their perception of circular business practices in organisations. Thus, the empirical results support the hypothesis H1.

Model summary of regression analysis

R Square	Adjusted R Square	Significance F
0.544	0.543	p < 0.001

Table 20: Model summary of H2 regression analysis (Author, 2026)

Regression coefficients			
Predictor variable	Coefficient	P-value	Interpretation
Resource Efficiency	0.717	p < 0.001	Significant Positive Relationship

Table 21: Regression coefficients for H2 (Author, 2026)

The second regression model assessed the relationship between circular business practices and perceived resource efficiency. The results of the regression were statistically significant when Significance F was < 0.001. The R-square value of 0.544 means that the circular business practices account for about 54.4% of the variation in perceived resource efficiency, while the Adjusted R-square value is 0.543, which is consistent with the explanatory strength of the model after adjustments. There was a positive and statistically significant regression coefficient ($\beta = 0.717$, $p < 0.001$), indicating that the higher the perceived level of implementation of circular business practice, the higher the perceived level of resource efficiency within organisations. Thus, there was empirical support for H2 in the studied sample.

Model summary of regression analysis		
R Square	Adjusted R Square	Significance F
0.483	0.482	p < 0.001

Table 22: Model summary of H3 regression analysis (Author, 2026)

Regression coefficients			
Predictor variable	Coefficient	P-value	Interpretation
Innovation Performance	0.674	p < 0.001	Significant Positive Relationship

Table 23: Regression coefficients for H3 (Author, 2026)

The third regression model examined the positive relationship between circular business and innovation performance. The model was statistically significant (Significance F: $p < 0.001$). The R-squared value of 0.483 represents that the circular business practices account for about 48.3%

of the variance in perceived innovation performance, while the adjusted R-squared value of 0.482 shows that the model is relatively stable after calibration. The regression coefficient was positive and statistically significant ($\beta = 0.674$, $p < 0.001$), which means that respondents who rate circular business practices higher also rate the innovation-related organisational outcomes higher. The findings, therefore, indicate that there is a meaningful positive association between the variables studied and support H3.

Model summary of regression analysis		
R Square	Adjusted R Square	Significance F
0.405	0.403	$p < 0.001$

Table 24: Model summary of H4 regression analysis (Author, 2026)

Regression coefficients			
Predictor variable	Coefficient	P-value	Interpretation
Competitive Advantage	0.591	$p < 0.001$	Significant Positive Relationship

Table 25: Regression coefficients for H4 (Author, 2026)

The last regression analysis was focused on the relationship between circular business practices and competitive advantage. The regression model was a statistically significant model at the level of $p < 0.001$. The R-square value of 0.405 shows that about 40.5% of the variation in perceived competitive advantage is explained by circular business practices, and the adjusted R-square value of 0.403 shows that the model's explanatory capability is not significantly decreased after adjustment. The relationship between the two was positive and statistically significant ($\beta = 0.591$, $p < 0.001$), which indicates that if respondents believed that an organisation had stronger circular business practices, they also believed that the organisation had stronger competitive advantages. Thus, the empirical data indicate that H4 receives support in the sample of studies analysed.

Moderation Analysis

A moderation regression analysis was performed to test the moderation of managerial commitment on the relationship between circular economy principles and circular business practices. The overall model was statistically significant (Significance F at $p < 0.001$). The R-square value of 0.602 means that the model can explain the variation in the use of circular business practices approximately 60.2%, and the Adjusted R-square value of 0.599 confirms that the model has been

developed with a stable explanatory ability after adjustment. The relationship between circular economy principles and circular business practices was found to be statistically significant and positive, $\beta = 0.460$, $p < 0.001$. Managerial commitment was also statistically significant ($\beta = 0.373$, $p < 0.001$), indicating that the respondents consider that management support and strategic commitment are important enabling organisational factors for implementing circular business. But managerial commitment, interacting with the principles of the circular economy, was not statistically significant ($\beta = -0.001$, $p = 0.974$). Hence, managerial commitment was not statistically significant in this study, and H5 was not supported in the analysed sample.

R Square	Adjusted R-Square	Significance F
0.602	0.599	$p < 0.001$

Table 26: Model summary of moderation regression analysis (Author, 2026)

Predictor variable	Coefficient	P-value	Interpretation
Circular economy principles	0.46	$p < 0.001$	Significant
Managerial commitment	0.373	$p < 0.001$	Significant

Table 27: Moderation regression coefficients (Author, 2026)

Mediation analysis

The Sobel test was used for mediation analysis to explore if the organisational outcomes analysed were mediated by the circular business practices based on the circular economy principles. Results show mediation effects statistically across all three dimensions of the outcomes. The results of the Sobel test indicate that circular business practices can be seen as an important intermediate between circular economy principles and perceived organisational benefits in the fields of resource efficiency ($z = 9.380$, $p < 0.001$), innovation performance ($z = 8.341$, $p < 0.001$), and competitive advantage ($z = 7.115$, $p < 0.001$). The mediation effect was greatest for resource efficiency, indicating that circular practices have a specific impact on operational and resource outcomes. But the circular economy was a significant factor even after controlling for circular business practices, suggesting partial rather than full mediation. This implies that circular economy principles will

also have direct relationships with organisational outcomes, apart from circular business practices. Overall, the results suggest that the principles of the circular economy can be linked to resource efficiency, innovation performance and competitive advantage in part of the analysed research sample based on circular business practices.

