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The Role of Digital Innovation in Advancing the Circular Economy: Evidence from Plastic Manufacturing Enterprises in Hebron City, Palestine

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This thesis is submitted in fulfillment of the master's degree in administrative sciences at the College of Graduate Studies at Palestine Polytechnic University – Palestine.

Palestine, Hebron

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DEDICATION

To my beloved parents, whose endless love, support, and encouragement have been the foundation of my success. I dedicate this achievement to them and hope always to make them proud.

To my dear husband, whose patience, understanding, and unwavering support accompanied me throughout this academic journey and helped me overcome its challenges.

To my beloved children, who have been my greatest source of inspiration. I hope this achievement serves as an example that perseverance and hard work lead to success.

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The Role of Digital Innovation in Advancing the Circular Economy: Evidence from Plastic Manufacturing Enterprises in Hebron City, Palestine

الملخص

شهدت السنوات الأخيرة اهتمامًا متزايدًا بالابتكار الرقمي والاقتصاد الدائري باعتبارهما من أبرز التوجهات الحديثة الداعمة للاستدامة وتعزيز كفاءة استخدام الموارد في المؤسسات الصناعية. وتُعد التقنيات الرقمية المتقدمة، مثل الذكاء الاصطناعي وإنترنت الأشياء وتحليلات البيانات الضخمة والحوسبة السحابية، من الممكنات الرئيسة التي تسهم في تطوير العمليات الصناعية وتحسين الأداء البيئي والتشغيلي. وفي المقابل، يركز الاقتصاد الدائري على تعظيم الاستفادة من الموارد والحد من النفايات وإطالة دورة حياة المنتجات بما يحقق التنمية المستدامة. وعلى الرغم من تزايد الاهتمام العالمي بالعلاقة بين الابتكار الرقمي والاقتصاد الدائري، إلا أن الدراسات التطبيقية التي تناولت هذه العلاقة في البيئة الفلسطينية، وخصوصًا في قطاع الصناعات البلاستيكية، ما تزال محدودة.

سعت هذه الدراسة إلى استقصاء أثر الابتكار الرقمي في تعزيز الاقتصاد الدائري في مصانع البلاستيك بمدينة الخليل، مع فحص دور الجاهزية التنظيمية كمتغير وسيط، والدعم الحكومي كمتغير معدل في هذه العلاقة. واعتمدت الدراسة المنهج الكمي، حيث جُمعت البيانات من خلال استبانة مُهيكلة وُزعت على عينة مكونة من (63) مصنعًا من مصانع البلاستيك في مدينة الخليل. ولتحليل البيانات واختبار فرضيات الدراسة، تم استخدام أسلوب نمذجة المعادلات الهيكلية(Structural Equation Modeling - SEM)
لتحليل العلاقات بين متغيرات الدراسة واختبار النموذج المقترح.

أظهرت نتائج الدراسة أن الابتكار الرقمي يسهم في تعزيز الاقتصاد الدائري بصورة غير مباشرة من خلال الجاهزية التنظيمية، مما يدل على أن توفر البنية التحتية الرقمية والموارد التنظيمية والقدرات البشرية الداعمة للتحول الرقمي يمثل عاملًا حاسمًا في تحويل مبادرات الابتكار الرقمي إلى ممارسات فعلية تدعم الاقتصاد الدائري. كما بينت النتائج عدم وجود تأثير معدل ذي دلالة إحصائية للدعم الحكومي على العلاقة بين الابتكار الرقمي والاقتصاد الدائري.

وفي ضوء هذه النتائج، توصي الدراسة بضرورة تعزيز جاهزية المؤسسات الصناعية للتحول الرقمي من خلال تطوير البنية التحتية التكنولوجية، وتنمية المهارات الرقمية للعاملين، وتوفير الموارد التنظيمية اللازمة لتبني التقنيات الحديثة، بما يسهم في تعزيز تطبيق ممارسات الاقتصاد الدائري وتحقيق التنمية الصناعية المستدامة.

الكلمات المفتاحية: الابتكار الرقمي، الاقتصاد الدائري، الجاهزية التنظيمية، الدعم الحكومي، نمذجة المعادلات الهيكلية، مصانع البلاستيك، مدينة الخليل.

Abstract

In recent years, Digital Innovation and Circular Economy have received growing interest as important solutions towards sustainability and resource efficiency in industrial companies. The use of advanced digital technologies such as Artificial Intelligence (AI), Internet of Things (IoT), Big Data Analytics, and Cloud Computing has become a key enabler to improve operational performance and environmental sustainability. The Circular Economy aims to maximize resource use, minimize waste, and prolong product lifespans as a means of sustainable development. Despite significant global interest in the relationship between Digital Innovation and the Circular Economy, there is a lack of empirical evidence in the Palestinian context, particularly in the plastic manufacturing sector.

This study set out to examine the effect of Digital Innovation on the Circular Economy of plastic manufacturing companies in Hebron City—the effects of Organizational Readiness as a mediator and Government Support as a moderator were also explored. A quantitative research method was used, and data were gathered through a structured questionnaire administered to a sample of 63 plastic manufacturing enterprises in Hebron City. Structural Equation Modeling (SEM) was used in this study to test the hypotheses and analyze the relationships among the variables.

The results indicated that Digital Innovation plays an indirect role in the development of the Circular Economy via Organizational Readiness, underscoring the role of organizational readiness, technological infrastructure, and human resources in driving digital innovation initiatives to effective circular economy practices. The results also showed that the relationship between Digital Innovation and the

Circular Economy was not statistically significant when moderated by Government Support.

The study suggests that organizational readiness for digital transformation can be increased by establishing technological infrastructure, training employees in digital skills, and equipping them with the organizational resources needed to implement advanced digital technologies. These efforts can help to implement Circular Economy Practices effectively and contribute to sustainable industrial development.

Keywords: Digital Innovation, Circular Economy, Organizational Readiness, Government Support, Structural Equation Modeling (SEM), and Plastic Manufacturing Enterprises, Hebron City.

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1 Chapter One: Introduction

1.1 Introduction

The modern industrial context is undergoing significant, dynamic changes due to technological advances, environmental pressures, and the growing demand for sustainable production systems. Digital technologies have transformed the way organizations create value, compete, and operate over the past 20 years. Artificial Intelligence (AI), the Internet of Things (IoT), Big Data Analytics, Cloud Computing, Blockchain, and digital platforms are all technologies that have become key to enhancing operational efficiency, decision-making, and the creation of new business models. In this context, digital innovation has become a strategic capability for organizations, enabling them to rethink their processes, optimize resource use, and adapt more quickly to market and environmental conditions (Fichman et al., 2014; Vial, 2019; Kroh et al., 2024).

Meanwhile, environmental issues such as climate change, resource scarcity, waste management, and pollution have made it imperative to find new business models that enable an economy to sustain growth while protecting the environment. A traditional linear economic model has been criticized as the "take, make, use, dispose" model, which assumes a constant need for resource extraction and is responsible for environmental degradation. Adopting a sustainable approach, the Circular Economy (CE) has been one of the main concepts gaining momentum as a solution to these challenges, proposing a sustainable economic model focusing on the preservation of the value of products, materials and resources for as long as possible, minimizing waste and reducing the environmental impact (Kirchherr, Reike, & Hekkert, 2017; Bressanelli et al., 2022).

The circular economy is about more than just recycling. Instead, it is a more general shift in production and consumption systems that seeks to ensure the value of products, materials, and resources for as long as possible. It involves several strategies, such as reducing resource use, reusing, repairing, remanufacturing, recovering resources, and redesigning products to maximize their life cycles and reduce their environmental footprint (Kirchherr et al., 2017; Bressanelli et al., 2022). They are especially relevant for manufacturing industries, where there is a high dependence on raw materials, energy, logistics, and production processes that create waste. Therefore, the implementation of circular economy practices would enhance resource efficiency, reduce industrial costs, improve environmental performance, and boost the sustainability of industrial enterprises (Kirchherr et al., 2017; Bressanelli et al., 2022).

Recent research shows that digital innovation can be especially important in supporting the adoption of circular economy practices. Digital technologies enable organizations to manage resource use, track resource and product flows throughout their life cycles, enhance production planning, optimize waste management, and facilitate data-driven decision making. In the case of machine, material and product monitoring, for instance, IoT can be used for the real-time tracking of these assets; for resource planning and operational decisions, big data can be utilized to enhance efficiency; for predictive maintenance and process optimization, AI can be used to predict the lifespan of machines and materials, and for supply chain transparency and traceability, blockchain can be employed to ensure the traceability of materials and products. For instance, with machine, material and product monitoring, IoT can be used for the real-time tracking of these assets; with resource planning and operational decisions, big data can be utilized to enhance efficiency; with predictive maintenance and process optimization, AI can be used to predict the lifespan of machines and materials; with supply chain transparency and traceability, blockchain can be employed to ensure the traceability of materials and products (Jabbour et al., 2019; Bressanelli et al., 2022; Jauhar et al., 2023; Neri et al., 2025). In this context, innovation through digital means is seen as a crucial tool for realizing the "Smart Circular Economy," in which a combination of data, technologies, and circular practices leads to new forms of sustainable value.

Digital innovation is particularly relevant in manufacturing sectors that consume large amounts of raw materials and produce high volumes of waste. Integrating digital technologies with the circular economy is becoming increasingly relevant to the plastic manufacturing sector, which consumes significant resources and poses environmental problems during the production and disposal of plastic products (Jabbour et al., 2019; Neri et al., 2025). Plastic products are used in diverse industries, including packaging, construction, agriculture, household consumer products, and many other economic activities. The sector also raises several concerns regarding raw material consumption, production residues, waste generation, plastic waste management, and recycling constraints, highlighting the need for more sustainable production systems (Kirchherr et al., 2017; Bressanelli et al., 2022). The attributes of the plastic manufacturing industry render it an ideal case study for exploring the potential of digital innovation to support the shift towards more circular, resource-efficient, and sustainable industrial processes.

Palestine's industrial companies face challenging economic, political, infrastructural, and environmental conditions that hinder their sustainable development and competitiveness. As a result of these conditions, there is a need for innovative solutions that can enhance operational efficiency, optimize resource use, and enable sustainable industrial development (MAS, 2024). Hebron City has a significant concentration of industries and is a well-known industrial center in Palestine, with substantial plastic production. This sector accounts for a share of the city's industrial base, generates employment, and promotes local production and economic activities (PIPA, 2023; PCBS, 2023). However, the plastic production industry still faces challenges related to resource utilization, waste generation, environmental constraints, technological maturity, and rapidly growing market competitiveness. The challenges underscore the need to adopt innovative and sustainable solutions to improve environmental and operational outcomes.

There is growing global interest in linking digital innovation to the circular economy, but little empirical research has focused on this interaction in the Palestinian industrial context. Existing research has mainly concentrated on developed economies or on a more general industrial context, whereas comparatively little work has been done in the context of developing economies and of context-specific industrial sectors (Jabbour et al., 2019; Bressanelli et al., 2022; Neri et al., 2025). Indeed, there is still limited empirical research on the effect of digital innovation on the CE practices of plastic manufacturing business units in Hebron City. This establishes a gap in geographical, sectoral, and empirical research, especially considering the economic importance and environmental relevance of this sector.

Thus, the main objective of this study is to explore the role of digital innovation in advancing the circular economy in plastic manufacturing enterprises in Hebron City. The selected industrial sector and geographical context help make the study more practical and context-sensitive in understanding how to support circular practices, enhance resource efficiency, minimize waste generation, and advance sustainable industrial development using digital technologies.

In addition, the study recognizes the importance of organizational readiness and government support as important organizational and institutional factors that may influence the effectiveness of digital innovation in advancing circular economy implementation.

1.2 Research Background

Governments, organizations, and researchers around the world have come to realize that sustainable thinking is a critical global issue and are seeking to rethink traditional industrial and economic models. To achieve sustainable development, organizations must prioritize economic growth while reducing environmental harm and being more responsible in their use of resources. The circular economy has become a significant framework for sustainability, seeking to shift the production and consumption processes from a linear to a more regenerative and resource-efficient model.

The concept of the circular economy is to keep resources, products, and materials in use for as long as possible. The circular economy is not about waste being the end of manufacturing, consumption, and product use; it is about waste becoming a new source of inputs in manufacturing processes. The method is especially important in the manufacturing sector, where both resource inputs and outputs significantly affect operations. Kirchherr et al. (2017) describe the circular economy as the typical three Rs (Reduce, Reuse, Recycle) and more recent efforts to extend the concept towards broader strategies like repair, refurbishment, remanufacturing, and recovery.

At the same time, digital innovation has emerged as one of the top transformative factors in organizations. Digital Innovation is the application of digital technology to the development or improvement of products, services, processes, and business models, delivering value and enhancing organizational performance. It goes beyond the simple adoption of technologies; it is about organizations' capacity to embed digital technologies within their strategies, operations, and decision-making processes (Fichman et al., 2014; Ramdani, Raja, & Kayumova, 2022; Kroh et al., 2024).

In recent studies, the link between digital innovation and the circular economy has been gaining in importance. The use of digital technologies presents many opportunities to address barriers to implementing the circular economy. Examples include using digital technology to increase visibility across the supply chain, track materials, collect precise information on resource use, and facilitate coordination among stakeholders. The integration of digital data with circular practices can enable smart circular systems that create value while minimizing environmental impacts, as Bressanelli et al. (2022) suggest. Likewise, Neri et al. (2025) emphasize that digital technologies can assist in circular design, manufacturing, and supply chain management.

Several digital technologies are especially important for implementing the circular economy. IoT technologies can support real-time monitoring of resources, machines, and products. Big data analytics enables the handling of large, complex data sets and helps make better operational decisions. By leveraging AI technology, companies can anticipate equipment failures, streamline manufacturing operations, and eliminate inefficiencies. Blockchain can help provide transparency and traceability, particularly for products, materials, and waste that flow among multiple actors in the value chain. Cloud computing also offers flexible digital infrastructure for data storage, sharing, and analysis. These technologies can be combined to open up new avenues for enhancing circular practices in manufacturing businesses.

However, there remains a disparity in the adoption of digital innovation and circular economy practices across countries and sectors. Financial constraints, lack of digital infrastructure, poor policy support, lack of technical skills, and reluctance to organizational change are common challenges encountered by organizations in developing economies. Such barriers can limit companies' potential to reap the benefits of digital transformation and sustainability-driven innovation (Jabbour et al., 2019; Galvão et al., 2018; Panchal, Singh, & Diwan, 2021).

Many of these challenges exist in the Palestinian context. Palestinian industrial enterprises frequently face economic uncertainty, limited access to advanced technologies, infrastructure constraints, and growing competition. Meanwhile, these businesses are also called upon to be more efficient and waste-free, and to meet mounting sustainability demands. The Environment Quality Authority (EQA, 2023) identified waste management systems, an increase in recycling rate, and sustainable industrial practice as the main environmental priorities in Palestine. The Authority has highlighted the importance of minimizing waste production and promoting resource recovery to promote environmental sustainability and economic resilience. The industrial sector's strategic role in the Palestinian economy has been highlighted in recent national statistics. The industrial sector remains one of the most important contributors to economic activity, employment creation, and local production in Palestine, according to reports from the Palestinian Central Bureau of Statistics. Meanwhile, as reported in the environment, there has been growing concern about solid waste generation and plastic pollution, which are now major issues in the field of sustainability and demand more effective resource management and recycling practices. The analysis of solid waste composition in Palestine shows that plastic materials make up a significant portion of recyclable waste, and the recovery or recycling of this waste remains relatively small compared with the amount of recyclable waste present. The conditions highlighted the need to adopt innovative, sustainable industrial methods to enable industries in Palestine to become more resource-efficient, generate less waste, and implement circular economy principles. However, the sector is still grappling with major structural and technological issues that may hinder its implementation of advanced digital and sustainable practices.

The plastics industry is one of the largest and most important industrial sectors in Palestine. According to data from the Palestinian Central Bureau of Statistics (PCBS), there were 243 active plastic manufacturing companies in Palestine in 2019 across the private and non-governmental sectors (PCBS, 2023). Moreover, industrial production of rubber and plastic products in the West Bank grew to about USD 113 million in 2017, making the sector a significant contributor to industrial output (PCBS, 2017). Hebron City is considered one of the most significant industrial cities in Palestine and is home to numerous factories producing plastic pipes, packaging materials, household items, and construction products (Palestine Investment Promotion Agency [PIPA] 2023).

The relevance of the plastic manufacturing sector is further increased by its close ties to environmental issues. This is additionally supported by the close relationships the plastic manufacturing sector has with environmental issues. Plastic products are a large part of current industrial and consumer use, but they also contribute to growing concerns about waste accumulation, recycling efficiency, and resource consumption. According to reports on waste management in Palestine, plastic waste constitutes a significant share of recyclable solid waste, and recovery and recycling rates remain insufficient. It is therefore crucial to enhance the sustainability performance of plastic production companies, both for environmental protection and competitiveness. In this context, digital innovation can offer new possibilities to foster waste reduction, enhance recycling, optimize resource use, and enable the shift towards circular economy practices.

However, both problems and opportunities in the plastic manufacturing industry need to be addressed. , but the industry's importance should not be ignored. Intensive use of raw materials in the plastic manufacturing process results in a high proportion of production waste, underscoring the need for more sustainable production systems and effective waste management. In this sense, digital technologies such as Artificial Intelligence, the Internet of Things, and data analytics could offer new possibilities for more efficient resource use, optimizing production processes, improving recycling operations, and facilitating the implementation of the circular economy. Thus, the study of the impact of digital innovation on the circular economy practices of plastic production companies in Hebron City has gained significant importance for both industry sustainability and competitiveness.

Alongside the economic and industrial significance of the plastic manufacturing industry in Hebron City, there are various environmental and operational challenges. The manufacturing of plastics uses raw materials and energy, and continuous production can generate significant industrial waste and residues. Furthermore, the need for more sustainable production systems in the sector has been growing due to the rising environmental concerns about waste management and resource consumption. Such challenges demand that industrial enterprises implement new strategies and practices to boost operational efficiency and minimize environmental impacts.

Here, the Circular Economy (CE) offers an appealing framework for improving the sustainability of plastic manufacturing enterprises. The principles of the circular economy encourage organizations to reduce material losses, maximize material efficiency, encourage the reuse and recycling of production waste, and extend the life cycle of products and materials. Production cost reduction, environmental performance enhancement, and long-term competitiveness are all aspects that such practices can improve. The implementation of circular economy principles, however, often requires technological capabilities to effectively monitor, manage, and optimize resource flows within organizations.

Digital innovation is increasingly recognized as a pivotal enabler of a circular economy. Organizations now have access to new advanced digital technologies, such as Artificial Intelligence (AI), Internet of Things (IoT), Big Data Analytics, and Cloud Computing, to track production processes in real time, analyze resource consumption patterns, minimize operational inefficiencies, enable predictive maintenance, and enhance coordination in supply chains. These capacities can support the shift from linear production systems to more sustainable and circular industrial systems through digital innovation.

Successful implementation of circular economy practices can also rely on institutional and organizational conditions, in addition to technological ones. While organizations can have sophisticated digital technologies, their effectiveness can be affected by organizational readiness, which encompasses technological infrastructure, managerial commitment, employee skills and knowledge, financial resources, and supportive organizational cultures. Similarly, the government can be a key enabler of digital transformation and sustainability-oriented projects through policies, regulatory frameworks, strategic programs, and incentives, all of which can drive innovation and the uptake of circular economy practices. This has made it even more relevant to understand how digital innovation, organizational readiness, and government support work together to implement the circular economy effectively, especially in resource- and environment-constrained sectors, such as industry.

Although the link between digital innovation and circular economy practices is increasingly acknowledged globally, current empirical research focuses on high-level industrial markets and developed economies. Understanding of this relationship is limited, particularly in developing economies and, in particular, in the industrial context in Palestine. In addition, although the plastic manufacturing industry is economically important and environmentally relevant, studies specifically on plastic manufacturing companies are still relatively limited. Hence, this study aims to address important geographical, sectoral, and empirical gaps by examining the role of digital innovation in circular economy practices within plastic manufacturing enterprises in Hebron City.

This becomes more critical when the potential cost of failing to resolve the problem is considered. Unless plastic manufacturing enterprises adopt digital innovation and circular economy practices, they will have to contend with rising production costs, poor raw material utilization, rising production waste, and rising environmental compliance pressures. Not only that, but the lack of modernizing production and resource management practices could jeopardize competitiveness in increasingly sustainability-focused markets. Given the current economic and environmental pressures on Palestinian industries in 2025–2026, there are concerns that industries will be unable to enhance productivity, reduce costs, minimize waste, or sustain themselves without adopting digital and circular practices. As a result, to ensure the future competitiveness and sustainability of plastic manufacturing enterprises in Hebron City, it is essential to understand how digital innovation can support the implementation of the circular economy.

1.3 Problem Statement

Researchers, policymakers, and industrial organizations globally have been captivated by the opportunities offered by digital innovation and circular economy (CE) practices. Digital innovation and circular economy (CE) principles have garnered increasing interest among researchers, policymakers, and industrial organizations worldwide. Digital technologies such as Artificial Intelligence (AI), Internet of Things (IoT), Big Data Analytics, and Cloud Computing are becoming increasingly significant for implementing the circular economy by enabling more efficient resource use, reducing waste generation, increasing recycling rates, and supporting sustainable production. Nevertheless, despite this increased interest, research findings in this area have been somewhat disjointed, and most empirical research has been conducted in developed economies and highly industrialized settings. However, the extent to which digital innovation is driving the implementation of the circular economy in resource-constrained, infrastructure-challenged, and institutionally limited developing economies remains poorly understood.

Industrial enterprises in the Palestinian context are subject to specific economic, technological, and environmental conditions that differ significantly from those in developed countries. Palestinian industries still struggle with a lack of technological infrastructure, economic difficulties, limited access to advanced digital technologies, and rising demands for sustainability. While digital transformation and sustainable development are now recognized as developing key competencies for industrial competitiveness, empirical evidence on the role of digital innovation in supporting circular economy practices in Palestinian industrial enterprises is limited. Moreover, the effects of organizational readiness and government support on this relationship have been hardly explored in the literature on Palestine.

Industry is one of the most important and polluting sectors in Hebron City, particularly plastic manufacturing. Plastic production companies depend heavily on raw materials and energy resources and generate significant production waste and environmental problems. The sector is thus increasingly being called upon to become more efficient in resource use, reduce waste, and ensure more sustainable production processes. While digital technologies have great potential to contribute to these goals, there is limited empirical data on how plastic manufacturing companies in Hebron City use them to achieve circular economy practices. Furthermore, the processes by which organizational readiness supports this relationship, and the potential impact of government support on it, remain poorly understood.

Hence, there is a clear research gap in the field of geography, sector, and empirical research on the role of digital innovation for promoting plastic manufacturing enterprises' Circular Economy practices in Hebron City. This study aims to fill this gap by revealing the direct impact of digital innovation on the implementation of CE, the direct impact of organizational readiness, and the indirect impact of government support on the implementation of CE, with evidence to support sustainable industrial development in the Palestinian context.

1.4 Significance of the Study

The significance of this study stems from the growing interest in digital transformation, the implementation of the circular economy, and sustainable industrial development worldwide. As industries are continually being pushed to improve resource efficiency, reduce environmental impacts, and stay competitive, digital innovation and the circular economy are key academic and practical interests. Besides, there has been a shift in focus toward organizational and institutional conditions that shape sustainability-oriented change, particularly organizational readiness and government support. The study is important because of the type of industry studied and the location of the industry, which is Hebron City in Palestine, one of the most important industrial centers, especially in the production of plastics.

1.4.1Theoretical Significance

Theoretically, this research fleshes out the current knowledge on digital innovation and integration of the circular economy. While the literature on the role of digital technologies in facilitating sustainability and circular economy practices exists, most prior research has either focused on developed economies or been industry-general. Therefore, there is limited empirical evidence from the developing economies in general and especially in the context of Palestine.

This study contributes to this aspect by providing empirical evidence from the plastic manufacturing industry in Hebron City. After reviewing the literature on the subject, the researcher found that no empirical study in Palestine to date has investigated digital innovation, organizational readiness, government support, and the implementation of the circular economy within an integrated framework. Thus, the study contributes to the existing literature and adds to the body of evidence by providing context-specific findings from an important industrial area that has received limited research attention.

In addition, the study contributes to the theoretical debate by viewing digital innovation not only as a technological phenomenon but also as a strategic organizational capability that supports resource efficiency, waste reduction, recycling, and sustainable production. The study further extends current understanding by examining the role of organizational readiness as an organizational mechanism and government support as an institutional condition that may influence circular economy implementation. Consequently, the study provides a more comprehensive explanation of how digital technologies contribute to sustainable industrial transformation within resource-constrained environments.

Moreover, the research addresses current academic calls for more specific, context-oriented studies on Digital Transformation and Sustainability. A more detailed understanding of the potential of digital innovation to foster circular economy practices can be gained by focusing on the plastics manufacturing sector, which is characterized by varying levels of technological readiness, resource use patterns, environmental impacts, and operational needs.

1.4.2 Research Contribution and Novelty

The study offers several specific contributions that make it unique from previous studies. First, from a theoretical perspective, the study builds on the existing literature on digital innovation and CE by exploring the role of digital innovation in CE practices, mediated by organizational readiness. This study builds on numerous prior studies that primarily examined the direct link between digital technologies and desired sustainability outcomes by incorporating organizational readiness as a mechanism to explain how digital innovation translates into actual circular economy practices.

Second, in context, the study contributes to the sparse empirical literature on developing economies, particularly in the Palestinian industrial setting. The current research on digital innovation and the circular economy has been conducted primarily in developed countries or across industrial sectors, with few studies addressing Palestinian manufacturing businesses. Accordingly, the study aims to provide context-specific evidence for Hebron City, an important industrial region in Palestine.

Third, the study is conducted from a sectoral perspective and includes plastic manufacturing firms, which are highly relevant to the concept of a circular economy because they rely on raw materials, produce production waste, face recycling challenges, and have an environmental footprint. The study's emphasis on this sector addresses the demand for research in this sector rather than being limited to manufacturing industries in general.

Practically, the study reminds us of the environmental and economic costs of inaction; fourth, it is a practical reminder that it is not too late to act. If digital innovation and circular economy practices are not adopted, this will result in inefficient resource use, production waste, high operational costs, reduced competitiveness, and increased environmental pressure on plastic production firms in Hebron City. Hence, the study offers practical guidance to managers, policymakers, and industrial stakeholders who can help promote sustainable industrial transformation.

1.4.3 Practical Significance

As a practical application, the study offers useful suggestions for managers, owners, and decision-makers at plastic manufacturing companies in Hebron City. The findings will help organizations better understand how digital innovation, organizational readiness, and government support can collectively facilitate circular economy implementation through improving resource efficiency, reducing material losses, supporting recycling activities, and strengthening sustainable production practices. Therefore, the study can inform enterprises' decision-making regarding digital transformation and investments in sustainable production practices.

The research can also contribute to policymakers, governmental bodies, and industrial support entities by providing evidence-based findings to inform the formulation of policies, programs, and incentives that encourage the adoption of digital innovation and the circular economy in Palestinian industries. These can encompass technical support schemes, capacity-building programs, investments in IT systems, and financial incentives to promote sustainable industrial practices.

Furthermore, the results could benefit industrial associations, chambers of commerce, development agencies, and research institutions in their efforts to modernize industry and advance sustainability. The study can help inform the design of effective awareness campaigns, training programs, and collaborative efforts to promote sustainable industrial transformation by identifying opportunities and barriers to integrating digital innovation with circular economy practices.

Lastly, the study has significant environmental and societal implications. In light of the environmental issues associated with plastic production, waste reduction, resource efficiency, recycling, and minimizing environmental impact could be achieved by improving circular economy practices in the plastic sector. Concurrently, such enhancements can improve the competitiveness and sustainability of industrial businesses, leading to local economic development and contributing to the overall sustainable development goals in Palestine.

1.5 Research Questions

Main Research Question

What is the role of digital innovation in advancing circular economy practices in plastic manufacturing enterprises operating in Hebron City?

Sub-Research Questions

RQ1: Does digital innovation significantly affect the implementation of the circular economy in plastic manufacturing enterprises operating in Hebron City?

RQ2: Does digital innovation significantly affect organizational readiness in plastic manufacturing enterprises operating in Hebron City?

RQ3: Does organizational readiness significantly affect the implementation of the circular economy in plastic manufacturing enterprises operating in Hebron City?

RQ4: Does organizational readiness mediate the relationship between digital innovation and circular economy practices in plastic manufacturing enterprises operating in Hebron City?

RQ5: Does government support moderate the relationship between digital innovation and circular economy implementation in plastic manufacturing enterprises operating in Hebron City?

1.6 Research Objectives

Main Objective

To examine the role of digital innovation in advancing circular economy practices in plastic manufacturing enterprises operating in Hebron City.

Specific Objectives

O1: To examine the effect of digital innovation on the implementation of the circular economy in plastic manufacturing enterprises operating in Hebron City.

O2: To examine the effect of digital innovation on organizational readiness in plastic manufacturing enterprises operating in Hebron City.

O3: To examine the effect of organizational readiness on the implementation of the circular economy in plastic manufacturing enterprises operating in Hebron City.

O4: To examine the mediating role of organizational readiness in the relationship between digital innovation and circular economy practices in plastic manufacturing enterprises operating in Hebron City.

O5: To examine the moderating role of government support in the relationship between digital innovation and circular economy implementation in plastic manufacturing enterprises operating in Hebron City.

1.7 Research Hypotheses

H1: Digital innovation has a significant positive effect on the implementation of the circular economy in plastic manufacturing enterprises operating in Hebron City.

H2: Digital innovation has a significant positive effect on organizational readiness in plastic manufacturing enterprises operating in Hebron City.

H3: Organizational readiness has a significant positive effect on the implementation of the circular economy in plastic manufacturing enterprises operating in Hebron City.

H4: Organizational readiness positively mediates the relationship between digital innovation and circular economy practices in plastic manufacturing enterprises operating in Hebron City.

H5: Government support positively moderates the relationship between digital innovation and circular economy implementation in plastic manufacturing enterprises operating in Hebron City.

1.8 Limitations of the Study

As with all empirical studies, this study is carried out within certain parameters, which restrict its scope and help interpret its results. The following are the limitations:

1.8.1 Subject Limitations

The study aims to examine the role of digital innovation in advancing circular economy implementation, while considering the mediating role of organizational readiness and the moderating role of government support. Therefore, the study focuses exclusively on the variables included in the proposed conceptual framework and does not examine other organizational, technological, environmental, or strategic factors that may influence the implementation of the circular economy.

1.8.2 Human Limitations

The study focuses on plastic manufacturing enterprises in Hebron City, with the target population comprising managers, department heads, supervisors, technical employees, administrative employees, and other related personnel from these enterprises. These respondents have been chosen as they are likely to have sufficient knowledge of their organizations. These respondents have been selected because they are expected to possess sufficient knowledge of their organizations' digital innovation initiatives, circular economy practices, organizational readiness, and the institutional conditions for government support.

1.8.3 Spatial Limitations

The study is conducted geographically, focusing on plastic manufacturing companies in Hebron City, Palestine. The choice of this sector was based on its economic importance, industrial density, and links to sustainable development and the circular economy. The results thus need to be understood in the context of this particular industry sector and geographical region, and should therefore be treated with caution when extrapolating them to other industry sectors or geographical areas.

Hebron City was selected because it has the largest concentration of plastic manufacturing enterprises in Palestine and is a major industrial hub for the plastic sector.

1.8.4 Temporal Limitations

The study takes place during the academic year 2025/2026. Thus, the results are limited to the organization, technology, management, and perceptions of the time.

1.8.5 Methodological Limitations

The study is quantitative, using a structured questionnaire as the primary data collection method. This allows the researcher to collect information from a relatively large number of respondents and statistically analyze the hypothesized relationships between the study variables. However, this approach may not fully capture the deeper contextual information and organizational dynamics that could be explored through qualitative techniques such as interviews, focus groups, or case studies.

In addition, a practical challenge arose during data collection, as 10 plastic manufacturing enterprises declined to participate despite repeated attempts to secure their cooperation. Although the required sample size was achieved, this may have slightly affected the representativeness of the study population.

1.8.6 Analytical Limitations

This study investigates the proposed relationships among digital innovation, organizational readiness, government support, and the implementation of the circular economy, as perceived and assessed by respondents. While reliable and valid statistical methods are used to ensure the results' reliability and validity, they still depend on the accuracy and objectivity of participants' responses. The study also uses a cross-sectional research design, which makes it difficult to draw conclusions about causal relationships among the variables and to observe changes in them over time.

1.9 Thesis Structure

The thesis is presented in five chapters, each addressing an aspect of the study, and they are interdependent and complementary in achieving the study's objectives.

Chapter One: Introduction

The chapter aims to give a brief introduction to the study and also its basic components. It contains an introduction, research background, problem statement, significance of the study, research questions, research objectives, research hypotheses, limitations of the study, and the thesis structure. The chapter establishes the foundation for understanding the significance of investigating the role of digital innovation in advancing circular economy implementation within plastic manufacturing enterprises operating in Hebron City, while considering the mediating role of organizational readiness and the moderating role of government support.

Chapter Two: Literature Review and Theoretical Framework

The literature review and theory have been covered in this chapter and are related to the study variables. It introduces the concepts of digital innovation, circular economy, organizational readiness, and government support. The chapter also examines the theoretical and empirical relationships among these variables, identifies the research gap, develops the conceptual framework, and formulates the study hypotheses. This chapter also discusses the connections between these variables, as seen in earlier empirical research and theory. In addition, it determines the research problem, conceptualizes the study, and proposes research hypotheses.

Chapter Three: Research Methodology.

The chapter presents the methodology used in this study. It outlines the research philosophy, research design, study population, sampling process, data collection instrument, questionnaire development, measurement scales, validity and reliability analyses, and statistical techniques for data analysis. The chapter also describes the process for testing the proposed direct, mediating, and moderating relationships in the conceptual model.

Chapter Four: Data Analysis and Results

This chapter presents the empirical results of the study. It involves descriptive statistics, a demographic analysis, reliability and validity tests, a test of the measurement model, and a test of the structural model. In addition, the chapter presents the findings on the direct effects of digital innovation, In addition, the chapter presents the findings related to the direct effect of digital innovation on circular economy implementation, the mediating role of organizational readiness, and the moderating role of government support within plastic manufacturing enterprises operating in Hebron City.

Chapter Five: Discussion, Conclusion, and Recommendations.

This chapter addresses the study's results and the literature and theories that supported it. States the main findings, theoretical contributions, and implications for practice of the study. It also provides recommendations for managers, policymakers, industry stakeholders, and researchers. It concludes with guidance for future research on digital innovation, circular economy implementation, organizational readiness, government support, and sustainable industrial development.

2 Chapter two: Literature review and theoretical framework

2.1 Digital Innovation

2.1.1 Introduction to Digital Innovation

Over the last two decades, digital innovation has given rise to one of the most significant and impactful themes in academic and managerial discourse. It has become closely linked to the radical changes driven by the Fourth Industrial Revolution.

This revolution has had a profound impact on the increased use of digital technologies in many economic activities and business areas. At the same time, environmental crises and economic pressures have forced organizations and economies to change their development model to be more sustainable.

Digital innovation, in this context, has been growing in importance as a strategic enabler of the transition towards a circular economy, as it can restructure organizational processes, increase resource efficiency, and promote the creation of more innovative, effective, and sustainable business models.

Further, digital technologies have undergone profound development. They are driving major shifts in the global economy, making digital innovation a primary driver for sustainable economic development and competitiveness in today's organizations and economies. The objective of this work is therefore to present a comprehensive theoretical background for the concept of digital innovation by analyzing its historical development, various definitions, elements, and the basic digital tools and technologies on which it is based.

2.1.2 Historical Evolution of Digital Innovation

The history of digital innovation began in the mid-twentieth century, when first-generation computers emerged, and electronic technology was developed, establishing the technological underpinnings for later digital innovations. This made rapid progress with the development of Moore's law, which states that the number of transistors that can fit on a microchip doubles roughly every 24 months. This led to a significant rise in computing power and a corresponding decrease in costs, enabling the expansion of digital technologies across both economic and organizational processes.

The first significant era in which information was digitized, from analog to digital, was the Internet era of the 1990s. This change enabled data storage, processing, and transmission to and from the data, improving organizational efficiency. As the new millennium began, the increasing use of information and communication technologies (ICTs) (e.g., cloud computing, smartphones, big data analytics) set the stage for the development of digital innovation as a concept that goes beyond merely automating traditional processes.

Digital innovation reached a more mature stage around 2010 and is linked to a broader digital transformation. In this phase, digital innovation is not simply an improvement on current products and services. However, it has become a redesign of business models, organizations, decision-making, and the value-creation process. Since then, academic studies on digital innovation have increased considerably, shifting from viewing digitalization as a technological aid to a strategic enabler of organizational innovation and institutional transformation (Uršič & Čater, 2024). Likewise, Ramdani et al. (2021) argue that digital innovation is a crucial factor in improving an organization's competitiveness because it enables firms to develop adaptable business models that leverage opportunities in the digital environment.

2.1.3 Definitions of Digital Innovation

Digital innovation is a concept that has been defined in many ways in the academic literature, and in practice, it is dynamic, with multiple and complex theoretical and practical underpinnings. Regardless of this variety, most definitions describe digital innovation as the efficient creation of new products, services, processes, and business models that leverage digital capabilities to deliver sustainable value.

Fichman et al. (2014) state that digital innovation is the "discovery, development, and diffusion of new products, services, and business models using information technology" and stress the "holistic nature of innovation throughout the process. In contrast, Hinings et al. (2018) focus on implementation, describing digital innovation as the creation and enactment of new products and services using digital technologies. Likewise, Hund et al. (2021) emphasize the value aspect of digital innovation: "Digital innovations are innovations, profoundly scalable and value-driven, which are based on digital technologies.

Later research has been more integrative and strategic in nature. Kroh et al. (2024) define digital innovation as an organizational capability to leverage digital technologies and data to develop new solutions, products, or services that positively impact strategic performance and create value. In addition, Neri et al. (2024) explicitly link digital innovation to sustainability goals, defining it as the application of digital technologies (including the Internet of Things, artificial intelligence, and big data) to redesign processes and value chains to support circular economy objectives. From an application perspective, Alhawari et al. (2021) conceptualize digital innovation as a set of technological and organizational capabilities that enable firms to leverage digital technologies and data to enhance performance and develop new business practices.

In general, these definitions suggest that digital innovation is more about a mindset shift in how value is created and delivered than about technology alone, and explicitly point to the importance of flexibility, experimentation, and user-centered design.

2.1.4 Components of Digital Innovation

Digital Innovation has components. Recent literature has highlighted that digital innovation goes beyond the technological aspect and is embedded in a system of technological, organizational, and human elements that interact to enable organizations to create sustainable value and remain adaptive in the rapidly changing digital environment. This integrative view emphasizes the complexity and systemic nature of digital innovation as a process across the whole organization.

Thus, Kroh et al. (2024) suggest seven fundamental dimensions of digital innovation: digital orientation, digital processes, digital mindset, digital networks, technological capabilities, digital data management, and change capability. The study states that the combination of these dimensions is the basic foundation for effective Digital Innovation.

Building on an integrative view, Ramdani et al. (2021) define digital innovation at three distinct levels – individual, organization, and environment – that are interrelated. The multiple levels highlight the importance of synergy among people, organizations, and their external environment for successful digital innovation.

These views align with the wider academic understanding of the elements of digital innovation, such as disruptive business models, user-centered design processes, data-driven decision-making, organizational agility and experimentation, digital ecosystems, and tight linkages between digital innovation and broader digital transformation. All these elements place digital innovation as a strategic approach to reconfigure organizational practices and value creation in the digital world.

2.1.5 Tools and Technologies of Digital Innovation

Recent literature highlights that digital innovation relies on advanced digital tools and technologies deployed as key enablers of digital transformation. They contribute to technological development, better decision-making, increased operational efficiency, and innovative business models.

The Internet of Things (IoT) is one of the most visible technologies in digital innovation, in which physical things are connected to digital systems to collect real-time data and use digital tools for resource tracking throughout the product life cycle. In the context of industry and service businesses, Jauhar et al. (2023) highlight the high value of IoT for operational efficiency, data-driven decision-making, and transparency across the value chain.

Another pillar of digital innovation is the use of big data and analytics, which enable organizations to process and analyze massive, complex datasets and uncover patterns, trends, and future requirements. Big data analytics, they write, is a key enabler of digital innovation that can help use resources more effectively, boost operational efficiency, and drive sustainable practices.

Digital innovation is another area where artificial intelligence (AI) is making a significant impact, with applications in machine learning, deep learning, and natural language processing. AI can automate processes, analyze data, and provide intelligent insights. Rusch et al. (2022) demonstrate that AI can contribute to game-changing solutions, including predictive maintenance, product design enhancement, and operational performance improvement.

Moreover, blockchain technology has become a pivotal digital enabler for transparency and security in transactions, especially in the context of supply chains and circular value systems. Magrini et al. (2021) reported that blockchain can be used to reliably track products and transactions, thereby improving trust and promoting circular economy practices.

In addition, digital platforms are important enablers of data and resource sharing, bringing together several actors – such as suppliers, customers, and partners – to create a value chain. The authors of Soldatos et al. (2021) stress that digital platforms will improve integration within supply chains and will facilitate co-innovation. Cloud Computing provides scalable and flexible computing resources, while Virtual Augmented Reality (VR/AR) technologies provide immersive digital experiences widely used in training, design, and marketing.

2.1.6 Stages of Digital Innovation Adoption

In recent times, the literature has focused on digital innovation adoption as a step-by-step, systematic process that goes beyond technology implementation to organizational transformation and value creation. In this context, Ramdani et al. (2021) suggest that digital innovation is a process with four main stages. Such stages can be combined into a broader adoption perspective in a coherent sequential model as follows:

The process starts with the Intention and Readiness stage, which corresponds to the awareness and exploration stage. In this phase, organizations realize that digital innovation is key and embark on preparing the environment for digital adoption through a strong digital vision, readiness analysis, resource allocation, and leadership and employee buy-in for digital transformation.

This is followed by the Adoption stage, where a formal decision to adopt digital innovation is made. Organizations choose digital technologies that are right for them and may run a pilot to assess feasibility and reduce uncertainty before rolling them out to the wider organization.

The third stage is Implementation – embedding digital innovation in organizational processes and structures. This stage includes implementing digital technologies, adapting processes, and building the technological and human capacity to do so effectively.

The last step is Use and Value Realization, focusing on integration and continuous improvement. In this phase, organizations aim to derive the greatest value from digital innovation through the effective application of digital solutions, performance improvements, data-informed decision-making, and the creation of sustainable competitive advantages. The adoption of digital innovation requires systematic coordination and integration of these phases, which can help organizations transition from technology adoption to real digital transformation and create value over time, as emphasized by Ramdani et al. (2021).

2.1.7 The relationship between Digital Innovation, Sustainability, and the Circular Economy

Current academic research has shown a significant and complementary link between digital innovation and sustainability, with digital innovation a crucial enabler of the shift towards more sustainable and efficient development models. Digital innovation is not just about improving economic performance but also about redesigning the Organizational structure and the Business Model to optimize resource use, limit environmental impacts, and improve societal sustainability.

Digital technologies such as big data analytics, the Internet of Things, and artificial intelligence are key to helping organizations become more resource-efficient, reduce waste, and be more transparent in their supply chains. Digital innovation is ultimately a strategic process of big change within the organization that can help achieve sustainable goals (Vial, 2019). Likewise, Rusch et al. (2022) show how digital innovation and intelligent technologies can lead to sustainable solutions that increase environmental efficiency and support responsible decision-making.

This connection between digital innovation and sustainability is even more apparent within the circular economy framework. Digital innovation is already a cornerstone in supporting circular economy models, as it enables product tracing, increases resource efficiency, reduces waste, and develops sustainable business models, according to research by Bressanelli et al. (2022). Furthermore, the authors propose the notion of the ‘Smart Circular Economy', which integrates digital data and physical resources to create new value and enable better, more informed decision-making.

In general, digital innovation can be seen as a strategic means of achieving sustainability, especially when considering circular economy principles, by balancing economic performance with environmental and social values and supporting the transition towards more sustainable production and consumption systems.

2.1.8 Digital Innovation as a Strategic Enabler

Recent academic literature highlights that digital innovation is not just a technological choice or operational instrument, but a strategic lever to enhance organizations' adaptability to the quick environmental and economic changes and to create sustainable competitive advantage. Digital innovation is a strategic force because it can transform organizational strategy, business models, and value creation processes when digital technologies, organizational capabilities, and people work together.

In this context, Fichman et al. (2014) argue that digital innovation is not merely a technological application but a strategic process that affects products, services, and business models. Digital innovation is also important for digital transformation, as Vial (2019) notes, as it can facilitate significant organizational changes that help achieve long-term strategic goals. Kane et al. (2015) point out that the strategic value of digital innovation lies not in technology itself, but in how it is used to increase organizational agility, accelerate innovation, and enable data-driven decision-making.

Empirical evidence is also in support of this view in recent times. Firms with higher digital innovation capabilities are more likely to innovate their business models, more likely to practice the circular economy, and better positioned to do so (Neligan et al., 2022). Furthermore, Alsuhaibany (2025) reports that digital innovation directly impacts operational efficiency and cost savings, and also boosts corporate sustainability, further establishing its importance as a key strategic lever that aligns economic performance with environmental responsibility.

In sum, digital innovation can be seen as a key pillar of strategic innovation, connecting strategic vision to digital technologies and enabling organizations to integrate innovation, sustainability, and competition in ever-changing business scenarios.

2.1.9 Digital Innovation Summary

The literature review shows that digital innovation is a system of organizational capabilities, digital technologies, and managerial practices that enables the generation of new value by effectively leveraging digital technologies. Digital innovation is no longer about improving the efficiency of the business itself, but about how it changes business models and value-creation processes.

Additionally, the literature highlights the key role of digital innovation in driving the transition to a circular economy by promoting resource traceability throughout the life cycle, optimizing processes, reducing waste, and creating sustainable business models. Digital innovation is one of the drivers in this context, enabling a connection between economic performance and environmental sustainability goals.

Based on the above, a comprehensive understanding of the digital innovation concept, its components, and tools serves as the theoretical foundation for the study examining the role of digital innovation in improving the circular economy. These will be discussed further in the following parts of this chapter.

2.2 Circular Economy

2.2.1 Introduction to the Circular Economy

The circular economy is one of the most important concepts and changes in practice in the sustainability field over the last few decades. It emerged in response to the environmental and economic problems of the traditional linear economic model, characterized by intensive resource extraction, production, consumption, and disposal. The rapid depletion of natural resources, waste accumulation, and the growing impacts of climate change have made the need for alternative economic models that balance economic growth with environmental protection more urgent.

In this context, the notion of 'circular economy' has become a holistic development model focused on optimizing resource utilization, reducing waste and losses across the production and consumption chains, and enhancing reuse, remanufacturing, and recycling of products and materials. It thus provides a comprehensive solution to the linear economy, repurposing the idea of growth toward sustainable value creation rather than resource extraction.

For this reason, this section will introduce the theoretical background of the circular economy by exploring its evolution and origins, its different definitions, its main principles, and the differences between the linear and circular economies. This discussion draws on relevant academic literature and provides a theoretical basis for understanding the role of the circular economy in achieving sustainable development.

2.2.2 Origins and Evolution of the Circular Economy

While the concept of reusing and efficiently managing resources is not new, the theoretical and conceptual underpinnings of the circular economy can be traced to several schools of thought. One of the important early contributions was Kenneth Boulding's 1966 concept of an economy as a “Spaceship Earth,” emphasizing the need to manage and recycle resources for its long-term sustainability.

In 1976, Walter Stahel and Geneviève Reday presented a pioneering report to the European Commission, The Potential for Substituting Manpower for Energy, in which they highlighted the need to extend product lifespans through reuse and repair. This work established some valuable precedents for future thinking about the circular economy. Later, in 1990, the term “circular economy” was more formally defined by David Pearce and Kerry Turner in their book Economics of Natural Resources and the Environment, as an “economic system based on closed-loop resource flows where the inputs and outputs of resources are minimized.”

Even though these early contributions, the circular economy in its current form started to become more distinguishable in the 1990s and took off in the last 20 years. Kirchherr et al. (2017) state that the circular economy is inspired by several intellectual traditions, including environmental economics, industrial ecology, and sustainable design. After 2010, however, it began to gain momentum worldwide and became more common to see it used by governments and international organizations as an important development roadmap.

Moreover, the bibliometric analysis by Ruiz-Real et al. (2018) shows significant growth in academic interest in the circular economy after 2015, as evidenced by an increase in publications on the subject, underscoring its growing relevance in both scientific and practical terms. Furthermore, Rosa et al. (2019) emphasize the strong relationship between CE development and Industry 4.0 technologies and digital transformation, which have been effective tools for applying CE principles. The Ellen MacArthur Foundation has also been a key enabler of the circular economy worldwide by creating detailed frameworks and ‘how-to’ guidance for different sectors.

2.2.3 Definitions of the Circular Economy

The notion of the circular economy has been interpreted differently in the academic and applied literature owing to its broad definition and multidimensionality. While these are diverse, the underlying goals are the same: to reduce natural resource consumption, eliminate waste, and close production and consumption cycles to ensure long-term sustainability.

An early definition of the circular economy was given by Pearce and Turner (1990), who described it as an economic system of closed-loop resource flows aimed at minimizing virgin material inputs and waste outputs. The emphasis of this definition is on the material part of resource flows and on the need for loop closure to enhance environmental and economic efficiency.

The circular economy is an economic model that aims at keeping products, materials, and resources in use for as long as possible, while reducing waste generation through reuse, recycling, and remanufacturing (Kirchherr et al., 2017). In a thorough analytical study, the same authors examined 114 definitions of the circular economy. They found that the concept is often linked to the “3Rs” principle (reduce, reuse, recycle) and that it places particular emphasis on economic and environmental aspects.

Likewise, the Ellen MacArthur Foundation describes the circular economy as an economic system that strives to eliminate waste and pollution, circulate products and materials at their highest value, and regenerate nature. This definition emphasizes the transformative character of the circular economy as an integrated model of development that combines environmental and economic goals.

More recently, Scholtysik et al. (2025) define the circular economy as an economic system in which the use of primary resources is minimized, product lifetimes are extended, and materials are reintegrated into systems through the closure of resource loops, the narrowing of loops, and the slowing of material cycles. In an applied sense, Panchal et al. (2021) view the circular economy as an operating business model that seeks to balance environmental, economic, and social aspects by optimizing resource use and minimizing the environmental consequences of economic activities.

In general, the circular economy is an integrated model of sustainable production and consumption that focuses on sharing, leasing, reusing, repairing, refurbishing, and recycling products and materials to maximize their use and avoid waste.

2.2.4 Core Principles of the Circular Economy

Overall, the academic literature has reached consensus on the principles underpinning the circular economy, which aims to change how things are produced and consumed to avoid resource depletion and increase sustainability. These principles offer an integrated approach that relates design, efficient resource use, and product life cycle extension strategies.

The Ellen MacArthur Foundation defines the circular economy as being based on three principles: Design out waste and pollution; Keep products and materials in use for as long as possible through re-use, repair, refurbishment, re-manufacture, and recycling; and Regenerate natural systems by eliminating the use of non-renewable resources, moving to renewable energy, and safely returning biological materials to the biosphere.

The sweeping principles listed here are a movement from prevention to recovery and have been expanded to other concepts, such as the 3Rs (Reduce, Reuse, Recycle), which has turned into the more comprehensive 9Rs (Refuse, Rethink, Reduce, Reuse, Repair, Refurbish, Remanufacture, Repurpose, Recover). In this context, Galvão et al. (2018) highlight the need to reduce resource consumption through more efficient processes and sustainable product design as a key pillar of the circular economy. Planning (2018) emphasizes reuse as an important means of extending product lifecycles and reducing the need for new production. The recycling process is also discussed by Magrani et al. (2021) as a practical option for closing resource loops, particularly in the industrial and electronics sectors. Additionally, Bressanelli et al. (2022) point out that maintenance, upgrading, and remanufacturing are key strategies for extending product life, which is essential for maximizing value. Lastly, Jauhar et al. (2023) point out that achieving circular efficiency in supply chains requires enabling resource recovery, such as recovering materials and energy from waste.

Taken together, these principles form a coherent set for implementing the circular economy, offering a cohesive approach that combines preventive design, circular resource management, and the resulting sustainable outcomes.

2.2.5 Core Components of the Circular Economy

New publications suggest that the circular economy rests on a series of interdependent elements that work together to turn waste into value and minimize resource depletion throughout the life cycle of products. The success of the circular economy relies on synergy among these elements at the design, production, consumption, and organizational levels.

Circular product design is one of the basic pillars of the circular economy, and it involves designing products to be durable, repairable, easily disassembled, reusable, and recyclable. This component is strongly related to clean and sustainable production, which aims to reduce energy and material use, environmental impacts (including emissions), and make production processes efficient and environmentally friendly.

Responsible consumption is another key element, which involves shifting consumption behavior towards more sustainable options, such as sharing, leasing, and re-use, to reduce demand for consumer goods and minimize waste. This is complemented by waste and resource management, which seeks to convert waste into valuable resources through recycling, material recovery, and energy recovery, to close resource loops.

Circular business models are also integral to operationalizing the circular economy, providing innovative methods for value creation that are linked to services, extended product life cycles, and efficient resource use. In this context, Suchek et al. (2021) highlight the need to align and integrate these elements within an organizational and strategic framework (including policy, structure, and organizational culture) to achieve the successful implementation of the circular economy at the practical level.

Overall, the circular economy is not based on individual elements but on a coherent, integrated system that interacts to achieve long-term economic efficiency and environmental sustainability.

2.2.6 The Difference between the Circular Economy and the Linear Economy

The circular economy represents a paradigm shift from the linear economy, which has been in use since the Industrial Revolution. The linear economy follows a take–make–dispose approach, with a one-way flow of resources that results in the permanent loss of natural resources, landfilling of waste, high environmental costs, and a lack of long-term sustainability (Kirchherr et al., 2017).

The opposite of the linear economy is the circular economy, which is based on different principles – minimizing resource use, reusing products, recycling materials, or recovering value. It aims to achieve the following main goals: prolonging the lifespan of resources and products, reducing waste generation, reducing environmental impacts, and generating sustainable economic value. The key difference between the two models is that closed-loop resource systems are necessary for the circular economy, as opposed to linear, one-way flow systems, and that maintain product and material value over time, as mentioned by Rosa et al. (2019)

The key differences between the two models can be summarized as follows:

Table 2.1: Linear Economy vs Circular Economy

Dimension	Linear Economy	Circular Economy
Core Model	Take – Make – Dispose	Closed-Loop System
Resource Use	Continuous extraction of virgin resources	Resource preservation, reuse, and circulation
Waste	End-of-life outcome	Input for new processes
Design Focus	Short product life and rapid consumption	Durability, repairability, and recyclability
Environmental Impact	High (pollution, emissions, and waste accumulation)	Lower (sustainability, regeneration, and emission reduction)

Overall, the linear economy places environmental pressure on resources and the economy while relying on a one-directional resource flow that is less economically efficient. The circular economy, on the other hand, aims to create a sustainable production and consumption system in which the value of products and materials is retained for as long as possible, minimizing environmental impacts and improving long-term economic outcomes.

2.2.7 Selected Academic Studies on the Circular Economy

Several influential academic studies have played an important role in the conceptualization, practical application, business modeling, and social and institutional aspects of the circular economy's theoretical framework. In this regard, Winans et al. (2017) investigated the evolution of the circular economy concept and related developments in major countries worldwide, including China, Germany, and Japan. The study suggested that the successful application of the circular economy depends on integrated public policies, technological and social innovation, and learning from successful and unsuccessful international experiences.

Murray et al. (2017) explored the circular economy from a multidisciplinary perspective, focusing on its ethical and social aspects in a global context. The authors argued that social considerations, in addition to environmental and economic ones, must be taken into account to achieve genuine sustainability, which requires collaboration among stakeholders, including governments, businesses, and civil society.

Regarding business models, Lewandowski (2016) presented a conceptual framework for designing circular business models, highlighting the possibilities of incorporating circular economy principles into companies' strategies through various means, including resource recovery, extension of product life, and collaboration platforms. The framework offers a practical guide for companies aiming to move from linear to circular and sustainable business models.

Furthermore, Kirchherr et al. (2017) provided one of the most detailed analyses of the circular economy by examining 114 definitions. Their conclusions show that people typically think of the circular economy as the triple R's (reduction, reuse, and recycling), with a particular focus on economic potential and environmental preservation. The study also emphasized the importance of developing a more standard and consistent definition to support the measurement and practical implementation.

These studies collectively highlight the circular economy as a multidimensional problem that requires integrating policy frameworks, business models, innovation, and social aspects, and show how it can serve as an approach to sustainable development.

2.2.8 Barriers to the Implementation of the Circular Economy

Although the circular economy is great for the environment and the economy, numerous issues hinder its adoption and effectiveness across organizations and economies. According to the literature, these barriers are multidimensional, including technical, organizational, financial, and behavioral barriers.

Galvão et al. (2018) report key technical hurdles, including inadequate technologies and supporting infrastructure to enable circular practices, as well as insufficient technical skills. At the organizational level, a lack of regulation, policy incentives, and coordination among stakeholders hinders the transition towards circular production and consumption. Moreover, resistance to change at the managerial and employee levels is a major behavioral hurdle that hinders the transformation process.

A financial challenge is the high initial investment required for the transition, including cleaner technologies, process changes, and product and supply chain redesign. The costs can make the circular economy unattainable for organizations, especially small and medium-sized enterprises. Moreover, Panchal et al. (2021) point out the absence of clear indicators and metrics to measure circular performance as an additional challenge that can limit the organization's capacity to track progress and quantify the economic and environmental benefits of circular efforts.

Overall, the adoption of circular-economy barriers must be supported by public policy, regulatory clarity, investments in innovation and digital technologies, and the development of organizational capabilities and awareness. These are vital to provide an enabling landscape for the shift to more sustainable economic models.

2.2.9 The Circular Economy in the Context of Digital Transformation

Digital transformation is increasingly recognized as a key driver of the circular economy, providing the technological backbone and analytical tools needed to implement circular principles more effectively and efficiently. Digital transformation is not just about digitizing tasks; it is about redesigning production systems and value chains to enable resource tracing, sophisticated data analytics, and fact-based decision-making.

Neri et al. (2024) find that the use of digital technologies, including advanced data analytics and the Internet of Things, can facilitate the implementation of the circular economy by enabling better data management and tracking of resource flows throughout the product life cycle. The study highlights the importance of integrating digital data with operational processes to enhance transparency and efficiency across the value chain, thereby improving waste reduction, reuse, and recycling practices.

Likewise, Bressanelli et al. (2022) demonstrate that digital data can complement physical resources and open new opportunities for value creation by facilitating circular business models based on product life extension, resource recovery, reuse, and recycling. The authors present the idea of the “smart circular economy”, in which real-time data is used to support circular decision-making and enhance environmental and economic performance.

Digital transformation, in general, can be seen as a strategic lever for the circular economy, as it can help address issues such as supply chain complexity, resource management, and the measurement of the circular economy's performance. This does so by helping move away from linear models of production and consumption toward more sustainable ones.

2.2.10 Summary of the Circular Economy Section

The literature review shows that the circular economy is a holistic economic model designed to achieve sustainability by making production and consumption systems more efficient in resource use and reducing waste. In the last decade, the concept has developed far more quickly and is gaining more attention in both research and application due to rising environmental and economic pressures.

The key elements of the circular economy are highlighted as resource reduction, reuse, recycling, extending the product life, and resource recovery. The principles support closing production and consumption loops and maximizing the value of materials. The traditional linear economy, with its extraction, manufacture, use, and disposal, has been widely criticized for depleting resources, generating waste, and leading to long-term unsustainability.

Although the circular economy offers numerous benefits, it faces many technical, organizational, financial, and behavioral hurdles. More recently, however, research has highlighted the role of digital technologies and digital innovation in enabling strategic solutions to address these barriers, including improved data management, resource tracing, and the creation of circular business models. For this reason, this synthesis can serve as a logical stepping stone to the rest of this chapter, which will explore the potential of digital technologies to support and advance the circular economy.

2.3 Organizational Readiness

2.3.1 Introduction to Organizational Readiness

Organizational Readiness is considered one of the top factors for the success of organizational change, innovation projects, and digital transformation programs—the level of an organization's readiness for successful technology adoption and implementation, as well as for strategic initiatives. From the perspective of digital innovation and the implementation of a circular economy, organizational readiness can be divided into several key aspects, including technological infrastructure, managerial commitment, employee capabilities and skills, financial resources, and a positive organizational culture. All these factors play a role in an organization's success in delivering digital innovation initiatives to action and sustainable results.

The more prepared an organization is, the more likely it is to embrace cutting-edge technologies, adapt to environmental shifts, mitigate implementation challenges, and secure sustainable competitive advantages. On the other hand, where the organization is not ready, digital innovation efforts may be less effective than needed, and the likelihood of implementing the circular economy may be lower. Hence, organizational readiness has emerged as a prominent topic in research on digital transformation, innovation adoption, and organizational change for sustainability.

Organizational readiness means that an organization is ready to implement, adopt, and maintain new practices, technologies, and strategic changes. It includes resources, infrastructure, managerial commitment, employee competencies, organizational culture, and other skills and abilities that enable successful implementation processes. An organization that is better prepared to respond to environmental changes is more likely to address implementation challenges, maximize the benefits of innovation and transformation programs, and achieve better results.

In the digital era, the need for organizational readiness has grown tremendously. Digital technologies offer significant potential for enabling operational efficiency, competitiveness, and sustainable development. However, they will require a high level of capacity building within the organization in technological, human, financial, and managerial terms. In the absence of readiness, investments in digital technologies can fall short of expectations, even when the technologies used are at the forefront.

Organizational readiness is also a topic of much research and discussion in recent years, especially in the field of sustainability and the circular economy. Transitioning to circular economy practices is not always straightforward and requires large-scale organizational changes, including new technologies, process redesign, new business models, and improved cooperation among stakeholders. This cannot happen without sufficient organizational readiness. Organizations, therefore, are seeing organizational readiness as a strategic capability that will help them take digital innovation projects to operational and environmental sustainability.

In manufacturing sectors, organizational readiness is even more important due to the complexity of production systems and the need to manage resources and processes during technological integration. The organization's readiness level can be a key indicator of how far an SME can go in leveraging digital innovations to support the circular economy's implementation and drive sustainable industrial development. Therefore, the dimensions of organizational readiness and their understanding are crucial for explaining variations in the success and sustainability performance of industrial enterprises during digital transformation.

2.3.2 Definitions of Organizational Readiness

The concept of organizational readiness can be defined in various ways in the management, innovation, and organizational change literature. While there are several definitions, depending on the theoretical perspective and the context in which researchers practice, most focus on the organization's readiness to succeed with change and its capacity to mobilize the resources needed for transformation initiatives.

Weiner (2009) proposed that organizational readiness for change is the psychological and behavioral readiness of organizational members to change, as well as their confidence in their ability to implement the necessary changes successfully. This view assumes that readiness is both a commitment to change and confidence in organizational capabilities.

In the literature, organizational readiness is generally perceived as a multidimensional phenomenon and categorized into four groups: technological, managerial, employee, and financial. These dimensions are all factors that influence an organization's ability to implement circular economy practices and successfully integrate digital innovation.

Organizational readiness from the resource-based view is the availability and sufficiency of organizational resources, competencies, and capabilities necessary to implement and adopt new technologies and innovations. Organizational resources and capabilities are viewed as fundamental sources of competitive advantage by Barney (1991), who argued that organizations with superior resources are better equipped to implement strategic changes and innovation initiatives successfully.

From a digital transformation perspective, organizational readiness has been described as encompassing technological infrastructure, managerial support, financial resources, employee competencies, and organizational culture (Ramdani et al., 2022). This definition captures the multifaceted nature of readiness and its close links to digital innovation initiatives.

Organizational readiness has also been emphasized in recent studies for its role in sustainability-oriented transformations. According to Khroh et al. (2024), organizational readiness refers to the level of organizational capabilities required to design, implement, and integrate innovative digital solutions into operational and strategic activities. Likewise, Awad et al. (2025) state that organizational readiness is the key to unlocking opportunities for digital innovation and circular economy practices.

Based on the above discussion, the definition of organizational readiness in this research is the capacity of plastic manufacturing enterprises to successfully introduce digital innovation and apply circular economy practices across technological, managerial, financial, human, and cultural dimensions.

2.3.3 Theoretical Foundations of Organizational Readiness

There are several organizational readiness theory-based frameworks that describe how organizations build the capabilities needed to embrace innovation, adapt to the environment, and attain sustainable competitive advantage. The most relevant theoretical frameworks for this research were the Resource-Based View (RBV) and the Dynamic Capabilities Perspective.