Outcome	Sobel z	p-value	Result
Resource efficiency	9.379502	p < 0.001	Partial Mediation
Innovation Performance	8.341067	p < 0.001	Partial Mediation
Competitive Advantage	7.114944	p < 0.001	Partial Mediation

Table 28: Summary of Sobel Mediation Analysis Results (Author, 2026)

3.3 Evaluation of Research Results

This section analyses and discusses the empirical results in Section 3.2. The results obtained from the analysis are compared with the theoretical and analytical discussion of chapters 1 and 2. In addition, the section includes the implications of the revised empirical model and an assessment of the overall significance of the research's findings.

Summary of Main Empirical Findings

The empirical results show that circular economy principles are positively related to the analysed organisational outcomes, as are the circular business practices and the managerial commitment. The most obvious connections were found between circular business practices and resource efficiency, innovation performance and competitive advantage. The results of the mediation analysis also indicated that adoption of circular practices partially mediates the link between the principles of the circular economy and perceived business effects. Managerial commitment was not found to be a statistically significant moderator, but was still found to be an important enabler of organisational factors that directly correlated with circular business practices. Results for the overall are indicative of empirical support for the research model proposed within the sample analysed.

Hypothesis	Statistical Test	Result	Decision
H1	Correlation and regression	Significant positive relationship	Supported
H2	Correlation, regression, mediation	Significant positive relationship	Supported
H3	Correlation, regression, mediation	Significant positive relationship	Supported
H4	Correlation, regression, mediation	Significant positive relationship	Supported
H5	Moderation regression	Interaction effect not significant	Not supported

Table 29: Summary of empirical hypothesis testing results (Author, 2026)

Evaluation of Hypotheses

The overall empirical results showed that the proposed research model is comparatively validated with the analysis sample. H1 was supported, indicating that higher perceptions of circular economy principles were associated with greater implementation of circular business practices. This, in sum, supports the ideas of Kirchherr et al. (2017) and Geissdoerfer et al. (2020) who argued that the implementation of the circular principles becomes meaningful in the organisation when it is translated into operational and strategic business activities. The results can thus be read as a sign of growing correlation between conceptualising a circularity and embedding it in business practice.

H2, H3 and H4 were additionally separately supported, indicating that there is a positive relationship between circular business practices and the analysed organisational outcomes. From this perspective, the empirical model suggests that respondents not only see circular practices as sustainability-related practices but also as mechanisms that are potentially also associated with organisations' resilience, innovation capability, and long-term competitiveness. This is similar to Bocken et al. (2019), who suggested that the circular implementation of business can help to create value and innovation opportunities, and Geissdoerfer et al. (2020), who associated circular transformation with other sustainability outcomes in the organisation. Moreover, the mediation

results indicate that the organisational outcomes analysed are partially mediated by circular business practices, which supports the conclusion that circular economy principles are related to those outcomes through the mediating role of circular business practices.

Managerial commitment was not found to be a statistically significant moderator between the principles of circular economy and the practices of circular economy and was therefore not included in the analyses of H5. However, the results indicate that managerial commitment is also an important enabling organisational factor, similar to Berry et al. (2022), who identified managerial support and strategic coordination as key enabling factors in circular transformation processes.

Empirical finding	Literature support	Interpretation
Circular economy principles were positively associated with circular business practices	Kirchherr et al. (2017); Geissdoerfer et al. (2020)	Circular principles may support organisational implementation when translated into operational activities
Circular business practices were positively associated with organisational outcomes	Bocken et al. (2019); Geissdoerfer et al. (2020)	Circular implementation may contribute to innovation, efficiency, and long-term organisational value
Operational circular activities were perceived more strongly than strategic integration	Ghisellini et al. (2016); Kirchherr et al. (2018)	Organisations may find operational circular practices easier to implement than long-term strategic transformation
Managerial commitment was significant directly but not as a moderator	Berry et al. (2022)	Management support may function more as an enabling organisational condition than as an interaction effect

Table 30: Comparison between empirical findings and theoretical literature (Author, 2026)

Overall, the relationship between theory and empirical evidence seems to be consistent, as evidenced by the comparison of the findings with the discussions in Chapters 1 and 2. Overall, the results support the theoretical approach that the implementation of the circular economy is not only related to environmental activities, but also to other organisational and strategic outcomes. Concurrently, the higher level of perception of operational practices than strategic integration

suggests that organisations are still in a relatively transitional phase of circular transformation. Moreover, the empirical results further the analytical discussion in that they indicate that managerial commitment can be more directly viewed as an organisational enabling factor instead of as a statistically significant moderator in the proposed empirical model.

Revised Empirical Model

The revised empirical model is based on the final results of the empirical research. Managerial commitment was not found to be a statistically significant moderator between the circular economy principles and circular business practices, which is why the moderation relationship proposed in H5 was not included. Conversely, managerial commitment is shifted to become a direct enabling organisational factor for the implementation of circular business. The updated model thus suggests that the principles of circular economy are positively correlated with the implementation of circular business practices, which are in turn positively correlated with resource efficiency, innovation performance and competitive advantage in organisations.