2.3.3.1 Resource-Based View (RBV)

The Resource-Based View (RBV) is one of the most influential theories in strategic management and organizational studies. Barney (1991) originally developed the RBV, which posits that organizational performance and competitive advantage depend heavily on organizations' resources and capabilities. This theory suggests that valuable, rare, inimitable, and non-substitutable resources enable organizations to sustain their competitive advantages.

From an organizational readiness perspective, the RBV posits that organizations should possess adequate internal resources to pursue innovation and transformation programs. These encompass physical resources, such as technology and financial resources, and intangible ones, such as the manager's skills and experience, organizational culture, staff knowledge, and capacity to learn.

RBV's value to digital innovation is especially important given the significant investments often required in technology, staff training, and organizational changes when implementing digital transformation. Overall, organizations with greater technological competence, supportive leadership, and adequate financial resources are more likely to be ready to use digital technologies and maximize their potential benefits. Thus, organizational readiness may be regarded as an expression of the strategic resources and capabilities highlighted by the RBV.

Moreover, the RBV offers a valuable theoretical approach to understanding why organizations vary in their capacity to engage in circular economy practices. More prepared enterprises could be better positioned to leverage digital technologies, reimagine their operations, and develop new solutions to achieve their sustainability goals. For this reason, RBV provides a solid theoretical basis for understanding the link between digital innovation and the implementation of the circular economy and for identifying the importance of organizational readiness.

2.3.3.2 Dynamic Capabilities Perspective

The Dynamic Capabilities Perspective extends the Resource-Based View by emphasizing an organization's capacity to adapt its resources through change, renewal, and reconfiguration in response to changing environmental conditions. This approach goes beyond the resource paradigm, focusing instead on the ability to integrate, develop, and evolve resources to meet new opportunities and challenges.

The Dynamic Capabilities Perspective suggests that a successful organization is one that continually creates new capabilities that enable it to sense environmental changes, seize new opportunities, and transform existing operational processes. These are especially vital in fast-changing markets where technologies are rapidly developing, customer needs are changing, and sustainability demands are growing.

Dynamic capabilities are the ability to adapt processes and integrate new technologies into organizational processes to keep pace with technological innovations in the digital era. Likewise, adopting circular economy principles entails changing processes, forming new partnerships, creating new business models, and reconfiguring resources. These activities are very similar to those of dynamic capabilities.

Thus, organizational readiness can be considered as one of the significant expressions of dynamic capabilities. Leaders who score high on readiness are more likely to have the adaptive capacities needed for digital transformation and change to be sustainable. This view thus offers further theoretical grounding for exploring organizational readiness as a crucial pathway through which digital innovation enables the implementation of the circular economy.

2.3.4 Dimensions of Organizational Readiness

Organizational readiness is a multidimensional construct encompassing an organization's general readiness to innovate, implement change, and respond to environmental pressures. The literature indicates that readiness is not a simple phenomenon but a manifestation of the interaction among technological, managerial, human, financial, and cultural capabilities within the organization. All these aspects contribute to the successful implementation of digital transformation initiatives and sustainability-oriented practices (Ramdani et al., 2022; Kroh et al., 2024).

Organizational readiness can be considered the basis for technology adoption and organizational transformation, especially in the context of digital innovation and the implementation of the circular economy. Based on this, the study adopts five interrelated dimensions of organizational readiness: technological, managerial, human resource, financial, and cultural.

2.3.4.1 Technological Readiness

Technological readiness is the availability, sufficiency, and quality of technological infrastructure and capabilities to enable innovation and digital transformation programs. It encompasses the organization's IT infrastructure, digital platforms, software systems, communication networks, data management capabilities, and technological expertise.

High-technology-readiness organizations have the software and hardware in place to embrace new technologies such as the Internet of Things, Big Data Analytics, Cloud Computing, and Artificial Intelligence. The technologies help organizations achieve more efficient operations, track resource use, streamline production, and promote circular-economy approaches. However, insufficient technological infrastructure has sometimes posed a significant challenge to organizational transformation and the adoption of innovations (Kroh et al., 2024; Ramdani et al., 2022).

For manufacturing companies, technological readiness is especially significant, as many digital technologies are key to process automation, production monitoring, predictive maintenance, and resource optimization. So, in general, organizations with greater technological readiness are more likely to use digital innovation to achieve sustainability and circular economy goals.

2.3.4.2 Managerial Readiness

Managerial readiness is the attitude, support, and vision of an organization's leaders towards innovation and change efforts. As an important part of an organization, top management sets priorities, allocates resources, formulates strategic visions, and provides enabling contexts for adopting innovations.

A crucial factor in the success of a digital transformation initiative is managers' commitment to the process, as they shape organizational decisions, employee motivation, and culture. Supportive leadership fosters experimentation, helps implement change, and minimizes resistance to innovation. On the other hand, if management has not become a strong supporter, the organization may struggle to adopt new technologies and sustainability measures.

Several studies have highlighted the role of top management support as one of the most significant success factors of digital innovations. Leaders who pave the way for innovation and sustainability foster conditions that facilitate organizational learning, the adoption of new technology, and long-term transformation (Uršič & Čater, 2024; Awad et al., 2025).

2.3.4.3 Human Resource Readiness

Human resource readiness is the knowledge, skills, competencies, and capabilities of the employees to support innovation and organizational change. Employees need to develop new technical skills and adapt to new work environments as more organizations adopt digital technologies.

Digital transformation demands a workforce that can effectively leverage digital tools, understand data, and navigate technological challenges while engaging in ongoing learning. Therefore, organizations must invest in employee development, training programs, and skill-enhancement initiatives that build readiness capacities.

Human resource readiness also includes employees' receptivity towards change and innovation programs. Businesses with learning-oriented staff tend to be more effective at implementing digital technology and meeting future sustainability needs. Thus, employee competence and continual learning are also aspects of organizational readiness (Ramdani et al., 2022).

2.3.4.4 Financial Readiness

Financial readiness is the organization's capacity to allocate financial resources to innovation, digital transformation, and sustainability efforts. Significant capital outlay may be required for the purchase and installation of the technology and its software, staff training, process changes, and organizational redesign.

The larger an organization is in terms of financial resources, the greater the chance of investing in new technologies, testing new approaches, and maintaining ongoing transformation programs. Conversely, financial constraints are often the reason why organizations are unable to take advantage of innovation opportunities and strategic action.

However, financial preparedness is particularly important in developing economies, where a lack of resources can be a major constraint on the adoption of innovation. Therefore, manufacturing companies need to ensure sufficient financial resources to support the implementation and sustainability of digital innovation and the circular economy.

2.3.4.5 Cultural Readiness

Cultural readiness is defined as the extent to which organizational values, beliefs, norms, and behaviors foster innovation, learning, and change. Organizational culture shapes employee attitudes towards new technologies, change efforts, and organizational change programs.

Cultivating a culture of creativity, experimentation, collaboration, and continuous improvement positively influences the adoption of innovations. These cultures foster an environment where employees can freely experiment with new ideas, learn from their mistakes, and participate in organizational development programs.

On the other hand, an organization with a rigid culture and low willingness to change and take risks could hinder the implementation of innovation and its adaptability. As a result, cultural readiness is considered one of the key factors to successful digital transformation and change towards sustainability.

Cultural readiness is especially relevant for organizations striving for a circular economy because circular practices may require changes to mindsets across traditional operations, resource management, and stakeholder engagement. So, fostering a positive organizational culture is critical to successful long-term transformation efforts.

2.3.5 Organizational Readiness and Digital Transformation

Research on the relationship between organizational readiness and digital transformation has attracted considerable attention in recent management and information systems literature. While technology offers organizations new opportunities to become more efficient and competitive, the ability to use digital technology effectively is key to a successful digital transformation.

Digital transformation is more than just the adoption of new technology. It demands basic structural, procedural, capacity, and business-model transformations within organizations. As a result, organizations need to have the appropriate levels of readiness to manage these changes effectively. Even though the organization has the technological infrastructure, it is not enough to support the adoption of digital transformation initiatives; other factors, such as leadership commitment, employee competencies, financial resources, and organizational culture, are also important (Kroh et al., 2024; Ramdani et al., 2022).

Multiple reports have shown that within a business, those that are more "ready" to be a digital organization will be more successful at doing so. By implementing readiness, organizations can address the challenges of change, minimize resistance, expedite technology adoption, and maximize ROI on digital investments. In addition, organizational readiness improves the organization's capacity to respond to new technologies and market changes continuously.

For manufacturing companies, organizational readiness is an important factor, especially when digital transformation involves implementing new technologies across production systems, supply chain operations, and resource management processes. Technological investments can be made, but the benefits of digital innovation will not be fully realized without readiness.

Furthermore, organizational readiness is a key factor in the successful implementation of sustainability-oriented digital solutions. Digital technologies can support circular economy practices as follows: resource monitoring, waste reduction, recycling management, and production optimization. However, these benefits can only be realized if organizations are ready to embed technology effectively in their operational and strategic processes.

Thus, organizational readiness can be considered a key driver of digital innovation for sustainable organizational development and a main success factor for digital transformation.

2.3.6 Organizational Readiness as a Mediating Variable

In recent literature, organizational readiness is being increasingly identified as an important mediator between the innovation initiatives and organizational outcomes. Digital innovation does not necessarily affect performance directly, but rather through the organization's capability to implement technology, learn, and change.

In this view, organizational readiness mediates the relationship between digital innovation and organizational outcomes. While digital innovation can provide access to cutting-edge technologies and solutions, the potential benefits are realized only when the organization is ready to innovate and implement these technologies effectively. Better-prepared companies are better able to translate their technology investments into operational improvements, sustainable outcomes, and competitive advantage.

Both the Resource-Based View and the Dynamic Capabilities Perspective support the role of organizational readiness as a mediator. These theories indicate that an organization's ability to exploit innovation opportunities depends on related resources and adaptability. In turn, by helping to implement processes and minimizing barriers to change, organizational readiness can help to build the link between digital innovation and desired organizational outcomes.

Organizational readiness can be especially significant when organizations implement circular economy practices, which may require substantial organizational changes, such as process redesign, employee engagement, and the integration of technologies and strategies. The success rate of organizational implementation of digital innovation projects to effective circular economy practices is higher for those with high readiness.

In this study, organizational readiness is therefore considered a mediating variable that facilitates digital innovation and the implementation of the circular economy. Organizational readiness could enhance the effectiveness of digital innovation in supporting circular-economy practices in plastic manufacturing businesses in Hebron City by improving organizations' capacity to adopt, integrate, and use digital technologies.

2.3.7 Summary

The concept of organizational readiness was discussed as an important organizational capability that aids the adoption of innovation and organizational transformation. In this discussion, the multidimensional nature of organizational readiness was discussed, and its key dimensions, such as technological readiness, managerial readiness, human resource readiness, financial readiness, and cultural readiness, were examined.

The section also discussed the linkages between organizational readiness and digital transformation, highlighting the importance of readiness for technology adoption, organizational transformation, and sustainable development. Moreover, organizational readiness was introduced as a mediating factor that helps organizations successfully implement digital innovation and deliver meaningful organizational outcomes.

The reviewed literature and theoretical foundations indicate that organizational factors are crucial determinants of the successful implementation of digital innovation and circular economy practices. Thus, it is considered a mediating variable in the current study, as it explains how digital innovations foster the practice of the circular economy in plastic manufacturing companies in Hebron City.

2.4 Government Support

2.4.1 Introduction

Government support is becoming an increasingly important factor in promoting innovation, digital transformation, and sustainable development. Governments have been realizing that market mechanisms do not necessarily induce large-scale ecological and technological changes in recent years. Therefore, public institutions have developed several policies, strategies, incentives, and support measures to facilitate the adoption of innovation, strengthen their innovative capacity, and promote sustainable business.

The shift to digital innovations and the implementation of the circular economy will require significant investments, institutional coordination, conducive rules and regulations, and knowledge exchange. Within this context, government support acts as an enabler to remove some of the challenges of technology uptake, organizational change, and sustainability-focused programs. Governments can implement appropriate policies and institutional frameworks to facilitate the adoption of new technologies and sustainable business models by organizations.

For industrial companies, government policy is especially important for reducing uncertainty, accessing resources, improving infrastructure, and ensuring long-term competitiveness, particularly in less-developed economies. Hence, it is important to understand the nature and effects of government support when examining the factors driving digital innovation and the implementation of the circular economy.

2.4.2 Definitions of Government Support

Government support refers to the practices, policies, programs, incentives, and institutional measures that public authorities undertake to support organizational development, the adoption of innovation, and sustainable economic development. This support can take the form of finance, regulation, infrastructure, education, or strategy, in line with national priorities and development goals.

Awad et al. (2025) define government support as the policy, strategic measures, and institutional structures that promote organizations to implement innovative and sustainable practices. Such mechanisms create an enabling environment that lessens the barriers to innovation and fosters organizational transformation.

Likewise, Jabbour et al. (2019) assert that government institutions play a pivotal role in creating conditions conducive to sustainability-oriented innovation by establishing enabling regulations, offering incentives, increasing stakeholder participation, and encouraging environmental responsibility. Government can therefore play a pivotal role in accelerating the adoption of digital technologies and circular economy practices.

In this study, government support is defined as the extent to which the government supports the adoption of digital innovation and circular economy practices by plastic manufacturing enterprises in Hebron City through its policies, national strategies, regulatory frameworks, and institutional initiatives.

2.4.3 Forms of Government Support

Governments can support organizations in several ways that affect their behavior and their ability to adopt innovation. Several types of support relevant to digital transformation and sustainability programs have been identified in the literature.

2.4.3.1 Financial Incentives

One of the more direct avenues of government assistance is financial incentives. They can take the form of grants, subsidies, tax breaks, low-interest loans, innovation funds, and financial instruments to support investments in innovative digital technologies and sustainable production systems.

Support for SMEs' finances is especially crucial when they are resource-constrained in implementing circular economy measures or adopting advanced technologies. Governments can alleviate financial and investment risks and costs, thereby increasing innovation and advancing sustainability goals within organizations (Jabbour et al., 2019).

2.4.3.2 Regulatory Support

Regulatory support is the creation of laws, regulations, standards, and policy frameworks that facilitate innovation and sustainable business. Clear regulation, less administration, and policies that reward environmentally responsible behavior are all ways governments can encourage digital transformation and the implementation of the circular economy.

Enabling and supportive regulatory frameworks give organizations more clarity and confidence, and foster longer-term investment in innovation. On the other hand, poor or ineffective regulations can create disincentives to adopting new technologies and/or sustainability-related measures.

2.4.3.3 Infrastructure Support

Infrastructure support includes measures taken by the government to build and maintain the physical and information and communication technology infrastructure needed for innovation and economic growth, such as communication networks, digital connectivity, information technology infrastructure, industrial zones, and innovation ecosystems.

Organizations can be significantly affected by the availability of reliable infrastructure when considering the use of digital technologies and how effectively they can engage in modern economic activities. Hence, the deployment of infrastructure is considered a key enabler of successful digital transformation (DT) (Ramdani et al., 2022).

2.4.3.4 Knowledge and Training Support

Governments often promote innovation via education, training, research, and knowledge sharing. Partnerships with universities, vocational training programs, research centers, technology transfer programs, and awareness campaigns are all forms of such support.

Knowledge and training are used to develop human capital and to improve organizations' ability to adopt innovations. The collaboration among academia, industry, and government institutions, especially in sharing knowledge, fostering innovation, and enhancing organizational preparedness for technological and sustainability-driven transformations, is crucial for advancing solutions to address climate change and pollution. Collaborative efforts among academia, industry, and government institutions are particularly important because they facilitate knowledge exchange, promote innovation, and strengthen organizational readiness for technological and sustainability-related transformations (Awad et al., 2025).

2.4.4 Government Support and Digital Innovation

The interactions between public support for innovation and digital innovation have been broadly studied in the innovation and public policy literature. Government influence on digital innovation occurs when governments create environments that encourage organizations to adopt new technologies, invest in research and development, and engage in innovation.

National digitalization strategies, technology policies, innovation incentives, and investments in digital infrastructure can significantly increase organizations' willingness and capacity to embrace digital technologies. Organizations with supportive policies are more likely to invest in digital transformation projects because they have confidence in the policy environment and its ability to provide the necessary resources.

Evidence from several studies indicates that government support positively affects the rate of technology adoption, innovation performance, and organizational competitiveness. Therefore, government support is often regarded as an external factor influencing the success of digital transformation (Ramdani et al., 2022; Awad et al., 2025).

2.4.5 Government Support and Circular Economy

Government support is also crucial to encourage the implementation of the circular economy. Significant organizational changes may be required to implement circular economy projects, including redesigning processes, improving waste management systems, expanding recycling infrastructure, and adopting sustainable production practices. The change often relies on enabling public policies and institutional structures.

Governments can promote the adoption of the circular economy by implementing environmental regulations, providing incentives for sustainable production, supporting recycling programs, and encouraging resource use. National sustainability strategies can also support the transition towards circular economic systems by integrating organizational goals with environmental and development goals.

Studies suggest that organizations are more likely to implement circular economy practices when they operate in policy environments where sustainability goals are clearly defined, supportive policies are in place, and incentives are provided. As such, government support is a key enabler of the circular economy's implementation (Jabbour et al., 2019; Kirchherr et al., 2017).

2.4.6 Government Support as a Moderating Variable

More recent research studies have begun to consider government support as a moderating variable that can influence the relationship between organizational capabilities and innovation outcomes. In many cases, government support influences organizational behavior not directly but by shaping the extent of success the organization can achieve in implementing innovation programs.

In the context of digital innovation and the circular economy, government support can strengthen the link between digital innovation and sustainable use. Firms in supportive policy contexts might have a better chance of exploiting digital technologies to improve resource efficiency, reduce waste, control recycling, and support sustainable production. On the other hand, even when technological capabilities are in place, the effectiveness of digital innovation projects can be undermined by insufficient policy support.

In this context, the role of government will be to complement the benefits of digital innovation by providing a supportive institutional climate, regulatory incentives, and strategic guidance. In this study, Government support is considered as a moderating variable that can affect the relationship between Digital innovation and the implementation of the CE in plastic manufacturing businesses in Hebron City.

2.4.7 Summary

This section explored the role of government support in digital innovation and the implementation of the circular economy. A range of government support measures was identified, including financial, regulatory, and infrastructure support, as well as knowledge and training. The literature indicates that government support is an important factor in implementing innovation, enhancing organizational capacities, and driving sustainability-oriented transformation.

The section also discussed the linkages between government support, digital innovations, and circular economy (CE) practices. Previous studies have shown that supportive government policies and institutional frameworks can create favorable conditions for organizations to adopt digital technologies and sustainable practices. Therefore, the role of government support as a moderating factor in this relationship is introduced in the conceptual framework of this study, which can reinforce the relationship between digital innovation and the implementation of the circular economy in plastic production companies in Hebron City.

2.5 Barriers to Digital Innovation and Circular Economy Implementation

2.5.1 Introduction

Many organizational, technological, institutional, and environmental factors affect the successful implementation of digital innovation and circular economy practices. Digital transformation and sustainability can be strategic priorities for organizations, but various constraints can make it difficult for them to adopt and implement these practices effectively. Knowing what these obstacles are and how they can influence innovation efforts and sustainability changes makes one think about their impact. One considers the influence of these inhibitors, as they can significantly affect the success of innovation projects and/or sustainability-oriented transformations.

2.5.2 Financial Barriers

One of the most common challenges identified in digital innovation and the implementation of a circular economy is financial constraints. Significant infrastructure, software, employee training, and organizational restructuring may be required to implement advanced digital technologies. Likewise, implementing circular economy projects can entail additional costs for process redesign, reuse systems, and sustainable production technologies. With limited resources, organizations may not be able to pursue innovation and sustainability efforts (Jabbour et al., 2019; Galvão et al., 2018).

2.5.3 Technical and Technological Barriers

Technical barriers can be a lack of technological expertise, insufficient digital capabilities, inadequate infrastructure, and limited access to advanced technologies. There are some challenges for organizations in integrating digital systems, managing the use of complex technological solutions, or securing staff members with specialized technical skills. These constraints hinder digital transformation and the implementation of the circular economy (Cagno et al., 2021; Schöggl et al., 2023).

2.5.4 Institutional and Policy Barriers

The institutional problems are a lack of governmental support, poor regulatory systems, insufficient incentives, and a lack of public policy support. Government institutions have a crucial role to play in supporting innovation and sustainability, for instance, by enacting laws, providing incentives, constructing infrastructure, and building capacity. Without proper support, organizations may have greater difficulty implementing the principles of the digital and circular economies (Awad et al., 2025; Jabbour et al., 2019).

2.5.5 Organizational Resistance to Change

One barrier to change in organizations is common resistance. Employees and managers can resist new technologies, process changes, or changes in work routines because they are uncertain, perceive risks, or worry about losing their jobs. This opposition can hinder digital transformation initiatives and lessen the impact of sustainability initiatives. Therefore, it is important for organizations to handle change processes proactively and to promote positive attitudes towards innovation (Weiner, 2009).

2.5.6 Infrastructure Limitations

Infrastructure is a key precondition for successful digital transformation. If technology is less developed than in other areas and the technological infrastructure and/or communication channels are weak, organizations may struggle to implement advanced technologies. Infrastructure constraints are especially relevant in developing economies, where the digital ecosystem is underdeveloped (Ramdani et al., 2022).

2.5.7 Awareness and Knowledge Barriers

The key to the successful implementation of circular economy practices is a clear understanding of sustainability principles, resource-efficiency concepts, and the potential benefits to the organization. The lack of knowledge among managers and employees can affect organizations' willingness to invest in circular economy measures and limit the adoption of new sustainable solutions. Awareness and knowledge are thus key prerequisites for successful transformation (Suchek et al., 2021).

2.5.8 Summary

The literature indicates various challenges in implementing digital innovation and circular economy practices within organizations. They include financial constraints, technical barriers, lack of government support, organizational barriers to change, infrastructure, and a lack of understanding of sustainability concepts. It is important to understand these barriers, as they affect the organization's ability to incorporate digital technologies and circular-economy practices effectively. Therefore, an insightful assessment of these barriers can help identify conditions that enable or block sustainable industrial transformation.

2.6 Relationships among Study Variables

2.6.1 Introduction

The interconnectedness of the variables studied has gained prominence in the literature on digital transformation, sustainability, and the implementation of the circular economy. Although digital innovation is well known as a key factor in organizational change and sustainable development, it can be affected by both internal organizational and external institutional conditions. Hence, it is important to understand the interdependencies between digital innovation, organizational readiness, government support, and the implementation of the circular economy to explain how organizations can effectively realize sustainable outcomes.

This section summarizes theoretical and empirical studies reviewed on the interrelationships among the study variables. In particular, it examines the relationship between digital innovation and circular economy implementation, the relationship between digital innovation and organizational readiness, the relationship between organizational readiness and circular economy implementation, the mediating role of organizational readiness, and the moderating role of government support. The review serves as the basis for developing the study hypotheses and the proposed conceptual framework.

2.6.2 Digital Innovation and Circular Economy

In recent years, the relationship between digital innovation and the circular economy has become one of the most prominent topics in sustainability and innovation research. The rising awareness of environmental issues, limited resources, and the need for sustainable production has spurred organizations to seek new and creative solutions that integrate sustainability goals with technological advancements. In this context, digital innovation has become a key driver of circular economy implementation.

Digital innovation plays a role in circular economy practices by providing organizations with tools to track resources, optimize production processes, make informed decisions, and recover and reuse materials. In contrast to conventional production systems, circular economy systems require continuous information flows, transparency, traceability, and coordination among various stakeholders. Digital technologies offer the infrastructure to meet these needs and equip organizations to better manage resources across the product lifecycle (Bressanelli et al., 2022).

Several digital technologies are recognized as key enablers to implement the circular economy. The Internet of Things (IoT) enables companies to acquire data on material flow, product utilization, equipment operation, and resource use in real time. This kind of information enhances visibility in supply chains and helps manage resources more effectively. Likewise, big data analytics can analyze vast amounts of operational data to uncover opportunities to improve efficiency, minimize waste, and optimize production systems. Cloud computing enables data and information sharing and collaboration within the supply chain, and AI can enhance predictive decision-making and process optimization (Neri et al., 2024).

The literature shows that digital innovation can support the principles of the circular economy, such as reducing waste, extending product lifecycles, optimizing recycling processes, and optimizing waste management systems. According to Bressanelli et al. (2022), digital technology can be used to repurpose waste as it is collected, analyzed, and put to use throughout the production and consumption process. They have introduced their Smart Circular Economy framework, which values the data as a resource to enhance the circular performance.

Likewise, Alhawari et al. (2021) found that digital innovation capabilities positively affect an organization's capacity to implement circular economy practices. Their research shows that a digital orientation, technological capabilities, and data management systems have a significant impact on circular innovation performance. The authors found that companies with higher digital capacity are more likely to take actions considered effective in implementing the circular economy and to have sustainability-related objectives.

A positive correlation between digital maturity and the adoption of circular business models was also found by Neligan et al. (2022). They found that digitally advanced organizations are better able to embed CE principles in their operations, as digital technologies enable them to track and manage resources, optimize processes, and coordinate actors across value chains. As a result, digital transformation can be regarded as the accelerator for the development of a circular business model and sustainable value creation.

More recently, research has also highlighted the role of digital innovation within the objectives of the circular economy. Digital innovation offers the potential to shift away from traditional waste management strategies toward integrated resource management systems (Awad et al., 2025). Digital platforms, predictive analytics, artificial intelligence, and information systems can enable closed-loop production systems, leading to better environmental performance and more efficient, competitive operations.

Besides that, digital innovation enhances transparency and traceability in the supply chain, both of which are key requirements for implementing the circular economy. New technologies like blockchain and the Internet of Things (IoT) make it possible to track products and materials from production to use and reuse, remanufacturing, recycling, or recovery. These capabilities contribute to more sustainable resource management practices and reinforce the organization towards circularity (Jauhar et al., 2023).

Theoretically, the connection between digital innovation and the circular economy can be understood through the Resource-Based View (RBV), which posits that individual technologies constitute strategic organizational resources that can provide sustainable competitive advantages (Barney, 1991). Advanced digital capabilities enable organizations to adopt and integrate circular economy practices by providing the resources and competencies needed to support innovation, resource optimization, and sustainability efforts.

The literature reviewed indicates a strong, consistent link between digital innovation and the implementation of the circular economy. Digital technologies enable organizations to optimize resource use, minimize waste, support recycling programs, improve environmental performance, and create sustainable business models. Therefore, the significance of digital innovation as a key enabler of the transition to a circular economy across industrial sectors is gaining traction.

Based on a literature review, the current study suggests that digital innovation positively affects the implementation of CE in plastic manufacturing companies in Hebron City.

Critical Analysis

In line with this, digital innovation is increasingly recognized in prior studies as a key enabler of circular economy practices by supporting resource efficiency, reducing waste, improving recycling, and enabling sustainable production systems. Most of these studies, however, have been undertaken in developed economies and major industrial organizations. There has been sparse research on the development of resource-poor, institutionally weak economies. Moreover, only a few studies have explored the connection between the plastic manufacturing industry. In this regard, further empirical evidence is needed to explore the role of digital innovation in implementing the circular economy in Palestine's industrial context.

2.6.3 Digital Innovation and Organizational Readiness

Digital innovation is not just about having the right technology; it is also about preparing for and managing technological shifts. This has led to the relationship between digital innovation and organizational readiness being increasingly explored in recent literature on innovation and digital transformation. Researchers are deepening their understanding of the interdependence between digital innovation and organizational readiness, whereby the use of digital technologies can strengthen organizational capabilities, and organizational readiness supports the effective implementation of digital innovation initiatives.

Digital innovation can involve re-thinking operations, building new skills, investing in technology, and implementing new ways to make decisions and manage resources. In today's era of digital transformation, organizations are compelled to improve their internal capacity, employees' skills, leadership engagement, and supportive organizational culture. Together, these changes increase organizational preparedness (Kroh et al., 2024).

Some research indicates that firms that are more inclined to pursue digital innovation tend to invest more in technological infrastructure and human capital development. In the case of digital transformation efforts, many of them tend to trigger organizational changes in technological readiness, employee skills, and managerial competence, Ramdani et al. (2022) argue. Digital technologies will promote the development of organizational systems that enhance learning, knowledge sharing, and continuous improvement, while boosting their overall readiness for future innovation and change.

Digital innovation is also helping organizations be better prepared through improved access to information and decision-making. Digital technologies help organizations gather, process, and use data more effectively, enabling managers to make decisions and respond faster to environmental changes. These capabilities enhance the organization's flexibility and reinforce readiness to carry out strategic initiatives (Uršič & Čater, 2024).

Moreover, digital innovation can shape the organizational culture by fostering innovation-oriented norms and values and by motivating people to pursue continuous learning and experimentation. Digital technology implementation improves organizational culture to be more open, collaborative, and innovative when successful. These attributes are regarded as key factors to help organizations become ready to implement future transformation efforts (Awad et al., 2025).

Theoretically, the Dynamic Capabilities Perspective offers a helpful framework for understanding the nexus between Digital Innovation and Organizational Readiness. From this point of view, organizations are constantly evolving to acquire the means to sense opportunities, adapt to environmental changes, and reconfigure resources in response to shifting conditions. Digital innovation also supports these capabilities by offering organizations tools and knowledge, which in turn, strengthen flexibility, learning, and strategic responsiveness.

Likewise, the Resource-Based View (RBV) theory proposes that digital technologies are valuable assets that can enhance internal resources and create a competitive advantage for the organization (Barney, 1991). Investments in digital innovation will empower organizations to build strategic resources that will further equip them for future innovations and sustainability efforts.

Another finding from the empirical evidence is that being ready for digital innovation is positively correlated with digital innovation. Research shows that organizations with greater digital adoption are more technologically capable, have more supportive leadership structures, better-trained employees, and are better prepared for organizational change (Kroh et al., 2024; Ramdani et al., 2022). As a result, digital innovation is seen as a key enabler for organizational readiness.

In plastic production companies, digital innovation can boost preparedness in several ways, including enhancing technological infrastructure, strengthening employee capabilities, improving operational procedures, and supporting strategic decision-making. Such enhancements can boost the organization's ability to adopt sustainability-focused projects and meet evolving environmental and market needs.

From the literature reviewed, it can be argued that digital innovation positively impacts organizational readiness. Thus, the present study suggests that digital innovation has a great positive impact on the organizational readiness of plastic manufacturing companies in Hebron City.

Critical Analysis

The literature reviewed mostly confirms the positive impact of digital innovation on organizational readiness. Digital technologies help to build technological infrastructure, increase employee skills, and increase organizational flexibility. However, the majority of the available literature has been on digital transformation in developed nations and service-driven industries. Few empirical studies on the degree of organizational readiness that digital innovation can foster in manufacturing organizations in developing countries are available. This indicates the need to explore the Palestinian industrial environment further.

2.6.4 Organizational Readiness and Circular Economy

Circular economy practices entail significant organizational changes, including production processes, resource management systems, organizational culture, employee behavior, and business strategies. This has made organizational readiness an important factor in the success of circular economy implementation. Organizations may understand how circular economy principles can benefit them, but the journey towards circular practices is driven by their willingness to make these changes.

Organizational readiness plays a role in implementing the circular economy by providing the capacity to embrace new technologies, restructure operations, and manage organizational change. Companies with appropriate technological infrastructure and staff, supportive management, and strong financial backing are better equipped to implement circular economy practices (Weiner, 2009) successfully.

Technological readiness is a key determinant of CE adoption in the literature. Several circular practices rely on high-tech tools to track resources, minimize waste, coordinate and manage recycling efforts, and coordinate supply chains. However, even with awareness of the value of such practices, organizations may face challenges in implementing them due to limited technology. Thus, technological preparedness is an important prerequisite for implementing the circular economy (Bressanelli et al., 2022).

Managerial preparedness is another important factor for the success of the circular economy. Leadership commitment affects strategic priorities, organizational investment in sustainability, and organizational support for sustainability projects. Managers actively promoting sustainability and innovation are more likely to set the stage for the successful implementation of the circular economy. Their backing helps break down organizational resistance, boost employee engagement, and enable sustainable transformation efforts (Awad et al., 2025).

Another key element that can affect the adoption of a circular economy is human resource readiness. Employees are at the heart of sustainability measures, the use of digital technologies, and supporting process optimization. The more companies have an effective, knowledgeable, and skilled workforce, the better they can incorporate circular principles into their everyday activities and continue to improve their operations. Therefore, in the context of the successful implementation of the circular economy, employees' competencies and training programs play a direct role (Ramdani et al., 2022).