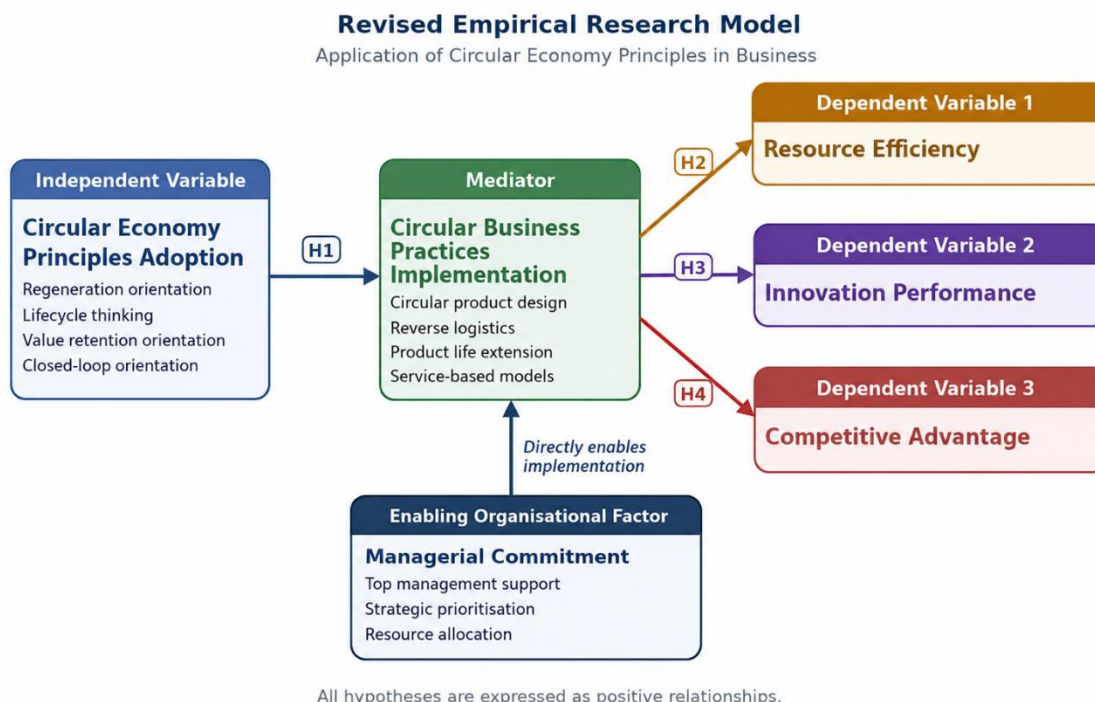


Figure 4: Revised Empirical Research Model (Author,2026)

Academic and Practical Implications

The results add to the academic knowledge in the field as they help build the knowledge base of the translation of principles of the circular economy to practical activities of organisations and wider business results. The study also backs up the claim that the implementation of a circular economy should be assessed and measured beyond the environmental dimension, but also with regard to strategic and operational aspects. The separate analysis of the resource efficiency, the innovation performance and the competitive advantage further helps in structuring the understanding of circular business outcomes.

The results may have practical implications, as they indicate that, in practice, it could be beneficial to incorporate circularity elements into other business processes, besides limited sustainability projects. The findings also show that managerial commitment, organisational readiness and internal coordination are still important enabling factors for successful circular transformation. Moreover, the results could be applicable to the behaviours of international business organisations tasked with greater sustainability demands, innovation pressures, and long-term competitiveness challenges in international markets.

Research Limitations

There are some limitations in interpreting the findings of this study. First, convenience sampling was employed in the study, which limits the representativeness of the sample analysed. Second, the empirical analysis was based on the perception of the respondents to the questionnaires, which means that the results come from perceptions rather than from the actual performance of the organisations. Thirdly, the study used a cross-sectional research design, which only took a snapshot of perceptions at one moment. Thus, the relationships that were found in the empirical model should not be understood as causal relationships. Further, the results might not necessarily be representative of other industries, countries or organisational settings, as the sample used in the analysis may not be representative of the business populations in these settings.

Future Research Recommendations

For future research, probability sampling techniques should be used to increase the representativeness and generalisability of the research findings. Longitudinal research designs can also provide greater insight into the trajectory of implementing the circular economy. The study could also be extended to compare the implementation of the circular economy across countries

and sectors to identify differences in context. More detailed information on implementation barriers and strategic opportunities may be available in industry-specific studies. Furthermore, future empirical research ought to include objective organisational performance indicators along with perception-based measures, so as to enhance the reliability and applicability of the analysis.

This chapter has given an empirical review of the use of the principles of circular economy in business organisations. The results showed a positive perception of the principles of the circular economy, circular business approach, commitment of the managers, and organisational outcomes associated with resource efficiency, performance in innovation, and competitive advantage. The proposed research model was tested for reliability, correlation, regression, moderation, mediation, and regression assumption tests. The findings indicated that circular business practices are partly used to explain the linkage between the principles of the circular economy and organisational performance. Even though managerial commitment was not found as a notable moderator, it was still an enabling organisational factor in the updated empirical model.

Conclusions and Recommendations

Conclusions

1. Having investigated the theoretical aspects of applying circular economy principles in business, it can be concluded that the circular economy should be understood not only as a waste-reduction or recycling approach, but as a systemic business transformation model. The theoretical analysis showed that circular economy principles are based on regeneration, closed resource loops, value retention, lifecycle thinking, waste prevention, reuse, repair, remanufacturing and recycling. In the business context, these principles require changes in product design, production processes, resource management, value creation logic and business models. Therefore, the application of circular economy principles in business is most effective when circularity is integrated into strategic and operational decision-making rather than implemented as isolated environmental initiatives.

2. Having analysed the empirical level of research on the application of circular economy principles in business, it can be concluded that circular economy implementation is associated with positive business outcomes, but these outcomes depend on organisational readiness and strategic integration. The analysis of previous empirical studies, institutional reports and statistical data showed that circular economy practices may contribute to resource efficiency, cost reduction, innovation performance, stakeholder trust and long-term competitiveness. However, the reviewed evidence also revealed that the implementation of circular economy principles is limited by financial constraints, organisational resistance, insufficient managerial support, weak incentives, regulatory uncertainty and limited knowledge, especially among small and medium-sized enterprises. Thus, the empirical literature confirms that circular economy application in business is not automatic; it requires internal capabilities, managerial commitment, innovation capacity and collaboration across the value chain.

3. After evaluating theoretical and empirical research findings, a theoretical model for applying circular economy principles in business was constructed, showing that circular economy principles influence business outcomes through circular business practices. The developed model links circular economy principles, circular business practices and perceived business outcomes into one coherent framework. In this model, circular economy principles act as the starting point of circular transformation, circular business practices function as the mechanism

through which these principles are operationalised, and business outcomes are reflected in resource efficiency, innovation performance and competitive advantage. Managerial commitment was included as an important organisational factor because leadership support, resource allocation and strategic orientation may strengthen the implementation of circular economy principles in business practice.

4. Having empirically tested the developed research model, it can be concluded that the model was generally supported by the research results, although the moderating role of managerial commitment was not statistically confirmed. The empirical research showed that the adoption of circular economy principles is positively associated with the implementation of circular business practices. Circular business practices were also positively associated with perceived resource efficiency, innovation performance and competitive advantage. The mediation analysis indicated that circular business practices partially mediate the relationship between circular economy principles and perceived business outcomes. However, managerial commitment did not statistically significantly moderate the relationship between circular economy principles and circular business practices, although it remains an important enabling factor for circular transformation. Therefore, businesses are recommended to integrate circular economy principles into strategy, strengthen circular product design, reverse logistics, product life extension and recovery systems, allocate sufficient managerial and financial resources, and monitor circular economy outcomes through clear performance indicators.

Recommendations

1. Circularity should be adopted into the long-term strategic decision-making of businesses as opposed to a circularity initiative taken as an isolated sustainability initiative. Circular product and process design should also receive more organisational focus since it is the design-oriented circular transformation that respondents viewed as somewhat weaker than operational recovery-based and service-based practices. It is also recommended that organisations should reinforce reverse logistics systems, product life extension activities and service-based business models as they were positively correlated with the analysed organisational results.
2. Effective resource allocation, monitoring of implementation, and increased participation of employees in circular initiatives should also be used to strengthen managerial

commitment. Because managerial support was found as a critical enabling organisational factor, six companies can gain advantages by introducing circularity to organisational culture and long-term strategic planning processes.

3. Moreover, organisations must conduct a regular review of the results of the implementation of the circular economy, especially regarding the efficiency of resources, the performance of innovations, the competitive advantage, and the resilience of businesses in the long term. Continuous assessment could assist organisations to be more in line with circular initiatives and operational enhancement, innovation prospects, and larger business aims.

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Summary

Šio darbo pagrindinis dėmesys buvo skiriamas žiedinės ekonomikos principų ir žiedinės verslo praktikos taikymui verslo organizacijose ir jų ryšiui su organizacijos rezultatais. Tyrime daugiausia dėmesio skirta išteklių naudojimo efektyvumui, inovacijų našumui, konkurenciniam pranašumui ir vadovų įsipareigojimui remti žiedinės ekonomikos įgyvendinimą. Duomenys buvo renkami naudojant anketas, o kiekybinis tyrimo metodas buvo naudojamas su 384 respondentais iš įvairių organizacijų ir pramonės šakų.

Rezultatai parodė, kad bendras respondentų požiūris į žiedinės ekonomikos principus ir žiedinės verslo praktiką buvo teigiamas. Organizacijos rezultatai, kurie buvo teigiamai susiję su žiedine verslo praktika, taip pat buvo susiję su efektyvumu, inovacijomis ir konkurencingumu. Empirinė analizė taip pat atskleidė, kad ryšį tarp žiedinės ekonomikos principų ir organizacijos rezultatų iš dalies lemia žiedinė verslo praktika. Vadovų įsipareigojimas nebuvo statistiškai reikšmingas kaip moderatorius, tačiau tai buvo svarbus organizacinis veiksnys, palengvinantis įgyvendinimo procesus.

Apskritai tyrimas rodo, kad žiedinės ekonomikos įgyvendinimas gali būti sėkmingas, jei žiedinės ekonomikos principai yra gerai integruoti į operacinę ir strateginę verslo veiklą. Tyrimas taip pat prisideda prie žiedinės transformacijos supratimo, integruojant tvarumo, inovacijų ir organizacines perspektyvas į empirinį tyrimo modelį.

Appendices

Appendix 1. Questionnaire

QUESTIONNAIRE

Application of Circular Economy Principles in Business

Dear	Respondent,
This questionnaire is designed for academic research conducted within a master's thesis. Its purpose is to examine how circular economy principles are applied in business organisations. All responses will be treated confidentially and analysed only in aggregated form. Please answer the statements based on your organisation's current practices and performance. There are no right or wrong answers; only your professional judgement is important. Estimated completion time: 7–10 minutes.	