The financial preparedness also contributes to the implementation of CE practices. Many of the steps towards circular systems involve investments in new technologies, process redesign, recycling facilities, and sustainability projects. Those organizations with adequate financial means tend to be able to make these investments and to maintain transformation programs over time. On the other hand, financial constraints are often a key barrier to organizations in achieving their circular economy goals effectively (Jabbour et al., 2019).

Moreover, organizational culture is a major factor affecting the implementation of the circular economy. An innovation and collaboration culture, as well as one that is environmentally responsible and encourages continuous learning, can help enable circular practices. On the other hand, cultures within the organization that are resistant to change and more short-term oriented might delay sustainability initiatives and reduce the effectiveness of circular economy strategies.

The Dynamic Capabilities Perspective can also be used to explain the organizational readiness and the implementation of the circular economy. One theory holds that organizations with high adaptive capacity will be better able to address sustainability issues and reconfigure their resources in response to new opportunities. The capabilities are exactly what are needed for a circular economy approach, as it is an ongoing process of adaptation, innovation, and organizational learning.

Evidence of organizational readiness is increasingly important in achieving sustainability and circular economy goals and is supported by empirical studies. According to Kroh et al. (2024), the success of transformation towards sustainable development is determined in large part by the organization's capabilities and readiness. Likewise, Awad et al. (2025) state that organizational readiness will increase the effectiveness of digital innovation, thereby helping organizations translate technology investments into tangible circular economy results.

Organizational readiness is crucial in plastic manufacturing enterprises, given issues of resource efficiency, waste management, recycling, and environmental sustainability. More prepared companies can adopt circular practices, optimize resource use, minimize waste, and meet sustainability goals.

The literature reviewed suggests that organizational readiness is a critical enabler for implementing the circular economy. Successful results and long-term efforts in the circular economy are more likely to yield within organizations that are well equipped technologically, managerially, humanly, financially, and culturally.

After reviewing the theoretical and empirical findings, the current study suggests that organizational readiness (OR) has a significant positive effect on the implementation of the circular economy in plastic manufacturing businesses in Hebron City.

Critical Analysis

The literature identifies organizational readiness as one of the main prerequisites for implementing circular economy (CE) practices. Sustainability-oriented initiatives tend to be more easily implemented by organizations with the right technological infrastructure, management commitment, financial resources, and workforce capacity. Empirical results remain limited in developed countries and, to a lesser extent, in developing countries. Thus, the findings of this study need further empirical investigation to determine their applicability to Palestinian manufacturing enterprises.

2.6.5 The Mediating Role of Organizational Readiness

As digital transformation projects grow more complex, researchers have started to focus on the role of organizational capacities in explaining the impact of digital investments on organizational results. Digital innovation offers access to new and exciting technologies and solutions for the organization; however, implementing these technologies depends on the organization's internal readiness and capabilities to drive change successfully. Organizations are therefore increasingly studied as a mediating factor that accounts for the pathways through which digital innovation leads to sustainability outcomes, such as the implementation of the circular economy.

A mediating variable is a variable that helps to connect an independent variable and a dependent variable. Given the current state of research, organizational readiness is considered a mediating factor in implementing circular economy practices through digital innovation. This view indicates that digital innovation may not necessarily lead to circular-economy outcomes. Rather, digital innovation can first increase the organization's readiness and then enable the successful implementation and adaptation of circular economy practices.

Such a mediating relationship can be explained from the Resource-Based View (RBV) and the Dynamic Capabilities Perspective. The RBV posits that organizations gain a competitive advantage from valuable resources and capabilities that enable them to capitalize on opportunities and overcome obstacles (Barney, 1991). Digital innovation is an organizational resource, but it is the organization's ability to develop complementary capabilities that support implementation and value creation that makes the difference. One of these capacities is organizational readiness, which assesses how well organizations have the technological, managerial, financial, and human resources to translate innovation into tangible results.

Likewise, the Dynamic Capabilities Perspective focuses on how organizations need to continually reconfigure their resources to meet the demands of dynamic environments. Digital innovation is vital in enhancing information processing, learning, flexibility, and responsiveness, which are the attributes of dynamic capabilities. The improvements enhance organizational readiness and further strengthen the organization's ability to undertake complex sustainability projects, such as circular economy initiatives.

Some empirical research supports the mediating role of organizational readiness in technology adoption and organizational transformation. The study by Ramdani et al. (2022) revealed that organizational capabilities play a key role in the success of digital transformation projects and shape the extent to which organizations can leverage digital technologies to enhance operational performance and sustainability outcomes. Similarly, Kroh et al. (2024) highlighted that the key factor of organizational readiness is that it "sets the conditions for organizational adaptation and change" to ensure the successful implementation of digital innovation.

Organizational readiness and the implementation of the circular economy are particularly relevant in the manufacturing industry. Many circular economy implementations entail significant organizational transition, including process redesign, technological change, employee engagement, and strategic alignment. However, even with digital technologies at its disposal, an organization might not be well prepared to implement these changes. On the other hand, organizations that score higher on readiness tend to be better at translating digital innovation into effective circular economy practices.

In recent sustainability research, there is also a growing understanding of the importance of organizational readiness as a linkage between innovation and sustainability outcomes. Awad et al. (2025) state that organizational readiness can contribute to organizations' capacity to use digital technologies to achieve environmental and sustainability goals. Readiness builds the technology's adoption potential, enhances employees' capabilities, and supports organizational change, thereby making circular economy implementation more effective.

Organizational readiness can be especially significant for plastic manufacturing businesses in Hebron City due to issues such as optimizing resources, managing waste, embracing technology, and promoting sustainability. Digital innovation can boost organizational readiness by improving technological infrastructure, developing employees' skills, and fostering a positive organizational culture. These enhancements, in turn, could provide an enabling environment for the implementation of CE principles and help enable more environmentally sustainable industrial operations.

Organizational readiness is hypothesized to mediate the relationship between digital innovation and circular economy implementation, based on the literature studied. Hence, the current study introduces the concept that digital innovation can boost organizational readiness, which in turn can support the effective implementation of circular economy practices in plastic manufacturing companies in Hebron City.

Critical Analysis

While some studies have highlighted the role of organizational readiness in supporting organizational transformation and innovation outcomes, little research has examined how it mediates the relationship between digital innovation and the implementation of the circular economy. It is already known that the use of digital technologies alone is not enough to achieve sustainable outcomes unless organizations are sufficiently ready to make the best use of these technologies. This gap calls into question the need for examining organizational readiness as a mediating variable in the present study.

2.6.6 The Moderating Role of Government Support

Digital innovations do not happen without the circular economy. Beyond organizational capacity to innovate, the external environment can also affect the viability of innovation efforts and sustainability transitions. Government support is one of the most significant institutional mechanisms affecting organizations' uptake of digital technologies and circular economy practices.

Government support refers to the policies, regulations, strategic actions, incentives, and institutional frameworks that the government implements to foster innovation, sustainability, and economic growth. Governments can minimize barriers to the adoption of innovation, enable access to resources, and establish favorable conditions for sustainable industrial transformation through supportive policies and regulatory frameworks (Awad et al., 2025).

Digital transformation and the implementation of the Circular Economy have become high priorities for sustainable development in recent years among governments around the world. As a result, numerous countries have adopted national digitalization policies, sustainability policies, environmental laws, innovative incentive programs, and cooperation projects with industry, scientific, and information technology institutions. The goal of these measures is to enhance organizational capacity and promote innovative and sustainable practices.

Given the moderating role of government support, the relationship between digital innovation and the implementation of the circular economy may not be uniform across organizations, as the strength of government support varies among them. In the context of a robust government support system, organizations are more likely to incorporate digital technologies, sustainability programs, and circular economy practices. On the other hand, a lack of policy support, weak policy regulations, or limited institutional support can negatively affect the outcomes of digital innovation, creating an environment for a circular economy. On the contrary, a lack of policy support, weak policy regulations, or limited institutional support can undermine digital innovation outcomes and hinder the creation of a circular-economy environment.

This is in line with the institutional theory, which focuses on external institutional contexts as influences on organizational behavior and strategic choices. Adopting innovation and sustainability practices in organizations can be driven by a combination of factors, such as regulatory requirements, policy incentives, and institutional expectations. Government support can therefore boost the effectiveness of digital innovation by fostering an environment that motivates organizations to pursue a circular economy.

Governmental support has been identified in several studies as both a key driver of digital transformation and a key enabler of the circular economy. Jabbour et al. (2019) concluded that supportive public policies significantly influence organizations' willingness to implement sustainability-related innovations. Similarly, Awad et al. (2025) stated that policy support, national sustainability strategies, and institutional incentives are key factors in integrating digital innovation with the circular economy.

The relationship between digital innovation and the circular economy can be shaped by government support in several ways. Firstly, supporting regulations offer clear guidance and incentives for sustainable production to the organization. Secondly, the national digitalization strategies promote investments in advanced technologies and digital infrastructure. Third, partnership efforts among universities, research institutions, and industry help transfer knowledge and spread innovation. Last but not least, environmental policies and sustainability incentives promote the use of a circular business approach and resource-efficient production systems.

Government assistance could be especially significant for plastic manufacturing companies in Hebron City, given the obstacles involved in incorporating new technology and meeting sustainability requirements, as well as limited resources. These enterprises can benefit from supportive policies and institutional measures to reduce barriers to digital innovation and maximize its benefits. This means that government interventions can enhance the positive impact of digital innovation on the implementation of the circular economy.

Based on the literature reviewed, the relationship between digital innovation and circular economy practices is expected to be moderated by government support. In this sense, the positive impact of digital innovation on the implementation of the circular economy is expected to be accentuated by higher levels of government support for industrial enterprises.

Critical Analysis

Government support is a critical institutional driver of digital transformation and sustainability efforts. However, previous research on its moderating effect is inconclusive. Some studies found that governmental policies, incentives, and regulatory frameworks had a significant positive effect. In contrast, others indicated that the effect was less pronounced, depending on the sector and context. Further research is therefore needed to determine the extent to which government support enhances the relationship between digital innovation and the implementation of the circular economy in Palestinian manufacturing companies.

2.6.7 Integrated Conceptual Framework

In light of the theory and empirical evidence synthesized in this chapter, an integrated conceptual framework is proposed to explain the interrelationships among the study variables. The framework is built from a synthesis of the literature on digital innovation, organizational readiness, and government support, as well as on the implementation of the circular economy. It represents the theoretical assumption underlying the study and serves as the basis for hypothesis development and empirical testing.

The independent variable in the framework is digital innovation, and the dependent variable is the implementation of the circular economy. The adoption of digital innovation as an independent variable is supported by the large amount of available literature that shows how digital technologies have a fundamental role in improving resource efficiency, enabling sustainable production systems, increasing traceability, reducing waste, and supporting circular business models (Alhawari et al., 2021; Bressanelli et al., 2022; Neri et al., 2024).

The framework also suggests organizational readiness as a mediating variable. The proposition is built on the argument that digital innovation does not necessarily lead to circular-economy outcomes. Organizations, however, need sufficient technological capabilities, managerial support, employee skills and knowledge, financial resources, and an open organizational culture to use digital technologies effectively and translate them into circular economy practices. Hence, organizational readiness is expected to encompass mechanisms by which digital innovation affects the implementation of the circular economy.

Moreover, government support is included as a moderating variable. The available literature indicates that external institutional factors significantly influence how organizations adopt innovation and implement sustainability measures. National digitalization strategies, sustainability regulations, incentives, and cooperation programs can create a supportive institutional environment that enhances organizations' ability to leverage digital innovation for circular economy implementation. Thus, the relationship between digital innovation and circular economy practices is expected to vary according to the level of government support.

The proposed conceptual framework thus builds on the assumption that digital innovation directly affects the implementation of the circular economy and increases organizational readiness. Organizational readiness, in turn, positively contributes to the adoption and implementation of circular economy practices in the organization. In addition, the link between digital innovation and the implementation of the circular economy is expected to strengthen as government support increases.

As such, the conceptual framework combines organizational factors and institutional factors, both internal and external to the organization, to provide a holistic understanding of the role of digital innovation in facilitating the implementation of the circular economy in plastic manufacturing companies in Hebron City.

Research Hypotheses

Based on the reviewed theoretical and empirical literature, the following hypotheses are proposed:

Hypothesis Development

H1: Digital Innovation and Circular Economy

Previous studies have consistently reported a positive relationship between digital innovation and circular economy implementation. Research conducted by Alhawari et al. (2021), Bressanelli et al. (2022), Neligan et al. (2022), and Neri et al. (2024) demonstrated that digital technologies improve resource efficiency, enhance recycling activities, support waste reduction, and facilitate sustainable production systems. Based on these findings, the following hypothesis is proposed:

H1: Digital innovation has a significant positive effect on the implementation of the circular economy in plastic manufacturing enterprises operating in Hebron City.

H2: Digital Innovation and Organizational Readiness

The literature suggests that digital innovation strengthens organizational readiness by enhancing technological infrastructure, improving employee capabilities, supporting managerial decision-making, and promoting organizational adaptability. Empirical studies by Ramdani et al. (2022), Kroh et al. (2024), and Awad et al. (2025) reported positive associations between digital innovation and organizational readiness. Therefore, the following hypothesis is proposed:

H2: Digital innovation has a significant positive effect on organizational readiness in plastic manufacturing enterprises operating in Hebron City.

H3: Organizational Readiness and Circular Economy

Previous studies indicate that organizations with adequate technological, managerial, financial, and human capabilities are better positioned to successfully implement circular economy practices. Studies such as Jabbour et al. (2019), Bressanelli et al. (2022), Kroh et al. (2024), and Awad et al. (2025) emphasized the importance of organizational readiness in achieving sustainability and circular economy objectives. Accordingly, the following hypothesis is proposed:

H3: Organizational readiness has a significant positive effect on the implementation of the circular economy in plastic manufacturing enterprises operating in Hebron City.

H4: The Mediating Role of Organizational Readiness

Existing literature suggests that digital innovation alone may not be sufficient to achieve sustainability outcomes unless organizations are ready to use digital technologies effectively. Studies by Ramdani et al. (2022), Kroh et al. (2024), and Awad et al. (2025) support the argument that organizational readiness acts as a mechanism through which digital innovation can generate positive organizational outcomes. Based on this reasoning, the following hypothesis is proposed:

H4: Organizational readiness positively mediates the relationship between digital innovation and circular economy practices in plastic manufacturing enterprises operating in Hebron City.

H5: The Moderating Role of Government Support

Previous studies indicate that government policies, incentives, and institutional support can strengthen organizations' ability to benefit from digital technologies and sustainability initiatives. Although findings remain somewhat inconsistent across contexts, evidence suggests that stronger governmental support can enhance the effectiveness of digital innovation in achieving circular economy outcomes. Therefore, the following hypothesis is proposed:

H5: Government support positively moderates the relationship between digital innovation and circular economy implementation in plastic manufacturing enterprises operating in Hebron City.

Proposed Research Model

The proposed research model can be illustrated as follows:

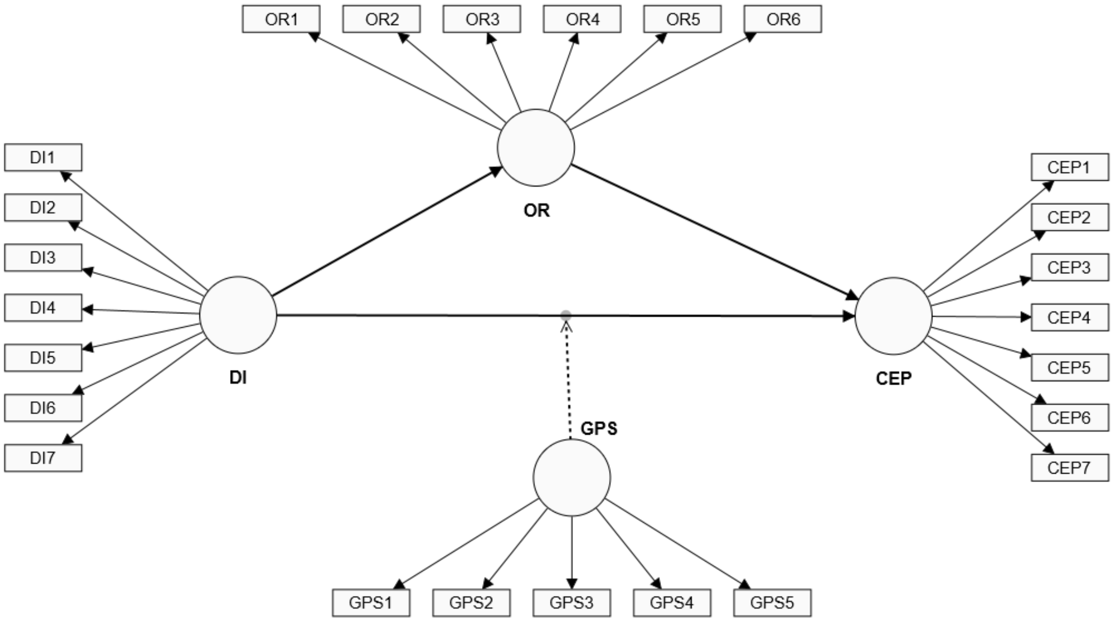

Figure 2.1 Proposed Research Model

The proposed model assumes that digital innovation influences circular economy implementation both directly and indirectly through organizational readiness. Organizational readiness is expected to facilitate the translation of digital innovation into effective circular economy practices, thereby serving as a mediating variable. Furthermore, government support is expected to enhance the relationship between digital innovation and circular economy practices by acting as a moderating variable.

2.6.8 Summary

This section reviewed the theoretical and empirical relationships among the study variables and laid the conceptual foundation for the proposed research model. The presentation revealed that digital innovation is playing an increasingly important role in implementing the circular economy by optimizing resource use, improving operational efficiency, enabling data-driven decision-making, and promoting sustainable production systems.

The review also highlighted that organizational readiness is a capability that affects the successful adoption of digital technologies and the implementation of circular economy practices. The literature indicates that organizations with necessary technological, managerial, human, financial, and cultural capabilities are more likely to achieve significant sustainability impacts from digital innovations.

The section also explored the influence of external institutional factors, particularly government support, which may strengthen the relationship between digital innovation and the implementation of the circular economy. Governmental policies, regulations, national strategies, and collaborative initiatives can create favorable conditions that facilitate the adoption of digital innovations and support sustainability-oriented transformation.

Based on the Resource-Based View (RBV), the Dynamic Capabilities Perspective (DCP), and empirical studies, an integrated conceptual framework was developed to examine the relationships among digital innovation, organizational readiness, government support, and circular economy implementation. The framework incorporates direct and indirect relationships among the core study variables, while government support is considered a moderating factor that may influence the strength of the relationship between digital innovation and circular economy implementation. The framework laid the groundwork for testing the study hypotheses empirically in the following chapters.

The literature reviewed generally supports the study of digital innovation to promote CE practices in plastic manufacturing companies of Hebron City. The methodology applied to examine these relationships and test the hypotheses is presented in the next chapter.

2.7 Critical Analysis of Previous Studies

In academic research, reviewing past studies is not merely a summary of results but a systematic, critical analysis that evaluates research methods, strengths and weaknesses, the convergence and divergence of findings, and the generalizability of results. This analytical approach is of paramount significance in interdisciplinary domains, such as digital innovation and the circular economy, where diverse theories and methodological approaches coexist.

2.7.1 Comparison of Research Methodologies

A review of previous studies shows considerable methodological diversity. The literature is dominated more by quantitative methods, especially studies using surveys and structural equation modeling, such as those by Alhawari et al. (2021), Neligan et al. (2022), and Awad et al. (2025). Statistical evidence from these studies reinforces the positive link between digital innovation and circular-economy practices.

Several studies use qualitative approaches, such as case studies and in-depth interviews, which provide more detailed information about organizational mechanisms and implementation challenges, as in Oghazi et al. (2024). A third type of study is mixed methods, with quantitative validation followed by qualitative exploration to increase analytical depth, as in Kroh et al. (2024).

However, most previous research has focused on the direct link between digital innovation and circular economy practices. Less research has focused on the organizational mechanisms that account for this relationship, such as organizational readiness, or on the influence of institutional factors, such as government support.

2.7.2 Assessment of Strengths and Limitations

The literature studied presented advantages, such as a solid theoretical basis for understanding the relationship between digital innovation and the circular economy and coverage of digital technologies, including IoT, big data, and artificial intelligence. Furthermore, the results are more rigorous and testable due to the growing use of empirical approaches.

There are, however, limits to the extent of that. There are a vast number of studies that offer insights into individual aspects of digital innovation, but few that offer insights into integrative approaches. There are inconsistencies in the conceptualization and measurement of key variables, which makes it hard to compare studies. In addition, empirical studies on developing or emerging economies are scarce, and most employed cross-sectional designs, which limit the ability to draw causal inferences over time. In addition, there is a lack of in-depth research that takes a holistic approach to digital innovation, organizational readiness, government support, and circular economy practices within a comprehensive framework. However, the complex interactions among these factors remain poorly understood, particularly in developing countries.

2.7.3 Areas of Convergence and Divergence in Findings

Although most studies indicate that digital innovation is positively associated with the implementation of the circular economy, there is less consensus on the organizational and institutional conditions that strengthen this relationship. While some studies draw attention to organizational capacity and preparedness, others highlight external policy and regulatory support.

Most studies show positive results of digital innovation for the circular economy, including resource efficiency, circular business models, and environmental and economic sustainability. In the theoretical and empirical studies, this is reflected.

However, there are variations in how digital is affecting them, in the digital-enabling technology components, and in their digital maturity in achieving meaningful circular outcomes. Many of the differences can be attributed to differences in industry focus, sample size, and institutional/economic context.

2.7.4 Generalizability of Research Findings

Although there is significant value in the work done, there are shortcomings in the generalizability of past work. Most empirical studies have been conducted in developed countries, particularly European countries, and in certain industrial sectors. Other factors, such as regulatory differences and existing digital infrastructure, also limit the extent to which findings can be transferred to other settings.

Moreover, some of these studies use small or non-random samples, which reduces the external validity of the results, underscoring the need to conduct more research in other geographical and sectoral settings to strengthen the results and their applicability.

Moreover, although the plastic manufacturing industry plays a significant role in environmental problems and their associated circular economy, research specifically targeting it has been lacking. The existing results only apply to sectors with known high material consumption and high waste generation.

2.7.5 Summary

This critical analysis reveals important gaps in both theoretical and empirical research concerning the relationship between digital innovation and circular economy implementation. Previous research has not sufficiently examined the combined roles of organizational readiness as a mediating mechanism and government support as a moderating factor within a single theoretical framework, particularly in developing countries and industry-specific contexts. In addition, limited attention has been given to plastic manufacturing enterprises despite their significant economic and environmental importance. Therefore, the present study seeks to address these gaps by proposing and empirically testing a theoretical framework that examines the direct effect of digital innovation on circular economy implementation, the mediating role of organizational readiness, and the moderating role of government support in plastic manufacturing enterprises operating in Hebron City.

2.8 Research Gap and Positioning of the Current Study

2.8.1 Introduction

Although there is a significant body of literature on digital innovation and the circular economy, important theoretical, empirical, and contextual gaps remain. Some of the research conducted so far has contributed significantly to the understanding of the role digital technologies can play in supporting sustainability and circular economy practices. The literature, however, remains scattered across various fields, sectors, and geographical areas. Moreover, there has been limited focus on the organizational and institutional arrangements that affect the effectiveness of digital innovation in implementing the circular economy.

The present study extends prior work and addresses some of the gaps identified in the critical review of those works. In particular, it aims to offer a more holistic view of the role digital innovation can play in implementing a circular economy by including organizational readiness as a mediator and government support as a moderator within a single analytical framework.

2.8.2 Theoretical and Empirical Gaps in Previous Studies

2.8.2.1 Limited Integration between Digital Innovation and Circular Economy

While digital innovation and the circular economy are increasingly related fields of research, numerous studies still focus on one or the other. The majority of conceptual and review papers, such as Rosa et al. (2019) and Neri et al. (2024), focus on digital technologies and their conceptual relationships, and do not empirically analyze how digital innovation affects the implementation of the circular economy at the organizational level.

Similarly, the empirical evidence from Alhawari et al. (2021) and Neligan et al. (2022) supports a positive relationship between DIGIT and circular economy practices. Many of these studies, however, tend to analyze only specific aspects of the relationship and do not develop a holistic explanatory framework that accounts for the complexity of digital transformation and the implementation of a circular economy.

2.8.2.2 Limited Attention to Organizational Readiness:

There has been considerable emphasis on organizational readiness in the literature on organizational change and digital transformation. However, it remains under-researched regarding its contribution to digital innovation–circular economy (DE) research. Most previous studies have focused more on technological aspects than on the organizational capabilities needed to implement a successful circular economy.

Few empirical studies have linked digital innovation to circular economy outcomes through organizational readiness. Little is therefore known about the roles of technological infrastructure, managerial support, employee competencies, financial resources, and organizational culture in the relationship between digital innovation and the successful application of the circular economy.

2.8.2.3 Limited consideration of government support

Government support has been identified as a critical enabler of innovation adoption and of achieving sustainable transformation. On the other hand, few studies have examined government support as an institutional context that can help or hinder the effectiveness of digital innovation in promoting circular economy practices.

Existing research typically focuses on organizational aspects or technological components, while the moderating role of governmental policies, sustainability strategies, regulatory mechanisms, and institutional incentives remains under-researched. Therefore, the role of organizational and institutional factors in implementing the circular economy remains poorly understood.

2.8.2.4 Limited Integrated Models

Another significant deficiency is the lack of integrated models that combine technological, organizational, and institutional aspects into a single model. Current research often investigates direct links between digital innovation and circular economy practices while neglecting the mechanisms and conditions that mediate the relationship between innovation and practice.

There is therefore a need for detailed frameworks that not only clarify whether digital innovation affects the implementation of the circular economy, but also the conditions under which it does so.

2.8.3 Geographical, Sectoral, and Methodological Limitations

2.8.3.1 Geographical Limitations

Many empirical studies on digital innovation and circular economy practices have been conducted in developed economies, particularly in

European countries. There is relatively little evidence from developing and emerging economies, where institutions, economies, technologies, and infrastructure differ.

Findings from developed-country contexts may be applicable but might also be affected by differences in digital maturity, technological infrastructure, governmental support, and regulation. Thus, further empirical research is required to enhance the knowledge about these relationships in developing countries such as Palestine.

2.8.3.2 Sectoral Limitations

Manufacturing industries have been the focus of much research on the circular economy, but only a few studies have examined sectors. The existing studies generally focus on the overall industrial sector rather than on sectors that are more resource-intensive, waste-producing, and recyclable.

The plastic manufacturing sector, which contributes immensely to the economy and is very relevant to the environment, has received little attention in particular. Considering the current debates around plastic waste, resource efficiency, and sustainable production, more research is required in this sector to understand how digital innovation can support the implementation of the circular economy.

2.8.3.3 Methodological Limitations

In terms of method, the most frequently used method in previous studies is cross-sectional research, a quantitative method. Studies such as these may yield strong statistical evidence, but they leave little room for understanding long-term transformation processes and causal dynamics.

Moreover, the use of different variable definitions, measurement methods, and analytical techniques complicates comparisons of results across studies. The limited number of studies that integrate analytical models with empirical research further underscores the need for more empirical studies to provide more comprehensive explanations of the relationships among digital innovation, organizational factors, and the implementation of the circular economy.

2.8.4 Positioning of the Current Study and Value Added

2.8.4.1 Theoretical Contribution

The current study adds to the existing literature on digital innovation and the circular economy by offering a more complete theoretical framework of the digital innovation-OR-GE-CEE relationship. The study's overall contribution is to integrate institutional and organizational aspects into the existing knowledge on digital technologies and circular economy practices within a single analytical framework, as most previous studies have focused on the direct link between the two.

The theoretical value of this study lies in the development of an integrated framework that explains the implementation of the circular economy through the interaction among digital innovation, organizational readiness, and government support. The study extends existing theoretical views by integrating technological, organizational, and institutional dimensions into a single explanatory model.

The study also contributes to the theory by integrating the Resource-Based View (RBV) and the Dynamic Capabilities Perspective to explicate how digital innovation can support the implementation of the circular economy. The study particularly highlights the internal organizational mechanism of readiness and the external institutional condition of government support as factors that can affect the effectiveness of digital innovation in pursuing circular economy outcomes. The study contributes to the theoretical debate on the transition towards sustainability and offers a more comprehensive understanding of the drivers of CE implementation.

2.8.4.2 Empirical Contribution

From an empirical standpoint, the study offers quantitative evidence on the relationships among digital innovation, organizational readiness, government support, and the implementation of the circular economy in plastic manufacturing enterprises in Hebron City. The study's empirical analysis of the proposed framework, using primary data collected from the sector, which has received scant scholarly attention, thus provides new insights into the field of digital transformation and sustainability in developing economies.

The research fills the gap in recent calls for more empirical studies of the mechanisms by which implementing digital innovation is a tool for circular economy implementation. In contrast to many previous studies that mainly examined direct relationships, the present study analyzes direct and indirect effects. It presents evidence of the mediating role of organizational readiness in the translation of digital innovation into circular economy practices.

In addition, this study contributes to the literature by providing an empirical analysis of government support as an institutional factor in the proposed framework. The results show that government support did not significantly moderate the relationship between digital innovation and the implementation of the circular economy in the context studied. The result is important because it provides empirical evidence of the context specificity of institutional support and suggests that internal organizational capabilities are more important than external support mechanisms.

The study contributes significantly to empirical knowledge of digital innovation and its role in implementing a circular economy by elucidating that digital innovation's contribution to the circular economy occurs mainly through organizational readiness. Therefore, the results contribute to existing knowledge on the organizational mechanisms that enable sustainable industrial transformation and provide context-specific evidence for the plastic manufacturing industry in Palestine.

2.8.4.3 Contextual Contribution

The study makes a valuable contribution through its contextual focus, as the area of Palestine has not been widely explored in the literature on the application of digital innovation and the implementation of a circular economy. The majority of prior empirical research has focused on developed countries, particularly in Europe and other technologically advanced regions. As a result, little is known about how these relationships function under different economic, institutional, and technological conditions in developing economies.

In addition, the study examines only plastic manufacturing businesses in Hebron City. This sector is of particular interest because of its economic role and its direct connection to resource consumption, waste generation, recycling, and environmental sustainability. This study is, to the researcher's best knowledge, one of the first empirical studies conducted in Palestine to address, within an integrated framework, the challenges of digital innovation, organizational readiness, government support, and the implementation of the circular economy. Thus, the study contributes to expanding the geographical and sectoral scope of the existing literature.

In addition, the study was among the first empirical studies to examine the above relationships in the context of Palestinian plastic manufacturing enterprises, yielding context-specific knowledge that can assist future research and theory building in other developing-economy contexts.

2.8.4.4 Practical Contribution

The value of the study lies in its potential to inform managers, industrial associations, development agencies, and policy-makers. The results could assist managers of plastic manufacturing businesses in better understanding the potential of digital innovation to enhance resource efficiency and reduce waste, as well as aid in implementing recycling programs and adopting the circular economy. Furthermore, the research underscores the importance of company preparedness for the successful implementation of digital technologies and sustainability initiatives.

The results can also inform policymakers in formulating better policies, strategies, and support programs for digital transformation and circular economy practices in Palestine's industrial sector. In addition, industrial associations, chambers of commerce, and development organizations can use the findings to design training, awareness, and collective efforts that promote sustainable industrial development. The overall goal of the study is to improve the competitiveness, sustainability, and long-term resilience of plastic manufacturing enterprises in Hebron City and the Palestinian industrial sector.

2.8.5 Justification of Variable Selection and Research Model

2.8.5.1 Justification for Selecting Digital Innovation

The independent variable is digital innovation, as it is a key factor in organizational transformation, sustainability, and the implementation of the circular economy. The potential of digital technologies to increase resource efficiency, optimize processes, facilitate information exchange, and enable sustainable production systems has been consistently demonstrated in prior studies.

2.8.5.2 Justifications for Selecting the Circular Economy

Circular economy was chosen as the dependent variable because it is the primary sustainability outcome for which organizations seek to innovate with digital tools. The implementation of the circular economy reflects better use of resources, less waste, recycling, recovery, and sustainable production.

2.8.5.3 Justifications for Selecting Organizational Readiness.

The choice of organizational readiness as a mediating factor was motivated by the fact that the success of digital innovation requires organizational capabilities and preparedness. The literature indicates that digital innovation to support sustainable outcomes requires adequate technological infrastructure, managerial commitment, employee competencies, financial resources, and supportive organizational cultures.

2.8.5.4 Justifications for Selecting Government Support.

Government support was selected as a moderator in the study because institutional environments can influence organizational behavior and the adoption of innovation. Government policies, sustainability strategies, regulatory frameworks, and institutional incentives can enhance organizations' capacity to leverage digital innovation in implementing the circular economy.

2.8.5.5 Development of the Conceptual Framework

Based on the RBV, DCP, and previous empirical studies, the present study proposes an integrated conceptual model in which digital innovation serves as the independent variable, circular economy implementation as the dependent variable, organizational readiness as a mediating variable, and government support as a moderating variable.

2.8.6 Summary

The literature review showed that significant gaps exist both theoretically and empirically in the field of digital innovation and the implementation of the circular economy across the geographical, sectoral, and methodological dimensions. While much existing research offers important insights into the role of digital technologies in supporting sustainability, little has focused on the organizational and institutional mechanisms that underpin these relationships.

To overcome these shortcomings, the current study proposes and tests a three-stage model that investigates the direct effects of digital innovation on the implementation of the circular economy, the mediation role of organizational readiness, and the moderating role of government support in plastic-manufacturing companies in Hebron city. By this means, it intends to contribute to theory development and to the understanding of sustainable industrial transformation in the context of developing economies.

2.9 Summary of Previous Studies

2.9.1 Organized Synthesis of Key Literature Findings

Previous research has been reviewed and analyzed, showing that the fields of digital innovation and the circular economy have become highly intertwined in the past decade. Digital innovation is clearly identified as a key capability that helps organizations redesign processes, improve operational efficiency, enhance resource management, and contribute to sustainable development through advanced digital technologies.

The reviewed studies show that digital technologies such as the Internet of Things (IoT), Artificial Intelligence (AI), Big Data Analytics, Cloud Computing, and Blockchain are important tools for implementing the circular economy. These technologies can help to improve resource efficiency, reduce waste generation, enhance product traceability, and facilitate recycling activities and circular business models (Alhawari et al., 2021; Bressanelli et al., 2022; Neri et al., 2024).

The literature also indicates that organizational and institutional factors, as well as technologies, affect the implementation of circular economy practices. Some studies point to the roles of organizational capabilities, leadership commitment, employee competencies, and organizational culture in supporting digital transformation and sustainability initiatives. Similarly, policy and institutional support mechanisms, regulatory frameworks, and government policies have been identified as important factors that impact innovation adoption and sustainability outcomes (Awad et al., 2025; Ramdani et al., 2022).

While the vast majority of studies show that digital innovation positively affects the adoption of the circular economy, there are inconsistencies regarding the magnitude of this effect, the most important technological aptitude, and the contexts in which the circular economy can be adopted successfully. These differences tend to be correlated with geographical, industry, organizational, and methodological differences.

2.9.2 Linking Previous Studies to the Thesis Framework

It can be inferred that the synthesis of the previous studies supported the conceptualization used in the present research. The literature reviewed shows that digital innovation is a key enabler of circular economy implementation, as it helps optimize resource use, increase operational efficiency, support sustainable production, and promote organizational change.

Meanwhile, the literature suggests that this would not necessarily be enough to guarantee the success of circular economy implementation. Several studies highlight the significance of organizational readiness as a key capability for the effective adoption and use of digital technologies. In addition, the impact of institutional and policy-related factors on the success of innovation programs and transformation towards sustainability has been demonstrated.

The current study builds on this research and proposes an integrated framework to examine how digital innovation directly affects the implementation of the circular economy, how organizational readiness serves as a mediator, and how government support serves as a moderator. This framework captures the multifaceted nature of transformation for sustainability. It offers a more holistic description of the contribution of digital innovation to the circular economy outcomes of plastic manufacturing enterprises in Hebron City.

2.9.3 Positioning the Current Study within Existing Literature

The current study builds on the existing literature and addresses a few gaps identified in previous studies. First, while previous studies have focused on the direct link between digital innovation and circular economy practices, the present study shows that this is not always the case. Rather, organizational readiness is a key factor through which digital innovation can support the implementation of the circular economy.

Secondly, it addresses the lack of interest in organizational readiness in the past studies on digital innovation in the circular economy. The results provide empirical evidence supporting the claim that technological infrastructure, managerial engagement, employees' skills, financial capabilities, and organizational culture are crucial inputs for converting digital innovation into CE results.

Thirdly, the study adds to the limited body of literature investigating how government support influences innovation and circular economy initiatives in the digital context. Contrary to expectations and some previous studies, government support was not found to have a significant moderating effect. The results indicate a possible regional and industrial variation in institutional support.

Lastly, it provides context-specific evidence from the plastic manufacturing businesses in Hebron City. To the best of the researcher's knowledge, it is the first empirical study in Palestine to examine digital innovation, organizational readiness, government support, and circular economy implementation within a single coherent framework.

2.9.4 Summary

This chapter provided a critical literature review and analysis of digital innovation, implementation of the circular economy, organizational preparedness, and government support. The review showed that digital innovation is a key enabler for sustainable industrial transformation and an essential factor in advancing circular economy practices.

The chapter also highlighted the importance of organizational readiness as an internal capability and government support as an institutional factor that may shape the effectiveness of digital innovation in delivering circular economy outcomes. An integrated conceptual framework was developed by synthesizing theoretical and empirical studies to explain the relationships among the study variables and to form the basis for the proposed research hypotheses.

In general, the literature review underscores the importance of studying the role of digital innovation in implementing the circular economy in plastic manufacturing companies in Hebron City. The results of the review will provide solid theoretical support for the research methodology and empirical analysis presented in the next chapter.

3 Chapter Three: Research Methodology

3.1 Introduction

This chapter presents the methodology used to conduct the research. It explains the research design, population and sample, data-collection instrument, and data-analysis methods. Since the study aimed to examine the role of digital innovation in advancing circular economy practices in plastic manufacturing enterprises operating in Hebron City, the chapter also describes the statistical tools used to assess organizational readiness as a mediator and government and policy support as a moderator within the research model.

3.2 Research Design

This study aimed to examine the role of digital innovation in advancing circular economy practices in plastic manufacturing enterprises operating in Hebron City. The main study variables included digital innovation as the independent variable and circular economy practices as the dependent variable. In addition, organizational readiness was examined as a mediating variable, and government support as a moderating variable, in the relationship between digital innovation and circular economy practices. These variables were consistent with the research questions, hypotheses, and conceptual model.

To achieve the study aim, a quantitative explanatory cross-sectional design was used. This design was appropriate because the research examined relationships among measurable variables at a single point in time (Creswell & Creswell, 2023; Saunders et al., 2023). Quantitative explanatory designs are commonly used when the researcher aims to test a conceptual framework involving direct and indirect relationships among variables through statistical analysis (Creswell & Creswell, 2023; Saunders et al., 2023).

3.3 Population and Sample

The study population was identified through the records of the Hebron Chamber of Commerce and Industry, which served as the primary source for locating plastic manufacturing enterprises operating in Hebron City. According to the Chamber's 2025 records, 82 enterprises were identified within the study context and were approached during the data collection process.

A census approach seeks to collect data from every eligible unit in a defined population, whereas sample-size formulas are primarily used when a researcher intends to select a subset from a larger population for inference and generalization (Australian Bureau of Statistics, 2023; Taherdoost, 2017). Therefore, the researcher sought to include all 82 identified plastic manufacturing enterprises rather than draw a partial sample.

The unit of analysis was the enterprise. However, data were collected from one knowledgeable respondent per enterprise. This key-informant approach was appropriate because the study required information on organizational-level practices, including digital innovation, operational processes, circular economy practices, organizational readiness, and government or policy support conditions. Accordingly, the targeted respondent in each enterprise was selected from positions expected to have sufficient knowledge of the enterprise's practices, such as general managers or chief executive officers, department or division managers, supervisors or section heads, administrative employees, technical or operational employees, or other relevant personnel.

During data collection, all 82 enterprises were approached. However, 10 enterprises refused to participate, resulting in 72 returned questionnaires. After reviewing the returned questionnaires, two responses were excluded because they were incomplete or did not provide sufficient information for statistical analysis. Therefore, 70 questionnaires were initially deemed valid and subsequently screened against the study’s inclusion criteria.

Since the study focused on digital innovation, only enterprises that reported using digital technologies were included in the final analysis. This criterion was assessed using a screening question that asked whether the organization uses digital technologies, such as the Internet of Things, artificial intelligence, and cloud computing, to improve operational efficiency. Of the 70 initially valid responses, 63 answered “Yes” and 7 answered “No.” Consequently, the 7 responses from enterprises that did not use digital technologies were excluded from the final analysis.

The exclusion of these seven enterprises was necessary to maintain consistency with the study's objectives and inclusion criteria and may introduce some selection bias. Digital technologies may impose various organizational, technological, or financial requirements on enterprises that do not use them, more than on those that do. As a result, the study's findings should be viewed primarily in the context of plastic manufacturing companies with at least a minimal level of digital technology adoption.

Accordingly, the final analyzable sample comprised 63 valid enterprises, each represented by a knowledgeable respondent. The response rate was 87.8% (72 out of 82), while the final analyzable sample accounted for 76.8% of the total target population (63 out of 82). This final sample was methodologically appropriate because the core relationships examined in the study, particularly the relationship between digital innovation and circular economy practices, could only be meaningfully analyzed among enterprises with actual exposure to digital technologies. The process of reaching the final study sample is summarized in Figure 3.1.

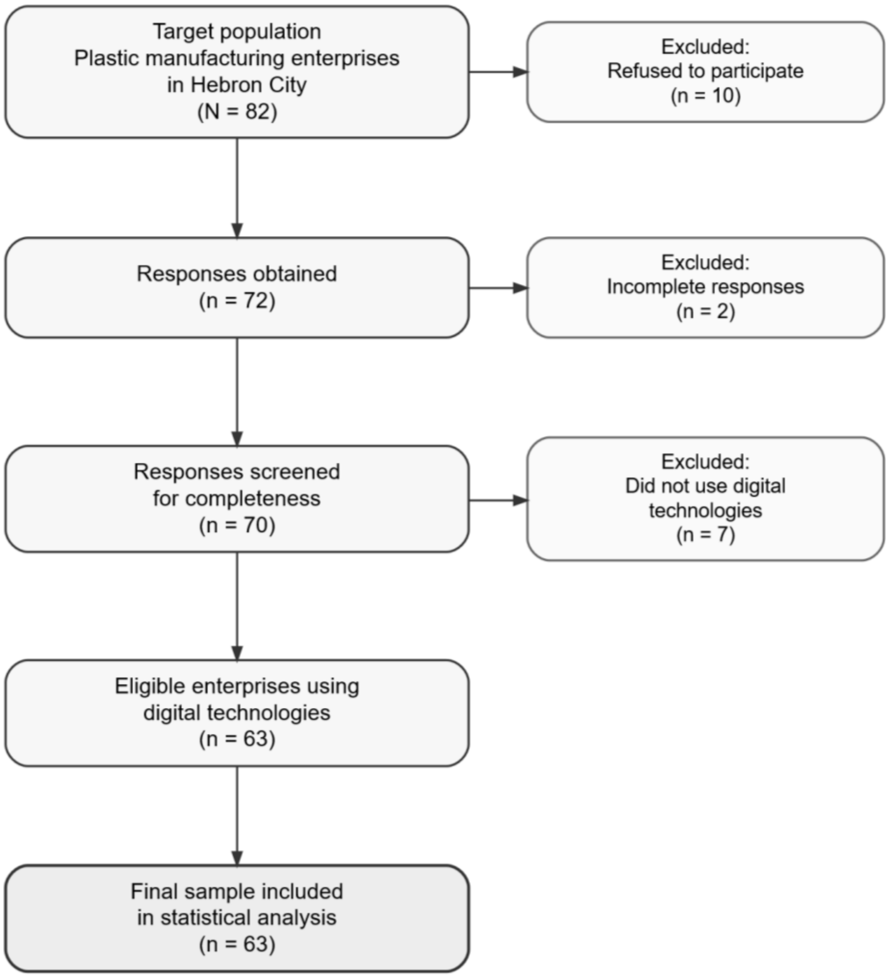

Figure 3.1 Participant flow diagram showing the selection of the final study sample.

3.4 Ethical Considerations

The research was conducted in accordance with the basic principles of research ethics. Participation in the research was voluntary, and respondents were informed that the questionnaire was prepared for academic research purposes only. They were also informed that all responses would be treated with strict confidentiality and used only in aggregate form for statistical analysis, without identifying individual respondents or enterprises.

No personally identifying information was required from respondents, and the questionnaire did not include sensitive questions or any experimental interventions. Respondents had the right to refuse to participate, withdraw from the study, or leave any question unanswered without consequences. The introductory section of the questionnaire also clarified that there were no right or wrong answers and encouraged respondents to answer honestly based on their organization’s actual practices and experience.

These procedures were adopted to protect participants’ privacy, ensure voluntary participation, and maintain responsible use of the collected data. Accordingly, the data collection process was carried out ethically and respectfully, consistent with general research ethics principles related to confidentiality, informed participation, anonymity, and academic integrity.

3.5 Instruments Used

The research used a structured questionnaire to collect data from respondents working in plastic manufacturing enterprises operating in Hebron City. The questionnaire consisted of several main sections. The first section included firm profile information, such as firm age, number of employees, ownership type, enterprise location, and Chamber of Commerce classification. The second section included respondent profile information, such as the job title, years of experience, educational level, and department or functional area. The other sections measured the main study constructs, including digital innovation, circular economy practices, government and policy support, organizational readiness, and barriers to implementation.

The questionnaire items were measured using a five-point Likert scale, ranging from 1 = strongly disagree to 5 = strongly agree. The use of this scale was appropriate because it allowed respondents to express the degree of their agreement with each statement and enabled the researcher to calculate means, standard deviations, and other statistical indicators. The measurement items were developed from prior literature and aligned with the study's constructs. These constructs were consistent with the research questions, hypotheses, and conceptual model. Table 3.1 displays the study constructs, measurement items, and references.

Table 3.1: Study Constructs, Measurement Items, and References

Construct	**Measurement items**	**Reference**
Digital Innovation	1. Digital platforms help our company manage supply chains and logistics efficiently. 2. Our organization uses data analytics to support strategic and operational decision-making. 3. The company regularly invests in new digital technologies and systems.	Developed by the researcher based on Nambisan et al. (2019)

	4. The organization continuously encourages employees to utilize digital tools for generating new and innovative ideas. 5. Digital technologies facilitate collaboration with customers and suppliers. 6. Our firm integrates digital solutions into the development processes of products and services. 7. The organization increasingly relies on digital transformation to improve its overall performance and enhance its competitiveness.	
Circular Economy Practices	1. Products or services are designed to minimize waste. 2. Production materials are reused or recycled whenever possible. 3. The company monitors energy and water consumption to improve efficiency. 4. Waste generated from production	Developed by the researcher based on Kirchherr et al. (2017)

	processes is reused or repurposed. 5. Our company cooperates with other firms to exchange or recycle resources. 6. We seek to extend product life cycles through repair, reuse, or remanufacturing. 7. The organization systematically incorporates environmental sustainability considerations into the design and development of its products and services.	
Barriers to Implementation	1. Limited financial resources hinder investment in digital technologies. 2. Lack of technical expertise limits the implementation of circular innovation. 3. Government policies do not sufficiently support digital and sustainable innovation. 4. Resistance to organizational change slows the adoption of new technologies. 5. Infrastructure limitations restrict	Developed by the researcher based on Jabbour et al. (2019)

	digital transformation initiatives. 6. Limited awareness of circular economy benefits affects its implementation.	
Organizational Readiness	1. Our organization has sufficient digital infrastructure to support innovation. 2. Top management is committed to adopting and supporting digital transformation strategies within the organization. 3. The organization continuously develops its employees' skills in digital technologies and sustainability. 4. The company allocates financial resources for innovation and sustainability projects. 5. Organizational culture encourages experimentation, learning, and innovation. 6. Our firm possesses the technological capabilities needed for	Developed by the researcher based on Barney et al. (1991)

	digital transformation.	
Government and Policy Support	1. Government policies encourage the adoption of sustainable innovation. 2. There are clear national strategies promoting digitalization and the circular economy. 3. Collaboration between universities and industry is encouraged in Palestine. 4. The policy environment supports green and digital transformation. 5. Regulatory frameworks provide incentives for circular and sustainable practices.	Developed by the researcher based on Awad et al. (2025)

Source: Developed by the Author

3.5.1 Content Validity

Content validity is the extent to which the items of a questionnaire adequately represent the conceptual domain of the construct being measured. In the current study, content validity was ensured through several steps. First, the questionnaire items were developed based on prior studies and relevant literature on digital innovation, circular economy practices, organizational readiness, and government and policy support. The items were then organized according to the study constructs:

digital innovation, circular economy practices, organizational readiness, and government and policy support. This structure was consistent with the study questions, hypotheses, conceptual model, and questionnaire dimensions.

Second, the questionnaire was reviewed by academic and field experts to ensure that the items were clear, relevant, and suitable for measuring the intended constructs. This procedure is consistent with recommended content validation practices, where expert judgment is used to evaluate whether questionnaire items are relevant, clear, and representative of the intended construct domain (Yusoff, 2019). The experts' feedback was used to improve the wording of some statements and to ensure that the questionnaire was appropriate for the context of plastic manufacturing enterprises operating in Hebron City. This step helped confirm that the items were understandable to the target respondents and reflected the practical nature of digital transformation, sustainability, and circular economy practices within industrial enterprises.

Third, the questionnaire was prepared in a language suitable for the respondents. During this process, attention was given to preserving the meaning of the original items while making the wording clear and culturally appropriate for the Palestinian industrial context. This linguistic review was important to ensure that the items preserved the intended meaning of the original wording and were understandable within the local business and manufacturing environment, consistent with guidance on cross-cultural adaptation of self-report instruments (Beaton et al., 2000). After reviewing and refining the questionnaire, the final version was considered suitable for data collection. The final version of the questionnaire is presented in Appendix 1.

3.6 Data Analysis Method

Both descriptive and inferential statistical methods were used to analyze the study data and answer the research questions. Descriptive statistics summarized firm and respondent characteristics and respondents' responses on digital innovation, circular economy practices, government and policy support, barriers to implementation, and organizational readiness. Inferential statistics tested the research hypotheses and examined relationships among variables. This approach aligns with quantitative survey research, in which descriptive statistics summarize the sample and variables, while inferential statistics test relationships between variables (Creswell & Creswell, 2023; Saunders et al., 2023).

3.6.1 Descriptive Statistics

Means and standard deviations were used to summarize responses to the study constructs, while frequencies and percentages were used to describe the study sample. The sample responses were classified using a five-point scheme. Furthermore, the breadth of each class was calculated using the following equation to classify the five-point Likert mean scores into meaningful interpretation levels (Alkharusi, 2022; Boone & Boone, 2012):

$$\text{Class width} = \frac{\text{Maximum} - \text{Minimum}}{\text{Number of classes}} = \frac{5-1}{5} = 0.80$$

Following the class width calculation, the answer categories were gradually formed, beginning with the scale's lowest value of 1 and working their way up to the class width. The distribution of mean scores for these agreement class levels is shown in Table 3.2.

Table 3.2: Mean Score Interpretation

Mean Score	Interpretation
1.00 – 1.79	Very Low
1.80 – 2.59	Low
2.60 – 3.39	Medium
3.40 – 4.19	High
4.20 – 5.00	Very High

Source: Developed by the Author

3.6.2 Inferential Statistical Tools

Inferential statistical analysis was used to test the research hypotheses, which examine relationships among digital innovation, organizational readiness, government support, and circular economy practices. The study used Partial Least Squares Structural Equation Modeling (PLS-SEM) in SmartPLS 4.

3.6.2.1 Structural Equation Modeling (SEM)

When a research model includes multiple interrelated constructs and simultaneous direct, indirect, and interaction effects, multivariate techniques are required to estimate relationships jointly rather than in isolation. Structural equation modeling (SEM) is a second-generation multivariate technique that enables the simultaneous assessment of relationships among latent constructs while accounting for measurement error (Chin, 1998; Gefen et al., 2000; Golob, 2003).

SEM can be implemented using covariance-based SEM (CB-SEM) or partial least squares SEM (PLS-SEM). CB-SEM is typically employed for strict theory testing and confirmation under stronger distributional and sample-size assumptions. In contrast, PLS-SEM is primarily variance-based and well-suited for prediction-oriented models and for maximizing explained variance in endogenous constructs (Hair et al., 2017).

In this study, PLS-SEM was selected to analyze the data due to its suitability for the research model, sample size, and data characteristics. The final sample comprised 63 participants from 63 organizations, a relatively small sample size for covariance-based SEM (CB-SEM) methods, especially when the model includes direct, indirect, and interactive relationships among several underlying variables (Hair et al., 2022; Hair et al., 2019). The Kolmogorov-Smirnov test also showed that all study items were non-normally distributed (see Appendix 2), making PLS-SEM more appropriate. As a variance-based SEM method, PLS-SEM does not require the strict assumptions of multivariate normality that some traditional SEM methods do (Hair et al., 2022; Sarstedt et al., 2022). In addition, PLS-SEM is suitable for predictive and interpretive studies that aim to test relationships between underlying variables and estimate the strength of effects within the model, including testing the impact of digital innovation on circular economy practices, the mediating role of organizational readiness, and the moderating role of government support (Hair et al., 2019; Guenther et al., 2023). Accordingly, bootstrapping was used to test the significance of the path coefficients and evaluate the measurement and structural models using criteria from the PLS-SEM literature (Hair et al., 2022; Kock & Hadaya, 2018).

PLS-SEM distinguishes between the structural, or inner, model, which specifies relationships among latent constructs, and the measurement, or outer, model, which specifies the relationships between constructs and their observed indicators (Hair et al., 2014, 2017). In the present study, the measurement model was specified reflectively, with changes in the latent constructs expected to be reflected in corresponding changes across their associated indicators. The study model included digital innovation as the independent variable, circular economy practices as the dependent variable, organizational readiness as the mediating variable, and government support as the moderating variable. Figure 3.1 illustrates the PLS-SEM measurement and structural models, with constructs represented by circles and study items by rectangles.

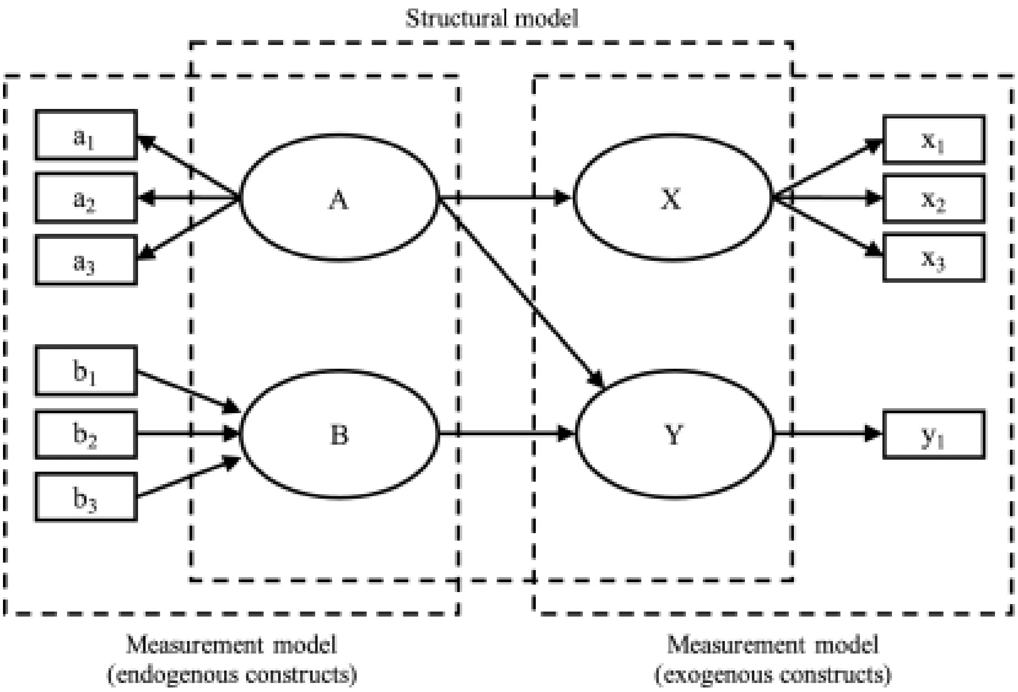

Figure 3.2: Simple Illustration of a PLS-SEM Model; Adopted from Russo & Stol (2022)

Based on the study constructs, hypotheses, and the SmartPLS model, the measurement model was specified as reflective for the first-order constructs. The main PLS-SEM model included reflective constructs representing the digital innovation, circular economy practices, government and policy support, and organizational readiness. The study factors included in the study model are summarized in Table 3.3.

Table 3.3: **Study Factors Included in the Study Model**

Abbreviations	**Construct**	**# of items**
DI	Digital Innovation	7
CEP	Circular Economy Practices	7
OR	Organizational Readiness	6
GPS	Government and Policy Support	5

Source: Developed by the Author.

Figure 3.3 presents the initial PLS-SEM model specification of the current study. The model includes digital innovation as the independent variable, circular economy practices as the dependent variable, organizational readiness as the mediating variable, and government and policy support as the moderating variable. The figure also shows the initial indicators assigned to each construct before the measurement model refinement.

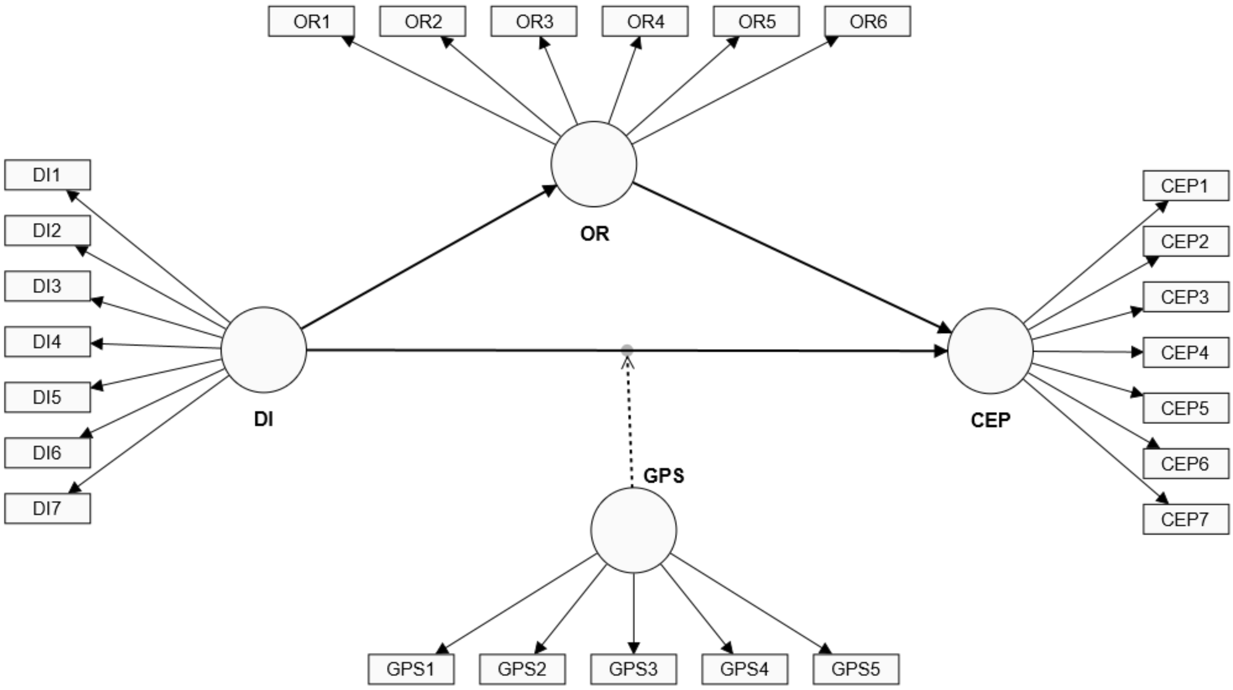

Figure 3.3: PLS-SEM Measurement Model of the Study; Source: Smart-PLS Output

3.6.2.1.1 PLS-SEM Evaluation

Two steps of the analytical procedure were conducted to evaluate the study model: measurement evaluation (validity and reliability of the measures) and structural model evaluation (testing the study hypotheses).

3.6.2.1.1.1 Measurement Model Evaluation

The measurement model is evaluated in three main stages: internal consistency, convergent validity, and discriminant validity (Hair et al., 2021). First, internal consistency is verified using both Cronbach's alpha and composite reliability, with values exceeding 0.70 being acceptable (Hair et al., 2021)

Convergent validity is assessed using outer loadings and average variance extracted (AVE). Outer loadings of 0.70 or above were considered acceptable, while AVE values close to or above 0.50 were evaluated together with composite reliability and the theoretical relevance of the indicators. However, outer loadings between 0.40 and 0.70 may be retained when the indicators are theoretically important, support content validity, and when the construct reliability remains acceptable.

For discriminant validity, the Fornell-Larcker criterion is also applied, which states that the square root of the AVE value for any construct must be higher than any correlation between that construct and any other constructs. Finally, the heterotrait–monotrait ratio (HTMT) was examined as an additional criterion for discriminant validity; HTMT values should preferably be below 0.85, while values below 0.90 may be acceptable for conceptually similar constructs (Henseler et al., 2015).

3.6.2.1.1.2 Structural Model Evaluation

Hair et al. (2017) identified several criteria for evaluating a structural model. The first involves using variance inflation factors (VIFs) to assess multicollinearity among the independent variables. Ideally, the results should be below 5, indicating no significant multicollinearity.

The second involves using the coefficient of determination (R^2) to assess the proportion of variance explained by the independent variables. R^2 was used to assess the proportion of variance explained in the endogenous constructs, namely Academic Learning Skills and Academic Performance. Higher R^2 values indicate greater explanatory power of the structural model. Finally, the effect size test (f^2) examines the relative importance of each independent variable used in the structural model.

According to Cohen (1988), f^2 values of 0.02, 0.15, and 0.35 indicate small, medium, and large effects, respectively.

4 Chapter Four: Data Analysis & Results

4.1 Introduction

This chapter presents an analysis of the study data and the main results from the questionnaires. It begins by describing the participating enterprises' characteristics and respondents' professional characteristics, followed by descriptive statistics for the main study constructs. Then, reports the evaluation of the measurement and structural model using PLS-SEM. Finally, it presents the results of the direct, mediating, and moderating relationships among the study variables.

4.2 Descriptive Statistics

This section presents the descriptive statistical analysis of the study data. The analysis includes three main parts. First, it describes the characteristics of the participating plastic manufacturing enterprises and the respondents representing them, including firm age, number of employees, main business sector, ownership type, enterprise location, Chamber of Commerce classification, job title, years of experience, educational level, and department or functional area. Second, it presents descriptive results for the main study constructs: digital Innovation, circular economy practices, organizational readiness, and government and policy support. Third, it presents descriptive results for barriers to implementation.

4.2.1 Enterprise Characteristics

The organizational characteristics of the participating enterprises were examined to provide a clear description of the enterprises included in the final analysis. These characteristics included firm age, number of employees, ownership type, enterprise location, and company classification as defined by the Chamber of Commerce.

As shown in Table 4.1, the total number of enterprises included in the analysis was 63. In terms of firm age, the largest group of enterprises had been operating for more than 20 years (34.9%), followed by those operating for 5–10 years (31.8%). This indicates that a substantial proportion of the participating enterprises had relatively long operational experience. Regarding the number of employees, most enterprises had fewer than 10 employees (50.8%), followed by those with 10–49 employees (31.8%), suggesting that the sample was predominantly composed of small enterprises.

In terms of ownership type, private companies accounted for the majority of the sample (76.2%), followed by family-owned businesses (15.9%). With respect to enterprise location, most enterprises were located in the West Bank–South region (79.4%). Finally, based on Chamber of Commerce classification, First Class enterprises represented the largest group among valid responses (43.6%), followed by Premium Class enterprises (29.0%).

Table 4.1: Distribution of Participating Enterprises According to Organizational Characteristics

Variable	**Category**	**Frequency (N)**	**Percentage (%)**
Firm age	Less than 5 years	9	14.3

	5–10 years	20	31.8
	11–20 years	12	19.0
	More than 20 years	22	34.9
Number of employees	Less than 10	32	50.8
	10–49	20	31.8
	50–249	7	11.1
	250 or more	4	6.3
Ownership type	Private company	48	76.2
	Public company	4	6.3
	Family-owned business	10	15.9
	Cooperative/partnership	1	1.6
Location of the enterprise	West Bank – North	7	11.1
	West Bank – Central	6	9.5
	West Bank – South	50	79.4
Company classification	First Class	27	43.6
	Second Class	10	16.1
	Special Class	7	11.3
	Premium Class	18	29.0

Source: Developed by the Author Using SPSS Output. Note. Percentages for company classification are based on valid responses (n = 62).