Response scale

1	2	3	4	5
Strongly disagree	Disagree	Neither agree nor disagree	Agree	Strongly agree

Section 1. Respondent and Organisation Profile

Respondent's position	• Top management • Middle management • Sustainability or operations specialist • Other
Firm size	• Micro (1–9 employees) • Small (10–49 employees) • Medium-sized (50–249 employees) • Large (250 or more employees)
Industry	• Manufacturing • Retail • Services • Construction • Logistics

	Other you can change industries, but leave in such way not in an open question
Firm age	- Less than 5 years 5–10 years 11–20 years - More than 20 years
Market scope	- Local - National - International

Section 2. Circular Economy Principles

Statement	1	2	3	4	5
Our organisation integrates circular economy principles into strategic decision-making.	☐	☐	☐	☐	☐
Our organisation considers product or process impacts across the full life cycle when making decisions.	☐	☐	☐	☐	☐
Our organisation seeks to minimise waste and pollution through preventive measures rather than only end-of-pipe solutions.	☐	☐	☐	☐	☐
Our organisation aims to keep products, components, and materials in use for as long as possible.	☐	☐	☐	☐	☐
Our organisation seeks to reduce dependence on virgin materials through reuse, recovery, or recycling.	☐	☐	☐	☐	☐

Section 3. Circular Business Practices

Statement	1	2	3	4	5
Our organisation designs products or operational processes in ways that facilitate durability, repair, reuse, refurbishment, or recycling.	☐	☐	☐	☐	☐
Our organisation has systems for collecting, returning, or recovering used products or materials.	☐	☐	☐	☐	☐
Our organisation extends product life through maintenance, repair, reuse, refurbishment, or remanufacturing.	☐	☐	☐	☐	☐
Our organisation recovers value from by-products, waste streams, or secondary materials.	☐	☐	☐	☐	☐

Statement	1	2	3	4	5
Our organisation applies service-based or performance-based models that create value beyond one-time product sales.	☐	☐	☐	☐	☐

Section 4. Business Outcomes

Please evaluate the extent to which circular business practices have contributed to the following outcomes in your organisation.

Resource Efficiency

Statement	1	2	3	4	5
Circular business practices have reduced material waste in our organisation.	☐	☐	☐	☐	☐
Circular business practices have improved the efficiency of resource use in our organisation.	☐	☐	☐	☐	☐
Circular business practices have reduced costs associated with materials, waste, or resource consumption.	☐	☐	☐	☐	☐

Innovation Performance

Statement	1	2	3	4	5
Circular business practices have stimulated the development of new products, services, or processes.	☐	☐	☐	☐	☐
Circular business practices have strengthened our organisation's ability to innovate.	☐	☐	☐	☐	☐
Circular business practices have created new business opportunities or market possibilities for our organisation.	☐	☐	☐	☐	☐

Competitive Advantage

Statement	1	2	3	4	5
Circular business practices have strengthened our organisation's position relative to competitors.	☐	☐	☐	☐	☐
Circular business practices have improved our organisation's reputation among customers, partners, or other stakeholders.	☐	☐	☐	☐	☐
Circular business practices have contributed to long-term business value and organisational resilience.	☐	☐	☐	☐	☐

Section 5. Managerial Commitment

Statement	1	2	3	4	5
Top management clearly supports circular economy initiatives in our organisation.	☐	☐	☐	☐	☐
Management allocates sufficient time, budget, and other resources to circular economy initiatives.	☐	☐	☐	☐	☐
Management actively encourages employees to adopt circular practices in their daily work.	☐	☐	☐	☐	☐
Management monitors the progress of circular economy implementation in the organisation.	☐	☐	☐	☐	☐
Management treats circular economy implementation as a long-term strategic priority.	☐	☐	☐	☐	☐

Thank you for your time and valuable contribution to this research.

Appendix 2. Descriptive Statistics Outputs

Respondent's Position Response

Respondent's Position Types	Count of Respondent's position	Count of Respondent's position2
Middle management	176	45.83%
Sustainability or operations specialist	129	33.59%
Top management	65	16.93%
Consultant	2	0.52%
Sales personnel	1	0.26%
Visual management	1	0.26%
Analyst	1	0.26%
Engineer	1	0.26%
Commercial Associate	1	0.26%
Student	1	0.26%
Entrepreneur	1	0.26%
Underwriter / Insurance Analyst	1	0.26%
IT operations	1	0.26%
Working Student Business analysis	1	0.26%
Research in physics (pH. D)	1	0.26%
Office worker	1	0.26%
Grand Total	384	100.00%

Firm Size Response

Firm size Types	Count of Firm size	Count of Firm size2
Medium-sized (50–249 employees)	150	39.06%
Large (250 or more employees)	100	26.04%
Small (10–49 employees)	93	24.22%
Micro (1–9 employees)	41	10.68%
Grand Total	384	100.00%

Industry Response

Industry Types	Count of Industry	Count of Industry2
Services	138	35.94%
Construction	111	28.91%
Logistics	69	17.97%
Retail	27	7.03%
Manufacturing	20	5.21%
Other	19	4.95%
Grand Total	384	100.00%

Firm Age Response

Firm Age Types	Count of Firm age	Count of Firm age2
11–20 years	159	41.41%
More than 20 years	87	22.66%
5–10 years	85	22.14%
Less than 5 years	53	13.80%
Grand Total	384	100.00%

Market Scope Response

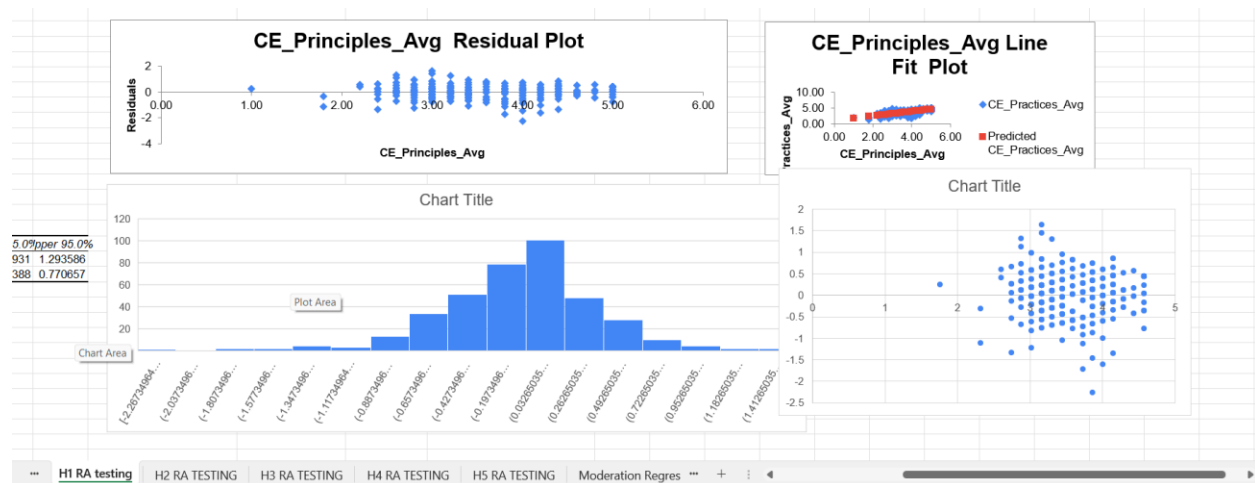
Types	Count of Market scope	Count of Market scope2
National	202	52.60%
International	117	30.47%
Local	65	16.93%
Grand Total	384	100.00%

Appendix 3. Reliability Analysis Outputs

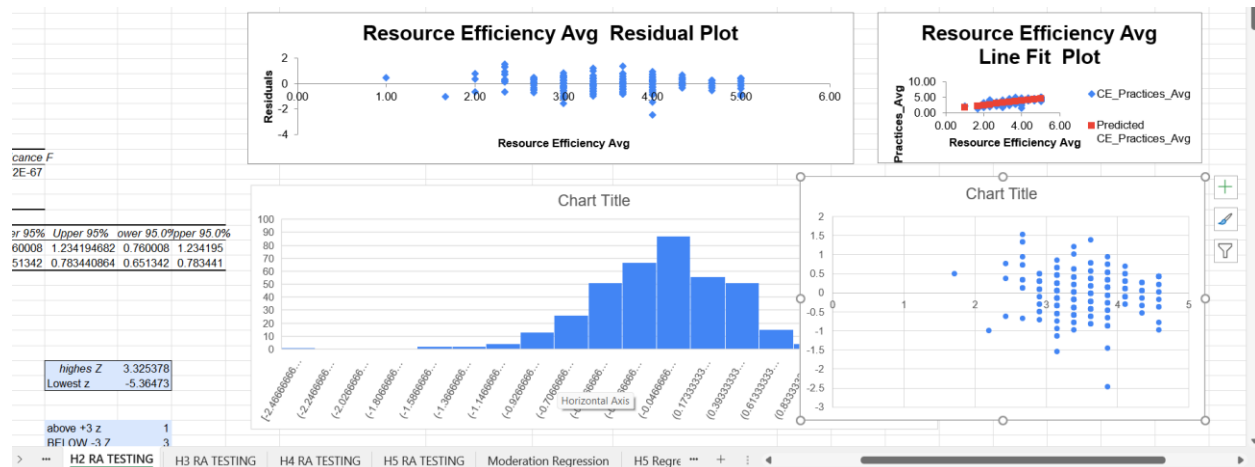
CE Principles Item Variances	CE Practices Item Variances	Business Outcomes _Total	Managerial Commitment _Total	Resource efficiency _total	Innovation performance _Total	Competitive advantage _Total
1.05	0.97	0.85	0.87	0.85	0.81	0.80
0.87	0.80	0.82	0.83	0.82	1.03	0.95
1.03	0.98	0.85	0.97	0.85	0.80	0.87
0.94	0.95	0.81	0.91			
0.86	0.79	1.03	0.78	2.52	2.64	2.62
		0.80		4.41	4.45	4.83
4.74	4.49	0.80	4.35	0.64	0.61	0.69
12.33	11.60	0.95	11.60			
0.77	0.77	0.83	0.78			
		7.75				
		32.90				
		0.86				