4.2.2 Sample Characteristic

The respondent characteristics were examined to describe the individuals who represented the participating enterprises and provided the study data. These characteristics included job title, years of experience in the current organization, educational level, and department or functional area.

As shown in Table 4.2, regarding job title, general managers or chief executive officers represented the largest group of respondents among valid responses (45.2%), followed by department or division managers (24.2%) and administrative employees (16.1%). This indicates that most responses were provided by individuals in managerial or administratively relevant positions, which is appropriate given the organizational nature of the study variables.

Among respondents with years of experience, the largest group had less than 3 years in the current organization (38.8%), followed by those with 10 years or more (32.3%) and those with 5 to less than 10 years (29.0%). Regarding educational level, most respondents held a bachelor's degree (56.5%), followed by diploma and master's degree holders, each with 8 respondents (12.9%). Finally, regarding department or functional area, the largest group of respondents worked in top management (38.7%), followed by finance/accounting (21.0%) and marketing and sales (12.9%). These results indicate that the sample included respondents from different organizational levels and functional areas, with strong representation of managerial and decision-related positions.

Table 4.2: Distribution of Respondents According to Professional Characteristics

Variable	Category	Frequency (N)	Percentage (%)
Job title	General Manager / CEO	28	45.2
	Department / Division Manager	15	24.2
	Supervisor / Section Head	3	4.8
	Administrative Employee	10	16.1
	Technical / Operational Employee	5	8.1
	Other	1	1.6
Years of experience	Less than 3 years	24	38.8
	5 to less than 10 years	18	29.0
	10 years or more	20	32.3
Educational level	Diploma	8	12.9
	Bachelor's Degree	35	56.5
	Master's Degree	8	12.9

	Doctorate (PhD)	4	6.5
	Other	7	11.2
Department / functional area	Top Management	24	38.7
	Finance / Accounting	13	21.0
	Information Technology	3	4.8
	Production / Operations	6	9.7
	Marketing and Sales	8	12.9
	Human Resources	5	8.1
	Research and Development (R&D)	1	1.6
	Other	2	3.2

Source: Developed by the Author Using SPSS Output. Note. Percentages for job title, years of experience, educational level, and department/functional area are based on valid responses (n = 62).

4.2.3 Descriptive Analysis of Study Factors

The main study constructs were assessed to examine the level of digital innovation, circular economy practices, organizational readiness, and government and policy support among plastic manufacturing enterprises in Hebron City. These constructs represent the core variables of the study model, with digital innovation as the independent construct, circular economy practices as the dependent construct, organizational readiness as the mediating construct, and government and policy support as the moderating construct.

4.2.3.1 Digital Innovation Analysis

This section presents the results of the first research question, which stated: **“What is the current level of digital innovation adoption in plastic manufacturing enterprises operating in Hebron City?”** To answer this question, digital innovation was assessed by examining the extent to which participating enterprises use data analytics, digital technologies, digital tools, and digital transformation to support strategic and operational decision-making, innovation, collaboration, product and service development, performance improvement, and competitiveness.

As shown in Table 4.3, the overall mean score for digital innovation was 3.90, with a standard deviation of 0.45, indicating a high level of adoption among the participating enterprises. The highest mean was recorded for DI5, “Digital technologies facilitate collaboration with customers and suppliers” (M = 4.02, SD = 0.58), followed by DI4, “The organization encourages employees to use digital tools for generating new and innovative ideas” (M = 3.98, SD = 0.73), and DI6, “The firm integrates digital solutions into the development processes of products and services” (M = 3.97, SD = 0.65). These findings indicate that digital innovation was most evident in customer and supplier collaboration, employees' use of digital tools, and the integration of digital solutions into product and service development.

The lowest mean was recorded for DI3, “The company regularly invests in new digital technologies and systems” (M = 3.71, SD = 0.75). Although this item had the lowest mean within the construct, it still fell within the high level. Overall, the findings indicate that plastic manufacturing enterprises operating in Hebron City reported a high level of digital innovation adoption, with stronger agreement on the practical use of digital technologies in collaboration and innovation activities than on regular investment in new digital technologies and systems.

Table 4.3: Descriptive Statistics of the Digital Innovation Construct

	Construct and Items	Mean	Standard Deviation	Max.	Min.	Interpretation
DI	**Digital Innovation**	**3.90**	**0.45**	**4.86**	**2.86**	**High**
DI1	Digital platforms help the company manage supply chains and logistics efficiently.	3.83	0.81	1	5	High
DI2	The organization uses data analytics to support strategic and operational decision-making	3.87	0.64	5	2	High
DI3	The company regularly invests in new digital technologies and systems	3.71	0.75	5	2	High
DI4	The organization encourages employees to use digital tools for generating new and innovative ideas	3.98	0.73	5	2	High
DI5	Digital technologies facilitate collaboration with customers and	4.02	0.58	5	2	High

	suppliers					
DI6	The firm integrates digital solutions into the development processes of products and services	3.97	0.65	5	2	High
DI7	The organization increasingly relies on digital transformation to improve performance and competitiveness	3.90	0.73	5	1	High

Source: Developed by the Author Using SPSS Output.

4.2.3.2 Circular Economy Practices Analysis

This section presents the results of the second research question, which stated: **"What is the current level of circular economy implementation in plastic manufacturing enterprises operating in Hebron City?"** To answer this question, circular economy practices were assessed to examine the extent to which participating enterprises apply waste minimization, reuse and recycling, repurposing of production waste, resource exchange, product life-cycle extension, and environmental sustainability.

As shown in Table 4.4, the overall mean score for circular economy practices was 3.91 with a standard deviation of 0.58, indicating a high level of circular economy implementation among the participating enterprises. The highest mean was recorded for CEP2, "Production materials are reused or recycled whenever possible" (M = 4.00, SD = 0.95), followed by CEP7, "The organization systematically incorporates environmental sustainability into product/service design and development” (M = 3.97, SD = 0.74), and CEP4, “Waste generated from production processes is reused or repurposed” (M = 3.90, SD = 0.89). These findings indicate that circular economy practices were most evident in material reuse and recycling, integration of environmental sustainability, and the reuse or repurposing of production waste.

The lowest mean was recorded for CEP1, “Products or services are designed to minimize waste” (M = 3.79, SD = 0.86). Although this item had the lowest mean within the construct, it still fell within the high level. Overall, the findings indicate that plastic manufacturing enterprises operating in Hebron City reported a high level of circular economy practices, with stronger agreement on recycling and reuse-related practices than on waste-minimizing design.

Table 4.4: Descriptive Statistics of the Circular Economy Practices Construct

	Construct and Items	Mean	Standard Deviation	Max.	Min.	Interpretation
CEP	**Circular Economy Practices**	**3.91**	**0.58**	**5.00**	**2.29**	**High**
CEP1	Products or services are designed to minimize waste	3.79	0.86	5	1	High
CEP2	Production materials are reused or recycled whenever possible	4.00	0.95	5	1	High

CEP3	The company monitors energy and water consumption to improve efficiency.	3.86	0.75	5	2	High
CEP4	Waste generated from production processes is reused or repurposed	3.90	0.89	5	1	High
CEP5	The company cooperates with other firms to exchange or recycle resources	3.81	1.00	5	1	High
CEP6	The company seeks to extend product life cycles through repair, reuse, or remanufacturing	3.84	0.87	5	1	High
CEP7	The organization systematically incorporates environmental sustainability into product/service design and development	3.97	0.74	5	1	High

Source: Developed by the Author Using SPSS Output.

4.2.3.3 Organizational Readiness Analysis

This section presents the results of the third research question, which stated: **"What is the current level of organizational readiness in plastic manufacturing enterprises operating in Hebron City?"** To answer this question, organizational readiness was assessed to examine the extent to which the participating enterprises possess the internal conditions needed to support digital innovation and sustainability practices. These conditions included digital infrastructure, top management commitment, employee skills, financial resources, organizational culture, and technological capabilities. This construct included six items.

As shown in Table 4.5, the overall mean score for organizational readiness was 3.65, with a standard deviation of 0.58, indicating a high level of organizational readiness among the participating enterprises. The highest mean was recorded for OR5, “Organizational culture encourages experimentation, learning, and innovation” (M = 3.84, SD = 0.75), followed by OR3, “The organization continuously develops employees’ skills in digital technologies and sustainability” (M = 3.79, SD = 0.81). These findings indicate that organizational readiness was most evident in the enterprises’ innovation-oriented culture and in their efforts to develop employees’ skills in digital technologies and sustainability.

The lowest mean was recorded for OR1, “The organization has sufficient digital infrastructure to support innovation” (M = 3.51, SD = 0.80). Although this item had the lowest mean within the construct, it still fell within the high level. Overall, the findings indicate that plastic manufacturing enterprises operating in Hebron City reported a high level of organizational readiness, with stronger agreement on innovation culture and employee skill development than on the sufficiency of digital infrastructure.

Table 4.5: Descriptive Statistics of the Organizational Readiness Construct

	Construct and Items	Mean	Standard Deviation	Max.	Min.	Interpretation
OR	**Organizational Readiness**	**3.65**	**0.58**	**5.00**	**1.67**	**High**
OR1	The organization has sufficient digital infrastructure to support innovation	3.51	0.80	5	1	High
OR2	Top management is committed to adopting and supporting digital transformation strategies	3.63	0.83	5	1	High
OR3	The organization continuously develops employees' skills in digital technologies and sustainability	3.79	0.81	5	1	High
OR4	The company allocates financial resources for innovation and sustainability projects	3.57	0.86	5	1	High
OR5	Organizational culture encourages experimentation, learning, and innovation	3.84	0.75	5	1	High
OR6	The firm possesses the technological	3.52	0.78	5	2	High

	capabilities needed for digital transformation					

Source: Developed by the Author Using SPSS Output.

4.2.3.4 Government Support and Policies Analysis

This section presents the results of the third research question, which stated: “What is the level of government and policy support perceived by plastic manufacturing enterprises operating in Hebron City?” To answer this question, government and policy support was assessed to examine respondents’ perceptions of the extent to which government policies, national strategies, university–industry collaboration, the policy environment, and regulatory frameworks support sustainable innovation, digitalization, green transformation, and circular economy practices. This construct included five items.

As shown in Table 4.6, the overall mean score for government and policy support was 3.25, with a standard deviation of 0.73, indicating a medium level of perceived support among the participating enterprises. The highest mean was recorded for GPS3, “Collaboration between universities and industry is encouraged in Palestine” (M = 3.67, SD = 0.84), followed by GPS4, “The policy environment supports green and digital transformation” (M = 3.46, SD = 0.91). Both items fell within the high level. This indicates that respondents perceived university–industry collaboration and the general policy environment for green and digital transformation more positively than other aspects of government and policy support.

The lowest mean was recorded for GPS1, "Government policies encourage the adoption of sustainable innovation" (M = 2.92, SD = 1.15), followed by GPS5, "Regulatory frameworks provide incentives for circular and sustainable practices" (M = 3.08, SD = 1.01). Both items fell within the medium level. Overall, the findings indicate that Government and Policy Support was perceived at a medium level, with stronger agreement regarding university–industry collaboration and the policy environment, but weaker agreement regarding direct government policy encouragement and regulatory incentives for circular and sustainable practices.

Table 4.6: Descriptive Statistics of the Government and Policy Support Construct

	Construct and Items	**Mean**	**Standard Deviation**	**Max.**	**Min.**	**Interpretation**
GPS	**Government and Policy Support**	**3.25**	**0.73**	**5.00**	**1.60**	**Medium**
GPS1	Government policies encourage the adoption of sustainable innovation	2.92	1.15	5	1	Medium
GPS2	There are clear national strategies promoting digitalization and the circular economy	3.11	1.00	5	1	Medium
GPS3	Collaboration between universities and industry is encouraged	3.67	0.84	5	2	High

	in Palestine					
GPS4	The policy environment supports green and digital transformation	3.46	0.91	5	1	High
GPS5	Regulatory frameworks provide incentives for circular and sustainable practices	3.08	1.01	5	1	Medium

Source: Developed by the Author Using SPSS Output.

4.2.3.5 Implementation Barriers Analysis

This section presents the results of the descriptive question: "What is the level of implementation barriers perceived by plastic manufacturing enterprises operating in Hebron City?" To answer this question, barriers to implementation were assessed descriptively to examine respondents' perceptions of the main organizational and institutional challenges that may hinder digital innovation and the implementation of the circular economy. These barriers included financial constraints, a lack of technical expertise, insufficient government policy support, resistance to organizational change, infrastructure limitations, and limited awareness of the benefits of the circular economy. This construct included six items and was analyzed descriptively because it was not included as a latent construct in the final hypothesized PLS-SEM structural model.

As shown in Table 4.7, the overall mean score for barriers to implementation was 3.85, with a standard deviation of 0.45, indicating a high level of perceived barriers among the participating enterprises. The highest mean was recorded for BAR6, "Limited awareness of circular economy benefits affects its implementation" (M = 4.08, SD = 0.70), followed by BAR5, “Infrastructure limitations restrict digital transformation initiatives” (M = 4.00, SD = 0.76), and BAR1, “Limited financial resources hinder investment in digital technologies” (M = 3.87, SD = 0.85). These results indicate that limited awareness, infrastructure constraints, and financial limitations were the most prominent perceived barriers.

The lowest mean was recorded for BAR3, “Government policies do not sufficiently support digital and sustainable innovation” (M = 3.67, SD = 1.05), followed closely by BAR4, “Resistance to organizational change slows the adoption of new technologies” (M = 3.68, SD = 0.71). Although these items had the lowest means within the construct, they still fell within the high level. Overall, the findings indicate that plastic manufacturing enterprises operating in Hebron City perceived implementation barriers to be high, with particular concerns regarding awareness of circular economy benefits, infrastructure readiness, and financial resources.

Table 4.7: Descriptive Statistics of the Implementation Barriers Construct

	Construct and Items	Mean	Standard Deviation	Max.	Min.	Interpretation
BAR	**Barriers to Implementation**	**3.85**	**0.45**	**4.83**	**2.83**	**High**
BAR1	Limited financial resources hinder investment in digital	3.87	0.85	5	1	High

	technologies					
BAR2	Lack of technical expertise limits the implementation of circular innovation	3.79	0.81	5	2	High
BAR3	Government policies do not sufficiently support digital and sustainable innovation	3.67	1.05	5	1	High
BAR4	Resistance to organizational change slows the adoption of new technologies	3.68	0.71	5	2	High
BAR5	Infrastructure limitations restrict digital transformation initiatives	4.00	0.76	5	1	High
BAR6	Limited awareness of circular economy benefits affects its implementation	4.08	0.70	5	1	High

Source: Developed by the Author Using SPSS Output.

4.3 Study Model Evaluation

The first step in evaluating the PLS-SEM model was assessing the measurement model. This step was conducted to ensure that the study instrument was reliable and valid before testing the structural relationships between the study constructs. The second step was the structural model evaluation, which aimed to assess relationships among the study constructs and determine whether the proposed model provided sufficient statistical evidence to test the study hypotheses.

4.3.1 Measurement Model Evaluation Results

The measurement model is evaluated in three main stages: convergent validity, discriminant validity, and internal consistency (Hair et al., 2021).

4.3.1.1 Convergent Validity

Convergent validity refers to the degree to which the indicators of the same construct are related to each other and measure the same underlying concept. In PLS-SEM, convergent validity is commonly assessed using outer loadings and average variance extracted (AVE), where outer loadings reflect indicator reliability, and AVE reflects the amount of variance captured by the construct from its indicators (Fornell & Larcker, 1981; Sarstedt et al., 2022).

4.3.1.1.1 Outer Loading

Outer loadings reflect the strength of the relationship between each indicator and its corresponding latent construct. In PLS-SEM, outer loadings are used to assess indicator reliability and to determine whether the items adequately represent their intended constructs. Generally, outer loadings of 0.70 or higher are preferred. However, indicators with loadings between 0.40 and 0.70 may be retained when they are theoretically important, and the construct's reliability and validity remain acceptable (Sarstedt et al., 2022; Hair et al., 2022).

As shown in Table 4.8, the initial outer loading values for the study indicators ranged from 0.377 for CEP3 to 0.809 for OR2. During the measurement model evaluation, two indicators were removed because their outer loadings were below the minimum acceptable threshold of 0.70. The measurement model also indicated that retaining these two indicators negatively affected the model's quality, particularly the internal consistency and convergent validity of the corresponding underlying constructs. The CEP3 (outer loading = 0.377) and DI1 (outer loading = 0.486) indicators were used. Indicator CEP3 was dropped because it loaded outside the recommended range of 0.70 and even the minimum acceptable range of 0.40, resulting in low reliability of the indicator data. Similarly, DI1 did not meet the recommended loading criterion. Maintaining these indicators may negatively affect construct reliability and convergent validity. Thus, these two indicators were not included in the final measurement model for further test of reliability and validity.

After removing these two indicators, the outer loadings of the remaining indicators ranged from 0.515 for OR1 to 0.809 for OR2. Most retained indicators either exceeded or approached the preferred threshold of 0.70, while some had loadings below 0.70 but remained above the minimum acceptable threshold of 0.40. These indicators were retained because they reflected relevant theoretical aspects of their constructs and because the internal consistency reliability results showed acceptable values for all constructs. Therefore, the final outer loadings provided adequate support for the measurement model's indicator reliability.

Table 4.8: Outer loading of indicators

Construct and Indicators	**Outer Loading**	**Decision**

CEP	**Circular Economy Practices**		
CEP1	Products or services are designed to minimize waste.	0.600	Retained
CEP2	Production materials are reused or recycled whenever possible.	0.692	Retained
CEP3	The company monitors energy and water consumption to improve efficiency.	0.377	Removed
CEP4	Waste generated from production processes is reused or repurposed.	0.711	Retained
CEP5	The company cooperates with other firms to exchange or recycle resources.	0.686	Retained
CEP6	The company seeks to extend product life cycles through repair, reuse, or remanufacturing.	0.764	Retained
CEP7	The organization systematically incorporates environmental sustainability into product/service design and development.	0.773	Retained
DI	**Digital Innovation**		
DI1	Digital platforms help the company manage supply chains and logistics efficiently.	0.486	Removed
DI2	The organization uses data analytics to support strategic and operational decision-making.	0.596	Retained
DI3	The company regularly invests in new digital technologies and systems.	0.804	Retained
DI4	The organization encourages employees to use digital tools for generating new and innovative	0.760	Retained

	ideas.		
DI5	Digital technologies facilitate collaboration with customers and suppliers.	0.783	Retained
DI6	The firm integrates digital solutions into the development processes of products and services.	0.539	Retained
DI7	The organization increasingly relies on digital transformation to improve performance and competitiveness.	0.556	Retained
GPS	**Government and Policy Support**		
GPS1	Government policies encourage the adoption of sustainable innovation.	0.668	Retained
GPS2	There are clear national strategies promoting digitalization and the circular economy.	0.776	Retained
GPS3	Collaboration between universities and industry is encouraged in Palestine.	0.651	Retained
GPS4	The policy environment supports green and digital transformation.	0.748	Retained
GPS5	Regulatory frameworks provide incentives for circular and sustainable practices.	0.804	Retained
OR	**Organizational Readiness**		
OR1	The organization has sufficient digital infrastructure to support innovation.	0.515	Retained
OR2	Top management is committed to adopting and supporting digital transformation strategies.	0.809	Retained

OR3	The organization continuously develops employees’ skills in digital technologies and sustainability.	0.745	Retained
OR4	The company allocates financial resources for innovation and sustainability projects.	0.784	Retained
OR5	Organizational culture encourages experimentation, learning, and innovation.	0.662	Retained
OR6	The firm possesses the technological capabilities needed for digital transformation.	0.752	Retained

Source: Developed by the Author Using Smart-PLS Output

Figure 4.1 presents the final PLS-SEM model after indicator refinement. As shown in the figure, DI1 and CEP3 were removed from the final model. The retained indicators were then used to assess the final measurement model and proceed with the validity and reliability evaluation.

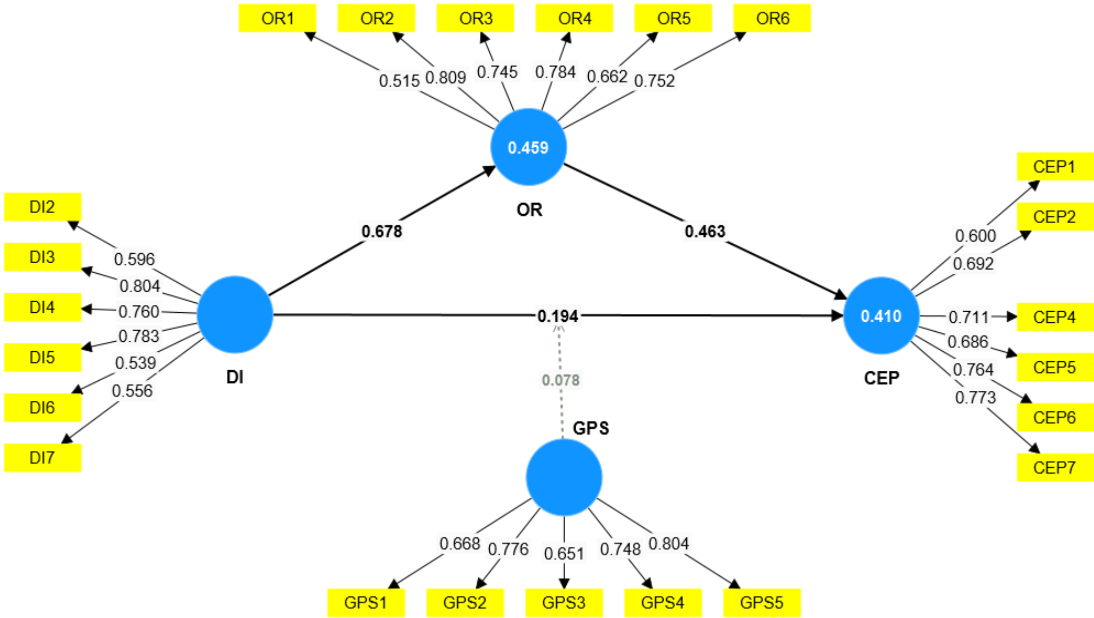

Figure 4.1: Final PLS-SEM Model after Indicator Refinement; Source: SmartPLS Output.

4.3.1.1.2 Average Variance Extracted

Average VaAverage Extracted Variance (AVE) is one of the main criteria used to assess convergent validity in PLS-SEM. It indicates the average amount of variance that a construct explains in its indicators. According to Fornell and Larcker (1981), an AVE of 0.50 or higher is generally considered acceptable, as it indicates that the construct explains at least half of the variance in its indicators. However, AVE should also be interpreted alongside composite reliability, Cronbach's alpha, outer loadings, and the construct's theoretical importance, especially when some indicators have loadings below the preferred threshold of 0.70.

As shown in Table 4.9, most constructs achieved acceptable AVE values at or above the recommended threshold of 0.50. The AVE values were 0.536 for government and policy support, 0.516 for organizational readiness, and 0.500 for circular economy practices. These results indicate acceptable convergent validity for these constructs. The AVE for digital innovation was 0.465, slightly below the conventional threshold of 0.50. However, the construct was retained because its internal consistency was acceptable, as indicated by its composite reliability and Cronbach's alpha, as recommended by Fornell & Larcker (1981) and Sarstedt et al.(2022), and because the retained indicators captured important theoretical aspects of digital innovation in the study context. The AVE results provided acceptable evidence of convergent validity for CEP, OR, and GPS.

Table 4.9: Result of average variance extracted (AVE)

Abbreviations	**Construct**	**AVE**
DI	Digital Innovation	0.465
CEP	Circular Economy Practices	0.500
OR	Organizational Readiness	0.516
GPS	Government and Policy Support	0.536

Source: Developed by the Author Using Smart-PLS Output

4.3.1.2 Discriminant Validity

Discriminant validity refers to the extent to which each construct is distinct from the other constructs in the model. In other words, it shows whether the indicators of one construct measure their intended construct more strongly than they measure other constructs. In this study, discriminant validity was assessed using the Fornell-Larcker criterion and the heterotrait-monotrait ratio (HTMT), which are commonly used criteria in reflective PLS-SEM measurement models (Fornell & Larcker, 1981; Henseler et al., 2015; Sarstedt et al., 2022).

In this study, the Fornell-Larcker and Heterotrait-Monotrait Ratio of Correlations (HTMT) criteria were applied to the constructs included in the measurement model: circular economy practices, digital innovation, government and policy support, and organizational readiness. The interaction term used to test the moderating effect was not interpreted because it represents a moderation term rather than a reflective construct measured by a separate set of questionnaire indicators.

4.3.1.2.1 Fornell-Larcker Criterion

The Fornell-Larcker criterion was used to assess discriminant validity among the reflective constructs. According to this criterion, the square root of the Average Variance Extracted (AVE), which appears on the diagonal of the matrix, should be higher than the correlations between the construct and the other constructs. This indicates that each construct explains more variance than its own indicators, and less than other constructs in the model.

As shown in Table 4.10, all constructs met the Fornell-Larcker criterion. The square roots of AVE were 0.707 for circular economy practices, 0.682 for digital innovation, 0.732 for government and policy support, and 0.718 for organizational readiness. These diagonal values were higher than the correlations between each construct and the other constructs. The strongest relationship was observed between digital innovation and organizational readiness, with a correlation of 0.678. Although this value was close to the square root of AVE for digital innovation, it remained slightly below the diagonal value for digital innovation and for organizational readiness. Therefore, the Fornell-

Larcker results support the discriminant validity of the study constructs, with a relatively strong but acceptable conceptual relationship between digital innovation and organizational readiness.

Table 4.10: Fornell-Larcker Criterion

Construct	**CEP**	**DI**	**GPS**	**OR**
CEP	**0.707**			
DI	0.526	**0.682**		
GPS	0.394	0.394	**0.732**	
OR	0.612	0.678	0.545	**0.718**

Source: Developed by the Author Using Smart-PLS Output

4.3.1.2.2 Heterotrait-monotrait Ratio of Correlations (HTMT)

The Heterotrait-Monotrait Ratio of Correlations (HTMT) was used as an additional criterion to assess discriminant validity. HTMT is considered one of the stronger approaches for evaluating discriminant validity in PLS-SEM because it assesses whether correlations between constructs are sufficiently lower than correlations among indicators of the same construct. According to commonly used guidelines, HTMT values below 0.85 indicate strong discriminant validity, while values below 0.90 may still be considered acceptable when the constructs are conceptually related (Henseler et al., 2015; Sarstedt et al., 2022).

As shown in Table 4.11, all HTMT values among the study constructs were below the recommended threshold of 0.85. The highest HTMT value was observed between organizational readiness and digital innovation, at 0.820. Although this value was the highest among the constructs, it remained below the conservative threshold of 0.85 and is theoretically reasonable because organizational readiness is closely related to the organization's ability to adopt and implement digital innovation. Therefore, the HTMT results support the discriminant validity of the measurement model.

Table 4.11: Heterotrait-Monotrait Ratio (HTMT) Result

Construct	**CEP**	**DI**	**GPS**	**OR**
CEP				
DI	0.591			
GPS	0.447	0.482		
OR	0.693	0.820	0.667	

Source: Developed by the Author Using Smart-PLS Output

4.3.1.3 Internal Consistency Reliability

Internal consistency reliability refers to the extent to which items measuring the same construct are consistent with one another. In other words, it indicates whether the indicators of each construct measure the same underlying concept. In this study, internal consistency reliability was evaluated using Cronbach's alpha (CA) and composite reliability (CR). Cronbach's alpha is commonly used to assess the reliability of multi-item scales. In contrast, composite reliability is particularly useful in PLS-SEM because it accounts for differences in the outer loadings of the indicators.

According to commonly used reliability criteria, CA and CR values above 0.70 indicate acceptable internal consistency, while values above 0.80 indicate good reliability (Sarstedt et al., 2022). As shown in Table 4.12, all constructs achieved acceptable reliability values. The CR values ranged from 0.835 to 0.862, and the CA values ranged from 0.768 to 0.809. Therefore, the results indicate that the study constructs had acceptable to good internal consistency and were suitable for further validity assessment and structural model testing.

Table 4.12: **Result of Cronbach's α (CA) and the Composite Reliability (CR) coefficients**

Abbreviations	**Construct**	**CR**	**CA**
DI	Digital Innovation	0.835	0.768
CEP	Circular Economy Practices	0.856	0.803
OR	Organizational Readiness	0.862	0.809
GPS	Government and Policy Support	0.851	0.787

Source: Developed by the Author Using Smart-PLS Output

4.3.2 Structural Model Evaluation Results

The structural model evaluation aims to assess relationships among the study constructs and to determine whether the proposed model provides sufficient statistical evidence to test the study hypotheses. In this stage, the relationships among digital innovation, organizational readiness, circular economy practices, and government and policy Support were examined using PLS-SEM. The evaluation included several procedures: checking multicollinearity using VIFs, assessing the model's explanatory power with the coefficient of determination (R^2), examining effect size (f^2), predictive relevance ($\mathbf{Q^2}$), and testing the significance of path coefficients via bootstrapping. These procedures were used to ensure that the structural model was appropriate and that the direct and indirect relationships between the constructs could be interpreted reliably. Based on these results, the study hypotheses were evaluated.

4.3.2.1 Multi-Collinearity Test

Before evaluating the structural model among the study constructs, multicollinearity was assessed using the Variance Inflation Factor (VIF). This step is important because high collinearity among predictor constructs can compromise the accuracy and stability of the estimated path coefficients. In PLS-SEM, VIF values below 5.00 generally indicate that multicollinearity is not a serious concern, and lower values provide stronger evidence that the structural paths can be interpreted reliably (Sarstedt, Hair, et al., 2022).

As shown in Table 4.13, all VIF values ranged from 1.000 to 2.346, well below the recommended threshold of 5.00. The highest VIF was observed for OR → CEP (VIF = 2.346), and the lowest for DI → OR (VIF = 1.000). These results indicate no evidence of problematic multicollinearity among the predictor constructs in the structural model. Therefore, the path coefficients can be interpreted without concern that high correlations among predictor constructs distorted the results.

Table 4.13: Collinearity Assessment using VIF.

	Paths	**VIF**
1	DI → CEP	1.860
2	DI → OR	1.000
3	OR → CEP	2.346
4	GPS × DI → CEP	1.072

Source: Developed by the Author Using Smart-PLS Output

4.3.2.2 Coefficient of Determination ($\mathbf{R^2}$)

The coefficient of determination (R^2) was used to assess the explanatory power of the structural model. R^2 represents the proportion of variance in each endogenous construct explained by its exogenous constructs. R^2 ranges from 0 to 1, with higher values indicating greater explanatory power. Following common guidelines, R^2 values of 0.02, 0.15, and 0.35 may be interpreted as weak, moderate, and strong explanatory power, respectively (Cohen, 1988; Sarstedt, Hair, et al., 2022).

As shown in Table 4.14, organizational readiness had an R^2 of 0.459, indicating that digital innovation explained 45.9% of the variance in organizational readiness. In addition, circular economy practices had an R^2 of 0.410, indicating that digital innovation, organizational readiness, and the interaction term between government and policy support and digital innovation together explained 41.0% of the variance in circular economy practices. These results suggest that the structural model has strong explanatory power for both endogenous constructs.

Table 4.14: Result of R^2

Endogenous Constructs	**R-square**	**Degree of explanation**
Organizational Readiness	0.459	Strong
Circular Economy Practices	0.410	Strong

Source: Developed by the Author Using Smart-PLS Output

4.3.2.3 Effect Sizes (f^2)

Effect size (f^2) was used to assess each predictor construct's relative contribution to the explained variance of the endogenous construct. In PLS-SEM, f^2 values indicate how much an endogenous construct's R^2 changes when a specific predictor is included in the model. According to Cohen's guidelines, f^2 values of 0.02, 0.15, and 0.35 indicate small, medium, and large effects, respectively (Cohen, 1988; Sarstedt, Ringle, et al., 2022).

As shown in Table 4.15, the reported f^2 values ranged from negligible to large effect sizes. The effect of digital innovation on organizational readiness was large ($f^2 = 0.850$), indicating that digital innovation made a strong contribution to explaining organizational readiness. The effect of organizational readiness on circular economy practices was medium ($f^2 = 0.155$), indicating that it contributed meaningfully to the explanation of these practices.