Appendix 4. Regression Assumption Testing Outputs

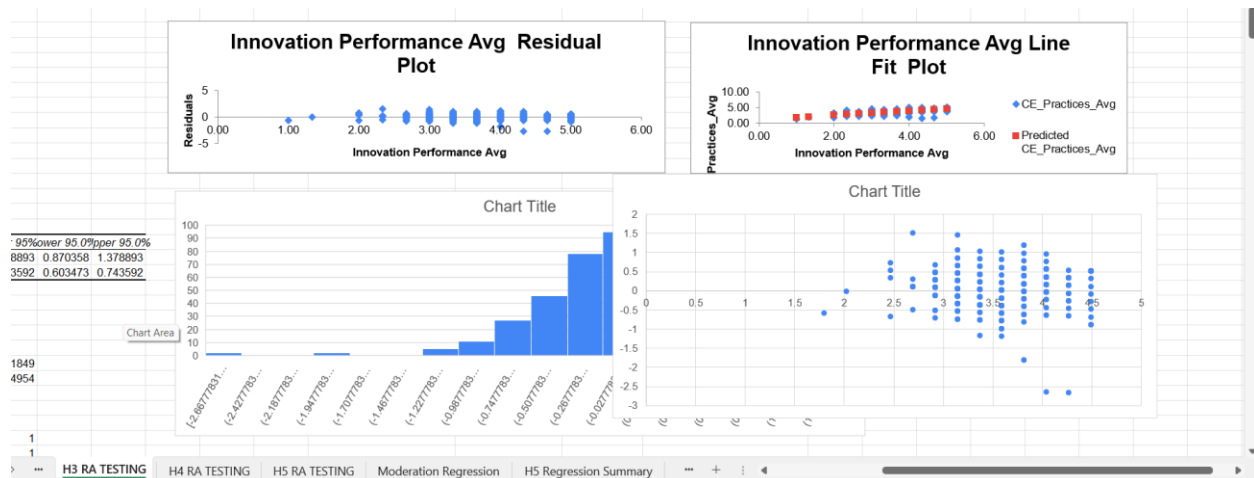
H1 RA Testing



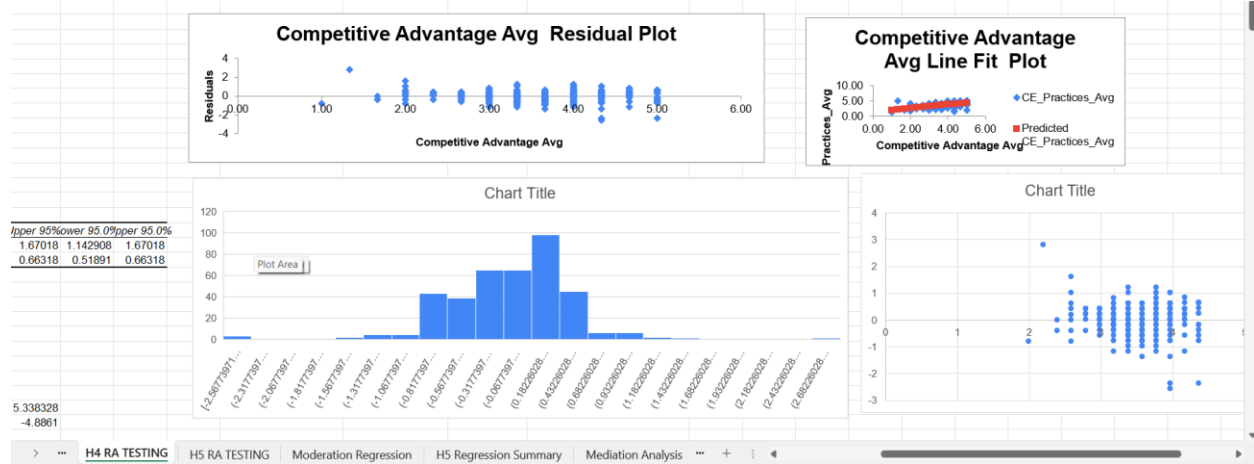
H2 RA Testing



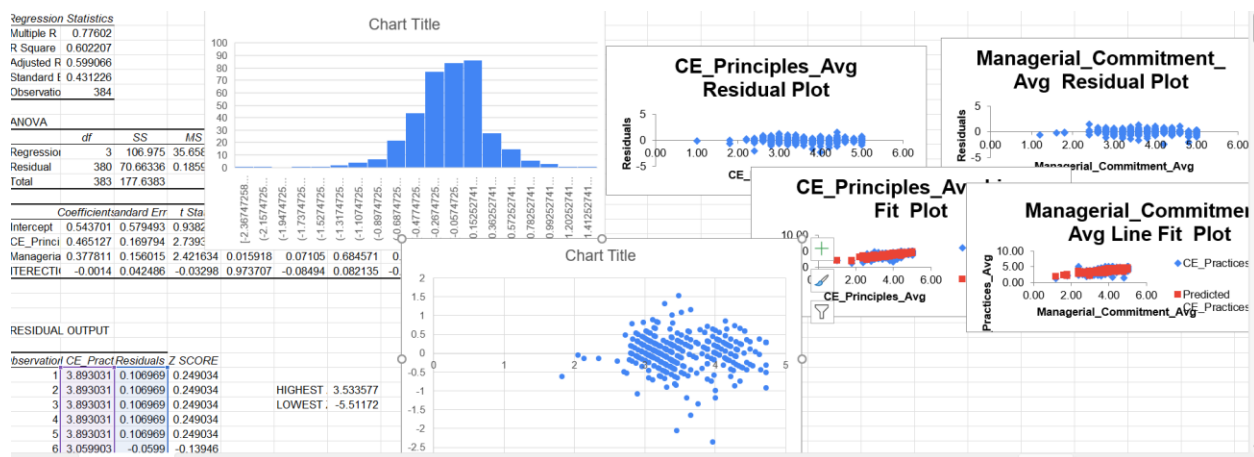
H3 RA Testing



H4 RA Testing



H5 RA Testing



Appendix 5. Regression and Coefficient Outputs

H1 SUMMARY OUTPUT

<i>Regression Statistics</i>	
Multiple R	0.725516
R Square	0.526373
Adjusted R Square	0.525133
Standard Error	0.469305
Observations	384

ANOVA					
	<i>df</i>	<i>SS</i>	<i>MS</i>	<i>F</i>	<i>Significance F</i>
Regression	1	93.50403	93.50403	424.5419	5.71903E-64
Residual	382	84.13431	0.220247		
Total	383	177.6383			

	<i>Coefficients</i>	<i>Standard Error</i>	<i>t Stat</i>	<i>P-value</i>	<i>Lower 95%</i>	<i>Upper 95%</i>	<i>Lower 95.0%</i>	<i>Upper 95.0%</i>
Intercept	1.053259	0.12223	8.617038	1.84E-16	0.81293145	1.293586	0.812931	1.293586
CE_Principles_Avg	0.703523	0.034144	20.60441	5.72E-64	0.636388446	0.770657	0.636388	0.770657

H2 SUMMARY OUTPUT

<i>Regression Statistics</i>	
Multiple R	0.73769
R Square	0.544187
Adjusted R Square	0.542994
Standard Error	0.460394
Observations	384

ANOVA					
	<i>df</i>	<i>SS</i>	<i>MS</i>	<i>F</i>	<i>Significance F</i>
Regression	1	96.66848	96.66848	456.063	3.72E-67
Residual	382	80.96986	0.211963		
Total	383	177.6383			

	<i>Coefficients</i>	<i>Standard Error</i>	<i>t Stat</i>	<i>P-value</i>	<i>Lower 95%</i>	<i>Upper 95%</i>	<i>Lower 95.0%</i>	<i>Upper 95.0%</i>
Intercept	0.997101	0.120585	8.268875	2.27E-15	0.760008	1.234194682	0.760008	1.234194
Resource				3.72E-67				
Efficiency Avg	0.717391	0.033593	21.35563	67	0.651342	0.783440864	0.651342	0.783440

H3 SUMMARY OUTPUT

<i>Regression Statistics</i>	
Multiple R	0.695195
R Square	0.483297
Adjusted R Square	0.481944
Standard Error	0.490182
Observations	384

<i>ANOVA</i>					
	<i>df</i>	<i>SS</i>	<i>MS</i>	<i>F</i>	<i>Significance F</i>
Regression	1	85.85203	85.85203	357.3025	9.9171E-57
Residual	382	91.7863	0.240278		
Total	383	177.6383			

	<i>Coefficients</i>	<i>Standard Error</i>	<i>t Stat</i>	<i>P-value</i>	<i>Lower 95%</i>	<i>Upper 95%</i>	<i>Lower 95.0%</i>	<i>Upper 95.0%</i>
Intercept	1.124626	0.12932	8.696482	1.03E-16	0.870358454	1.378893	0.870358	1.378893
Innovation Performance Avg	0.673533	0.035632	18.90245	9.92E-57	0.603473189	0.743592	0.603473	0.743592

H4 SUMMARY OUTPUT

<i>Regression Statistics</i>	
Multiple R	0.636048
R Square	0.404558
Adjusted R Square	0.402999
Standard Error	0.526207
Observations	384

<i>ANOVA</i>					
	<i>df</i>	<i>SS</i>	<i>MS</i>	<i>F</i>	<i>Significance F</i>
Regression	1	71.86493	71.86493	259.5398	6.30785E-45
Residual	382	105.7734	0.276894		
Total	383	177.6383			

	<i>Coefficients</i>	<i>Standard Error</i>	<i>t Stat</i>	<i>P-value</i>	<i>Lower 95%</i>	<i>Upper 95%</i>	<i>Lower 95.0%</i>	<i>Upper 95.0%</i>
Intercept	1.406544	0.134085	10.48998	8.59E-23	1.142907812	1.67018	1.142908	1.67018
Competitive Advantage Avg	0.591045	0.036688	16.11024	6.31E-45	0.518910334	0.66318	0.51891	0.66318

Appendix 6. Moderation Regression Outputs

MODERATION SUMMARY OUTPUT								
Regression Statistics								
Multiple R	0.7760							
	2							
R Square	0.6022							
	07							
Adjusted R Square	0.5990							
	66							
Standard Error	0.4312							
	26							
Observations	384							
ANOVA								
	<i>df</i>	<i>SS</i>	<i>MS</i>	<i>F</i>	<i>Significance F</i>			
Regression	3	106.975	35.65832	191.7565	1.04E-75			
Residual	380	70.66336	0.185956					
Total	383	177.6383						
	<i>Coefficients</i>	<i>Standard Error</i>	<i>t Stat</i>	<i>P-value</i>	<i>Lower 95%</i>	<i>Upper 95%</i>	<i>Lower 95.0%</i>	<i>Upper 95.0%</i>
Intercept	3.523367	0.025905	136.0118	0	3.472433	3.574302	3.472433	3.574302

CE_Principles_Centered	0.4600 65	0.043 87	10.48 708	9.07E -23	0.3738 08	0.546 323	0.373 808	0.546 323
Managerial_Commitment_Centered	0.3728 92	0.043 814	8.510 853	4.05E -16	0.2867 44	0.459 039	0.286 744	0.459 039
Interaction_Term	- 0.0014	0.042 486	- 0.032 98	0.973 707	- 0.0849 4	0.082 135	- 0.084 94	0.082 135

Appendix 7. Sobel Test Results Outputs

Outcome	a	SEa	b	SEb	Sobel z	p-value
Resource efficiency	0.704	0.034	0.505	0.048	9.379502	0
Innovation Performance	0.704	0.034	0.483	0.053	8.341067	0
Competitive Advantage	0.704	0.034	0.447	0.059	7.114944	1.12E-12