The results also showed that digital innovation had a small effect on circular economy practices ($f^2 = 0.034$). However, the interaction term GPS × DI also had a negligible effect ($f^2 = 0.013$). These results suggest that digital innovation was the strongest contributor to organizational readiness, while organizational readiness, in turn, made a meaningful contribution to circular economy practices. In contrast, the moderating interaction with digital innovation had a small effect size.

Table 4.15: Result of effect size (f^2)

Paths	$\mathbf{f^2}$	**Effect Size**
Digital Innovation → Circular Economy Practices	0.034	Small
Digital Innovation → Organizational Readiness	0.850	Large
Organizational Readiness → Circular Economy Practices	0.155	Medium
Government and Policy Support × Digital Innovation → Circular Economy Practices	0.013	Negligible

Source: Developed by the Author Using Smart-PLS Output

4.3.2.4 Predictive relevance ($\boldsymbol{Q^2}$)

Predictive relevance was assessed using Stone–Geisser's Q^2 statistic, which evaluates the model's ability to predict the indicators of endogenous constructs through the blindfolding procedure (Geisser, 1974; Stone, 1974; Sarstedt et al., 2022). Q^2 is calculated as $1 - SSE/SSO$, with values greater than zero indicating predictive relevance for the construct and values equal to or below zero suggesting no predictive relevance.

As shown in Table 4.16, circular economy practices had a Q^2 of 0.159, while organizational readiness had a Q^2 of 0.209. Because both values were greater than zero, the results indicate that the model had predictive relevance for both endogenous constructs. This means that the structural model reconstructed the indicators of circular economy practices and organizational readiness better than a mathematical mean-only benchmark.

In contrast, digital innovation and government and policy support had Q^2 values of 0.000 because they are exogenous constructs in the model and are not predicted by other constructs. Therefore, these values should not be interpreted as indicating a lack of predictive relevance.

Table 4.16: Result of Q^2

	SSO	**SSE**	**Q^2 (=1-SSE/SSO)**
Circular Economy Practices	378.000	317.793	0.159
Digital Innovation	378.000	378.000	0.000
Government and Policy Support	315.000	315.000	0.000
Organizational Readiness	378.000	299.022	0.209

Source: Developed by the Author Using Smart-PLS Output

4.3.2.5 Path Coefficients and Hypothesis Testing

At the final stage of structural model assessment, the hypothesized relationships were evaluated using bootstrapping in SmartPLS with 5,000 resamples. Bootstrapping was used to obtain standard errors, t-values, and p-values to assess the statistical significance of the structural relationships among the study constructs.

This section presents results for the study hypotheses regarding direct, mediating, and moderating relationships in the proposed model. The tested alternative hypotheses were:

H1: Digital innovation has a significant positive effect on the implementation of the circular economy in plastic manufacturing enterprises operating in Hebron City.

H2: Digital innovation has a significant positive effect on organizational readiness in plastic manufacturing enterprises operating in Hebron City.

H3: Organizational readiness has a significant positive effect on the implementation of the circular economy in plastic manufacturing enterprises operating in Hebron City.

H4: Organizational readiness positively mediates the relationship between digital innovation and circular economy practices in plastic manufacturing enterprises operating in Hebron City.

H5: Government support positively moderates the relationship between digital innovation and circular economy implementation in plastic manufacturing enterprises operating in Hebron City.

Accordingly, the following subsections present the direct-path, indirect-path, and moderation-path results based on the SmartPLS bootstrapping output. Figure 4.2 displays the structural model results of the study.

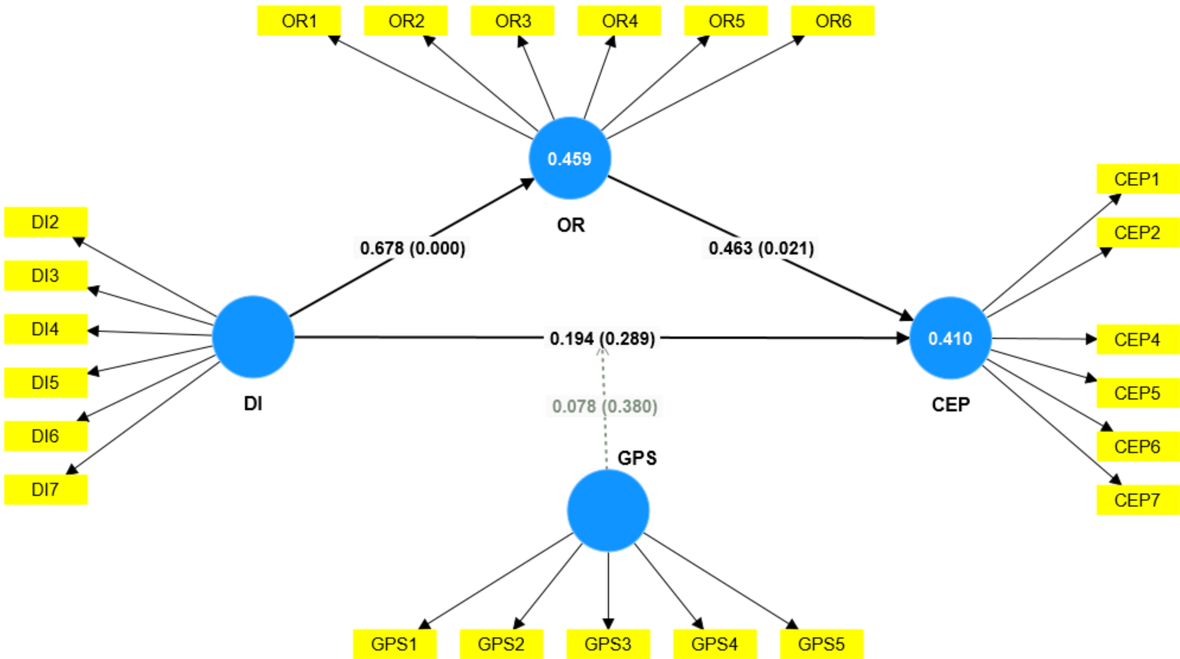

Figure 4.2: Structural Model Results of the Study; Source: SmartPLS Output.

4.3.2.5.1 Direct paths

As shown in Table 4.17, the first hypothesis examined the direct effect of digital innovation on circular economy practices. The results showed a positive but statistically non-significant effect ($\beta = 0.194$, STDEV = 0.183, $t = 1.061$, $p = 0.289$). Since the p-value was greater than 0.05, H1 was rejected.

The second hypothesis examined the effect of digital innovation on organizational readiness. The results showed a positive and statistically significant effect ($\beta = 0.678$, STDEV = 0.065, $t = 10.372$, $p < 0.001$). Since the p-value was below 0.05, H2 was accepted. This indicates that digital innovation has a statistically significant positive effect on organizational readiness.

The third hypothesis examined the effect of organizational readiness on circular economy practices. The results showed a positive and statistically significant effect ($\beta = 0.463$, STDEV = 0.200, $t = 2.311$, $p = 0.021$). Since the p-value was below 0.05, H03 was accepted. This indicates that organizational readiness has a statistically significant positive effect on circular economy practices.

Table 4.17: Direct Path Coefficients and Hypothesis Testing

	Path	**Coefficient (β)**	**STDEV**	**t-value**	**p-value**	**Hypothesis Decision**
H1	Digital Innovation → Circular Economy Practices	0.194	0.183	1.061	0.289	Reject
H2	Digital Innovation → Organizational Readiness	0.678	0.065	10.372	0.000**	Accept
H3	Organizational Readiness → Circular Economy Practices	0.463	0.200	2.311	0.021*	Accept

Indicates a significant relationship at 5%; ** indicates a significant relationship at 1%; STDEV: Standard deviation—source: Developed by the Author Using SmartPLS Output.

4.3.2.5.2 Indirect paths

The fourth hypothesis tested whether organizational readiness mediated the relationship between digital innovation and circular economy practices. The indirect effect was positive and statistically significant ($\beta = 0.314$, STDEV = 0.145, $t = 2.161$, $p = 0.031$). Because the p-value was below 0.05, H4 was accepted. This indicates that organizational readiness significantly mediated the relationship between digital innovation and circular economy practices.

This finding provides an important explanation of the structural model. Although the direct effect of digital innovation on circular economy practices was not statistically significant, the indirect effect through organizational readiness was. Therefore, the results suggest that digital innovation contributes to circular economy practices primarily by strengthening organizational readiness, and that organizational readiness fully mediates this relationship.

Table 4.18: Specific Indirect Effect and Mediation Hypothesis Testing

#	**Path**	**Coefficient (β)**	**STDEV**	**t-value**	**p-value**	**Hypothesis Decision**
H4	Digital Innovation → Organizational Readiness → Circular Economy Practices	0.314	0.145	2.161	0.031*	Accept

Indicates a significant relationship at 5%; ** indicates a significant relationship at 1%; STDEV: Standard deviation—source: Developed by the Author Using SmartPLS Output.

4.3.2.5.3 Moderating Path

The fifth hypothesis examined the moderating role of government support in the relationship between digital innovation and circular economy practices. This was tested through the interaction term between government and policy support and digital innovation. As shown in Table 4.19, the interaction effect was positive but statistically non-significant ($\beta = 0.078$, STDEV = 0.088, $t = 0.879$, $p = 0.380$). Since the p-value was greater than 0.05, H5 was rejected. This indicates that government support did not significantly moderate the relationship between digital innovation and circular economy practices.

Table 4.19: Moderating Effect and Hypothesis Testing

No.	**Path**	**Coefficient (β)**	**STDEV**	**t-value**	**p-value**	**Hypothesis Decision**
H5	Government and Policy Support × Digital Innovation → Circular Economy Practices	0.078	0.088	0.879	0.380	Reject

Indicates a significant relationship at 5%; ** indicates a significant relationship at 1%; STDEV: Standard deviation. Source: Developed by the Author Using Smart-PLS Output

4.3.2.6 PLSpredict: out-of-sample predictive power

The PLSpredict procedure evaluates the model's out-of-sample predictive performance using cross-validation. In this context, Q^2predict values greater than zero indicate predictive relevance, meaning that the PLS-SEM model has predictive ability for the corresponding endogenous construct. In addition, lower prediction errors, represented by Root Mean

Square Error (RMSE) and Mean Absolute Error (MAE), indicate better predictive accuracy (Shmueli et al., 2019).

As shown in Table 4.20, both endogenous constructs showed positive Q^2predict values. Circular Economy Practices recorded a Q^2predict value of 0.185, with RMSE = 0.946 and MAE = 0.714. Organizational Readiness recorded a higher Q^2predict value of 0.415, with RMSE = 0.801 and MAE = 0.597. Since both Q^2predict values were greater than zero, the results indicate that the model has out-of-sample predictive relevance for both endogenous constructs.

The results further show that the predictive performance was stronger for Organizational Readiness than for Circular Economy Practices, as Organizational Readiness had a higher Q^2predict value and lower prediction errors. Overall, these findings support the structural model's predictive adequacy, particularly for Organizational Readiness, and provide additional evidence that the model has predictive relevance beyond the explanatory assessment based on R^2 and path coefficients.

Table 4.20: Results of Predictive Power Using PLSpredict

Construct	**Q^2predict**	**RMSE**	**MAE**
Circular Economy Practices	0.185	0.946	0.714
Organizational Readiness	0.415	0.801	0.597

Source: Developed by the Author Using SmartPLS Output.

4.3.2.7 Importance–Performance Map Analysis (IPMA)

In PLS-SEM, the integration of importance and performance provides a practical basis for identifying strategic improvement priorities. Importance reflects the total effect of each predecessor construct on the target construct, while performance represents the latent construct scores, rescaled to a 0-100 metric (Ringle & Sarstedt, 2015). Accordingly, constructs with relatively high importance and moderate or improvable performance are usually considered the most relevant areas for managerial intervention, since improvement in these constructs is expected to generate stronger gains in the target outcome (Hair et al., 2017; Ringle & Sarstedt, 2015).

When the target construct is Circular Economy Practices (CEP), Digital Innovation (DI) has the highest importance value (0.508) and the highest performance score (64.674), indicating that DI is the strongest strategic driver of CEP in the model. This suggests that digital innovation capabilities should be protected, scaled, and further integrated into operational and environmental practices. Organizational Readiness (OR) also shows high importance (0.463) with a very similar performance level (64.258), placing it in the high-importance/high-performance quadrant. This indicates that internal readiness, including organizational capabilities, resources, and preparedness for change, represents another central pathway for strengthening circular economy practices.

By contrast, Government and Policy Support (GPS) records the lowest importance value (0.057) and the lowest performance score (54.486), positioning it in the low-importance/low-performance quadrant. Although GPS appears to be the weakest-performing construct, its limited overall effect on CEP suggests it is less actionable as a direct lever for improvement in the current model. Therefore, the IPMA results indicate that managerial and strategic attention should primarily focus on enhancing Digital Innovation and Organizational Readiness. At the same time, Government and Policy Support should be treated as a supportive contextual factor rather than the main direct driver of circular economy practices.

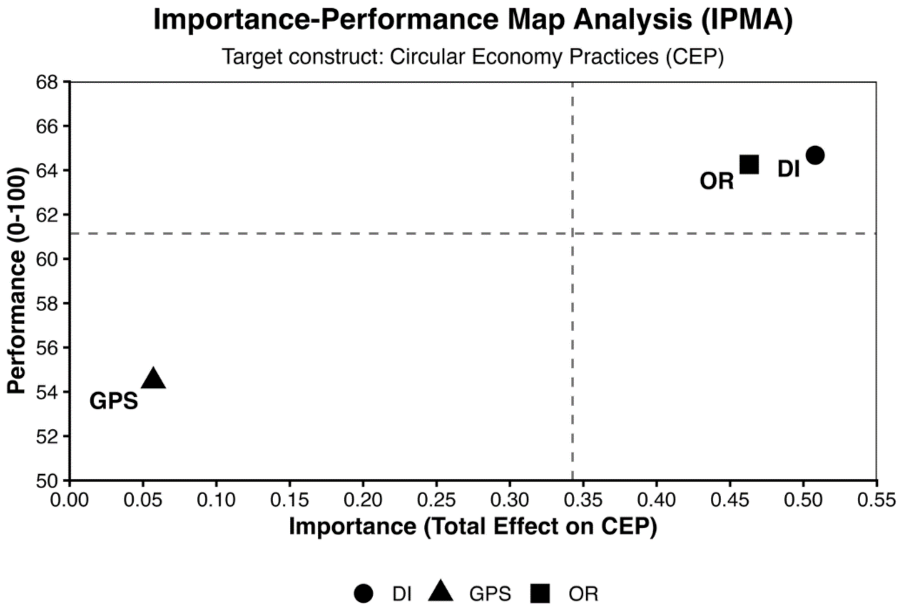

Figure 4.3: Importance-Performance Map Analysis (IPMA) for Circular Economy Practices.

To provide a comprehensive overview of the structural model assessment results, Table 4.21 summarizes the outcomes of all research hypotheses, including their statistical significance, support status, and brief interpretation.

Table 4.21 Summary of Hypotheses Testing Results

Hypothesis	Path	Decision	Effect	Interpretation
H1	Digital Innovation → Circular Economy Practices	Not Supported	No significant direct effect of digital innovation on circular economy practices.	Digital technologies alone were insufficient to generate circular economy outcomes directly due to organizational readiness.
H2	Digital Innovation → Organizational Readiness	**Supported**	Digital innovation had a significant positive effect on organizational readiness.	Digital innovation enhanced technological infrastructure, managerial processes, employee capabilities, and organizational preparedness.
H3	Organizational Readiness → Circular Economy Practices	**Supported**	Organizational readiness had a significant positive effect on circular economy practices.	Enterprises with stronger readiness levels were more capable of implementing circular economy practices effectively.
H4	Organizational Readiness Mediates the Relationship Between Digital Innovation and Circular Economy Practices	**Supported**	Organizational readiness significantly mediated the relationship between digital innovation and circular economy practices.	Digital innovation contributed indirectly to circular economy implementation by improving organizational readiness, indicating full mediation.
H5	Government Support Moderates the Relationship Between Digital Innovation and Circular Economy Practices	Not Supported	Government support did not significantly moderate the relationship between digital innovation and circular economy practices.	Enterprises relied more on internal capabilities and readiness than on external institutional support, while perceived government support remained moderate.

Table 4.21 indicates that three of the hypotheses were accepted (H2, H3, and H4), while the remaining two hypotheses (H1 and H5) were not accepted. The results showed that organizational readiness is a key determinant in translating digital innovation into circular economy practices. While digital innovation did not have a significant direct effect on circular economy practices, it exerted a significant indirect effect

through organizational readiness, indicating full mediation. In contrast, government support did not significantly moderate the relationship between digital innovation and circular economy practices.

5 Chapter Five: Discussion, Conclusion, and Recommendations.

5.1 Introduction

The results of the empirical investigations are interpreted in the context of the study's goals, research hypotheses, theoretical underpinnings, and prior empirical studies.

The emphasis is on the linkages between digital innovation, organizational readiness, government and policy support, and circular economy practices rather than on the specific characteristics of each. The mechanisms by which digital innovation can support the implementation of the circular economy are particularly highlighted, as is the role of organizational and institutional aspects in the relationship between these two.

Based on the empirical findings, the chapter presents the study's primary results and highlights its theoretical, managerial, and policy implications. It also makes practical suggestions for plastic manufacturing enterprises, politicians, universities, and industrial support institutions. Lastly, the study's constraints and suggestions for future research on digital innovation, organizational readiness, and the implementation of the circular economy in developing economies are discussed.

5.2 Discussion of the Findings

This study concludes that the results provide a clear picture of how digital innovation, Organizational Readiness, government support, and policy affect the practices of plastic manufacturing enterprises in Hebron

City, illustrating the interaction among these three factors. The overall results indicate that digital innovation is not the only motivator for implementing the circular economy in the enterprises studied; rather, it is driven primarily by the enterprises' internal readiness.

5.2.1 Discussion on Descriptive Findings

The descriptive results revealed that the majority of participating enterprises were private-sector manufacturing businesses, mainly small- and medium-scale enterprises with fewer than 10 employees. This result is significant since it shows that the study is representative of the situation of small plastic industries in Hebron City. Small businesses are typically low-resource, low-formalized, and have limited access to cutting-edge technology. This aligns with the findings of Jabbour et al. (2019), Galvão et al. (2018), and Panchal et al. (2021), who suggested that financial and infrastructure constraints, as well as limited technical capabilities, are common challenges to implementing sustainability and the circular economy, particularly in developing and resource-constrained settings.

It was also found that the majority of the respondents were general managers, chief executive officers, department managers, and administrative staff. This increases the trustworthiness of the answers provided, as these individuals are likely to have sufficient background information on their organizations' practices, including digital innovation, organizational readiness, government support, and circular economy practices. It is especially important because the study's variables are strategic and enterprise-level, not limited to individual employee-level variables.

The high level of digital innovation reported by the enterprises participating in the study suggests that plastic manufacturing enterprises in Hebron City are increasingly leveraging digital solutions to enhance their collaboration with customers and suppliers, to motivate their employees to think creatively about generating new ideas, and to integrate digital solutions into the development of plastic products and plastic services. This finding aligns with Fichman et al. (2014), Vial (2019), and Kroh et al. (2024), who have highlighted that digital innovation is not only about adopting technology but also about using digital tools to redesign processes, enhance coordination, and generate value. Additionally, it resonates with Alhawari et al. (2021), Bressanelli et al. (2022), and Neri et al. (2024), who suggested that digital technologies can support the implementation of circular economy practices by enhancing information flow, traceability, collaboration, and resource management.

The descriptive results also indicated a high level of circular economy practices, specifically reuse, recycling, environmental sustainability, and waste repurposing. This suggests that some circular processes are already being used in plastic manufacturing enterprises, although the processes are not necessarily organized or sophisticated. This is in line with Kirchherr et al. (2017), who described the circular economy as a model for the reduction, reuse, recycling, and recovery of resources. It further confirms the authors' opinion in Bressanelli et al. (2022), who noted the importance of creating value through extending resource use and reducing waste in the context of the circular economy.

There was also a high level of preparedness among the enterprises. The best features were an organizational culture supportive of experimentation, learning, and innovation, and ongoing employee development in digital and sustainability skills. This finding aligns with Weiner's (2009) contention that Organizational Readiness is a sign of an Organizational Readiness and dedication to change. It also aligns with

Ramdani et al. (2022) and Kroh et al. (2024), who noted that the factors influencing digital transformation are technological readiness, managerial support, employee competencies, financial resources, and culture conducive to innovation. The result that digital infrastructure is the least developed aspect, however, indicates that enterprises might be culturally and managerially prepared, but still need to build their technological base to maximize the value of digital innovation.

The level of government and policy support was considered medium. Collaboration between universities and industry is considered a strong aspect, as well as the overall policy context for green and digital transformation. In contrast, government encouragement and policy incentives are seen as weak. This is partially in line with the findings of Awad et al. (2025) and Jabbour et al. (2019), who highlighted the role of government policies, regulatory frameworks, and institutional incentives in facilitating sustainable innovation. The medium level of perceived support, however, indicates that, in the Palestinian context, government support has not yet been sufficiently direct, practical, or accessible to significantly affect enterprises' circular economy practices.

The descriptive results also indicated that levels of barriers to digital innovation and CE practices were high. The main challenges included low awareness of the circular economy's benefits, a lack of infrastructure, and limited financial resources. The results of this study show that, although plastic manufacturing companies in Hebron City reported relatively high scores in digital innovation, circular economy practices, and Organizational Readiness, many practical challenges remain to be addressed. This is similar to the results found by Galvão et al. (2018), who reported technical, enterprise, financial, and behavioral barriers as constraints to implementing the circular economy. It also confirms the study by Jabbour et al. (2019), which highlights that financial constraints, limited institutional support, and a lack of capabilities may hinder sustainability-oriented innovation. Likewise, Panchal et al. (2021) pointed out that unclear awareness, a lack of measurement indicators, and limited implementation capacity could hinder the adoption of circular economy practices. The finding also resonates with Suchek et al. (2021), who emphasize that awareness and knowledge play an important role in the successful transformation towards sustainability and the circular economy.

5.2.2 Discussion of Structural Model Findings

The analysis of structural model results showed that there were no statistically significant direct effects of digital innovation on circular economy practices. This finding is, at first glance, at odds with some previous studies that found a positive, direct link between digital innovation and the implementation of the circular economy. For instance, Alhawari et al. (2021), Neligan et al. (2022), Bressanelli et al. (2022), and Neri et al. (2024) pointed out that digital technologies can be used to support CE practices, including resource tracking, waste reduction, supply chain transparency, circular business models, and sustainable production processes.

However, the lack of a clear, direct impact does not mean that digital innovation is irrelevant. Instead, it implies that innovation in the digital world alone is not enough to achieve circular economy outcomes. This finding can be attributed to the nature of the enterprises studied, which are mostly small plastic manufacturing enterprises operating under resource constraints, infrastructure limitations, and financial difficulties. The descriptive results also indicated that implementation barriers remained relatively high, particularly the lack of knowledge about the benefits of the circular economy, infrastructure constraints, and financial constraints. When digital innovation practices are in place, these barriers can reduce the direct impact of digital technologies to create circular economy outcomes. Therefore, the high level of implementation barriers reported by the participating enterprises provides a reasonable explanation for the non-significant direct effect of digital innovation on circular economy practices observed in the current study. These barriers may limit enterprises' ability to translate digital technologies into tangible circular economy outcomes unless they are supported by sufficient organizational readiness.

Additionally, the findings revealed that digital innovation had a positive and significant influence on Organizational Readiness. This result aligns with Ramdani et al. (2022), who believed that digital transformation enhances an enterprise's capacity by improving its technical infrastructure, management processes, and employees' skills. Additionally, it aligns with Kroh et al. (2024), who highlighted the benefits of digital innovation on enterprise adaptability, learning capacity, and preparedness for change. Therefore, IT enterprises that demonstrate digital innovation practices are more likely to create internal conditions that enable innovation, sustainability, and enterprise-wide change.

The literature search did not reveal any conflicting main results on the positive effect of digital innovation on organizational readiness. The uniformity of results in various settings reinforces the case for digital innovation and improving enterprises' readiness for organizational change and transformation.

Similarly, Organizational Readiness had a positive and statistically significant impact on circular economy practices. This has been observed by Weiner (2009), who highlighted Organizational Readiness as an important factor in ensuring enterprise change is successful. It also aligns with the Resource-Based View (RBV) and the Dynamic Capabilities Perspective, which hold that technologies generate value only when enterprises possess the internal resources, competencies, and adaptive capabilities to translate technology into tangible results. In this study, Organizational Readiness appears to be a significant capability that helps plastic manufacturing companies implement circular economy practices, including recycling, reusing, reducing waste, and utilizing resources efficiently.

This conclusion aligns with prior research, which stressed the role of organizational capacities and preparedness in facilitating support for sustainability-oriented activities and implementation of the circular economy. The findings further confirm the statements made by Jabbour et al. (2019), Ramdani et al. (2022), and Kroh et al. (2024), which emphasized that sustainable transformation is a function of organizational resources, leadership commitment, and employee competencies. The literature reviewed did not suggest any significant conflicting results on this relationship.

The results of the study clearly highlight the strong mediating effect of Organizational Readiness on the relationship between digital innovation and circular-economy practices. The results showed no direct effect of digital innovation on CE practices, but an indirect effect through Organizational Readiness, indicating full mediation. Digital innovation helps implement the circular economy mainly by increasing organizational readiness.

This discovery directly addresses one of the major gaps identified in the literature review by focusing on the under-researched topic of Organizational Readiness in digital innovation/circular economy research. The discovery also corroborates the Resource-Based View and Dynamic Capabilities Perspective, which postulate that organizational resources and capabilities serve as means by which technological investments lead to lasting results. Previous studies, such as Alhawari et al. (2021) and Neligan et al. (2022), have focused mainly on the direct connection between digital innovation and the implementation of CE, with little consideration of how the relationship between these two works. In the present study, the authors build on this body of literature by demonstrating that digital innovation requires developing Organizational Readiness first to produce meaningful outcomes for the circular economy. This interpretation also aligns with the findings of Ramdani et al. (2022), Kroh et al. (2024), and Awad et al. (2025), which emphasized the need for enterprise capabilities, leadership commitment, employee competencies, and enterprise culture to facilitate successful digital and sustainability-oriented transformation.

This discovery is of special significance in the context of Palestinian industry. The economic uncertainty, infrastructure constraints, competition, and sustainability issues faced by plastic manufacturing companies in Hebron City are significant. In the context of these conditions, the internal readiness of enterprises is an important variable that enables them to leverage digital innovation effectively to optimize resource use, minimize waste, support recycling, and advance circular production.

Regarding government support, the findings revealed that government support did not have a statistically significant moderating effect on the relationship between digital innovation and circular economy practices. This finding suggests that the effectiveness of institutional support may vary across different economic and industrial contexts. This finding contrasts with some earlier research, such as Awad et al. (2025) and Jabbour et al. (2019), which highlighted government policies and regulatory bodies, incentives, and institutional support as key factors for the success of digital transformation and circular economy adoption.

A possible explanation is that existing governmental initiatives related to digital transformation and sustainability are not yet sufficiently accessible, intensive, or directly linked to the operational realities of small and medium-sized manufacturing enterprises. The findings indicate that internal organizational capabilities play a more influential role than external institutional factors in facilitating the implementation of the circular economy in the studied context.

Alternatively, enterprises may rely primarily on internal capabilities rather than external institutional support when pursuing sustainability-oriented transformation. This is confirmed by the results for the mediating variable, which revealed that Organizational Readiness had a significant mediating effect, while government support had no significant moderating effect. This is also confirmed by the descriptive results, which show a moderate level of perceived government support and relatively high implementation barriers.

More importantly, the lack of significance does not mean government support is unimportant. Instead, it indicates that the level, intensity, and availability of the support provided may be insufficient to produce a statistically significant difference. This interpretation is further supported by the Importance–Performance Map Analysis (IPMA), which also highlighted that the area of government and policy support had the lowest values for importance and performance.

In general, the results show that as the circular economy is implemented in plastic manufacturing companies in Hebron City, it is through the internal capacities of the enterprises and not only digital innovation or governmental intervention. Overall, the study contributes to the literature by providing evidence that digital innovation can support the implementation of the circular economy, primarily through Organizational Readiness. Moreover, it offers contextual evidence from Palestine suggesting that internal enterprise-level factors may be more important than external institutional factors in understanding the relationship between digital innovation and the circular economy. This is a significant contribution to research on the implementation of digital innovation, the circular economy, and sustainable industrial transformations in developing economies.

5.2.3 Discussion of Importance-Performance Map Analysis

Based on the Importance-Performance Map Analysis, the Digital Innovation practices had the highest importance value, and the highest performance score for circular economy practices, while Organizational Readiness was also at a high level of importance and performance. This finding is in line with the practical focus on digital innovation and Organizational Readiness as key aspects of implementing the circular economy.

This is in line with the broader literature identifying digital innovations as a strategic tool to support circular economy practices (Bressanelli et al., 2022; Neri et al., 2024). The results of the present study, however, give a more complex picture. Digital innovation was ranked as the most important and performed best. However, the structural model results indicate that it has a greater influence on the implementation of the circular economy through the Organizational Readiness dimension than directly. However, companies should not just invest in digital technologies; they also need to build capabilities within their enterprises to translate digital innovation into circular economy outcomes effectively.

The lowest score in the performance and importance value of IPMA was government and policy support. This finding further corroborates the structural model results, as government support had no significant moderating effect. In practice, government support should be considered in a supportive context rather than as the primary incentive for the enterprises under review to undertake circular economy practices. The key managerial concern, therefore, is on enhancing digital innovations and Organizational Readiness.

5.2.4 Overall Interpretation

Overall, the findings indicate that implementing the circular economy in plastic enterprises in Hebron City depends primarily on organizational readiness. Digital innovation is a crucial enabler, but it only works when coupled with the right organizational capabilities, resources, and culture. Hence, organizational readiness was identified as the leading pathway of digital innovation to support circular economy practices.

The key contribution of the study is that it shows how Organizational Readiness serves as a mediating variable between the digital innovation and adoption of circular economy practices. This result fills an important gap in the literature, as previous studies have frequently focused on the straightforward connection between digital innovation and circular economy practices and have lacked explanations of how this connection is realized within enterprises.

Finally, the study confirms that digital innovation is needed, but it is not enough to implement the circular economy. The shift to the circular economy should be done successfully by plastic manufacturing companies, but this will take place only if the companies in Hebron City are ready to shift, which means they should have supportive leadership, skilled labor, sufficient resources, technology infrastructure, and an environment that fosters innovation and eco-friendly practices.

5.3 Conclusions

The study finds that digital innovation plays an important role in supporting the implementation of the circular economy for plastic manufacturing enterprises in Hebron City, but not directly. The results show that organizational readiness is the primary driver of the relationship between digital innovation and circular economy practices. This means that implementing measures to achieve the circular economy requires, in addition to the use of digital technology, organizational conditions for innovation, such as leadership commitment, employees' competencies, technological support, and a culture of innovation.

The findings also show that organizational readiness is a key factor in implementing the circular economy, emphasizing the need for internal organizational capacities for sustainable transformation. Government and policy support, on the other hand, did not significantly moderate the relationship between digital innovation and circular economy implementation. This suggests that internal organizational factors exert a stronger influence than external institutional factors on circular economy outcomes in the context examined in this study.

In summary, this study contributes to the growing body of knowledge on digital innovation and the implementation of a circular economy, showing that organizational readiness is the critical link between them. The findings have important empirical implications for Palestinian industries and will contribute to a better understanding of the organizational fabric conditions needed to enable sustainable industrial transformation.

5.4 Implications of the Study

5.4.1 Theoretical Implications

The study is a valuable addition to the fields of digital innovation and the circular economy because it provides empirical evidence that the relationship between digital innovation implementation and the circular economy is not always linear. On the contrary, it was identified that organizational readiness plays a crucial role as a mediator between digital innovation and circular economy practices. This study extends previous research on digital innovation and sustainability outcomes by emphasizing the role of internal organizational capacities in explaining the link between digital innovation and sustainability outcomes. Additionally, the outcomes align with the Resource-Based View (RBV) and the Dynamic Capabilities Perspective, which emphasize the importance of possessing the right organizational capabilities and readiness to leverage technological resources to add value.

5.4.2 Managerial Implications

The results indicate that the use of digital technologies is not a foregone conclusion for boosting the performance of a circular economy. Instead, the focus of enterprises should be on enhancing organizational readiness by developing their employees, improving leadership commitment, facilitating organizational learning, building technological infrastructure, and allocating resources. The outcomes also reveal that improving awareness of the advantages of the circular economy, as well as tackling infrastructure and financial barriers, are key to strengthening the impact of digital innovation projects and creating sustainable operational improvements.

5.4.3 Policy Implications

The results show that government and policy support did not significantly moderate the relationship between digital innovation and circular economy implementation in the context studied. It implies that the effectiveness of existing support mechanisms needs to be re-evaluated, and that more practical, accessible, and targeted support schemes need to be introduced and implemented for industrial enterprises. Special focus needs to be paid to awareness programs, infrastructure development, technical support, and incentives that directly address the problems faced by small manufacturing companies. Improving coordination between government agencies, universities, and industry can further support a digital transformation environment and the implementation of the circular economy.

5.5 Recommendations

5.5.1 Recommendations for Plastic Manufacturing Enterprises

1. Strengthen organizational readiness by enhancing technological infrastructure, employee competencies, financial resources, and a culture of innovation.

2. Align digital innovation initiatives with circular economy objectives to improve resource efficiency, reduce waste, and support sustainable production.

3. Invest in digital infrastructure and continuous employee training to maximize the benefits of digital technologies and sustainability initiatives.

4. Promote employee participation, experimentation, and environmental responsibility to support innovation and circular economy practices.

5. Increase awareness of circular economy concepts and benefits to overcome one of the major barriers identified in the study.

5.5.2 Recommendations for Policymakers

1. Develop practical and accessible support mechanisms that address the actual needs of industrial enterprises in digital transformation and circular economy implementation.

2. Integrate digital transformation and circular economy goals into national industrial and sustainability strategies.

3. Provide targeted financial, technical, and advisory support for small and medium-sized manufacturing enterprises.

4. Invest in digital infrastructure and strengthen cooperation among government, universities, research institutions, and industry to support sustainable industrial transformation.

5.5.3 Recommendations for Universities and Industrial Associations

1. Expand research, training, and consultancy programs related to digital innovation, sustainability, and circular economy implementation.

2. Organize workshops and knowledge-sharing platforms to disseminate best practices and successful experiences among enterprises.

3. Develop joint training programs to enhance digital skills and awareness of circular economy concepts and sustainability practices.

4. Promote technology transfer and collaborative projects among universities, industrial enterprises, chambers of commerce, and development organizations to support sustainable industrial development.

5.6 Limitations of the Study

This study was conducted exclusively among plastic manufacturing businesses in Hebron City, Palestine. Thus, the results are specific to this industrial sector and geographical area, and caution should be exercised when extrapolating them to other sectors or areas.

Second, the study was cross-sectional, in which data were collected at one point in time. This method is suitable for studying relationships among variables, but cannot be used to detect change over time or to make certain conclusions about cause and effect.

Thirdly, the study was conducted with managers, supervisors, and employees of the enterprises involved. The findings are still subject to participants' views on the level of digital innovation, Organizational Readiness, government support, and circular economy practices in their organizations, as the respondents were selected based on their positions and familiarity with these practices.

Fourth, a practical limitation arose during data collection: 10 plastic manufacturing enterprises declined to participate in the study despite repeated attempts to secure their cooperation. Although the final sample remained adequate for statistical analysis and hypothesis testing, the non-participation of these enterprises may have reduced the representativeness of the target population and limited the inclusion of additional organizational perspectives that could further enrich the findings.

Finally, government and policy support were measured based on respondents’ perceptions. Therefore, the findings reflect how enterprises perceive the policy environment, regulatory incentives, and institutional support, rather than providing an objective evaluation of actual government programs, laws, financial incentives, or policy implementation mechanisms.

The study's findings, despite the limitations highlighted above, provide useful empirical evidence on the role of digital innovation in promoting the implementation of the circular economy in industry, and include important considerations of the organizational and institutional aspects of sustainable industrial transformation in the Palestinian context.

5.7 Directions for Future Research

Future research is encouraged to explore other mediating factors that may account for the relationship between digital innovation and the implementation of the circular economy. Other factors, such as digital maturity, innovation capability, organizational learning, and environmental orientation, can provide additional insights into the processes that link digital innovation and sustainability outcomes.

Second, future studies could explore other moderating factors that could affect the link between digital innovation and circular economy practices. Competitive pressure, environmental uncertainty, market dynamics, organizational size, and industry characteristics are among the possible moderators.

Third, extending the study to other Palestinian industrial sectors and geographical areas would evaluate the generalizability of the results and assess whether the relationships found are consistent across these sectors and areas.

Fourth, future researchers are encouraged to use longitudinal research designs to understand better the longitudinal relationships among digital innovation, organizational readiness, and circular economy practices and to provide more substantial evidence of causal relationships among the study variables.

Fifth, mixed methods, combining qualitative and quantitative approaches, are suggested to gain deeper insights into organizational transformation processes and to grasp the contextual factors that affect the implementation of circular economy practices.

Finally, future research can further examine the moderating role of government and policy support across different industrial and geographical contexts. Since government support did not exhibit a significant moderating effect in the present study, additional research is needed to determine whether this finding is context-specific or whether similar patterns exist in other developing economies.

5.8 Chapter Summary

In this chapter, a detailed explanation of the study results was provided, and the empirical findings were interpreted in light of the study objectives, theoretical background, and prior studies. The chapter presented the main findings of the analysis and the theories, managerial and policy implications of the findings. It also offered concrete suggestions to facilitate the uptake of circular economy practices in plastic-making companies, as well as recommendations from policy, university, and industrial support institutions. In addition, the chapter recognized the constraints of this research and proposed several avenues for further research.

Overall, the results showed that digital innovation contributes to the implementation of circular economy practices primarily through organizational readiness, which emerged as the key mechanism explaining this relationship. The study demonstrated that internal organizational capabilities exert a stronger influence than external institutional support in facilitating circular economy implementation within the studied context.

Thus, the study adds to the body of knowledge on digital innovation, organizational readiness, and sustainable industrial transformation, and offers contextualized evidence from plastic manufacturing companies in Hebron City, Palestine.

Language Editing Statement

Language editing and proofreading of this thesis were supported using Grammarly software to improve grammar, spelling, punctuation, and writing clarity. The researcher reviewed all suggested changes and retained full responsibility for the final content.

References

Alhawari, O., Awan, U., Bhutta, M. K. S., & Ülkü, M. A. (2021). Insights from circular economy literature: A review of extant definitions and unraveling paths to future research. Sustainability, 13(2), 859.

Alkharusi, H. (2022). A descriptive analysis and interpretation of Likert-scale data in educational and psychological research. Indian Journal of Psychology and Education, 12(2), 13–16.

Alsuhaibany, Y. (2025). Digital Innovation and Circular Economy: A Nexus for Sustainable Oil and Gas Sector Transformation in Saudi Arabia. Sustainability, 17(3), 1325.

Australian Bureau of Statistics. (2023, February 2). Census and sample. https://www.abs.gov.au/statistics/understanding-statistics/statistical-terms-and-concepts/census-and-sample

Awad, I. M., Nuseibeh, H., & Amro, A. A. (2025). Competitiveness in the era of circular economy and digital innovations: An integrative literature review. Sustainability, 17(10), 4599.

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

Beaton, D. E., Bombardier, C., Guillemin, F., & Ferraz, M. B. (2000). Guidelines for the Process of Cross-Cultural Adaptation of Self-Report Measures. Spine, 25(24), 3186–3191. https://doi.org/10.1097/00007632-200012150-00014

Boone, H., & Boone, D. (2012). Analyzing Likert Data. Journal of Extension, 50(2). https://doi.org/10.34068/joe.50.02.48

Bressanelli, G., Adrodegari, F., Pigosso, D. C. A., & Parida, V. (2022). Towards the Smart Circular Economy Paradigm: A Definition, Conceptualization, and Research Agenda. Sustainability, 14(9), 4960. https://doi.org/10.3390/su14094960

Cagno, E., Neri, A., Negri, M., Bassani, C. A., & Lampertico, T. (2021). The Role of Digital Technologies in Operationalizing the Circular Economy Transition: A Systematic Literature Review. Applied Sciences, 11(8), 3328. https://doi.org/10.3390/app11083328

Chin, W. W. (1998). Modern Methods for Business Research. In The partial least squares approach to structural equation modeling (pp. 295–336).

Cohen, J. (1988). Statistical power analysis for the behavioral sciences.

Creswell, J. W., & Creswell, J. D. (2023). Research Design: Qualitative, Quantitative, and Mixed Methods Approaches. SAGE Publications, Incorporated.

Dillman, D. A., Smyth, J. D., & Christian, L. M. (2014). Internet, Phone, Mail, and Mixed-Mode Surveys: The Tailored Design Method. Wiley.

Enders, C. K. (2022). Applied missing data analysis, 2nd ed. In Applied missing data analysis, 2nd ed. (pp. ix, 546–ix, 546). The Guilford Press.

Environment Quality Authority. (2023). National environmental strategy and action plan (2023–2027). Ramallah, Palestine: Environment Quality Authority.

Fichman, R. G., Dos Santos, B. L., & Zheng, Z. (2014). Digital innovation is a fundamental and powerful concept in the information systems curriculum. MIS Quarterly, 38(2), 329–353.

Fornell, C., & Larcker, D. F. (1981). Evaluating Structural Equation Models with Unobservable Variables and Measurement Error. Journal of Marketing Research, 18(1), 39. https://doi.org/10.2307/3151312

Galvão, G. D. A., De Nadae, J., Clemente, D. H., Chinen, G., & De Carvalho, M. M. (2018). Circular economy: overview of barriers. Procedia Cirp, 73, 79–85.

Gefen, D., Straub, D., Boudreau, M.-C., Gefen, D., & Boudreau, &. (2000). Structural Equation Modeling and Regression: Guidelines for Research Practice. Communications of the Association for Information Systems, 4(1), 7. https://doi.org/10.17705/1CAIS.00407

Golob, T. F. (2003). Structural equation modeling for travel behavior research. Transportation Research Part B: Methodological, 37(1), 1–25. https://doi.org/10.1016/S0191-2615(01)00046-7

Hair, J. F., Hult, G. T. M., Ringle, C. M., Sarstedt, M., Danks, N. P., & Ray, S. (2021). Partial Least Squares Structural Equation Modeling (PLS-SEM) Using R. https://doi.org/10.1007/978-3-030-80519-7

Hair, J. F., Hult, G. T. M., Ringle, C., & Sarstedt, M. (2017). A Primer on Partial Least Squares Structural Equation Modeling (PLS-SEM). Sage Publications.

Hair, J. F., Sarstedt, M., Hopkins, L., & Kuppelwieser, V. G. (2014). Partial least squares structural equation modeling (PLS-SEM): An emerging tool in business research. European Business Review, 26(2), 106–121. https://doi.org/10.1108/EBR-10-2013-0128

Hamedani, S. S., Aslam, S., Hamedani, S. S., & Natarajan, V. K. (2025). Transforming sustainability with digital innovation: Enhancing circular economy practices for SDG 12. Humanities and Social Sciences Letters, 13(3), 1080–1098.

Henseler, J., Ringle, C. M., & Sarstedt, M. (2015). A new criterion for assessing discriminant validity in variance-based structural equation modeling. Journal of the Academy of Marketing Science, 43(1), 115–135. https://doi.org/10.1007/S11747-014-0403-8/FIGURES/8

Hinings, B., Gegenhuber, T., & Greenwood, R. (2018). Digital innovation and transformation: An institutional perspective. Information and Organization, 28(1), 52–61. https://doi.org/10.1016/j.infoandorg.2018.02.004

Hund, A., Wagner, H. T., Beimborn, D., & Weitzel, T. (2021). Digital innovation: A review and a novel perspective. Journal of Strategic Information Systems, 30(4), 101695.

Ilić, M. P., Ranković, M., Dobrilović, M., Bucea-Manea-Țoniș, R., Mihoreanu, L., Gheța, M. I., & Simion, V. E. (2022). Challenging novelties within the circular economy concept under the digital transformation of society. Sustainability, 14(2), 702.

International Organization for Standardization. (2015). ISO 9001:2015 - Quality management systems — Requirements. International Organization for Standardization. https://www.iso.org/standard/62085.html

International Organization for Standardization. (2020). ISO 21502:2020 - Project, program and portfolio management — Guidance on project management. International Organization for Standardization. https://www.iso.org/standard/74947.html

Jabbour, C. J. C., de Sousa Jabbour, A. B. L., Sarkis, J., & Godinho Filho, M. (2019). Unlocking the circular economy through new business models based on large-scale data: an integrative framework and research agenda. Technological Forecasting and Social Change, 144, 546–552.

Jauhar, S., Pratap, S., Paul, S., & Gunasekaran, A. (2023). Internet of Things-based innovative solutions and emerging research clusters in the circular economy. Operations Management Research, 16(4), 1968-1988.

Joshi, A., Kale, S., Chandel, S., & Pal, D. (2015). Likert Scale: Explored and Explained. British Journal of Applied Science & Technology, 7(4), 396–403. https://doi.org/10.9734/BJAST/2015/14975

Kalogiannidis, S., Kalfas, D., Chatzitheodoridis, F., & Kontsas, S. (2022). The Impact of Digitalization in Supporting the Performance of the Circular Economy: A Case Study of Greece. Journal of Risk and Financial Management, 15(8), 349. https://doi.org/10.3390/jrfm15080349

Kane, G. C., Palmer, D., Phillips, A. N., Kiron, D., & Buckley, N. (2015). Strategy, not technology, drives digital transformation. MIT Sloan Management Review and Deloitte University Press.

Kim, H.-Y. (2013). Statistical notes for clinical researchers: assessing normal distribution (2) using skewness and kurtosis. Restorative Dentistry & Endodontics, 38(1), 52. https://doi.org/10.5395/RDE.2013.38.1.52,

Kirchherr, J., Reike, D., & Hekkert, M. (2017). Conceptualizing the circular economy: An analysis of 114 definitions. Resources, conservation and recycling, 127, 221–232.

Kroh, J., Globocnik, D., Schultz, C., Holdhof, F., & Salomo, S. (2024). Micro-foundations of digital innovation capability–A mixed method approach to develop and validate a multi-dimensional measurement instrument. Technological Forecasting and Social Change, 198, 122942.

Lewandowski, M. (2016). Designing the Business Models for the Circular Economy—Towards the Conceptual Framework. Sustainability, 8(1), 43. https://doi.org/10.3390/su8010043

Liu, Z., Liu, J., & Osmani, M. (2021). Integration of Digital Economy and Circular Economy: Current Status and Future Directions. Sustainability, 13(13), 7217. https://doi.org/10.3390/su13137217

Magrini, C., Nicolas, J., Berg, H., Bellini, A., Paolini, E., Vincenti, N., ... & Bonoli, A. (2021). Using the Internet of Things and distributed ledger technology to enable the digital circular economy: The case of electronic equipment. Sustainability, 13(9), 4982.

Murray, A., Skene, K., & Haynes, K. (2017). The circular economy: An interdisciplinary exploration of the concept and application in a global context. Journal of Business Ethics, 140(3), 369–380. https://doi.org/10.1007/s10551-015-2693-2

Nambisan, S., Lyytinen, K., Majchrzak, A., & Song, M. (2019). Digital innovation management: Reinventing innovation management research in a digital world. MIS Quarterly, 43(1), 223–238. https://doi.org/10.25300/MISQ/2019/13398

Neligan, A., Baumgartner, R. J., Geissdoerfer, M., & Schöggl, J. P. (2022). Circular disruption: Digitalization as a driver of circular economy business models. Business Strategy and the Environment, 31(8), 1–14.

Neri, A., Cagno, E., Susur, E., Urueña, A., Nuur, C., Kumar, V., & Sorrentino, C. (2024). Digital technologies and the circular economy: A systematic literature review and future research agenda. Technological Forecasting and Social Change, 198, 122942.

Oghazi, P., Mostaghel, R., & Hultman, M. (2024). International industrial manufacturers: Mastering the era of digital innovation and circular economy. Technological Forecasting and Social Change, 201, 123160.

Oliveira, M., Miguel, M., van Langen, S. K., Ncube, A., Zucaro, A., Fiorentino, G., ... & Genovese, A. (2021). Circular economy and the transition to a sustainable society: integrated assessment methods for a new paradigm. Circular Economy and Sustainability, 1(1), 99–113.

Palestine Economic Policy Research Institute (MAS). (2024). Innovation and industrial policy: Harnessing the knowledge economy for relief, rehabilitation, and recovery after the war in Gaza. MAS. https://mas.ps

Palestine Investment Promotion Agency (PIPA). (2023). Industrial sector profile and investment opportunities in Hebron Governorate. Palestine Investment Promotion Agency.

Palestine Investment Promotion Agency. (2023). Stretch Factory: Industry highlights. Palestine Investment Promotion Agency (PIPA). https://pipa.ps

Palestinian Central Bureau of Statistics (PCBS). (2017). Industrial production statistics report 2017. PCBS.

Palestinian Central Bureau of Statistics (PCBS). (2023). Industrial statistics annual report 2023. PCBS.

Palestinian Central Bureau of Statistics (PCBS). (2023). Press release on the occasion of World Environment Day 2023—Palestinian Central Bureau of Statistics.

Palestinian Central Bureau of Statistics. (2017). Industrial production statistics: Manufacture of rubber and plastics products. Retrieved through the CEIC Database. https://www.ceicdata.com

Palestinian Central Bureau of Statistics. (2023). Press release on the occasion of World Environment Day 2023. Palestinian Central Bureau of Statistics. https://www.pcbs.gov.ps

Panchal, R., Singh, A., & Diwan, H. (2021). Digital transformation and circular economy adoption in developing economies: Challenges and opportunities. Sustainability, 13(18), 10245.

Panchal, R., Singh, A., & Diwan, H. (2021). Does circular economy performance lead to sustainable development?–A systematic literature review—Journal of Environmental Management, 293, 112811.

Piedra-Muñoz, L., García-Granero, E. M., Tarpani, R. R. Z., & Gallego-Schmid, A. (2025). Digital Technologies: Description, Classification, and Links to Circular Economy. Business Strategy and the Environment.

Planing, P. (2018). Towards a circular economy: how business model innovation will help to make the shift. International Journal of Business and Globalization, 20(1), 71–83.

Project Management Institute. (2021). A guide to the Project Management Body of Knowledge (PMBOK® guide) and the standard for project management (7th ed.). International Organization for Standardization. https://www.pmi.org/standards/pmbok

Ramdani, B., Binsaif, A., & Boukrami, E. (2021). Business model innovation in the digital age: Organizational and environmental determinants. Information Systems Frontiers, 23(4), 949–963.

Ramdani, B., Raja, S., & Kayumova, M. (2022). Digital innovation in SMEs: a systematic review, synthesis and research agenda. Information Technology for Development, 28(1), 56–80.

Ringle, C. M.; Wende, S.; Becker, J.-M. (2024). SmartPLS 4. SmartPLS.

Rosa, P., Sassanelli, C., Urbinati, A., Chiaroni, D., & Terzi, S. (2020). Assessing relations between circular economy and industry 4.0: A systematic literature review. International Journal of Production Research, 58(6), 1662–1687. https://doi.org/10.1080/00207543.2019.1680896

Ruiz-Real, J. L., Uribe-Toril, J., De Pablo Valenciano, J., & Gázquez-Abad, J. C. (2018). Worldwide research on circular economy and environment: A bibliometric analysis—International Journal of Environmental Research and Public Health, 15(12), 2699.

Rusch, M., Schöggl, J. P., & Baumgartner, R. J. (2022). Application of artificial intelligence within circular economy practices: A systematic review. Sustainability, 14(3), 1235.

Rusch, M., Schöggl, J. P., & Baumgartner, R. J. (2023). Application of digital technologies for sustainable product management in a circular economy: A review. Business strategy and the environment, 32(3), 1159–1174.

Russo, D., & Stol, K. J. (2022). PLS-SEM for software engineering research: An introduction and survey. ACM Computing Surveys, 54(4). https://doi.org/10.1145/3447580;SUBPAGE:STRING:ABSTRACT;WEBSITE:WEBSITE:DL-SITE;REQUESTEDJOURNAL:JOURNAL:CSUR;TAXONOMY:TAXONOMY:ACM-P

Sarstedt, M., Ringle, C. M., & Hair, J. F. (2022). Partial Least Squares Structural Equation Modeling. Handbook of Market Research, 587–632. https://doi.org/10.1007/978-3-319-57413-4_15

Saunders, M. N. K., Lewis, P., & Thornhill, A. (2023). Research methods for business students. 860.

Schöggl, J. P., Rusch, M., Stumpf, L., & Baumgartner, R. J. (2023). Implementation of digital technologies for a circular economy and sustainability management in the manufacturing sector. Sustainable Production and Consumption, 35, 401-420.

Scholtysik, M., Rasor, A., Petzke, L., Koldewey, C., & Dumitrescu, R. (2025). An integrative perspective on digital technologies and circular economy: a systematic literature review. Proceedings of the Design Society, 5, 541-550.

Shmueli, G., Sarstedt, M., Hair, J. F., Cheah, J. H., Ting, H., Vaithilingam, S., & Ringle, C. M. (2019). Predictive model assessment in PLS-SEM: Guidelines for using PLSpredict. European Journal of Marketing, 53(11), 2322–2347. https://doi.org/10.1108/EJM-02-2019-0189

Soldatos, J., Kefalakis, N., Despotopoulou, A. M., Bodin, U., Musumeci, A., Scandura, A., ... & Colledani, M. (2021). A digital platform for cross-sector collaborative value networks in the circular economy. Procedia Manufacturing, 54, 64-69.

Stol, K. J. (2022). Digital innovation and organizational transformation: Emerging perspectives and future directions. Information and Software Technology, 148, 106908.

Suchek, N., Fernandes, C. I., Kraus, S., Filser, M., & Sjögrén, H. (2021). Innovation and the circular economy: A systematic literature review. Business Strategy and the Environment, 30(8), 3686-3702.

Taherdoost, H. (2017). Determining sample size: How to calculate survey sample size. International Journal of Economics and Management Systems, 2, 237–239.UBTYPE;PAGEGROUP:STRING:PUBLICATION

Tavera Romero, C. A., Castro, D. F., Ortiz, J. H., Khalaf, O. I., & Vargas, M. A. (2021). Synergy between circular economy and industry 4.0: A literature review. Sustainability, 13(8), 4331.

Ţurcan, I., Ţurcan, R., & Stratila, A. (2023). Digitalization and its role in the development of circular economy business models. In Competitiveness and sustainable development (pp. 103-109).

Uršič, D., & Čater, T. (2024). Digital innovation capability and organizational performance: A contemporary review. Technological Forecasting and Social Change, 198, 122876.

Uršič, D., & Čater, T. (2024). Exploring the role of digital innovation in management and business literature: A bibliometric analysis. Procedia Computer Science, 237, 874-881.

Vial, G. (2019). Understanding digital transformation: A review and a research agenda. The Journal of Strategic Information Systems, 28(2), 118–144. https://doi.org/10.1016/j.jsis.2019.01.003

Weiner, B. J. (2009). A theory of organizational readiness for change. Implementation Science, 4(1), 67. https://doi.org/10.1186/1748-5908-4-67

Winans, K., Kendall, A., & Deng, H. (2017). The history and current applications of the circular economy concept. Renewable and Sustainable Energy Reviews, 68, 825–833. https://doi.org/10.1016/j.rser.2016.09.123

Yusoff, M. S. B. (2019). ABC of Content Validation and Calculation of the Content Validity Index. Education in Medicine Journal, 11(2), 49–54. https://doi.org/10.21315/eimj2019.11.2.6

Zeiß, R. (2021). Circular Economy in the Digital Age–How Information Systems Can Advance Sustainable Consumption and Production (Doctoral dissertation, Universität zu Köln).

Appendix A: Questionnaire

The Role of Digital Innovation in Advancing the Circular Economy in Palestinian Enterprises

Dear Participant,

You are invited to participate in this academic research study, which aims to examine the role of digital innovation in advancing circular economy practices in Palestinian enterprises, with a particular focus on SMEs and industrial firms.

Your responses are highly valuable and will contribute to a better understanding of how digital technologies can support sustainable and circular business practices. All information provided will be treated with **strict confidentiality** and used **solely for academic research purposes**.

There are **no right or wrong answers**. Please respond honestly based on your organization's current practices and experience.

Definitions of Study Concepts

Digital Innovation: The use of modern digital technologies to develop or improve products, services, processes, and business models in ways that enhance efficiency and create added value for the organization.

Circular Economy: An economic model that aims to reduce waste and maximize the value of resources through reuse, recycling, remanufacturing, and sustainable resource management.

Estimated completion time: 10–12 minutes

Thank you for your time and cooperation.

Please indicate your level of agreement with the following statements using the **5-point Likert scale**:

Scale Meaning

1 Strongly Disagree

2 Disagree

3 Neutral

4 Agree

5 Strongly Agree

Section A: Firm Profile (Organizational Characteristics)

Please select the most appropriate answer

Firm age (years)

☐ Less than 5 years

☐ 5–10 years

☐ 11–20 years

☐ More than 20 years

Number of employees

☐ Less than 10

☐ 10–49

☐ 50–249

☐ 250 or more

Main business sector

☐ Manufacturing

☐ Services

☐ ICT / Technology

☐ Trade

☐ Other

Ownership type

☐ Private company

☐ Public company

☐ Family-owned business

☐ Cooperative / partnership

Location of the enterprise

☐ West Bank – North

☐ West Bank – Central

☐ West Bank – South

☐ Gaza Strip

How is your company classified according to the Chamber of Commerce?

☐ First Class

☐ Second Class

☐ Special Class

☐ Premium Class

Section B: Respondent Profile (Personal and Professional Characteristics)

Please select the option that best applies to you:

---

1. The organization I work for uses digital technologies (such as the Internet of Things, artificial intelligence, and cloud computing) to improve the efficiency of its operational processes.

☐ Yes

☐ No

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2. Job Title:

☐ General Manager / Chief Executive Officer
☐ Department / Division Manager
☐ Supervisor / Section Head
☐ Administrative Employee
☐ Technical / Operational Employee
☐ Other (please specify): ___________

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3. Years of Experience in the Current Organization:

☐ Less than 3 years
☐ 3 to less than 5 years
☐ 5 to less than 10 years
☐ 10 years or more

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4. Educational Level:

☐ Diploma
☐ Bachelor’s Degree
☐ Master’s Degree
☐ Doctorate (PhD)
☐ Other (please specify): ___________

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5. Department / Functional Area:

☐ Top Management
☐ Finance / Accounting
☐ Information Technology
☐ Production / Operations
☐ Marketing and Sales
☐ Human Resources
☐ Research and Development (R&D)
☐ Other (please specify): ___________

Section C: Digital Innovation

(Adapted from Nambisan et al., 2019)

Please indicate your level of agreement with the following statements

No.	Statement
1	Digital platforms help our company managing supply chains and logistics efficiently.
2	Our organization uses data analytics to support strategic and operational decision-making.
3	The company regularly invests in new digital technologies and systems.
4	The organization continuously encourages employees to utilize digital tools for generating new and innovative ideas.
5	Digital technologies facilitate collaboration with customers and suppliers.
6	Our firm integrates digital solutions into the development processes of products and services. The organization increasingly relies on digital transformation to improve its overall performance and enhance its competitiveness.

Section D: Circular Economy Practices

(Adapted from Kirchherr et al., 2017)

Please indicate your level of agreement with the following statements

No. Statement

No.	Statement
8	Products or services are designed to minimize waste.
9	Production materials are reused or recycled whenever possible.
10	The company monitors energy and water consumption to improve efficiency.
11	Waste generated from production processes is reused or repurposed.
12	Our company cooperates with other firms to exchange or recycle resources.
13	We seek to extend product life cycles through repair, reuse, or remanufacturing.
14	The organization systematically incorporates environmental sustainability considerations into the design and development of its products and services.

Section E: Barriers to Implementation

(Organizational and institutional challenges adapted from Jabbour et al., 2019)

Please indicate your level of agreement with the following statements

No.	Statement
15	Limited financial resources hinder investment in digital technologies.
16	Lack of technical expertise limits the implementation of circular innovation.
17	Government policies do not sufficiently support digital and

No.	Statement
	sustainable innovation.
18	Resistance to organizational change slows the adoption of new technologies.
19	Infrastructure limitations restrict digital transformation initiatives.
20	Limited awareness of the circular economy's benefits hinders its implementation.

Section F: Organizational Readiness

(Based on the Resource-Based View – RBV_ adapted from Barney et al., 1991)

Please indicate your level of agreement with the following statements

No.	Statement
21	Our organization has sufficient digital infrastructure to support innovation.
22	Top management is committed to adopting and supporting digital transformation strategies within the organization.
23	The organization continuously develops its employees' skills in digital technologies and sustainability.
24	The company allocates financial resources for innovation and sustainability projects.
25	Organizational culture encourages experimentation, learning, and innovation.

No.	Statement
26	Our firm possesses the technological capabilities needed for digital transformation.

Section G: Government and Policy Support

(adapted from Awad et al.,2025)

Please indicate your level of agreement with the following statements

No.	Statement
27	Government policies encourage the adoption of sustainable innovation.
28	There are clear national strategies promoting digitalization and the circular economy.
29	Collaboration between universities and industry is encouraged in Palestine.
30	The policy environment supports green and digital transformation.
31	Regulatory frameworks provide incentives for circular and sustainable practices.

Section H: The Relationship between Digital Innovation and the Circular Economy

(Integration between Digital Innovation and Circular Economy Practices adapted from Bressanelli et al. 2022)

Please indicate your level of agreement with the following statements

32 Digital technologies help our firm reduce material waste in production and operations.

33 The use of digital systems improves our ability to monitor resource consumption (e.g., energy, water, raw materials).

34 Digital tools enhance our company's ability to track products and materials throughout their life cycle.

35 Digital innovation helps our company redesign processes in ways that support circular economy practices.

36 Digital innovation facilitates the development of circular business models in our company.

37 Overall, digital innovation plays a significant role in advancing circular economy practices in our firm.

Section I: Additional Comments and Suggestions

Please take a moment to share any additional comments or suggestions you may have regarding the topic of this study. Your insights are highly valued and may contribute to improving the understanding and application of digital innovation in advancing circular economy practices.

Open-Ended Question:

Please provide any additional comments or suggestions that may help strengthen the role of digital innovation in advancing circular economy practices within Palestinian enterprises.

We sincerely appreciate your participation in this study.
Your contribution plays an important role in advancing knowledge on digital transformation and sustainability in Palestinian enterprises.

Appendix B: The normality result of the study indicators (items)

Items	Missing	Skewness	Kurtosis	Kolmogorov-Smirnov		
				Statistic	Df	Sig.
DI1	0	4.010	-1.703	0.410	63	0.000
DI2	0	0.499	-0.283	0.341	63	0.000
DI3	0	-0.161	-0.184	0.283	63	0.000
DI4	0	0.379	-0.491	0.302	63	0.000
DI5	0	2.022	-0.508	0.362	63	0.000
DI6	0	0.620	-0.340	0.329	63	0.000
DI7	0	2.742	-0.858	0.314	63	0.000
CEP1	0	1.239	-0.974	0.340	63	0.000
CEP2	0	1.989	-1.281	0.310	63	0.000
CEP3	0	1.210	-0.850	0.315	63	0.000
CEP4	0	1.102	-0.932	0.304	63	0.000
CEP5	0	0.937	-1.112	0.353	63	0.000
CEP6	0	1.494	-1.071	0.351	63	0.000
CEP7	0	4.285	-1.430	0.374	63	0.000
BAR1	0	1.338	-0.882	0.305	63	0.000
BAR2	0	0.725	-0.937	0.379	63	0.000
BAR3	0	-0.098	-0.677	0.276	63	0.000
BAR4	0	0.040	-0.267	0.307	63	0.000
BAR5	0	3.173	-1.129	0.325	63	0.000
BAR6	0	4.886	-1.264	0.328	63	0.000
OR1	0	0.693	-1.000	0.350	63	0.000
OR2	0	2.181	-1.324	0.369	63	0.000
OR3	0	1.734	-0.937	0.331	63	0.000

OR4	0	1.341	-0.946	0.311	63	0.000
OR5	0	3.085	-1.183	0.362	63	0.000
OR6	0	-0.248	-0.608	0.332	63	0.000
GPS1	0	-1.117	-0.296	0.238	63	0.000
GPS2	0	-0.648	-0.428	0.241	63	0.000
GPS3	0	-0.093	-0.632	0.336	63	0.000
GPS4	0	0.322	-0.799	0.310	63	0.000
GPS5	0	-0.476	-0.459	0.217	63	0.000